

Particle placement in early child language: A multifactorial analysis*

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Abstract

Recent studies of the English verb particle construction have shown that particle placement varies with a variety of linguistic features, which seem to influence the speaker's choice of a particular position. The current study investigates whether children's use of the particle varies with the same features as in adult language. Using corpus data from two English-speaking children, we conducted a multifactorial analysis of six linguistic variables that are correlated with particle placement in adult language. Our analysis reveals significant associations between the position of the particle and two of the six variables, the NP type of the direct object and the meaning of the particle, suggesting that children as young as two years of age process at least some of the features that motivate particle placement in adult speakers.

Keywords: particle placement; verb particle construction; language acquisition; multifactorial analysis

1. Introduction

Human language is essentially creative; adult speakers routinely comprehend and produce linguistic structures they have never heard or used before (Chomsky 1965). Young children are much less creative, however. Indeed, much recent empirical work suggests that children are initially very conservative learners, making only local generalizations from the ambient language and producing only lexically-specific constructions (see Tomasello 2003, for a review). As children grow older, they begin to analyze and generalize more deeply and widely, which enables them to create grammatical patterns of ever greater abstractness and flexibility (cf. Tomasello 2003; Diessel 2004).

This paper examines the use of the English verb particle construction (henceforth VPC) in early child language. The VPC consists of a transitive verb, a particle, and a noun phrase functioning as direct object. As can be seen in examples (1) and (2), the particle may precede or follow the direct object.¹

- (1) He looked up the number.
- (2) He looked the number up.

This raises the question what motivates the ordering of particle and direct object. When does the particle precede the direct object and when does it follow it? A number of studies have shown that in adult language particle placement varies with a variety of linguistic factors that seem to influence the speaker's decision to place the particle in a particular position (cf. Bolinger 1971; Fraser 1974, 1976; Bock 1977; Dixon 1982; Chen 1986; Hawkins 1994; Peters 1999; Wasow 2002; Dehé et al. 2002; Gries 1999, 2003).

An important factor that all studies recognize is the NP type of the direct object. If the object is an (unstressed) personal pronoun the particle follows it (cf. examples 3–4). But how do we account for the positioning of the particle in all other cases? A wide variety of factors have been proposed that seem to affect particle placement.

- (3) He looked it up.
- (4) *He looked up it.

To begin with, one factor that most studies consider important is the length of the direct object. The longer the object NP the more likely the occurrence of the particle after the direct object (cf. examples 5–8). However, since long NPs tend to be syntactically more complex than short ones, some authors suggested that it is primarily the complexity of the direct object, rather than its length, that influences particle placement (cf. Chomsky 1961; Fraser 1966).

- (5) He put it down.
- (6) He put the ball down.
- (7) He put the ball with the blue stripes down.
- (8) He put the ball that she had given him down.

Length and complexity are formal or syntactic features, but particle placement is also affected by semantic considerations. Several studies

have shown that particles indicating the direction or goal of a motion verb (cf. example 9) are more likely to follow the direct object than particles indicating the completion of an activity (cf. example 10) or particles having abstract meaning (cf. example 11) (cf. Fraser 1974; Wasow 2002; Gries 2003).

- (9) He pushed the chair away.
- (10) He ate up his lunch.
- (11) He turned on the TV.

In addition to syntactic and semantic factors, pragmatic factors influence particle placement. A number of studies have shown that the position of the particle varies with the information status of the direct object.² If the object expresses given or identifiable information, the particle tends to follow it (cf. example 12), but if it expresses new or unexpected information the particle tends to occur between verb and direct object (cf. example 13) (cf. Bock 1977; Chen 1986; Wasow 2002; Gries 2003).

- (12) What did she do with the ball? She picked the ball up.
- (13) What did she pick up? She picked up the ball.

Closely related to the information status of the direct object is the occurrence of an (in)definite determiner (cf. Lyons 1999). To simplify, an indefinite determiner indicates that the noun denotes a new and unfamiliar referent, whereas a definite determiner indicates that the referent is known or identifiable to the hearer. Thus, one would expect that definite NPs tend to precede the particle, while indefinite NPs tend to follow it (cf. Chen 1986).

- (14) I turn the light on.
- (15) I turn on a light.

Finally, it has been shown that the occurrence of stress accent correlates with the word order of the VPC. If the direct object carries stress accent the particle follows it, even if the object is pronominal (cf. example 16) (cf. Bolinger 1971; Chen 1986; Gries 2003).

- (16) Pick up HIM (not her).

Most researchers assume that all or at least a significant subset of these features influence the speaker's decision to place the particle before

or after the direct object; but there is no consensus in the literature as to the relative strength of the various factors. Some researchers assume that particle placement is primarily determined by syntactic features (cf. Hawkins 1994), others emphasize the importance of semantic properties (cf. Fraser 1974), and still others explain the positioning of the particle primarily in terms of pragmatic features (cf. Chen 1986).

