English particle verbs prime double object constructions in production

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Abstract

We report on a production priming experiment (N=238) in which particle verb constructions (*Ana lifted up Hsu*) prime double object constructions (*Ana gave Hsu the book*). This result is expected under syntactic models that take the two constructions to share abstract structure, including Small Clause approaches in the tradition of Kayne 1984, 1985. The result is not expressed by models positing no shared structure between the constructions, including common versions of complex predicate approaches to particle verb constructions and applicative approaches to double object constructions.

1 Introduction

This article reports on a production priming experiment designed to test predictions of competing approaches to two constructions in English—Double Object Constructions (DOCs), and Particle Verb Constructions (PVCs)—as in (1) and (2).

(1) Ana gave Hsu the book. [DOC]

(2) Ana lifted Hsu up. [PVC]

One prominent line of work descended from Kayne 1984, 1985 takes these two constructions to be structurally akin in that both contain small clauses (SCs). In the case of DOCs, this approach typically takes the recipient to be introduced as a small clause subject and the theme as the predicate as in (3) (Johnson 1991, Harley 1997, 2002, Richards 2001, Beck and Johnson 2004, Harley and Jung 2015). Some authors have taken the small clause in DOC contexts to be headed by a possession-denoting P (Kayne 1993, Pesetsky 1995, Den Dikken 1995, Harley 1995, 1997, 2002, Richards 2001, Harley and Jung 2015). Here, we set aside details of the internal structure of the small clause in both DOC and PVC contexts and simply represent the structure as a constituent with the label "SC".

(3) Ana gave [$_{SC}$ Hsu the book]. [DOC, SC approach]

For PVCs, SC approaches take the object to be introduced as the subject of a small clause denoting a spatial result state, as in (4a) (Aarts 1989, Den Dikken 1995, Svenonius 1996a,b, Harley and Noyer 1998, Ramchand and Svenonius 2002, Ramchand 2008). The particle–object word order variant is typically derived by moving the particle to a position to the left of the object (4b) (Ramchand and Svenonius 2002).[1]

(4) a. Ana lifted [$_{SC}$ Hsu up]. [Obj.–Part. order, SC approach]

b. Ana lifted up [$_{SC}$ Hsu ~~up~~]. [Part.–Obj. order, SC approach]

In contrast, the principal competitors in the literature to SC approaches for both of these constructions posit no common structure. Complex predicate approaches to PVCs, for example, take the particle and verb to be introduced in a constituent excluding the object, typically a composite terminal as in (5), corresponding to particle–object surface orders (Johnson 1991, Radford 1997, Dehé 2000,

2002, Farrell 2005, Basilico 2008, McIntyre 2015). Neither this structure nor structures for object–particle orders derived via excorporation yield syntactic isomorphism with DOCs on standard approaches. (We return to this issue in the discussion.)

(5) $\ldots[_{\text{VP}}\ [_{\text{V}}$ lift up] Hsu]. [Complex head structure]

For DOCs, the principal alternative to SC approaches in contemporary literature is the applicative structure, as in (6) (Marantz 1993, Bruening 2010a,b, 2018). This approach takes recipients to be merged VP-externally in an additional argument-introducing projection, ApplP. Because ApplP structures are not present in monotransitive particle verb structures, they likewise entail no syntactic isomorphism between the two constructions.

(6) Ana gave $[_{\text{ApplP}}$ Hsu $[_{\text{VP}}$ ~~gave~~ the book]]. [DOC, ApplP approach]

An expectation raised by small clause approaches to these constructions, or indeed any approach that takes PVCs and DOCs to share structure, is that the two constructions should interact in priming, where exposure to a linguistic form facilitates subsequent comprehension or increases the likelihood of production of a related form (Bock 1986, Pickering and Branigan 1998, Pickering and Ferreira 2008, Thothathiri and Snedeker 2008). Importantly, syntactic priming is known to be sensitive to abstract properties of structural representation (Ferreira 2003, Branigan et al. 1995, Oltra-Massuet et al. 2017), making it plausible that small clauses may be the kinds of syntactic objects capable of inducing priming effects. If so, one expects PVCs to be able to prime DOCs and vice-versa (Branigan and Pickering 2017). Competing approaches positing no syntactic relationship between these constructions predict no such priming effects. Below, we report on a production prim-

ing experiment designed to test this priming relationship in one direction—priming of DOCs by PVCs.

