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10 Acquiring particle placement in English: A corpus-based perspective*

Stefan Th. Gries[a]

1 Introduction

1.1 General introduction

One of the most challenging areas for infants acquiring English as their native language are multi-word verbs: There are many different kinds of such verbs – e.g., prepositional verbs, phrasal verbs, phrasal-prepositional verbs, verb-adjective combinations, in Quirk *et al*'s (1985) terminology – and they come with different kinds of semantic and syntactic patterns. One particularly multi-faceted type are transitive phrasal verbs, which exhibit the constituent order called particle placement (henceforth PrtPlc) exemplified in (1):

(1) (a) He $[_{VP}$ picked $[_{Prt}$ up] $[_{DirObj}$ the book]] V-Prt-DirObj
      (b) He $[_{VP}$ picked $[_{DirObj}$ the book] $[_{Prt}$ up]] V-DirObj-Prt

Not only can the same situation be described by two constituent orders, but the choice of constituent order is also nearly completely unconscious and influenced by many different variables. For instance, in the probably most comprehensive study of PrtPlc, Gries (2003a) has shown that the likelihood of V-Prt-DirObj significantly increases with

- phonological variables: long and/or contrastively stressed direct objects;
- syntactic variables: syntactically complex and indefinite determiners;
- semantic variables: abstract referents of the direct object and non-spatial meanings of verb-particle constructions (henceforth VPCs);

a   Stefan Th. Gries is Full Professor of Linguistics at the University of California, Santa Barbara. E-mail: stgries@linguistics.ucsb.edu

- discourse-pragmatic variables: new/uninferrable referents of the direct object.

(Cf. also Bolinger 1971.)

These factors influence PrtPlc strongly and significantly and are interrelated such that they can all be (a) related to how amounts of processing effort drive speakers' constructional choices; and (b) integrated into an interactive activation model of linguistic processing (cf. Gries 2003a, in particular Chapter 4 and pp. 159–161). Prototypically, the direct object of a V-Prt-DirObj construction is harder to process because it involves a new referent, which incurs more processing effort than a given one, with an indefinite determiner marking its newness, maybe with additional modification (increasing its length and complexity, etc.). By contrast, the prototypical direct object of a V-DirObj-Prt construction is an easy-to-process given and short pronominal object.

Some additional factors influencing PrtPlc that were uncovered later are also related to psycholinguistic processing. For example,

- PrtPlc is subject to priming effects: the occurrence of V-Prt-DirObj increases the likelihood of another such construction later in the discourse/text (Gries 2005);
- rhythmic alternation (Couper-Kuhlen 1986; Schlüter 2003) appears to play a role such that V-Prt-DirObj is preferred if it results in a sequences of one stressed and maximally two unstressed syllables (Gries 2007);
- on the basis of Gries's (2003a) data, Schnoebelen (2008) uses information-theoretic entropy-based measures inspired by Moscoso del Prado Martín to quantify the degree of compositionality of phrasal verbs, which in turn is a significant predictor of PrtPlc. (Schnoebelen refers to Moscoso del Prado Martín for how such measures relate to processing.)

A few other studies, however, have found determinants of PrtPlc that are not as easily subsumed under a single processing/activation-related hypothesis. For example, Browman (1986) has argued there is a preference of particles beginning with a vowel and high-frequency phrasal verbs for V-Prt-DirObj.[1] In addition, she points out individual lexically-specific preferences such that *up* and in particular *pick up* have a special preference for V-Prt-DirObj (cf. also Bolinger 1971: 10), and later corpus-based work has shown more comprehensive evidence for verb-specific preferences (cf. Gries and Stefanowitsch's 2004 distinctive collexeme analysis and

Schnoebelen 2008, where verb-specificity is included in a mixed-effects model).

Despite the complexity of the use of these constructions, there is very little work on the acquisition of PrtPlc. In this paper, I will examine data from the CHILDES set of corpora to explore some aspects of this alternation. More specifically, after a brief review of previous studies in §1.2, §2 describes the data selection and coding procedures. §3 discusses the results separately for each child. Finally, §4 concludes. One caveat is in order, however, which has to do with the facts that (a) PrtPlc is determined by at least two dozen highly interrelated factors; and that (b) the construction in (1a) is much rarer than that of (1b), which is why the results of this paper must be considered a starting point rather than a comprehensive analysis.

1.2 Previous studies

As mentioned above, there are only few empirical studies of the acquisition of PrtPlc. One robust finding is that V-DirObj-Prt appears in children's speech earlier and more often than V-Prt-DirObj. This finding may seem surprising because, as Gries (2003a: 141f) has shown, V-Prt-DirObj

- instantiates the cognitively basic scenario of transitive events, in which an agent acts on a patient (cf. Hopper and Thompson 1980);
- has the optimal configuration for parsing because the particle need not be kept in working memory until the direct object's processing has been completed;
- is less marked because the only near-categorical distributional restriction on its use is that it cannot occur with pronominal direct objects (and even that is not completely categorical, since V-Prt-DirObj is possible with contrastively-stressed pronominal direct objects,V-Prt-DirObj is possible);
- Dehé (2000) and Peters (2001) found that native speakers who are asked to combine words into a VPC more frequently create V-Prt-DirObj.

Nevertheless, studies unequivocally report a strong early preference for V-DirObj-Prt, in what Hyams *et al.* (1993) and Broihier *et al.* (1994) called the "stranded particle stage" (based on data for Eve, Sarah (Brown 1973) from the CHILDES archive and an additional unspecified child; cf. also Sawyer 2001). While these studies' focus on English and other Germanic VPCs from the perspective of Government and Binding Theory limits their relevance to this study, Broihier *et al.* (1994: 8) do also briefly comment

on the productivity of the alternation: "the alternation exists with individual particle verbs (e.g., *put on, pick up*), which argues against the view that the order of NP and particle is lexically governed by the choice of particular verbs."

