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Lisa filled water into the cup: The roles of entrenchment, pre-emption and verb semantics in German speakers' L2 acquisition of English locatives.

A central challenge for learners of English is discovering verbs' argument structure privileges; for example which verbs may appear in the figure-locative but not the ground locative construction (e.g. *Lisa poured water into the cup/ *Lisa poured the cup with water*), which show the opposite pattern (e.g. **Lisa filled water into the cup/ Lisa filled the cup with water*), and which may appear in both (e.g. *Lisa sprayed water onto the flowers/ Lisa sprayed the flowers with water*). This study investigated how adult L1 German learners of L2 English acquire these restrictions, in the face of potential transfer effects from a similar – but subtly different – pattern in the L1. The study took the form of a replication of a previous grammaticality judgment study conducted with native-speaking adults. The findings provide some evidence that, like L1 learners, advanced L2 learners use the fit between verb and construction semantics to acquire verbs' argument structure restrictions. Unlike L1 learners, however, they did not display any evidence of spontaneously using surface-based “inference-from-absence” processes such as entrenchment and pre-emption. We end by offering some potential learning and teaching strategies for L2 learners of English.

1. Introduction

A central challenge faced by language learners, whether L1 or L2, is discovering verbs' argument structure restrictions. Consider, for example, the English locative alternation. Children must learn that whilst many verbs may appear in both the figure locative (1a) and the ground locative (1b), verbs such as *pour* (2) and *fill* (3) are restricted to the former and the latter respectively.

Figure locative

- (1a) Lisa sprayed water onto the flowers
- (2a) Lisa poured water into the cup
- (3a) *Lisa filled water into the cup

Ground locative

- (1b) Lisa sprayed the flowers with water
- (2b) *Lisa poured the cup with water
- (3b) Lisa filled the cup with water

These restrictions are rather complex and, as such, are not yet fully mastered even by native English-speaking 5-6 year olds (Ambridge, Pine and Rowland 2012).

German speakers learning English as a second language face perhaps an even greater challenge, as they must learn these restrictions despite potentially damaging transfer from the L1: Although German has a locative alternation that is, in many respects, similar to English, some verbs behave quite differently to their English equivalents (e.g. Frense and Bennett 1996, Brinkmann 1997). For example, whilst English *pour* and *fill* are the archetypal figure-only and ground-only verbs, their German equivalents appear in both constructions (though ground-locative *gießen* ‘pour’ is mainly restricted to a particular kind of ground object: plants/flowers).

Figure locative

- (4a) Lisa gießt Regenwasser auf die Blumen
(5a) Lisa füllt Wasser in den Becher

Ground locative

- (4b) Lisa gießt die Blumen mit Regenwasser
(5b) Lisa füllt den Becher mit Wasser

An additional complication is that many German alternating and figure-only verbs have a related, morphologically-derived form (usually *be-*, but more rarely *ab-*, *voll-*, *ueber-* or *leer-*) that is ground-only:

Figure locative

- (6a) *Lisa befüllte Wasser in den Becher

Ground locative

- (6b) Lisa befüllte den Becher mit Wasser

Predicting exactly what kind of transfer effects this phenomenon will cause is not straightforward. One possibility is that L1 German learners of L2 English might incorrectly assume that some English alternating verbs are in fact ground-only, on the basis that there exists a ground-only translational equivalent in German (albeit a prefixed one). Another is that these learners might incorrectly assume that some English figure-only verbs are alternating because they alternate in German (at least if one adds a prefix). A third possibility is that these learners might incorrectly assume that some English alternating verbs are in fact figure-only because (a) the unmarked German form is figure-only (e.g. *spucken* ‘spit’ is figure-only, whilst *vollspucken* is ground-only) and (b) all English forms are unmarked. Whichever one of these possibilities is correct, we would expect few transfer effects for ground-only verbs, as most English ground-only verbs are also ground-only in German, though *fill* is a notable exception (see Appendix 1¹, 2²).

¹ Note that the translation equivalents provided in the Appendix are based on the English test sentences. For example, “pour” has more than one translation equivalent, but in the context of the English test sentences (“Homer poured water/tea/sauce into/onto the cup/mug/dinner”) the closest translation equivalent is “gießen”. In some cases, when the meaning of the verbs were slightly different across the English test sentences, we provide

The aim of the present study is to investigate how, in the face of these potentially serious transfer effects, German L2 English learners acquire verbs' argument structure restrictions with respect to the locative constructions. Our strategy is to replicate with this population a recent grammaticality judgment study that investigated the mechanisms by which L1 learners of English acquire these restrictions (Ambridge, Pine and Rowland 2012).