2 Data

Participants. Participants were 238 self-reported native speakers of English recruited through participant pools at two North American universities—CUNY-Queens College (N=152) and University of Pennsylvania (N=86)—who received course credit for participating in 2021-22. Participants ranged in age from 18 to 39 (median=19) and were from a range of self-reported genders. All participants were self-reported native speakers of English. Of these, 124 reported proficiency in a language other than English, with 111 reporting dominance in English and 13 reporting dual dominance.

Materials and procedure. The experiment consisted of two subdesigns. The first was a baseline subdesign replicating priming of DOCs by DOCs, vs. a prepositional dative (PD) control. The purpose of this part of the experiment was to verify that a simple ditransitive priming effect was reproducible using our materials, procedure and participant group. The second subdesign focused on the main comparison of interest, namely priming of DOCs by particle verb constructions vs. a matched non-particle verb control.

The experiment involved two kinds of trials: target trials in which production of a ditransitive sentences was biased, and prime trials biasing production of one of the two ditransitive frames (baseline subdesign) or a PVC vs. non-PVC sentence (particle verb subdesign). The dependent measure in the analysis reported below is production of DOC vs. PD responses in the target trials, and the main predictor is the produced response in the immediately preceding prime trial (Bock 1986,

Pickering and Branigan 1998).

For both subdesigns, the task in both prime and target trials was to complete a sentence given a sentence starter by typing into a field, using the sentence completion paradigm of Pickering and Branigan 1998, Pickering et al. 2002 Corley and Scheepers 2002, Kaschak et al. 2006, Kaschak 2007 and Kaschak et al. 2011.[2] Examples of prime trial stimuli for the baseline subdesign are given in figure 1. In figure 1a, a DOC response in the prime trial is biased via a starter consisting of a subject, ditransitive verb and an animate DP. In figure 1b, the starter, biasing a PD response, contains a subject, ditransitive verb and inanimate DP. Example prime stimuli for the second, particle verb subdesign are shown in figure 2. Here, PVC responses were biased using a starter consisting of a subject and particle verb, as in figure 2a. Particle verb primes in all trials were in the particle–object order to remove the possible confound of a priming effect of adjacent categories, i.e. whereby priming is attributable to like sequences of V-NP-X strings. Starters biasing non-PVC responses contained a subject and transitive verb as in figure 2b. Stimulus sentence starters for target trials for both subdesigns consisted of a subject followed by a ditransitive verb as in figure 3.[3]

(a) Stimulus biasing a DOC response.

(b) Stimulus biasing a PD response.

Figure 1: Example prime items for baseline subdesign.

For each subdesign, 24 unique lexicalizations were created for both primes and

(a) Stimulus biasing PVC response.

(b) Stimulus biasing a non-PVC response.

Figure 2: Example prime items for particle verb subdesign.

Figure 3: Example target item.

targets. Within each subdesign, prime subjects were counterbalanced across the two prime conditions, and target verbs were then distributed to lists by Latin Square. Each participant saw twelve experimental trials for each of the four condition (=48 trials/participant). No item contained identical verbs in both prime and target stimuli in order to avoid possible lexical boosting (Pickering and Branigan 1998). All targets for experimental items contained one of eight verbs in simple past form: *gave, loaned, handed, lent, passed, sold, threw*, and *tossed*. For experimental items, all subjects and indirect objects were two-syllable trochee names as in figures 1-3. All direct objects were two-syllable definite DPs, as in figure 1b. Each list consisted of 24 blocks containing one trial for each subdesign plus a filler, randomly ordered. The 24 filler items consisted of a subject followed by a monotransitive or intransitive verb (e.g. *Evelyn spoke . . .*) for both primes and targets.[4]

Participants completed the experiment remotely using a web-based application hosted on PCIbex farm (Zehr and Schwarz 2018). After receiving instructions on the task, participants completed two practice items before beginning the main ex-

periment, which took approximately 20 minutes to complete. Each participant response was scored and checked manually by two of the authors, both native speakers of North American English varieties. Response scores, on which the analysis was carried out, was based on participants' actual responses regardless of the bias provided.[5]

For both subdesigns, only DOC and PD target responses were included in the analysis, i.e. excluding "Other" responses, following Mahowald et al.'s (2016) procedure. Similarly, for prime responses in the baseline subdesign, only DOCs and PDs were analyzed. For the particle verb subdesign, prime responses were coded as PVCs vs. non-PVCs. Prime responses involving DOC and PD constructions were excluded from the PVC analysis as likely confounds. Only trials with valid primes and targets were included in the analysis. This yielded 2052 trials in the baseline subdesign and 2438 trials in the particle verb subdesign, with an overall exclusion rate of 61%.[6]

3 Results and discussion

Raw counts for the two subdesigns and the proportions of DOC target responses for each are given in table 1.[7]

		Target		Prop.
		DOC	PD	DOC
Prime	DOC	680	481	.59
	PD	438	453	.49

(a) Baseline subdesign.