The study closest in spirit to the present one is Diessel and Tomasello (2005), essentially a replication of Gries's (2003a) study of adult data to first language acquisition data. In 450 VPCs in the speech of Eve (Brown 1973) and Peter (Bloom 1973), Diessel and Tomasello observe 421 instances of V-DirObj-Prt (93.5%) but only 29 instances of V-Prt-DirObj (6.5%). They then code all VPCs for six different variables: the length, complexity, NP type, and definiteness of the direct object, the meaning of the particle, and the presence/absence of a directional adverbial. Just like Gries, they start out with a monofactorial analysis before turning to a multifactorial approach with a binary logistic regression.

Their monofactorial results are similar to Gries's (2003a): with some simplification, V-DirObj-Prt prefers short, simple, pronominal, or definite direct objects in constructions with spatial meanings whereas, on the whole, V-Prt-DirObj is associated with the opposite characteristics. The more sophisticated multifactorial approach, however, showed that, in the context of all variables, only NP type and spatial vs. non-spatial meaning are significantly correlated with the constructional choice. In addition, Diessel and Tomasello found that the caretakers' language exhibits the exact same patterning, both in terms of the constructions' frequencies and the question which factors are significantly correlated with PrtPlc.

Diessel and Tomasello (2005) broke interesting ground, and I follow their lead. However, given the little work on PrtPlc so far and the sparsity of their data – recall their mere 29 instances of V-Prt-DirObj – the field still needs additional exploration, but there are some ways in which I will depart from their approach. First, they conflated the data for their children, which is understandable given their objective of statistical modeling and data scarcity, but also rather untypical of acquisition studies because it hides potential differences between children; I will therefore study all children separately. Second, data scarcity also did not allow them to explore lexical effects in the two constructions in more detail, which is what I will attempt. Third, I will consider some phonological variables not previously examined and also informally explore the role of phrasal verb frequency. Finally, with regard to productivity, Diessel and Tomasello argue that, since the two children used many phrasal verbs and also phrasal verbs in both constructions, it does not make sense to assume the children's use is based on imitative rote-learning only:

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. (2005: 107)

However, in the absence of a clearly-defined operationalization of "extensive", this is somewhat speculative, and a superficial glance at data will in fact suggest the opposite, which is why I will explore this claim in more detail below. In sum, I will

- provide a descriptive overview of how transitive phrasal verbs are used on the basis of a larger corpus of VPCs;
- explore phonological and frequency variables that have so far received little attention in the scarce literature on the acquisition of VPCs;
- describe lexical variation in a larger corpus especially with an eye to degrees of productivity and with regard to children's first uses of V-Prt-DirObj.

2 Methods: Data and coding

This study is based on data from the CHILDES archive (cf. <http://childes.psy.cmu.edu/>), more specifically, on data from the Abe (Kuczaj 1976), Adam (Brown 1973), and Nina (Suppes 1974) corpora from the CHILDES databank. Instead of the raw data files, I used a version from the syntactically-annotated ReVerb database. The ReVerb project was supervised by Michael Israel during his postdoc at the Department of Psychology at the Max Planck Institute for Evolutionary Anthropology and aimed at providing a database of the development of verbal constructions in English-speaking children between (approximately) 1;6 and 5 years of age (cf. Michael Israel's website at <http://terpconnect.umd.edu/~israel/research.html>). In the original version of this database, multi-word verbs are annotated in terms of the verbs and prepositions/particles they involve; for example, the utterance *take your coat off* would be coded as involving the lexical material "$TAKE $P=OFF". While this annotation facilitates the identification of multi-word verbs, it does not reliably distinguish between intransitive prepositional verbs and transitive phrasal verbs. I therefore manually inspected a cleaned-up version of the ReVerb database by determining for each annotated verb that was

- produced by Abe (age range: 2;5.0 to 5;0.11), Adam (age range: 2;3.4 to 5;2.12), or Nina (age range: 1;11.16 to 3;3.8);
- lexically annotated as involving a "$P=";
- syntactically annotated as not being intransitive;

whether it constituted a transitive phrasal verb and, if so, which VPC. Given the messy nature of corpus data in general and language acquisition data in particular, several coding decisions merit brief mention here. The potentially most controversial of these is counting utterances such as (2) as VPCs:

(2) gonna put that umbrella on here (Nina, 2;9.26)

On the one hand, one may disagree and point out that *on here* can be replaced by *here* or *there*, yielding (3), which is not a VPC since it does not allow the alternation in question (cf. (4)).

(3) gonna put that umbrella here/there
(4) *gonna put here/there that umbrella

On the other hand, the children used *put on* as a phrasal verb as in, say, (5). Second, if a direct object becomes long/complex enough, even a "bipartite particle" such as *on here* can, in fact needs to, be preposed, as in the hypothetical example in (6).

(5) I put on a nightgown (Nina, 2;5.24)
(6) I put on here all the books that my parents had brought with them when they were last in Europe.

By analogy, I also included "bipartite particles" such as *back in* and *back on* as exemplified in (7) and six utterances with "tripartite particles" of the type in (8) in the data. (Naturally, the influence of a mere six such examples will be negligible.)

(7) you gonna put it back in? (Adam, 3;4.1)
(8) Mommy I'm gonna put it back in here (Nina, 3;0.10)

On the other hand, mostly I decided to err on the side of caution, especially when considering to count a tricky utterance as an instance of the (rarer) V-Prt-DirObj pattern. For example, utterances such as (9) could be a VPC with a direct object beginning with *this*, but also a case where a direct object has been omitted and *this* is used as a deictic accompanying a gesture, as in the hypothetical example of (10).

(9) put on this (Nina, 3;0.16)

(10) put the doll on this [pointing onto a table]

Similarly, utterances such as (11) look like a VPC but I have considered them an elided version of something like (12).

(11) get out my chair (Adam, 3;11.14)
(12) get out of my chair

After the VPCs were retrieved as mentioned above, they were manually annotated for several variables. Since the number of matches was too large to annotate all, I annotated

- all instances of V-Prt-DirObj; and
- a number of instances of V-DirObj-Prt such that I coded minimally one randomly chosen instance in each recording and maximally as many pseudo-randomly chosen instances as the recording contributed proportionally to all instances of V-DirObj-Prt for each child; the choice was *pseudo*-random because, when the next randomly-chosen utterance contained the same VPC as the previous one, I picked another one.