Moreover, it is unclear if and to what extent the various factors are independent of each other. Some of the factors seem to be closely related. For instance, as has been pointed out above, there is a correlation between length and complexity. A complex noun phrase tends to be longer than a simple one. Similarly, there appears to be a correlation between the length and information status of the direct object. A noun phrase providing new or unexpected information tends to be longer than a noun phrase resuming given information from the preceding discourse (the latter is often a simple pronoun; cf. Ariel 1990).

In order to determine the relative strength and correlation of the various factors, Gries (2003) conducted a multifactorial analysis investigating the effect of more than 20 factors on the positioning of the particle. His analysis revealed that the position of the particle varies with a wide variety of linguistic factors: the length and complexity of the direct object, the meaning of verb and particle, the occurrence of a directional adverbial, the occurrence of an indefinite determiner, the NP type of the direct object, and several others. However, not all of the factors that previous studies proposed have a significant effect on particle placement. For instance, some researchers suggested that the animacy of the direct object influences the positioning of the particle, but Gries' analysis shows that if we partial out the effect of other semantic features that are related to animacy (e. g., concreteness), animacy does not have a significant effect on particle placement.

Adopting the approach that Gries has used in his analysis of the VPC in adult language, we conducted a multifactorial analysis of particle placement in early child speech. Previous studies have shown that children tend to place the particle after the direct object (cf. Hyams et al. 1993; Broiher et al 1994; Bennis et al. 1995; Sawyer 2001), suggesting that children's use of the VPC deviates from its use in adult language; however, our data show that the particle appears in both positions very early. This raises the interesting question whether young children process the factors determining the placement of the particle? More generally one might ask, do children use the two particle positions productively? In what follows we report the results of a corpus-based analysis investigating the occurrence of different particle positions in early child speech.

2. Data

Our analysis is based on observational data from two English-speaking children aged 1;6 to 2;3. The data are taken from the CHILDES archives, a large computerized database of spontaneous child language (cf. MacWhinney 2000). The two children we examined are well-known from the literature: Peter is one of the children that Lois Bloom (1973) examined in her classical study, and Eve is one of the three children that Roger Brown (1973) investigated.

In a first step, we searched for all child utterances including one of 15 particles that frequently occur in the VPC (cf. Frazer 1976; Gries 2003). Only ten of the 15 particles appeared in the data: *up*, *down*, *on*, *off*, *in*, *out*, *back*, *away*, *over*, and *around*. Since all of these particles have multiple functions, our initial search did not only include VPCs, but also several other constructions, which we grouped into the five classes:

1. Transitive verb particle constructions (i. e., VPCs), consisting of a transitive verb, a particle, and a direct object.
2. Intransitive verb particle constructions, consisting of an intransitive verb and a particle.
3. Predicative verb particle constructions, consisting of the copula *be* and a particle.
4. Fragmented particle constructions, consisting of a noun and a particle or an isolated particle in a one-word utterance.³
5. Prepositional constructions, consisting of a prepositional phrase that may or may not be embedded in a clause.

Examples of the various constructions are given in (17) to (21). Table 1 shows how frequently each construction occurs in the data.

(17) He picked me up. [Transitive verb particle construction]

(18) He walked away. [Intransitive verb particle construction]

Table 1. *Frequency of particle and prepositional constructions*

	Peter	Eve	Total	Mean %
Transitive	291	281	572	22.4
Intransitive	232	256	488	19.0
Predicative	17	25	42	1.6
Fragmented	130	70	200	8.0
Prepositional	519	754	1273	49.1
	1189	1386	2575	100.0

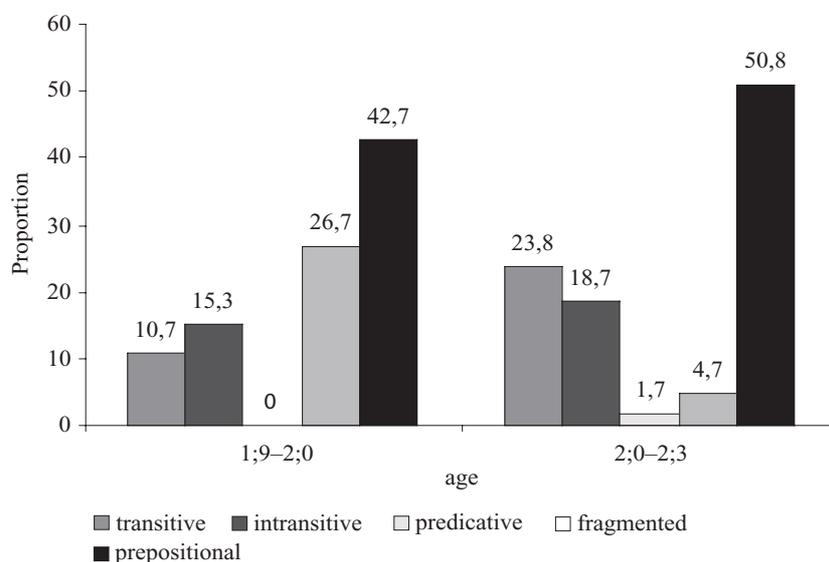


Figure 1. *Mean proportion of the various particle and prepositional constructions at different ages*

- (19) I am back. [Predicative verb particle construction]
 (20) a. Shoes on. [Fragmented verb particle constructions]
 b. Down! [Fragmented verb particle constructions]
 (21) Put it on the table. [Prepositional construction]

As can be seen in this table, the data include 572 instances of the VPC, which accounts for an average of 22.4% of the five constructions we examined. The vast majority of the VPCs appear after the second birthday. Figure 1 shows the development of the various constructions during the time period we examined (the numbers on which this figure is based are given in Table 1A in the appendix).