		Target		Prop.
		DOC	PD	DOC
Prime	PVC	726	523	.58
	Non-PVC	621	568	.52

(b) Particle verb subdesign.

Table 1: Response counts by condition for two subdesigns.

For baseline and particle verb subdesign results, separate generalized linear mixed-effects models were fit using the lme4 package in R (Bates et al. 2015, R

Core Team 2024), with target trial response as the dependent variable and the immediately preceding prime trial response as the fixed effect. Contribution of the fixed effect for both models was assessed via likelihood ratio test in comparison with a null model without the fixed effect predictor. For both analyses, maximal converging models are those with random intercepts for participant and target verb, but without random slopes.[8] Estimated means and 95% CIs for fixed effects for the two models are shown in figures 4 and 5.[9]

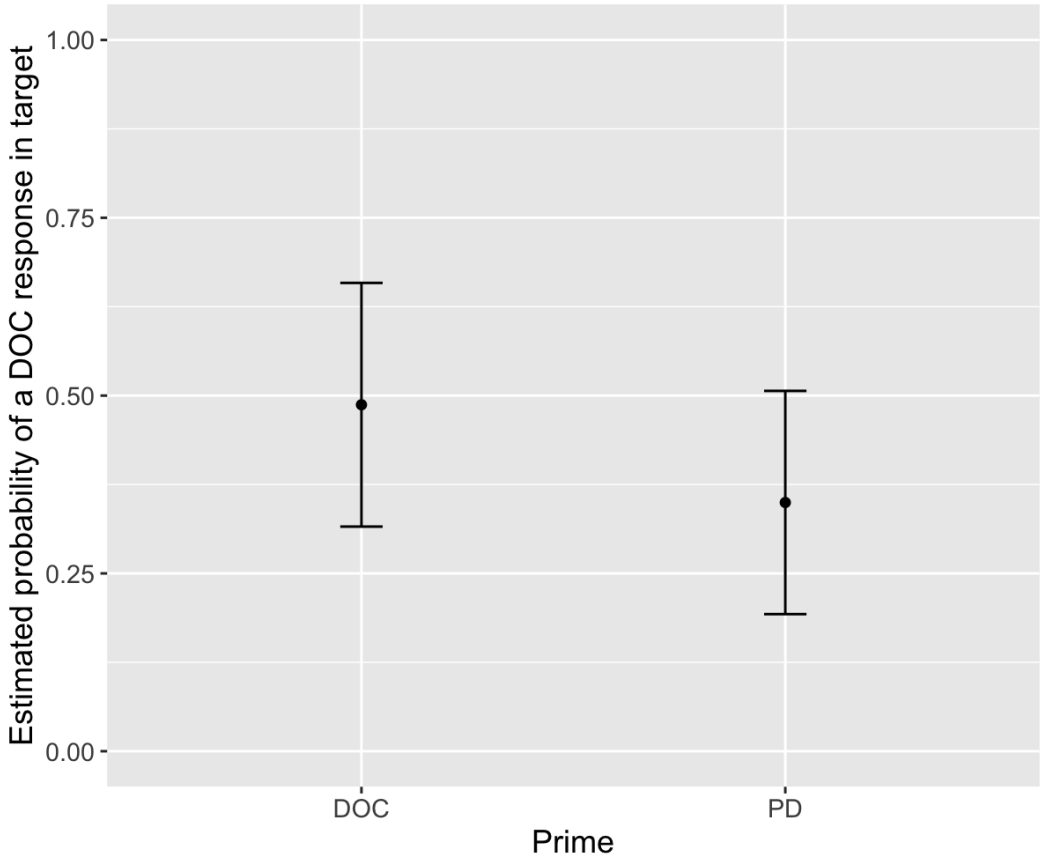


Figure 4: Model estimates for the baseline subdesign. Estimated means and 95% confidence intervals for the fixed effect (DOC vs. PD prime) in a model predicting DOC (vs. PD) responses. Model formula: Target response ~ Prime + (1 | Participant) + (1 | Target verb), Obs.=2052, N=236. Reference level of fixed effect =DOC.