The variables that were coded are the following:

- CONSTRUCTION: V-Prt-DirObj vs. V-DirObj-Prt;
- LENGTH of the direct object in morphemes: for instance, *you can match up the story with the pictures on here* (2) or *we can open up our presents* (3); a *plurale tantum* such as *clothes* was coded as one morpheme;
- OBJTYPE of the direct object: clause (as in *you find out where my piece goes*), definite lexical NP (as in *let's turn on the record*), indefinite lexical NP (as in *kick off a sock*), lexical NP with possessive pronoun (as in *can I put on my moccasins?*), lexical NP without determiners/premodification (as in *take away parachute*), name (as in *I hate Paul up*), pronominal (as in *(ex)cept how long will it take to pick up it?*);
- SEMANTICS of the particle: end states vs. completives. VPCs were coded as end states if one could say "after the action denoted by the VPC, the [referent of the direct object] is [particle]", as in *turn the light on* (after which the light is on) or *chop down a dead pear tree* (after which the tree is down); this coincides with what other studies categorized as spatial/locative uses. On the other hand, VPCs were coded as completives when the particle "solidified" the action by the verb so one could say "after the action denoted by the VPC, the [referent of the direct object] is completely [verb-edj", as

in *wake up kitten* (then, the kitten is awake but not necessarily up) or *them guys can beat up this guy* (after which this guy is beaten, but most likely not up); completives also cover (a tiny number of) metaphorical/idiomatic uses;

- the type of initial SEGMENT of the particle: V as for *pick up* and C as for *bring back*;

- CV ALTERNATION: the type of initial segment of the particle (from above) and the type of final segment of the verb.[2]

In the next section, I will discuss the results of the corpus analysis.

3 Findings

3.1 Overview

As a result of the above procedures, I obtained the data summarized in Table 10.1.

Table 10.1. Frequencies of Abe, Adam's, and Nina's VPCs

	Abe	*Adam*	*Nina*	*Totals*
V-Prt-DirObj	72	66	49	187
V-DirObj-Prt	1010	1578	898	3486
Totals	1082	1644	947	3673

The ratio of V-Prt-DirObj of all VPCs is reassuringly close to that reported in Diessel and Tomasello (2005), and while Table 10.1 indicates that the frequencies of the constructions differ significantly across the children ($\chi^2 = 9.43$; $df = 2$; $p<0.01$), the size of this effect is very small (Cramer's $V=0.05$), given the children's rather different age and MLU ranges.

3.2 The effect of LENGTH

The three panels of Figure 10.1 illustrate the correlation between CONSTRUCTION and LENGTH for each child separately with box-and-whisker plots, where the thick horizontal line/the plotted "x" represent the constructions' medians/means respectively, and where the boxes cover the central 50% of the data around the medians.
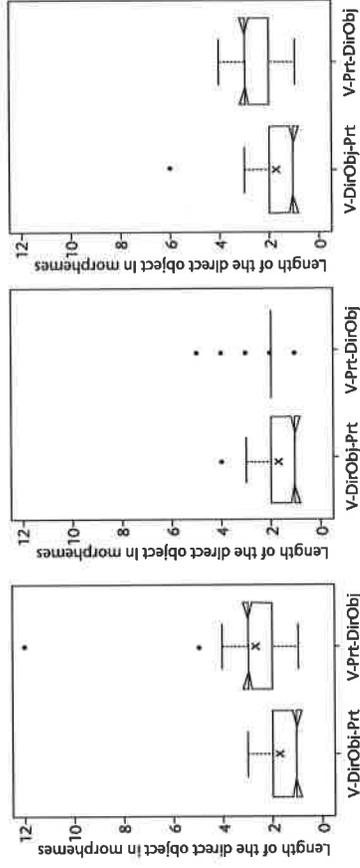
Figure 10.1. CONSTRUCTION × LENGTH (left: Abe; center: Adam; right: Nina)

U-tests show each child exhibits a significant tendency to use V-DirObj-Prt with, on average, shorter direct objects than V-Prt-DirObj (Abe: 1.6 vs. 2.8 morphemes; $W = 2780$; $p<0.001$; Adam: 1.4 vs. 2.1 morphemes; $W = 1666$; $p<0.001$; Nina: 1.8 vs. 2 morphemes; $W = 1468.5$; $p<0.05$; all reported averages are medians). These effects are in the direction expected from, but smaller than found in, adult data, but they are very similar to those observed by Diessel and Tomasello (2005: 100) for acquisition data. They can therefore be explained in terms of the workings of an interactive activation model or in terms of widely-attested processing effects as mentioned above. The fact that the effects observed in acquisition data are weaker than in adult data is of course due to the fact that children's utterances are in general shorter and thus do not contain the long objects necessary for stronger effects.

3.3 The effect of NP TYPE

The three panels of Figure 10.2 illustrate the correlation between CONSTRUCTION and OBJTYPE for each child with a cross-tabulation plot (cf. Gries 2009: 176f.); I have omitted four instances of V-Prt-DirObj. The color of the numbers and the parenthesized sign indicate whether an observed frequency is larger than expected (black and "(+)") or smaller than expected (gray and "(–)"), and the physical size of the number indicates the size of the effect (as a proportion of the Pearson residuals).

All panels deviate significantly from a random distribution (Abe: $\chi^2 = 58$; $df = 5$; $p<0.001$; Cramer's $V = 0.47$; Adam: $\chi^2 = 37.55$; $df = 5$; $p<0.001$; Cramer's $V = 0.49$; Nina: $\chi^2 = 26.54$; $df = 5$; $p<0.001$; Cramer's $V = 0.46$). The children are remarkably similar to each other. For most object types – (in)definite NPs, NPs without premodifiers, and pronouns – they pattern

Adam are sensitive to a coarse formal distinction – names/pronouns vs. lexical nouns – and, presumably its discourse-functional/information-structural motivation: referents of lexical nouns. Accordingly, the children's data can be integrated well into Gries's (2003a) above-mentioned accounts in terms of activation or processing cost. However, Abe and Adam are apparently *not* sensitive to the more fine-grained formal distinction – definite vs indefinite within the lexical objects – and its information-structural motivation: referents of definite NPs are generally more given than referents of indefinite NPs. Nina patterns nearly the same way, differing from Abe and Adam only with regard to her weak opposite preferences for names and lexical NPs with possessive pronouns.