As can be seen from this figure, up to the age of 2;0, a large proportion of the children's particles occur in fragmented particle constructions; they account for an average of 26.7% of the early data, while only 10.7% occur in the VPC. As the children grow older, the proportions change: fragmented particle constructions become less frequent, while the proportion of the VPC raises to a level of 23.8%.

If we consider the fragmented particle constructions more closely, we find that most of them express the same meaning as a VPC. For instance,

Table 2. *The occurrence of an overt direct object in the VPC*

	Peter	Eve	Total	Mean %
Overt object	210	240	450	78.8
No overt object	81	41	122	21.1
Total	291	281	572	100.0

Table 3. *Particles in the VPC*

	Peter Frequency	First	Eve Frequency	First	Total Frequency	Mean %
<i>on</i>	59	2;0	49	1;7	108	18.9
<i>off</i>	73	1;11	33	1;9	106	18.4
<i>back</i>	61	1;11	39	1;9	100	17.5
<i>up</i>	21	1;11	44	1;7	65	11.5
<i>in</i>	9	1;11	46	1;9	55	9.8
<i>away</i>	19	1;11	35	1;9	54	9.5
<i>out</i>	24	1;11	19	1;8	43	7.6
<i>down</i>	20	1;10	13	1;10	33	5.8
<i>over</i>	5	1;9	2	2;3	7	1.2
<i>around</i>	0	—	1	2;1	1	0.2
	291		281		572	100.0

a one-word utterances such as *Down!* is readily interpreted as *Put me down!* or *Put it down!* (depending on the discourse context), and a fragmented utterances such as *Shoes on!* can be paraphrased by a complete utterance such as *Put the shoes on!*. Assuming this analysis, Tomasello (1987) suggested that children grasp the meaning of the VPC before they master their form (cf. Tomasello 1987). Additional support for this hypothesis comes from the fact that children frequently omit the direct object in the VPC (cf. Sawyer 2001). Table 2 shows that a mean proportion of 21.1% of the children's VPCs does not include an overt object.

The earliest VPCs appear between the ages of 1;7 and 2;0. They involve all of the above mentioned particles except for *around*, which occurs only once in a VPC in the entire corpus. Table 3 shows the frequency of the various particles in the VPC and the age of their first appearance.⁴

On, *off* and *back* are the most frequent particles, followed by *up*, *in*, *away*, *out*, and *down*; *over* and *around* have only a few tokens. The ten particles appear with 38 different verbs. Most of them have just a few tokens. Table 4 lists the ten most frequent verbs that occur in the VPC.

Table 4. *The ten most frequent verbs in the VPC*

	Peter	Eve	Total in VPCs	Total in the entire corpus
<i>put</i>	120	144	264	597
<i>take</i>	72	30	102	178
<i>turn</i>	48	1	49	111
<i>blow</i>	0	20	20	33
<i>get</i>	4	14	18	447
<i>have</i>	1	14	15	429
<i>push</i>	6	8	14	41
<i>pick</i>	6	6	12	26
<i>move</i>	8	0	8	42
<i>pull</i>	1	6	7	25
	291	281	572	1929

As can be seen in this table, *put* is by far the most frequent verb that the children use in the VPC; it accounts for almost half of the ten most frequent verbs that appear in this construction. Apart from *put*, *take* is quite frequent in the VPC. If we compare the frequency of these verbs in the verb-particle construction with their occurrence in other construction types, we find that some of them are especially frequent in the VPC, while others appear primarily in other grammatical constructions. For instance, 44.2% of all instances of *put* occur in the VPC, but only 3.5% of all occurrence of *have* appear in the verb-particle construction.

3. Variables

For the statistical analysis we excluded all utterances in which the direct object had been omitted and distinguished two types of VPCs based on the position of the particle:

1. VPCs in which the particle follows the direct object (V NP P).
2. VPCs in which the particle precedes the direct object (V P NP).

Table 5 shows the frequency distribution of the two particle positions.

As can be seen in this table, the particle predominately follows the direct object. A mean proportion of 93.5% of all VPCs include the particle after the direct object, and only an average of 6.5% include the particle between verb and direct object. The occurrence of the latter is restricted to four particles: *up*, *on*, *off*, and *out*; all other particles occur exclusively after the direct object.

With two exceptions, all VPCs in which the particle precedes the direct object appear only after the second birthday. Thus, in accordance with

Table 5. Frequency of the different particle positions in the VPC

	Peter	Eve	Total	Mean %
V NP P	195	226	29	93.5
V P NP	15	14	421	6.5
	210	240	572	100.0

previous studies (cf. Hyams et al. 1993; Broiher et al. 1994; Bennis et al. 1995; Sawyer 2001), our data suggest that in the earliest VPCs the particle always follows the direct object; however, by the age of 2;0 children begin to use the particle in both positions (cf. Tomasello 1992: 173).