Figure 4 shows replication of the familiar priming effect whereby production of a

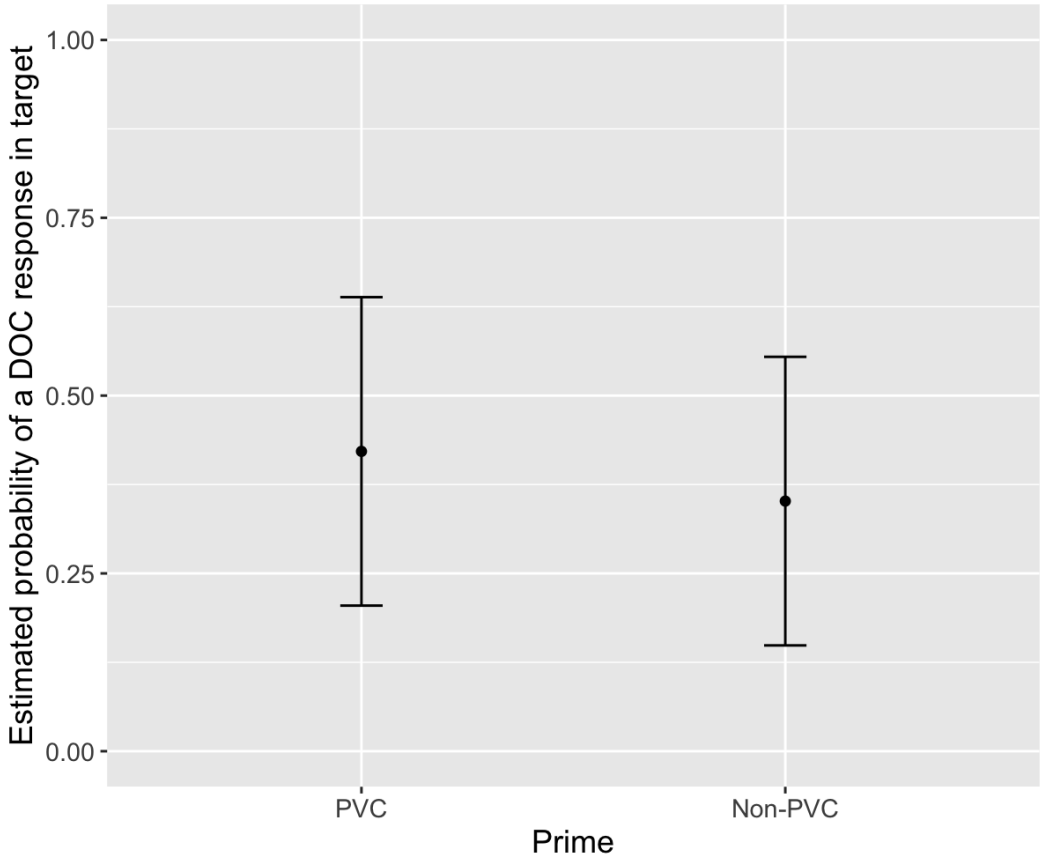


Figure 5: Model estimates for the particle verb subdesign. Estimated means and 95% confidence intervals for the fixed effect (PVC vs. Non-PVC prime) in a model predicting DOC (vs. PD) responses. Model formula: Target response ~ Prime + (1 | Participant) + (1 | Target verb), Obs.=2438, N=237. Reference level of fixed effect =PV.

DOC in a prime trial increases the likelihood of a DOC frame in a subsequent target trial (β=0.569, SE=.114, p<.001). Figure 5 illustrates a parallel, but weaker, priming effect with particle verb primes: exposure to a particle verb construction in a sentence completion task increases the likelihood of producing a DOC vs. a PD construction in an immediately subsequent target trial (β=0.296, SE=.105, p=.005).[10]

The results therefore suggest that particle verb constructions (relative to non-particle verb controls) prime DOCs relative to PDs.[11] The results are straight-

forwardly expected under SC approaches to both constructions, which are unique among the most prominent traditional approaches outlined above in positing shared structure.