There exists a considerable body of work investigating how native learners of English acquire verbs' argument structure restrictions (see Ambridge et al. 2013 for a review). This research has provided support for three proposals.

According to the *entrenchment* hypothesis (Braine and Brooks 1995), if a learner repeatedly encounters (a) a particular verb (e.g. *pour*) and (b) a particular construction (e.g. the ground locative) but never a collocation of the two, she infers that such uses (e.g. **Lisa poured the cup with water*) are ungrammatical ("else I would have heard it by now"). Entrenchment is a probabilistic, statistical-learning process. Each occurrence of a verb contributes to an ever-strengthening probabilistic inference that non-attested uses are not permitted. This hypothesis predicts that, all other things being equal, overgeneralization errors with higher frequency verbs (e.g. **Lisa poured the cup with water*) will be (a) produced less often and (b) rated as more unacceptable than equivalent errors with lower frequency verbs (e.g. **Lisa dribbled the cup with water*). The grammaticality judgment study of Ambridge et al. (2012) demonstrated that 5-6 year olds, 9-10 year olds and adults all show an entrenchment effect for locative overgeneralization errors of this type. Entrenchment effects have also been observed for other constructions, in both production and judgment studies (e.g. Brooks et al. 1999, Stefanowitsch 2008, Theakston 2004, Ambridge et al. 2008).

According to the *pre-emption* hypothesis (e.g. Goldberg 1995), overgeneralization errors (e.g. **Lisa poured the cup with water*) are probabilistically blocked not by *any* use of the relevant verb, but by uses in nearly-synonymous constructions (e.g. *Lisa poured water into the cup*). The claim is that the learning mechanism registers a mismatch between the expected verb+construction collocation and the one that is observed. For example, hearing *Lisa poured water into the cup* when **Lisa poured the cup with water* would have been at least as felicitous given the speaker's intended meaning constitutes probabilistic evidence against the grammaticality of the latter formulation. Thus the pre-emption hypothesis predicts a negative correlation between the acceptability of a given error (e.g. *pour*+ground locative construction, as in **Lisa poured the cup with water*) and the frequency of that verb in the most nearly synonymous construction; in this case, the figure locative (e.g. *Lisa poured water into the cup*). Entrenchment,

more than one translation equivalent. For example, in the sentence "Bart brushed paint onto the statue", the verb is best translated as "pinseln". However, in the sentence "Homer brushed leaves off the lawn" the same verb is best translated as "harken".

² The translations were supplied by a native German speaker, who is an advanced learner of English and a lecturer at a UK University (the second author).

in contrast, predicts a negative correlation between the acceptability of a given error and *overall* verb frequency.

These predictions are obviously difficult to disentangle, given that, in any corpus, the two counts are highly correlated. For errors involving the locative constructions, Ambridge, Pine and Rowland (2012) found support for both factors, but with some evidence of a larger effect for entrenchment (though perhaps only because the entrenchment measure inevitably shows more variance than the pre-emption measure). Certainly, studies that have focused on pre-emption (e.g. Brooks and Tomasello 1999, Brooks and Zizak 2002, Boyd and Goldberg 2011, Goldberg 2011) have found evidence for this effect.

The third mechanism that learners seem to use to acquire verbs' argument structure restrictions is *fit between verb and construction semantics*. There exist both class-based and more probabilistic versions of this account (e.g. Pinker 1989, Ambridge, Pine and Rowland 2012), but both share the same basic assumption: Each construction has its own independent meaning (e.g. Goldberg 1995), and only verbs whose meanings are sufficiently compatible with this construction meaning may appear in the construction. Roughly speaking, the English figure-locative construction denotes *motion of a substance into a container or location, often in a particular manner*, whilst the English ground-locative construction denotes *a state-change on the part of the container or location* (e.g. Pinker 1989). Thus "manner" verbs (e.g. *pour, dribble, drip*) can appear in the figure- but not the ground-locative construction, whilst "end-state" verbs (e.g. *fill, flood, cover*) show the opposite pattern. Verbs that alternate between the two (e.g. *spray, stack, scatter*) are assumed to denote both particular manners and particular end-states.

In order to test this hypothesis, Ambridge, Pine and Rowland (2012) asked adults to rate 60 verbs (20 figure-only, 20 ground-only, 20 alternating) for the extent to which they exhibit each of 18 semantic properties thought to be relevant to the meanings of the figure- and ground-locative constructions. These ratings were combined to yield seven composite predictors ("manner", "end-state", "splattering", "joining", "stacking", "gluing", "smearing"). Together, these predictors were able to significantly predict by-verb differences in participants' preference for figure- over ground-locative uses, for all age groups studied (5-6, 9-10, adults; see also Gropen, Hollander and Goldberg 1991a,b). Similar findings for other English constructions were observed by Ambridge (2013) and Ambridge et al. (2012).