Interestingly, the data include four utterances with two particles that frame the direct object.

- (22) You put on lipstick on. [Eve 2;1]
 (23) I do it turn on the light on. [Peter 2;1]
 (24) Taking off one my roller skates off [Peter 2;3]
 (25) Turn on a light off. [Peter 2;0]

As can be seen in (22) to (25), in three of the four utterances, the initial particle is repeated after the direct object (cf. examples 22–24); in the fourth case (cf. example 25), the two particles are different. Since these constructions deviate from the dominant pattern, the utterances in (22) to (25) have been grouped together with the VPCs in which the particle precedes the direct object.

All utterances were coded for six factors: (i) the length of the direct object, (ii) the complexity of the direct object, (iii) the NP type of the direct object, (iv) the meaning of the particle, (v) the occurrence of a definite or indefinite determiner, and (vi) the occurrence of a directional adverbial. All six factors vary significantly with particle placement in adult language (cf. Gries 2003).⁵ In what follows we discuss the coding of the six factors in turn.

The first factor, the *length* of the direct object, is measured in terms of the number of words included in the direct object. Some studies also considered the number of syllables (cf. Chen 1986; Gries 2003), but since the two measures had roughly the same effect in Gries' study, we decided to use only one of them. All VPCs were assigned to one of four levels:

1. VPCs in which the object consists of one word.
2. VPCs in which the object consists of two words.

3. VPCs in which the object consists of three words.
4. VPCs in which the object consists of four or more words.

The second factor, the *complexity* of direct object, comprises three levels:

- 2a. Simple NPs, consisting of a pronoun, a bare noun, or a noun and a determiner.
- 2b. Intermediate NPs, consisting of a noun and a second lexical element: an adjective, a genitive attribute, a prepositional phrase, or a coordinated NP.
- 2c. Complex NPs, i. e., NPs including a relative clause.

Most studies consider the complexity of the direct object a syntactic factor (cf. Hawkins 1994; Gries 2003), but the syntactic complexity of a noun phrase correlates closely with its meaning. For instance, a noun phrase consisting of a noun and a relative clause is both syntactically and semantically complex: its syntactic complexity is due to the fact that it involves embedding, and its semantic complexity arises from the fact that the embedded clause contains a separate proposition (cf. Diessel and Tomasello 2000; see also Diessel 2004). Thus, the complexity of the direct object concerns both syntactic and semantic features.

The third factor, the *NP type* of the direct object, reflects syntactic and pragmatic properties of the direct object. As pointed out in many studies, if the object is pronominal the particle has to follow it. However, this only holds for unstressed personal pronouns; stressed personal pronouns as well as demonstrative pronouns and indefinite pronouns, which are typically stressed, can in principle follow the particle like lexical NPs. Since our data do not provide phonetic information we were not able to distinguish between stressed and unstressed pronouns. Instead, we divided all pronouns into two classes based on their typical stress features: (1) personal pronouns, which are typically unstressed, and (2) all other pronouns, notably demonstratives and indefinites, which are typically stressed:

1. Personal pronouns
2. Other pronouns
3. Lexical NPs

The fourth factor is concerned with the *meaning* of the particle. As Chen (1986), Gries (2003) and others have shown, in VPCs in which verb and particle have idiomatic meaning, the particle tends to precede the direct object, whereas in VPCs in which verb and particle have spa-

tial meaning, the particle tends to follow it. Bolinger (1971) argued convincingly that the meaning of verb and particle is more accurately described as a continuum ranging from VPCs expressing spatial concepts to VPCs with highly idiomatic meanings; however, for the purpose of this study we divided the continuum into two categories:

1. VPCs in which the particle has spatial meaning.
2. VPCs in which the particle has non-spatial meaning.

The fifth factor, the (*in*)*definiteness* of the direct object, concerns only lexical NPs. Pronominal objects do not occur with an (in)definite determiner. However, since the multifactorial analysis requires that all utterances be assigned to a specific level, we also coded pronominal NPs. They were grouped together with bare nominals. Thus we distinguished three levels:

1. NPs including a definite determiner, i. e., a definite article, a demonstrative, or a possessive determiner.
2. NPs including an indefinite determiner, i. e., an indefinite article or an indefinite quantifier such as *some* or *any*.
3. NPs that do not include a determiner, i. e., pronouns and bare nouns.