An obstacle for an SC approach to the priming effects just described come from evidence that DOCs and SCs do not always distribute like true SC structures. Particularly important here is Bruening's (2018) evidence from depictive secondary predicates as in (7) and (8). Specifically, Bruening 2018 claims that in such contexts, the depictive must always predicate a property of the DP throughout the (higher) causing event and not just in the result state. In (7), for instance, Bruening observes that the depictive, *dry*, is most naturally understood as modifying the direct object not in the result state but throughout the entire caused event. Similarly, for PVC contexts, like (8), Bruening notes that *dirty* cannot modify the result state of the water being up, but rather must modify the entire caused event. If, then, the SC approach to both PVCs and DOCs is to be adopted, some other explanation must be given for empirical challenges to this approach. (See Bruening 2018 for an overview.)

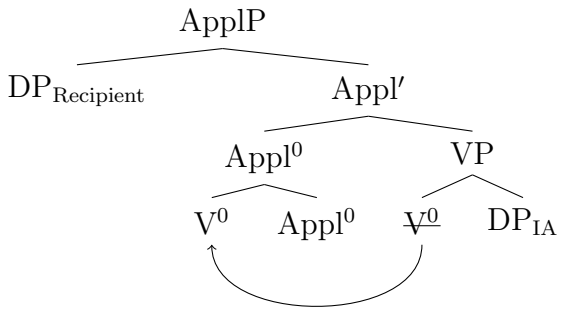
(7) As it left my hand it was wet, #but I threw him the ball dry.
(Bruening 2018)

(8) The water was completely pure, but because the sponges they were using were dirty, #they ended up sponging the water up dirty.
(Bruening 2018)

To be clear, the results summarized above do not uniquely support SC approaches to PVCs and DOCs, but rather *any* framework that yields structural isomorphism between them that is not shared with PDs. A reviewer notes that isomorphism be-

tween DOCs and particle verbs might be found in Bruening's (2021, 1047) implementation of the ApplP approach to DOCs. On this approach, V and Appl combine in syntax and form a complex predicate in the semantics with shared arguments (the possessor/internal argument and possessum/recipient) as in (9).[12] Prepositional datives involve no such complex predicate formation. This analysis, together with a complex predicate analysis of PVCs, would therefore furnish isomorphism between PVCs and DOCs—a complex predicate structure—not present in PDs. This structure would be underlying in the case of PVCs (on most such analyses) and derived in the case of DOCs. We know of no priming literature testing specifically whether movement or other syntactic operations can feed priming, and specifically whether priming is possible between two like structures, one base generated and another derived.[13]

(9)



4 Conclusion

The goal of this squib is to address a prediction about priming relations between particle verb constructions and double object constructions made by frameworks that take these two constructions to contain shared structure. Specifically, the prediction is that these two sentence types will prime each other in production vis-à-vis suitable controls. Here we report on a controlled production priming experiment

bearing out the predicted priming relationship in one direction, namely priming of DOCs by PVC primes. These results, therefore, suggest a syntactic relationship between DOCs and PVCs not present between PVCs and PD controls. These results are straightforwardly expressed by many small clause approaches in the tradition of Kayne 1984, 1985. The results are not expected under standard applicative approaches to DOCs (Bruening 2010a,b), nor complex predicate approaches to PVCs (Johnson 1991, Basilico 2008, McIntyre 2015). The results, moreover, support the utility of priming paradigms for probing finer grained representational issues (Branigan and Pickering 2017, Oltra-Massuet et al. 2017).

As noted by a reviewer, an important question raised by these results is whether DOCs are primable by structures whose analysis as SC constructions is less controversial such as bare-predicate complements of verbs like *consider*.

(10) Makayla considered [$_{\text{SC}}$ the remark appropriate].

Future work might consider this possibility.

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Notes

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[1]There are also SC-analyses of the word-order alternation in PVCs that do not mobilize particle movement, but NP-movement instead. See Guéron 1990 and Den Dikken 1995.

[2]Pickering and Branigan 1998 and Corley and Scheepers 2002 refer to these incomplete sentences as "fragments" and Kaschak et al. 2006 use the term "stem". Here, we use "starter" to avoid confusion with the former terms' usage in the ellipsis and morphology literature.

[3]A reviewer suggests that choice of this task vs. a picture description task (Bock 1986) may be partly responsible for the high exclusion rate (see below). As the reviewer helpfully points out, the sentence completion procedure is, however, a somewhat more ecologically valid procedure in constraining participants less in their choice of lexical material to produce.

[4]Because the primes for the two subdesigns differed, each subdesign's items effectively served as additional distractors for the other subdesign.

[5]For example, for the prime starter *Sammy gave the food . . .*, one participant responded, *one star on Yelp.* The response was scored as a DOC, even though the stimulus was designed to bias a PD response.