Thus there is evidence to suggest that L1 learners of English use entrenchment, pre-emption and verb+construction semantics to acquire verbs' argument structure restrictions with reference to the locative (and other) constructions. In the present study, we investigate whether the same is true for L1 German learners of English by replicating the study of Ambridge, Pine and Rowland (2012) with this population.

2. Method

2.1 Participants

Participants were 30 German undergraduate students studying English at the Institut für Anglistik und Amerikanistik at the University of Erlangen-Nürnberg. All students were relatively advanced learners of English. They had passed a university entry exam and were preparing for an exam on level C1 of the Common European Framework of Reference.

2.2 Materials

Participants completed a written questionnaire in which they were asked to rate the acceptability of figure- and ground-locative sentences using a 7-point Likert scale. The verbs used constituted the “main set” used in Ambridge, Pine and Rowland (2012, 264): 20 figure-only, 20 ground-only and 20 alternating verbs. These verbs are listed in Appendix 1, which also outlines the locative properties (i.e. figure-only, ground-only, alternating) of their closest translational equivalents in German).

The questionnaires, including the English instructions, were exactly the same as those used in this previous study, except that the German adults did not complete a further “extended set” of 82 verbs rated by the English adults (but not the English children). Each questionnaire included one figure- and one ground-locative sentence for each of the 60 verbs (120 sentences in total). There were six different versions of the questionnaire: three different sets of sentences (with different nouns used for the AGENT, FIGURE and GROUND), each presented in two pseudo-random orders. Within a given questionnaire, the figure- and ground-locative sentences for each verb used the same NPs (e.g. *Lisa poured water into the cup*/**Lisa poured the cup with water*).

The dependent measure (for the main analysis) was a “difference score” calculated by subtracting the rating for each ground-locative sentence (e.g. **Lisa poured the cup with water*) from its figure-locative equivalent (e.g. *Lisa poured water into the cup*). This constitutes a clean measure of participants’ preference for figure over ground locatives (or vice versa, for negative scores), uncontaminated by any general (dis)preferences associated with particular verbs, scenarios etc.

The independent measures (i.e. predictor variables) were taken directly from Ambridge, Pine and Rowland (2012). The *entrenchment* measure is simply the (log) frequency of each verb in the ICE-GB corpus. The *pre-emption* measure is the (log) frequency of each verb in the figure-locative construction (for figure-only verbs) or the ground-locative construction (for ground-only verbs). Because the dependent measure is positive for figure-only verbs and negative for ground-only verbs, both frequency counts were also transformed to be positive for figure-only verbs and negative for ground-only verbs (see Ambridge, Pine

and Rowland 2012, 267, for details). The *verb semantics* measures were the seven composite semantic features used in this previous study, which were originally calculated by collapsing ratings for 18 semantic properties relevant to the figure- and ground-locative constructions (see Ambridge, Pine and Rowland 2012, 265, for details).

3. Results and Discussion

3.1 Comparing L1 and L2 English speakers

Generally, as one would expect given their relatively advanced status, the L1 German English learners gave ratings that were very similar to those of their native-speaking counterparts. Figure 1 plots the dependent measure (preference for figure- over ground-locative uses) for the L1 German English learners (i.e. the data from the present study) against the native English-speaking adults (data taken from Ambridge, Pine and Rowland 2012). Although, overall, the correlation is very high ($r=0.85$, $p<0.001$), there are two interesting points to note.

The first is a different pattern of L1-L2 differences for the two types of non-alternating verbs. For the non-alternating figure-only (or “content-only”) verbs (+ symbols), the L1 speakers showed a greater preference for grammatical over ungrammatical uses (i.e. a greater dispreference for ungrammatical uses) than the L2 speakers. This is perhaps because many of the German equivalents of these verbs have morphologically-derived ground-only forms, meaning that L1 German speakers consider these verbs to be alternating verbs. The mean preference for figure- over ground-locative uses of figure-only verbs was generally in the region of 2-4 points on the 7-point scale for the L1 speakers, but only around 0-2.5 for the L2 speakers. For the ground-only verbs (triangles), the L1 and L2 speakers showed a similar range of dispreference scores for ungrammatical uses; 0-4 (negative) points on the scale. This is presumably because most English ground-only verbs are also ground-only in German. Thus, of the three possibilities for transfer effects outlined in the introduction, we seem to be observing the second: i.e. a small tendency towards the assumption that some English figure-only verbs are alternating because they alternate in German (at least if one adds a prefix).