3.4 The effect of SEMANTICS

The three panels of Figure 10.3 represent the correlations between CONSTRUCTION and SEMANTICS with cross-tabulation plots. (I have omitted 13 VPCs from these data for reasons discussed below.)

The results indicate that, on the whole, the children's use of VPCs is the one expected from, and explained for, adult data (cf. Gries 2003a: 87f.) and acquisition data (cf. Diessel and Tomasello 2005: 102); the distributions found for Abe and Nina are significant, while the one for Adam is only in the expected direction, but not significant (Abe: $\chi^2 = 6.38$; $df = 1$; $p<0.05$; Cramer's $V = 0.16$; Adam: $\chi^2 = 1.09$; $df = 1$; $p = 0.3$; Cramer's $V = 0.08$; Nina: $\chi^2 = 13.09$; $df = 1$; $p<0.001$; Cramer's $V = 0.32$).

In addition to the above correlation, 13 VPCs were classified in ways other than "end state" and "completive". Six were cases where the child seems to have used the 'wrong' direct object, cf. the examples in (13) and (14).

(13) (a) did Mommy already start picking up the living room? (Abe, 4;7.11)
    (b) she left for me to pick up the living room (Abe, 4;7.11)
    (c) I picked up the kitchen (Abe, 4;7.11)

Figure 10.3. CONSTRUCTION × SEMANTICS (left: Abe; center: Adam; right: Nina)

Abe — Particle semantic × Construction:

Particle semantic	V-DirObj-Prt	V-Prt-DirObj
completive	24 (-)	17 (+)
end state	164 (+)	48 (-)

Adam — Particle semantic × Construction:

Particle semantic	V-DirObj-Prt	V-Prt-DirObj
completive	11 (-)	11 (+)
end state	84 (+)	52 (-)

Nina — Particle semantic × Construction:

Particle semantic	V-DirObj-Prt	V-Prt-DirObj
completive	4 (-)	13 (+)
end state	74 (+)	33 (-)

Figure 10.2. CONSTRUCTION × OBJTYPE (left: Abe; center: Adam; right: Nina)

Abe — Obj Type × Construction:

Obj Type	V-DirObj-Prt	V-Prt-DirObj
definite	43 (-)	27 (+)
indefinite	16 (-)	9 (+)
name	1 (+)	0 (-)
no mod	7 (-)	4 (+)
pronoun pass. pron.	18 (-)	26 (+)
	106 (+)	5 (-)

Adam — Obj Type × Construction:

Obj Type	V-DirObj-Prt	V-Prt-DirObj
definite	21 (-)	30 (+)
indefinite	3 (-)	5 (+)
name	1 (+)	0 (-)
no mod	10 (-)	13 (+)
pronoun pass. pron.	6 (-)	8 (+)
	55 (+)	6 (-)

Nina — Obj Type × Construction:

Obj Type	V-DirObj-Prt	V-Prt-DirObj
definite	21 (-)	23 (+)
indefinite	7 (-)	5 (+)
name	1 (-)	4 (+)
no mod	3 (-)	7 (+)
pronoun pass. pron.	10 (+)	4 (-)
	37 (+)	4 (-)

alike. However, they pattern differently for names such that there is a very tiny effect due to Abe's and Adam's preference, and Nina's dispreference, for V-DirObj-Prt. Comparable data from adults also show only a very weak preference (for V-DirObj-Prt; cf. Gries 2003a: 85). More prominent, however, is the larger difference for lexical NPs with possessive pronouns: Adam and Abe prefer V-Prt-DirObj for these (the former strongly) while Nina (slightly) prefers V-DirObj-Prt.

Interestingly, most effects are identical to findings from adult data. However, each child violates the otherwise virtually categorical preference of pronominal objects for V-DirObj-Prt. Abe's five cases involve the particle *up*, three of these involve *pick up* and in 10 of the 15 cases the pronoun is either *yours* or the demonstrative pronouns *this/dis* and *that*; the remaining cases are one *everything* and four *its*. These observations are compatible with, for example, Browman's (1986) mention of the special status of *up* and *pick up* (but cf. below), and the fact that demonstrative pronouns preference for V-Prt-DirObj can be explained by their prominent/contrastive information status in their VP-final position.

Second, while adults prefer definite NPs and indefinite NPs in V-DirObj-Prt and V-Prt-DirObj respectively, the children studied here prefer V-Prt-DirObj with both kinds of determiners, which conforms to Diessel and Tomasello's (2005: 102) findings. The data therefore suggest that Abe's and Adam's main distinction with regard to PrtPlc is between longer lexical NPs (definite, indefinite, no premodification, and premodification with a possessive pronoun), which they strongly prefer with V-Prt-DirObj, and a class consisting of shorter names and pronouns, which they strongly prefer with V-DirObj-Prt. In other words, Abe and

(14) (a) I already ate cucumber I even ate the fridge up (Abe, 4;5.28)
(b) shovel up the street (Adam, 3;8)
(c) you (sup)posed to cut out de lines (Adam, 4;7)

The constructions in (13) all involve *pick up* DirObj_location used by Abe in the sense of "clean up DirObj_location by picking up DirObj_things in location," a use that Adam and Nina do not exhibit. This observation is unusual because Abe uses *pick up* like this only in one recording, but correctly in all remaining recordings. In fact, after Abe's uttering (13a), his father responds "yea, she picked up a lot", exemplifying the canonical use, to which Abe, however, responds with (13b). This is directly followed by another exchange in which the father provides the canonical use and Abe then picks up (no pun intended) the canonical use, too: Abe's father says "she picked up most of it", to which Abe responds "oh yea, she left me to pick up this stuff" followed by, one turn later, "I didn't have to pick up too much." But even after two utterances with canonical uses of *pick up*, Abe later reverts to his idiosyncratic use by uttering (13c), to which his mother responds (twice) "did you pick up all your toys" (Abe's answer to this does not involve *pick up*). It seems, therefore, that Abe definitely knows the canonical use of *pick up*, but assumes, if only briefly, the argument structure construction exemplified in (14) is normal, too.