Finally, the sixth factor measures the effect of a *directional adverbial* on the position of the particle. A number of studies have shown that in adult language, the occurrence of a directional adverbial increases the probability that the particle follows the direct object (cf. *put down the pen* vs. *put the pen down on the table*) (cf. Fraser 1974; Chen 1986; Gries 2003). Two levels are distinguished:

1. VPCs that include a directional adverbial.
2. VPCs that do not include a directional adverbial.

4. Results

We analyzed the data in two steps. In the first step, we considered each factor in isolation. More precisely, we conducted chi-square analyses examining the associations between the six predictor variables and the position of the particle. Because of the small sample size of one of the two positional patterns (i. e., V P NP) we only used exact chi-square tests. If the research design for a specific factor was larger than a 2×2 table, we compared observed and expected values and analyzed adjusted standardized residuals.⁶

In the second step, we conducted a multifactorial analysis. Specifically, we used a logistic regression studying the effect of the various factors on

particle placement when they act together. The logistic regression reveals possible associations between the predictor variables and indicates how strongly each one of them varies with the positioning of the particle. Since an exact logistic regression was computationally infeasible, we used a Monte Carlo sampling approach of the logistic regression (LogXact 5).

Pre-examination of the data revealed no significant difference between the two children, suggesting that Peter and Eve used the VPC in the same way.

4.1. Monofactorial analysis

Table 6 shows the distribution of the two particle positions relative to the length of the direct object. As can be seen in this table, in the majority of the children's VPCs the direct object consists of only one or two words. Objects including more than two words account for only 3.1% of the data.⁷

If we compare the length of the direct object in the two groups, we find that it varies with the position of the particle. The average length of the direct object is 2.1 words when the particle precedes it, and 1.3 words when the particle follows it. The difference is highly significant ($t(448) = -6.96$; $p < .001$). Moreover, the chi-square analysis of the cross-patterning reveals a significant association between the length of the direct object and the position of the particle ($\chi^2(3) = 57.56$; $p < .001$).

Table 7 shows the distribution of the two particle positions relative to the complexity of the direct object. Most object NPs are not only short but also simple: 96% of the children's VPCs include a simple direct object consisting of a pronoun, a bare noun, or a noun and a determiner, 3.6% include an intermediate NP containing at least two lexical elements, and only two VPCs include a complex object containing a relative clause.

Table 6. *Distribution of particle position relative to length*

	VP NP P		VP P NP		Total
	Frequency	Residuals	Frequency	Residuals	
1 word	279	5.7	4	-5.7	283 (62.9%)
2 words	133	-3.7	20	3.7	153 (34.0%)
3 word	9	-4.8	4	4.8	13 (2.9%)
4 words	0	-3.8	1	3.8	1 (0.2%)
	421		29		450

Table 7. *Distribution of particle position relative to complexity*

	VP NP P		VP P NP		Total
	Frequency	Residuals	Frequency	Residuals	
simple	406	1.8	26	-1.8	432 (96.0%)
intermediate	15	.0	1	.0	16 (3.6%)
complex	0	-5.4	2	5.4	2 (0.4%)
	421		29		450

Table 8. *Distribution of particle position relative to NP type*

	VP NP P		VP P NP		Total
	Frequency	Residuals	Frequency	Residuals	
Personal PROs	200	5.0	0	-5.0	200 (44.4%)
Other PROs	47	.7	2	-.7	49 (10.9%)
Lexical N	174	-5.4	27	5.4	201 (44.7%)
	421		29		450

Although the data include only very few complex and intermediate NPs, the overall result of the chi-square analysis is significant ($\chi^2(2) = 29.16$; $p < .004$). However, as can be seen from the adjusted standardized residuals, the effect is mainly due to the two complex NPs, which both follow the particle. If we collapse intermediate and complex NPs the result of the chi-square analysis is not significant ($\chi^2(1) = 3.25$; $p > .102$).

Table 8 shows the distribution of the two particle positions relative to the NP type of the direct object. Both pronominal and lexical NPs are very common. The vast majority of the pronominal NPs are personal pronouns; all other pronominal elements are much less frequent.

The overall distribution of the different NP types is highly significant ($\chi^2(2) = 30.51$; $p < .001$). The adjusted standardized residuals show that personal pronouns occur more often than expected if the particle follows the direct object, while lexical nouns occur more often than expected if the particle precedes the direct object. The distribution of other pronouns is similar in both groups.

Table 9 shows the distribution of the two particle positions relative to the meaning of the particle. Overall, particles with spatial meaning are much more frequent than particles with non-spatial meanings: 80.4% of

Table 9. *Distribution of particle position relative to meaning*

	VP NP P		VP P NP		Total
	Frequency	Residuals	Frequency	Residuals	
Spatial	345	3.1	17	-3.1	362 (80.4%)
Non-spatial	76	-3.1	12	3.1	88 (19.6%)
	421		29		450

Table 10. *Distribution of particle position relative to (in)definiteness*

	VP NP P		VP P NP		Total
	Frequency	Residuals	Frequency	Residuals	
Definite	90	-2.5	12	2.5	102 (22.7%)
Indefinite	25	-4.3	8	4.3	33 (7.3%)
No determiner	305	4.7	9	-4.7	315 (70.0%)
	421		29		450

the children's VPCs include a spatial particle and only 19.6% include a particle with non-spatial meaning.

The statistical analysis reveals a significant association between the meaning of the particle and its position ($\chi^2(1) = 9.385$; $p < .004$). Non-spatial particles precede the direct object more often than particles with spatial meaning.