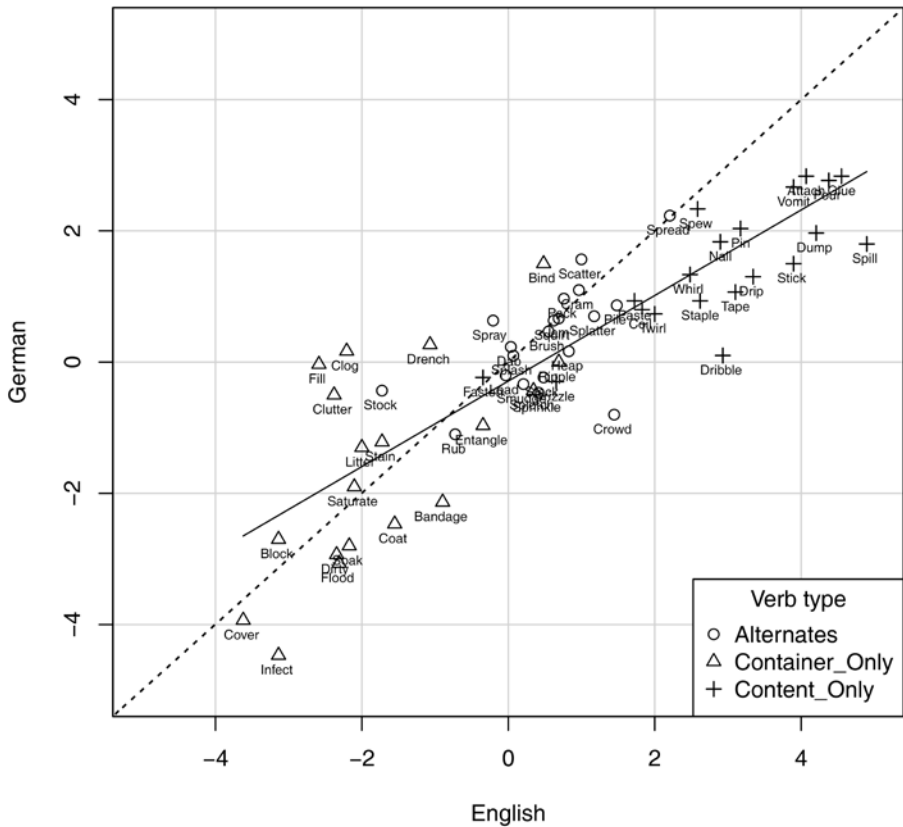


Figure 1. Preference for figure- over ground-locative uses of (+) figure-only (or “content-only”) verbs, (o) alternating verbs and (Δ) ground-only (or “container-only”) verbs for native L1 (X axis) and German L2 (Y axis) speakers of English.

The second interesting point to note from Figure 1 is that there is an important exception to this overall pattern of similar L1 and L2 performance for ground-only verbs. There are several ground-only verbs – most notably *fill*, but also *clutter*, *clog* and (to a lesser extent) *drench* for which the L2 speakers fail to exhibit the figure-locative dispreference shown by the L1 speakers. That is, whilst native English speakers show a strong dispreference for sentences such as **Lisa filled water into the cup*, German L2 English learners do not.

One possibility is that this finding reflects interference from the L1: the closest German equivalent of English *fill* is grammatical in both figure- and ground-locative constructions. Although one might object that the L2 learners do not show similar interference for *pour* – for which they show good performance – this could reflect the fact that German *pour* is mostly figure-only, and alternates only with certain types of ground object (mainly plants and flowers).

Another possibility is that L2 learners of English show better performance with *pour* than *fill* for the same reasons that native learners do. English speaking children find it much more difficult to detect – and to avoid – errors with *fill* (and other ground-only verbs) than *pour* (and other figure-only verbs) (e.g. Gropen, Hollander and Goldberg 1991a,b, Ambridge, Pine and Rowland 2012, Bidgood et al. submitted, Twomey, Chang and Ambridge, submitted). Thus it may be that both L1 and L2 learners struggle to acquire the precise semantics of either the English verb *fill* (which denotes the state-change of a container, not the motion of the contents) or the English figure-locative construction (which denotes the motion of the contents, not the state-change of the container).