The constructions in (14) are special in various senses. (14a) may be a canonical use if Abe used it to jocularly say "I ate very much", and (14b) could be a creative use of *shovel up* as "dig up" and, thus, a creative but otherwise canonical use just like *dig up the street*. In order to annotate the data conservatively, neither was not counted as a regular completive. Finally, (14c) is supposed to mean "cut out [some paper] *along* the lines".

Another set of VPCs not lumped together with the clear-cut cases is shown in (15).

(15) (a) wash off my hands (Abe, 2;11.18)
(b) wash my hands off (Abe, 3;1.18)
(c) would you wipe off my legs (Abe, 3;6.10)
(d) I wipe it off (Adam, 2;10.16)
(e) you clean it off (Nina, 2;3.28)

Here, the particle does not necessarily modify the referent of the direct object but the referent of another object that is not mentioned. For instance, after performing the action described in (15a), it is not the hands that are off, but, say, the dirt on my hands or legs, as described in *wash the dirt off my hands* (for (15a)), where the underlined parts indicate the material that made it into the utterance. For this reason, these constructions were not grouped with the cases where the particle denotes the resultant state of the direct object's referent.

The final two special cases shown in (16) were cases where I was not certain enough how to analyze them.

(16) (a) Beat two out Mommy beat two out (Abe, 2;8.8)
(b) I tear off a hole (Adam, 3;3.4)

In (16a), Abe may mean "beat a line with his brush" (judging from what appears to be a clarification from his father), but the meaning is not completely clear. Finally, (16b) is similar to examples in (15) in that the particle seems to refer to an unmentioned object – Abe seems to mean "I tore off something_2 of something_1," thereby creating a hole in something_2 – but it is also different in that the paraphrase that would turn it into a canonical adult utterance is more complex than those required for the cases in (15).

The previous sections were concerned with variables that were, sometimes slightly differently, also studied by Diessel and Tomasello. The following section explores phonological variables that have one rarely been studied in PrtPlc data from adults and not at all in PrtPlc data from children.

3.5 The effects of SEGMENT and CV ALTERNATION

Figure 10.4 shows cross-tabulation plots for the relation between CONSTRUCTION and SEGMENT.

Browman found a significant preference of particles beginning with a vowel for V-Prt-DirObj, but all three children exhibit only insignificant tendencies in this direction (Abe: $\chi^2 = 2.63$; $df = 1$; $p = 0.1$; Cramer's $V = 0.05$; Adam: $\chi^2 = 2.73$; $df = 1$; $p = 0.098$; Cramer's $V = 0.04$; Nina: $\chi^2 \approx 0$; $df = 1$; $p = 0.98$; Cramer's $V<0.001$). However, this insignificant result is less disappointing than it seems. First, the expected tendency was observed. Second, as discussed in note 1, the level of resolution – particle-initial segment: vowel vs. consonant – is not particularly high and maybe confounded with other factors. Finally, unlike most determinants of PrtPlc, this one does not appear to be integratable into a psycholinguistically

Abe

First particle segment	V-DirObj-Prt	V-Prt-DirObj
consonant	101 (+)	3 (-)
vowel	809 (-)	69 (+)
	Construction	

Adam

First particle segment	V-DirObj-Prt	V-Prt-DirObj
consonant	265 (+)	6 (-)
vowel	1313 (-)	60 (+)
	Construction	

Nina

First particle segment	V-DirObj-Prt	V-Prt-DirObj
consonant	111 (+)	0 (-)
vowel	1313 (-)	43 (+)
	Construction	

Figure 10.4. CONSTRUCTION × SEGMENT (left: Abe; center: Adam; right: Nina).

motivated account: there seems to be no psycholinguistic motivation for why the particle-initial segment should play a role. However, once a more precise resolution is adopted, the situation changes. If one considers not only the type of the particle-initial segment, but also its interaction with the verb-final segment, something that Browman (1986: 319–320) alludes to, but does not study, a different picture emerges; consider Figure 10.5.

If CV ALTERNATION played a role, then in V-Prt-DirObj, where the verb-final segment is immediately followed by the particle-initial segment, the type of the verb-final segment should be different from the particle-initial segment more often than expected by chance. This is the tendency that all three children exhibit, and preference is significant in the case of Abe (Abe: $\chi^2 = 6.5$; $df = 1$; $p = 0.01$; Cramer's $V = 0.08$; Adam: $\chi^2 = 0.23$; $df = 1$; $p = 0.63$; Cramer's $V = 0.01$; Nina: $\chi^2 = 1.11$; $df = 1$; $p = 0.29$; Cramer's $V = 0.03$). The fact that one child exhibited a significant tendency for CV ALTERNATION is one reason to assume that this variable is a better predictor than SEGMENT. A second one is that CV ALTERNATION is better motivated as a predictor. First, the variable SEGMENT is merely a stipulation or even only a generalization already based on PrtPlc data, whereas CV ALTERNATION is not only a phenomenon observed independently of PrtPlc, it is in fact just one instance of more general and well-known dispreference of very similar structures to appear in very close succession, a tendency that is, so to speak, the opposite of priming and is sometimes referred to as *horror aequi* (cf. Rohdenburg 2003). We know that speakers disprefer successive occurrences of stressed syllables, so-called stress clashes, or successive occurrences of unstressed syllables, so-called stress lapses (cf. Selkirk 1984; Schlüter 2003). In fact, we already know that adult PrtPlc itself is correlated with at least one instantiation of *horror aequi*, namely a preference for rhythmic alternation (cf. Gries 2007). Second, given that CV ALTERNATION is a realization of a more general phenomenon, it comes as no surprise that an explanation for this kind of patterning is available, and the explanation I favor involves exactly the activation-based model of language production that Gries (2003a) uses to unite all known determinants of PrtPlc.