Table 10 shows the distribution of the two particle positions relative to the occurrence of an (in)definite determiner. Overall, the data include 102 VPCs in which the direct object is marked by a definite determiner, and 33 VPCs in which the direct object occurs with an indefinite determiner. In all other VPCs, the direct object does not include a determiner, mainly because the object is pronominal.

The chi-square analysis is highly significant ($\chi^2(2) = 28.85$; $p < .001$). However, as can be seen from the adjusted standardized residuals, the effect is mainly due to the fact that NPs without a determiner pattern differently from NPs including a determiner. Since the original hypothesis concerns the occurrence of a determiner (see above) we conducted a second chi-square analysis in which we excluded the 'no determiner NPs'. The analysis revealed no significant association between particle position and determiner type ($\chi^2(1) = 3.076$; $p > .094$), suggesting that (in)definiteness marking (by a determiner) does not vary with particle placement in early child speech.

Table 11. *Distribution of particle position relative to directional adverbial*

	VP NP P		VP P NP		Total
	Frequency	Residuals	Frequency	Residuals	
No PP	409	-.9	29	.9	438 (97.3%)
PP	12	.9	0	-.9	12 (2.7%)
	421	29		450	

Finally, Table 11 shows the distribution of the two particle positions relative to the occurrence of a directional adverbial. Overall, there are only 12 VPCs including a directional adverbial in the entire corpus.

Although all directional adverbials occur in VPCs in which the particle follows the direct object, the occurrence of a directional adverbial is not significantly associated with the position of the particle ($\chi^2(1) = .849$; $p < .622$). This is probably because of the small sample size of VPCs including a directional adverbial.

To summarize the results thus far, four of the six factors we examined vary with the position of the particle if we consider them in isolation: the length of the direct object, the complexity of the direct object, the NP type of the direct object, and the meaning of the particle. In addition we found that NPs including a determiner follow the particle significantly more often than NPs without a determiner. However, this is mainly due to the fact that most of the NPs without a determiner are pronouns, which generally precede the particle. If we only consider lexical NPs including a determiner, the chi-square analysis does not yield a significant result, suggesting that (in)definiteness marking is not relevant to the positioning of the particle in early child speech. Moreover, the occurrence of a directional adverbial is not associated with the position of the particle. Although directional adverbials occur exclusively in VPCs in which the particle follows the direct object, the chi-square analysis does not yield a significant result, probably because VPCs including a directional adverbial are very rare in the data.

4.2. *Multifactorial analysis*

The monofactorial analysis shows that children's use of the particle varies with some of the most important factors that are correlated with particle placement in adult language. This suggests that children recognize at least some of the factors that influence adult speakers' decision to place the particle in a particular position. However, since some of the factors we examined may be confounded we also conducted a logistic

Table 12. *Result of the logistic regression analysis of particle placement as a function of the predictor variables length, complexity, meaning, NP type, (in)definiteness, and directional PP*

Factor	Odds ratio		p value
NP type	lexical Ns vs. personal PROs	= 72.46	.001
	other PROs vs. personal PROs	= 22.04	.029
	lexical Ns vs. other PROs	= 3.29	.156
Meaning	spatial vs. non-spatial	= 7.1	.001

regression. The aim of the logistic regression is to find the most parsimonious set of predictor variables that explain the most variation in the response variable, i. e., the position of the particle. To select the best model we first entered all predictor variables in the equation and then removed sequentially non-significant factors. The best model selected is shown in Table 12.^{8, 9}

As can be seen from this table, only two of the four factors that showed a significant association with particle placement in the chi-square analysis yield a significant result in the logistic regression, the NP type of the direct object and the meaning of the particle.¹⁰ If we consider the different levels of the NP type, we find a sharp contrast between lexical nouns and personal pronouns, which are strongly associated with different particle positions. Moreover, personal pronouns and all other pronouns are associated with different particle positions, but the association is weaker. Finally, lexical nouns and other pronouns are not associated with different particle positions.

The effect size of the overall model measured by Nagelkerkes R^2 is .315. If we remove the effect of the NP type from the model, the effect size reduces dramatically to Nagelkerkes $R^2 = .045$; however, if we remove the effect of the second significant factor, i. e., the meaning of the particle, the effect size reduces much less to Nagelkerkes $R^2 = .223$, suggesting that the NP type of the direct object has more predicative power than the meaning of the particle.

The two other factors that yielded significant results in the monofactorial analysis, the length and complexity of the direct object, are closely associated with the NP type of the direct object (NP type vs. length: $\chi^2(6) = 294.50$; $p < .001$; NP type vs. complexity: $\chi^2(4) = 23.23$; $p < .001$).

5. Discussion

Overall, the results of our study are consistent with Gries' analysis of particle placement in adult language. The positioning of the particle var-

ies with the NP type of the direct object and the meaning of the particle; both factors have a significant effect on adult speaker's use of the particle. However, there are also some differences between the results of Gries' study and our analysis of particle placement in early child language.