[6]The majority of these exclusions are due to invalid target responses: 56% (3179/5712) for the baseline subdesign, and 56% (3210/5712) for the PV subdesign. The exclusion rate for prime responses was 18% for the baseline subdesign (1025/5712) and 2% (102/5712) for the PV subdesign. The reason for the high exclusion rate among targets is that several of the eight verbs used—particularly *pass, sell, threw and*

toss favored monotransitive responses, e.g. *Ronald passed the bacon*. A reviewer notes, moreover, that there are more exclusions in the PD condition than in the prime condition (Table 1a). This reflects the fact that some of these verbs, including *pass* and *throw* require a theme but optionally allow for recipients in DOC/PD frames, and hence favored monotransitive responses with stimuli like *Gemma passed* .... (See Pesetsky 1995 and Bruening 2021 for a discussion of these issues.) Among other responses excluded from analysis were contexts with *her* like *Dolly sold her old toys*, ambiguous between a DOC and monotransitive interpretation, and likely misreadings of verbs including *handed* as *handled*, e.g. *Ronald handed all the affairs concerning finances while his wife was out of town*.

[7]The data and code for the results reported are available at: https://github.com/billhaddican/pvc_doc_priming.

[8]Variation across the eight target verbs in their favoring of DOC vs. PD responses is modeled via the random term for target verb.

[9]A reviewer suggests that, notwithstanding the different lexical material in the two subdesigns, the data might be analyzed in a single model, i.e. as a 2x4 design. The table below summarizes a generalized linear model predicting DOC target responses, with the four prime conditions as a single predictor using backward difference contrast coding. The model reveals effects similar to those for the separate subdesigns above: DOC and PV primes favor DOC target responses relative to PD and control primes respectively. No effect is observed for the PV/DOC comparison suggesting that particle verbs and DOCs behave similarly in their priming of DOCs.

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-0.431	0.394	-1.095	0.273
DOC-PD	0.604	0.114	5.297	0.000
PV-DOC	-0.069	0.104	-0.670	0.503
Control-PV	-0.289	0.104	-2.792	0.005

Model formula: Target response $\sim$ Prime + (1 + | Participant) + (1 | Target verb), Obs.=4490, N=237.

[10]The fact that the priming effect in figure 4 is larger than that in figure 5 perhaps stands to reason given that PD frames presumably prime PD responses, but non-PVC primes (in the PV subdesign) do not.

[11]A reviewer asks whether we can exclude an alternative interpretation of the results—one of no theoretical interest—whereby VPO word orders prime DOCs because they are like sequences of V-X-O word orders. We are aware of no literature addressing the possibility of such an effect specifically—a non-local, surface word order priming. Bock and Loebell (1990, 22) report on an experiment designed to consider similar issues, namely whether it is indeed "constituent structures that are primed, and not more superficial sentence features [...]." They find no priming effect between sentence pairs like PD *Susan brought a book to Stella* and a matching infinitival object relative like *Susan brought a book to study* that differ in constituency but are like in surface placement of a *to-* headed constituent. We take Bock and Loebell's (1990) evidence to disfavor the reviewer's suggested alternative interpretation, but we cannot exclude it.

[12]Subsequent movement of V to Voice gives a word order of the verb to the left of the recipient, but it is interpreted in Appl.

[13]Alec Marantz (pers. comm.) notes that another framework that yields syntactic isomorphism between PVCs and DOCs is that of Wood and Marantz 2017, in

which argument introducing Appl, Voice and P heads are reduced to a single functional head *i**, which is dissociated from theta role assignment. Such an approach would also need to provide for non-isomorphism between PDs and PVCs to express the present results. We are aware of no published work spelling out this proposal in detail for the specific cases of DOCs and PVCs.

A proposal related to SC approaches that also could potentially yield isomorphism between PVCs and DOCs is Pylkkänen's (2008) low Applicative Phrase. Pylkkänen 2008 proposes that in some constructions involving applied arguments, including English DOCs, recipients are introduced in a VP-internal phrase along with the theme. Here, the first object is not an argument of the verb at all, but rather is in a transfer-of-possession relationship with the theme. This is sometimes taken to be a variant of SC approaches, though Pylkkänen 2008 does not treat the low ApplP as denoting a caused result state as in other SC analyses (Harley 2002).

(i) $[_{\text{VP}}$ V $[_{\text{ApplP}}$ RECIPIENT Appl THEME]]

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