Segment type	V-DirObj-Prt	V-Prt-DirObj
different	172 (+)	4 (-)
same	838 (-)	68 (+)
	Construction	

Segment type	V-DirObj-Prt	V-Prt-DirObj
different	275 (+)	10 (-)
same	1303 (-)	50 (+)
	Construction	

Segment type	V-DirObj-Prt	V-Prt-DirObj
same	142 (+)	5 (-)
different	700 (-)	44 (+)
	Construction	

Figure 10.5. CONSTRUCTION × CV ALTERNATION (left: Abe; center: Adam; right: Nina)

From this perspective, CV ALTERNATION and other *horror aequi* effects result from how activation cycles of nodes function in interactive activation models. Such models (of linguistic knowledge) involve nodes (representing linguistic units on different hierarchical levels) and links between them, and nodes send and receive activation from other nodes via these links. When a node receives enough activation, it can be "selected", which means that, for example, the linguistic unit (or action routine) that it represents will be executed. Crucially, once a node, e.g., one representing "consonants", has fired and thereby facilitated the production of a consonant, it undergoes a short period of self-inhibition during which it is unlikely to be chosen for activation again, which is why the node for vowels is more likely to be chosen next, which naturally leads to, or at least favors, the kinds of alternating patterns often found (cf. MacKay 1987, esp. Chapters 1 and 2, for details and various kinds of neurological evidence for this model).

3.6 Lexically-specific results

One question that naturally arises with regard to all sorts of acquisition data is to what degree children's production consists just of verbatim repetitions or, in this case, rote-learned pairs of particular phrasal verbs in particular constituent orderings. Both Broihier *et al.* (1994) and Diessel and Tomasello (2005) argue against rote-learned VPCs, showing that there are phrasal verbs used in both constructions. However, Broihier *et al.* (1994) do not provide a systematic overview let alone frequencies of the phrasal verb types, tokens, and their occurrences in both constructions. Diessel and Tomasello are more systematic: they compare the effects of the variables they study in child language to the effects these variables exhibit in caretaker language, but also provide both phrasal-verb type frequencies (65 and 83 in Peter's and Eve's data from CHILDES) and several examples of phrasal verbs Peter and Eve use in both VPCs. However, the problem of data scarcity – recall their database contained only 421 and 29 (!) instances of V-DirObj-Prt and V-Prt-DirObj respectively – makes it difficult to get a reliable picture of how especially the latter construction is used and calls for more comprehensive description. This section will provide some descriptive overview data and explore the relation between the frequency of phrasal verbs and the constructional choices.

Since the main objective of this section is descriptive, I will begin with some summary tables. Tables 10.2, 10.3, and 10.4 list the frequencies of VPCs (abbreviated as *VPO* and *VOP* for reasons of space) for the most frequent phrasal verbs, verbs, and particles in Abe's, Adam's, and Nina's speech respectively.

Table 10.2. Frequencies of Abe's most frequent phrasal verbs, verbs, and particles; figures larger than expected are in bold

Phrasal verb	VPO : VOP	Verb	VPO : VOP	Particle	VPO : VOP
put in	0 : 124	put	11 : **307**	up	38 : **201**
put on	9 : 112	get	2 : **124**	on	16 : **218**
turn on	3 : 44	take	0 : 75	in	0 : **149**
get off	0 : 37	turn	4 : 71	off	4 : **132**
get out	1 : 35	cut	3 : 40	out	9 : **124**
pick up	**18** : 16	pick	**19** : 18	down	3 : 70
take off	0 : 34	throw	0 : 32	away	0 : 51
eat up	2 : 29	eat	2 : 29	back	0 : 21
take out	0 : 26	knock	1 : 23	over	2 : 15
throw away	0 : 26	bring	2 : 16	around	0 : 6
186 more types	39 : 527	91 more types	28 : 276	10 more types	0 : 23

Table 10.3. Frequencies of Adam's most frequent phrasal verbs, verbs, and particles; figures larger than expected are in bold

Phrasal verb	VPO : VOP	Verb	VPO : VOP	Particle	VPO : VOP
put in	1 : **196**	put	12 : **498**	up	11 : **335**
put on	11 : 145	take	9 : **227**	on	14 : 235
take off	7 : 127	get	3 : 66	off	13 : **227**
take out	1 : 78	knock	0 : 65	in	3 : **222**
eat up	0 : 54	turn	4 : 57	out	15 : 204
knock down	0 : 53	eat	0 : 55	down	6 : 161
pick up	2 : 39	cut	10 : 44	back	0 : 50
put up	0 : **38**	push	1 : 46	away	1 : 37
get out	3 : 29	pick	2 : 39	over	2 : 26
punch out	0 : **29**	punch	0 : **30**	back in	0 : 18
229 more types	41 : 790	103 more types	25 : 451	20 more types	1 : 63

Table 10.4. Frequencies of Nina's most frequent phrasal verbs, verbs, and particles; figures larger than expected are in bold

Phrasal verb	VPO : VOP	Verb	VPO : VOP	Particle	VPO : VOP
put on	5 : **129**	put	7 : **346**	on	5 : **238**
put in	0 : 104	take	9 : **168**	up	22 : **144**
take off	7 : 94	want	0 : 47	off	9 : **154**
take out	1 : 62	eat	1 : **40**	in	0 : **111**
eat up	1 : **40**	get	1 : 31	out	3 : **95**
want on	0 : 34	have	0 : 30	down	6 : 57
pick up	**11** : 19	pick	**11** : 19	away	2 : 25
put down	1 : 29	knock	0 : 26	back on	0 : 22
have on	0 : 27	wear	0 : 23	back in	0 : 19
wear on	0 : 23	wake	0 : 18	over	1 : 10
114 more types	23 : 337	57 more types	20 : 150	8 more types	1 : 23

Several observations are obvious: First and unsurprisingly, children's VPCs are largely concerned with concrete actions, often involving movement in space and resulting end states. Second and more relevantly and reassuringly, the children are similar to each other. For example, the phrasal verbs *put in, put on, take off, take out, pick up,* and *eat up* are among the most frequent for each child, and often their preferences for a construction are identical; the same is true of just the verbs and just the particles. Third, all children support Browman's observation of *pick up's* strong preference for V-Prt-DirObj, which is astonishing since, in Gries and Stefanowitsch's (2004) study of adult-only data, *pick up* was the most frequent phrasal verb, but had absolutely no preference for either construction.