First, in Gries' data both positions of the particle are common; overall, his data include approximately the same proportion of particles that precede the direct object and particles that follow it. However, there is a significant difference between spoken and written registers in adult language. In spoken adult language, about two-thirds of all particles follow the direct object and only one-third precedes it. In written adult language, the proportions are reverse: about two-thirds of all particles precede the direct object and only one-third follows it. Since child language is spoken language, one would expect that the particle tends to follow the direct object in early child speech. However, the proportion of particles that children place after the direct object is much higher than in spoken adult language: 66.5% of all particles occur after the direct object in Gries' spoken data, whereas 93.5% of all particles follow the direct object in our data.

Second, while Gries found a wide variety of factors that vary with the position of the particle, we found only two factors that are associated with particle placement in early child language, the NP type of the direct object and the meaning of the particle. In adult language, the position of the particle is also associated with the length and complexity of the direct object, with the occurrence of an (in)definite determiner, with the occurrence of a directional adverbial, and with several other factors. While some of these factors, notable the length and complexity of the direct object, yielded significant results in the monofactorial analysis, the logistic regression suggests that these factors were only significant in the chi-square analyses because they are associated with the NP type of the direct object: pronominal NPs are short and simple, while lexical NPs are longer and more complex.

How do we interpret these results? Do the children of our study use the two particle positions productively? If we look at the ambient language we basically find the same positional patterns as in early child speech. Parallel to our analysis of the children's data, we collected the VPCs from the mothers' data. The mothers' VPCs were coded in the same way as the VPCs of their children. Like Peter and Eve, their mothers use the particle predominantly after the direct object when they talk to their children: a mean proportion of 92.6% of the mothers' VPCs include the particle after the direct object, and only 7.3% include the particle between verb and direct object. What is more, the alternating position of the particle varies with the same factors as in the children's

Table 13. *Results of the chi-square analysis of the mothers' data*

Factor	value	df	p-value
Length	45.33	3	.001
Complexity	45.21	2	.001
NP type	53.14	2	.001
Meaning	36.42	1	.001
(In)definiteness	31.74	2	.001
Directional adverbial	6.72	1	.011

data. The statistical analysis of the mothers' VPCs yield basically the same results as the analysis of the children's VPCs. In the monofactorial analysis, all six factors are significant in the mothers' data, including the occurrence of a directional adverbial, which was not significant in the children's data. Table 13 summarizes the results of the chi-square analyses.

In the multifactorial analysis, only two factors are significant, the NP type of the direct object and the meaning of the particle. Thus, while Gries' analysis revealed significant associations between particle placement and a wide variety of linguistic factors, our data show that in child directed speech most of these factors are not associated with the position of the particle. The only factors that vary with the position of the particle in the mothers' data are the ones that are significantly associated with particle placement in the children's speech.

The parallelism between the children's data and the ambient language may suggest that children imitate or rote-learn the positional patterns of particular verb-particle combinations. However, if we look at the children's data more closely we find no evidence for this hypothesis. In a subset of the children's VPCs, gathered from six randomly selected files (three from each child), we did not find a single instance of direct imitation. While the children occasionally repeated a VPC from their own speech, they did not rely on an immediately preceding adult model, suggesting that imitation does not account for the parallelism between the children's and the mothers' data.

Moreover, both children used a wide variety of verb-particle combinations. Overall, there were 65 different types of verb-particle combinations in Peter's data, and 83 different types in Eve's data. Since most of them have just a few tokens, it is highly unlikely that the children memorize the positional pattern of each verb-particle combination.

Finally, there are a number of verb-particle combinations that the children used with both positional patterns (often within the same file) (cf. examples 28–36).¹¹

- | | | | |
|------|----|-----------------------------|-------------|
| (28) | a. | Pick them up. | [Peter 2;0] |
| | b. | Pick up my cup. | [Peter 2;1] |
| (29) | a. | Turn the light on. | [Peter 2;1] |
| | b. | Turn on a light. | [Peter 2;0] |
| (30) | a. | Don't take a wheels off. | [Peter 2;0] |
| | b. | Take off wheels. | [Peter 2;0] |
| (31) | a. | I can blow it up. [Eve 2;1] | |
| | b. | I want blow up this. | [Eve 2;1] |
| (32) | a. | You wipe it up. | [Eve 2;2] |
| | b. | He wiping up that I spill. | [Eve 2;2] |
| (33) | a. | Gloria picking her up. | [Eve 2;3] |
| | b. | Picking up leaves. | [Eve 1;10] |
| (34) | a. | Put their hats on. | [Eve 2;2] |
| | b. | She putting on her coat. | [Eve 2;2] |
| (35) | a. | Turn that on. | [Eve 2;3] |
| | b. | You turn on the fan. | [Eve 2;1] |
| (36) | a. | I take that off. | [Eve 2;0] |
| | b. | I take off my socks. | [Eve 2;2] |

While it is possible that children memorize both particle positions in some of these cases, we believe that the variation is so extensive that rote-learning cannot account for all of the data. In other words, we suspect that children are sensitive to at least some of the factors determining particle placement in adult language.