While these tables provide some summary information, they do not speak to the role of FREQUENCY, which Browman merely stipulated and that Schnoebelen incorporated in his approach. Consider, therefore, Figure 10.6, Figure 10.7, and Figure 10.8, which plot the proportions of V-Prt-DirObj for each phrasal verb against that phrasal verb's frequency in the child language. In each graph, the dashed horizontal line indicates the proportion of V-Prt-DirObj for a child, and the dashed curve is a non-parametric smoother summarizing the correlation for all phrasal verbs attested in both constructions.

Figure 10.7. The relation of the percentage of V-Prt-DirObj out of all constructions of a phrasal verb to that phrasal verb's frequency in Adam's speech

Frequency of verb-particle construction (log scale)

Percentage of V-Prt-DirObj (log scale)

take off
put on
pick up
have on
take off
turn on
blow up
wake up
get out
turn around
break away
mess up
make up
cut down
tear off
cut out
burst up
type up
chop down
battle up

Editor's Note: The type of overplotting illustrated in Figures 10.6 to 10.8 is common in statistical graphs. The position of the words is meaningful on both axes and indicates more populated areas.

Figure 10.6. The relation of the percentage of V-Prt-DirObj out of all constructions of a phrasal verb to that phrasal verb's frequency in Abe's speech

Frequency of verb-particle construction (log scale)

Percentage of V-Prt-DirObj (log scale)

put in
take off
get off
knock down
need on
put up
take away
get out
put up
get on
eat up
turn on
turn off
put on
cut out
beat up
bring down
have on
open up
bring over
chop down
fill up
pick up
mess up

Obviously, FREQUENCY is correlated with CONSTRUCTION even when its impact is neither measured in Schnoebelen's sophisticated way nor in Browman's somewhat problematic way (cf. again note 1). However, the relation between CONSTRUCTION and FREQUENCY is not the one discussed in Browman – it is the opposite: as the smoother and its negative slope indicate, higher phrasal-verb frequency is correlated with (higher percentages of) V-DirObj-Prt, and in some sense this is not surprising, given the frequency of talk about spatial movement and accessible referents in children's speech.

Finally, a potential objection must be anticipated. These data shed some doubt on Broihier *et al.*'s (1994) and Diessel and Tomasello's (2005) remarks regarding the productivity of the alternation. On the one hand, there are obviously phrasal verbs that occur in both constructions, but on the other hand, it is just as obvious that the vast majority of phrasal verbs does not: only $^{26}/_{196}$ of Abe's phrasal verb types are attested in both constructions, as are only $^{25}/_{239}$ of Adam's and $^{17}/_{124}$ of Nina's, and this is not "extensive variation" that Diessel and Tomasello simply "believe[d]" makes rote-learned VPCs very unlikely. (Their only evidence for this was a list of nine phrasal verbs that did alternate, and given the size of their corpus there was in fact little else they could do.) In fact, the proverbial devil's advocate might even say that both Diessel and Tomasello's findings as well as mine reported above could all be completely epiphenomenal in the sense that they only arise from properties of the approximately 90% of the verb types that do *not* alternate. The larger database of the present study, however, allows to address this threat by: (a) removing the potentially confounding non-alternating phrasal verbs and the way they enter into the analysis; and (b) repeating all statistical analyses from $3.2 to $3.5 for each child only with those phrasal verbs that a child uses in both constructions.[3] Space does not permit an exhaustive discussion of the results, but most results regarding the "traditional variables" prove to be robust (cf. the appendix for summary graphs):

- LENGTH: the objects of V-Prt-DirObj are longer than those of V-DirObj-Prt (all children);
- OBJTYPE: empty cells notwithstanding, all three children's data exhibit the same tendencies as before;
- SEMANTICS: all three children's data exhibit the same tendencies as before.

More surprising are the results for SEGMENT and CV ALTERNATION, which stand in exact opposition to the ones obtained earlier. When only alternating phrasal verbs are studied, Browman's hypothesized tendency of particles

Figure 10.8. The relation of the percentage of V-Prt-DirObj out of all constructions of a phrasal verb to that phrasal verb's frequency in Nina's speech

beginning with a vowel to occur in V-Prt-DirObj is not supported. The same holds for the hypothesized tendency of a preference for CV alternating patterns. Both of these latter results point to the need for more comprehensive and precise studies of the variables for only the alternating cases – such particulars are hard to predict – and some possibilities for further study will be outlined below.

4 Concluding remarks

Diessel and Tomasello (2005) and the present study have shown that, just like in adult speech, children's PrtPlc is governed by many interrelated variables from different levels of linguistic analysis. With regard to the sample of VPCs, children's VPCs are less variable than those of adults because children talk about what is relevant to them and cognitively manageable:

- they use a more restricted set of phrasal verbs, which is on the whole more concerned with concrete objects and motion through space to a final position;

- they exhibit a much more biased distribution of constructions, with V-DirObj-Prt accounting for 95% of all VPCs.

These effects can be explained straightforwardly. V-DirObj-Prt is used mainly for the scenario of a human agent causing an object to move, and this scenario is cognitively basic and highly salient for children, whose earliest single word-utterances already use particles such as *up* and *down* to refer to (resultant) locations of concrete objects (including themselves). Correspondingly, children disprefer this construction for more aspectual/completive and idiomatic meanings (e.g., *He eated up the meat* or *You find out where my piece goes*; cf. also Fischer 1971: 144). Also, V-DirObj-Prt is also more often used in spoken language and thus more likely to constitute a significant portion of the children's input.

With regard to the variables investigated here, I tried to go replicate and also go beyond Diessel and Tomasello (2005):

- rather than conflating the data, children were studied separately, and there were a few cases where a conflation would have masked individual differences;

- Diessel and Tomasello's monofactorial findings were confirmed both by replicating their methods but also by removing potentially

confounding lexical effects and checking only the phrasal verbs that alternate;

- some of the traditionally-studied variables exhibit different effect sizes (e.g., LENGTH);

- some traditionally-studied variables exhibit slightly different effects (e.g., OBJTYPE);

- the present study provided a more comprehensive overview of lexically-specific preferences;

- the present study investigated new variables that have rarely been studied: SEGMENT, CV ALTERNATION, FREQUENCY, and the special role of (*pick*) *up*.

Crucially, when all phrasal verbs are studied – not just the ones that alternate – then the effects known from adult data and from Diessel and Tomasello as well as the new phonological variables studied here for the first time are fully compatible with the psycholinguistically-motivated approach advocated by Gries (2003a) and adopted by Diessel and Tomasello and Schnoebelen. However, apart from the obvious need for a multifactorial study, several next steps suggest themselves.

First, some of the present results in turn require further scrutiny. For instance, there is the more general methodological question of whether to include in one's statistical analysis only those phrasal verbs that alternate (a common practice in sociolinguistic circles) or all phrasal verbs (as in Diessel and Tomasello). Abstractly speaking, the former approach appears methodologically more desirable in spite of the "damage" it does to sample sizes. The present study does not provide a clear-cut answer, however. On the one hand, the traditional determinants of PrtPlc, which are also the ones that are largely independent of particular lexical items, exhibited the same tendencies in both approaches. On the other hand, the new phonological determinants, which are much more tied to individual lexical items, did not yield the same results in both approaches, which may well mean that these variables' connections to individual lexical items is so strong that, once non-alternating phrasal verbs are disregarded, no effect remains. This may indeed be what is going on, and if it is, it would support the notion of preferably studying only alternating verbs, but further study is required, both of more, and more diverse, variables and more precise study of the CV alternation: rather than studying only the transition from the verb-final segment to the particle-initial segment, all possible transitions could be studied (end-of-verb to beginning-of-particle, end-of-particle to beginning-of-object for V-Prt-DirObj as well as end-of-verb to beginning-of-object and end-of-object to beginning-of-particle for V-DirObj-Prt) and

maybe restricted to short objects (because the kind of phonological planning giving rise to CV ALTERNATION may not operate across longer objects).

More research is also needed regarding the impact of definiteness. Like adults, children prefer V-Prt-DirObj with lexical direct objects, but unlike adults, (in)definiteness plays no role.[4] This may either be due to the fact that children indeed do not yet grasp the more subtle way in which determiners reflect information structure on top of the choice of lexical vs. pronominal objects, or it may mean that pointing gestures and other contextual clues facilitate referent identification and, thus, blur the role of definiteness; more study, maybe on the basis of video recordings, etc. can answer this question (cf. Allen *et al.* 2008 for an overview of related work).

Then, we need more detailed knowledge about individual phrasal verbs, verbs, and particles and their relation to more general determinants. For example, we have seen that *pick up* behaves very differently from all other verbs – why is that so, when does it begin, and how does it change over time? For example, the present data set contained something that, to my knowledge has hardly been mentioned or studied before with regard to adult PrtPlc and not at all for children, namely: (a) many bipartite particles of the types exemplified in (7) and (8) (i.e., *back in*, *back on*, etc.); and (b) modified particles as in *they eat the whole taco all up or you'll have to fix that all up or chop it right down*. While all these examples occur in V-DirObj-Prt (cf. Fraser 1974: 573), we know nothing about how and why this is so. Lastly in the area of lexically-specific constructional preferences, it would be useful to be able to carry out fine-grained *and* longitudinal studies where one identifies for a particular phrasal verb its first use in V-Prt-DirObj and then tracks back how the phrasal verb, but also just the verb and just the particle, is used over time by the child and in the ambient language, to gain a better understanding of what drives children's realization that a phrasal verb can be used in both constructions.

Finally, the question with maybe the largest scope of all: how does the acquisition of PrtPlc relate to the acquisition of other alternations, such as the dative alternation. Snyder and Stromswold (1997) have shown that children begin to acquire several alternations all around the same time (at approximately age 2;2) and since PrtPlc and the dative alternation are governed by similar determinants (cf. Gries 2003b and Bresnan *et al.* 2007), the holy grail is to develop a unified account of the acquisition of constituent order alternations, and the present study adds another piece of evidence to the claim that such an approach *must* be multifactorial. The present study does obviously not do all that, but if it helps stimulate research in this important area, one of its main objectives has been attained.

Notes

1. Two things are worth pointing out with regard to these variables. First, although Browman does not explore this, the variable vowel-initial vs. consonant-initial particle is of course highly correlated with the particle as such and its other phonological properties. First, in the present data set, there were only two particles beginning with /ʌ/, one of which is the most frequent particle *up*, the other being the extremely rare *under*. Since *up* on its own is correlated with the order V-Prt-DirObj, it is difficult to estimate how much of the initial-segment variable is due to other correlated variables. Second, there were three particles beginning with /ə/, and these are of course all from the very small group of particles with more than one syllable (*along*, *around*, and *away*), which may affect PrtPlc, too. Third, especially in V-Prt-DirObj, the initial segment of the particle may interact with the final segment of the verb such that speakers may unconsciously prefer a CV alternation pattern. While Gries (2003a: 120f) could not find such an effect, he only looked at one small sample of adult data and further systematic study of this is required and will be reported on below. The exact nature of this effect is, therefore, not clear yet, and awaits a larger and multifactorial study.

   Second, Browman does not explain why there should be a correlation between the frequency of a phrasal verb and its constructional preference. Schnoebelen's approach, in which frequency of occurrence figures in his entropy calculations, fares much better in that regard. Also, the way in which Browman operationalized the frequency of the phrasal verb may not be optimal since she did not only use the frequency of the phrasal verb proper, but added to that the frequencies of the verb and the particle. This may be problematic because, in adult language, *in* and *on* are not particularly frequent as particles in transitive phrasal verbs, but they are of course rather frequent everywhere else, which will distort the frequencies that are intended to only represent phrasal verb frequencies.

2. The coding of the final segment of the verb was based on the form produced by the child. That is, when the child used *blowed* as the past tense of *blow*, then this was coded as /d/ or C (for consonant).

3. Figures 10.6 to 10.8 already provide that kind of information because the smoothers are based on the alternating verbs only.

4. This is even so when the first two rows of Figure 10.2 are tested with a chi-square test for sub-tables (χ^2 for contingency within a sub-table = 0.06; $df = 1$; $p = 0.8$; cf. Gries, to appear, for details on, and the implementation of, this test).

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