That does not mean that children's use of particle placement is fully productive. Some of the children's verb-particle combinations are so frequently used with the same positional patterns that it is reasonable to assume that children learn these frequent patterns with a fixed particle position (cf. Tomasello 1992: 171–175). For instance, Peter's data include 37 VPCs in which *put* is combined with the particle *back*. In all 37 utterances, the particle occurs in final position, regardless of the NP-type, length, and complexity of the direct object. Other frequently occurring formulas that always occur with the particle in final position include *put _ down* (Peter 13 tokens), *put _ back* (Eve 36 tokens), *put _ in* (Eve 33 tokens), *put _ away* (Eve 25 tokens), and *have _ on* (Eve 14 tokens). All of these constructions are so frequent that they are likely to be stored as fixed expressions. Thus, while some of the children's VPCs seem to involve the productive use of particle placement, others appear to be

associated with an invariable particle position. Productive patterns and fixed formulas coexist in the child's mental grammar (cf. Diessel 2004: Chapter 2).

Let us finally ask why the children, as well as their parents, placed most of the particles after the direct object and why only two of the six factors we examined are associated with particle placement in our data. We suspect that the particle predominantly follows the direct object because most of the particles have a spatial meaning in our data: 80.4% of the children's VPCs include a spatial particle and 89.1% of the mothers' VPC have a spatial meaning. By contrast, only 38.0% of the particles in Gries' study are spatial (cf. Gries 2003:87). Since spatial particles tend to follow the direct object, the frequent occurrence of spatial particles provides a straightforward explanation for the high proportion of final particles in our corpus.

Moreover, our data include a very high proportion of short and simple object NPs. The object NPs in Gries' study, notably the ones in the written corpus, are longer and more complex. Since short and simple NPs tend to precede the particle, these factors support the predominance of final particle position in our data. Further, it may explain why these factors are not significant in the statistical analysis. In order to be able to measure the length and complexity of the direct object the corpus must include a large proportion of long and complex NPs. The same holds true for the two other factors that did not vary with the position of the particle: Although the particle generally followed the object when the VPC included a directional adverbial, the occurrence of a directional adverbial was not significant because there were only a few directional adverbials in the corpus. Similarly, the relatively small number of indefinite NPs might explain why this factor was not significant. However, if these factors would really influence the child's placement of the particle cannot be determined based on our data.

In sum, our analysis suggests that children's early use of the VPC is partially productive. While there are some frequent verb-particle combinations in which the particle is associated with a particular position, it is unlikely that children memorize the positioning of the particle in each of the many VPCs they produce. Rather, we suspect that children as young as two years of age are able to process at least some of the factors influencing particle placement in adult language. In order to test this hypothesis, we are now planning to conduct a series of experiments.

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Notes

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1. The VPC must be distinguished from constructions including a prepositional phrase. In contrast to particles, prepositions generally precede the associated noun phrase; cf. *He walked up the hill* – **He walked the hill up*.
2. For some discussion of the information status of discourse referents see Prince (1981).
3. One-word utterances such as *Down!* or *Up!* could in principle be seen as fragmented prepositional constructions; however, there are two reasons why we classified them as particles: First, one-word utterances carry stress accent, which is characteristic of particles but not of prepositions, and second, most one-word utterances have the same communicative function as verb-particle constructions (see below).
4. Table 3 shows only the frequencies of the various particles in the VPC, i.e., the four other constructions we examined in the preliminary analysis are disregarded.
5. Another factor that is associated with particle placement is stress (see above). Since our data do not provide phonetic information we were not able to examine the effect of stress on children's use of the particle. However, some of the factors we investigate tend to correlate with stress (e.g., NP type; see below).
6. An exact chi-square test is based on the calculation of the exact probability of a given chi-square test statistic and should be calculated when sample size or some of the expected values are small (Mundry and Fischer 1998). The exact chi-square test is computed similarly to the Fischer's Exact Test but not restricted to 2×2 tables; moreover, it uses the more appropriate underlying assumption of a product binomial distribution.
7. The adjusted standardized residuals indicate the degree to which a particular category deviates from the expected frequency: if > 2 (or < 2) the frequency is higher (or lower) than expected by chance.
8. Since the results of the analysis did not change when we included 'child' as a factor, we collapsed the data of the two children.
9. The odds ratio indicates the probability of a particular category to follow the particle compared to another category. For instance, lexical nouns are 72.46 times more likely to follow the particle than personal pronouns.
10. Since our analysis is based on relatively little data we did not compute the interactions of predictor variables.
11. Overall, there are 159 verb-particle combinations in which the particle occurs in both positions. Based on these data, we conducted a second logistic regression revealing a significant association between the position of the particle and the NP-type of the direct object; the meaning of the particle was not significant, probably because of the small sample size.

Appendix

Table A1. Mean proportions of the various particle and prepositional constructions at different ages

	1;6–1;11			2;0–2;3		
	Peter	Eve	Mean	Peter	Eve	Mean
Transitive	3	91	10.7	288	190	23.8
Intransitive	10	103	15.3	222	153	18.7
Predicative	0	0	0.0	17	25	1.7
Fragmented	45	55	26.7	85	15	4.7
Prepositional	49	240	42.7	484	514	50.8

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