3.2 Testing the Entrenchment, Pre-Emption and Verb/Construction Semantics hypotheses

In order to test the three theoretical accounts under investigation, we fitted mixed-effects linear regression models to the data. In order to ensure comparable results, we used exactly the same model-fitting procedure as that used for the native English-speaking adults in the study of Ambridge, Pine and Rowland (2012). This involved comparing models containing (a) the statistical predictors only (entrenchment and/or pre-emption), (b) the semantic predictors only and (c) both predictor types (using the anova procedure in the R environment).

Exactly as for this previous study, the optimal model included the semantic predictors and entrenchment but not pre-emption (as in the previous study, pre-emption is a highly significant predictor if entered *instead* of entrenchment, but does not explain significant additional variance if added to a model already containing the entrenchment predictor). Table 1 shows these models for the L1 adults (from Ambridge, Pine and Rowland 2012), and the L2 adults from the present study.

Table 1. Comparing the influence of entrenchment and verb+construction semantics on ratings of locative sentences by L1 and L2 English speakers.³

	L1 English				L2 English (German)			
	<i>M</i> (β)	<i>SE</i>	<i>t</i>	<i>p</i>	<i>M</i> (β)	<i>SE</i>	<i>t</i>	<i>p</i>
(Intercept)	0.19	0.45	0.43	0.665	-0.14	0.34	-0.40	0.632
Manner	0.10	0.06	1.77	0.077	0.09	0.04	2.14	0.024
End-State	-0.13	0.06	-2.21	0.027	-0.08	0.05	-1.78	0.060
S1 Splattering	-0.07	0.07	-1.04	0.299	-0.08	0.05	-1.44	0.130
S2 Joining	0.01	0.08	0.08	0.937	-0.05	0.06	-0.85	0.350
S3 Stacking	0.00	0.06	-0.03	0.976	0.03	0.05	0.66	0.500
S4 Gluing	0.26	0.07	3.89	0.000	0.18	0.05	3.58	0.001
S5 Smearing	-0.02	0.09	-0.26	0.798	0.00	0.07	0.05	0.948
Entrenchment	0.59	0.12	4.89	0.000	0.41	0.09	4.48	0.001
Verb Variance	0.28				0.15			
Participant Variance	0.00				0.00			
Model comparisons	AIC	logLik	Chi	<i>p</i>	AIC	logLik	Chi	<i>p</i>
(d) Statistics-only model	3959	-1974			4471	-2231		
(c) Stats + semantics model	3950	-1963	23.26	0.002	4463	-2220	22.10	0.002

Overall, the L1 and L2 speakers show a remarkably similar pattern. In both cases, one of the two broad-range semantic predictors (“Manner” or “End-state”), as well as the narrow range semantic predictor “Gluing” and the Entrenchment predictor reach statistical significance, with very similar effect sizes across the L1 and L2 speakers. The main difference is that, for the L1 speakers, the “End-state” predictor is significant, with the “Manner” predictor falling just short ($p=0.08$, n.s.), whilst, for the L2 speakers, the pattern is reversed (“End-state”, $p=0.06$, n.s.). The L2 speakers’ relative insensitivity to end-states accords with the previous finding that these speakers do not reject ungrammatical uses of some English end-state verbs, most notably *fill* (e.g. **Lisa filled water into the cup*), presumably due to transfer effects, coupled with a failure to fully appreciate the importance of state change in English – but not German – *fill*.

Nevertheless, the overall pattern of findings suggests that these advanced L2 English learners show near native-like performance in their use of the fit between verb and construction semantics to acquire verbs’ argument structure restrictions. The analysis presented above also suggests that they use entrenchment (and perhaps pre-emption) in a native-like way. However, this conclusion must remain tentative pending one final set of analyses.

³ *M* (β) = Mean (Beta), *SE* = Standard Error, *t* = test, *p* = value, AIC = akaike information criterion (a measure of how well the statistical model describes the data [lower AIC values = better fit]), logLik = log likelihood, Chi = Square

3.3 Clarifying the roles of entrenchment and pre-emption

Ambridge, Pine and Rowland (2012, 270) note that whilst difference scores, as used in the analyses reported above, clean up any general non-syntactic dispreferences associated with particular test sentences, they suffer from an important drawback when they are used to test the entrenchment and pre-emption hypotheses. Consider the case where repeated uses of *fill* in any construction (entrenchment) or in the ground-locative construction (e.g. *Lisa filled the cup with water*; pre-emption) contribute to the inference that non-attested, figure-locative uses (e.g. **Lisa filled water into the cup*) are not permitted. The problem with using difference scores to test this prediction is that any apparent entrenchment or pre-emption effect could, in principle, be a consequence of attested uses boosting the acceptability of the grammatical member of the pair rated in the study (e.g. *Lisa filled the cup with water*) rather than of attested uses reducing the acceptability of the ungrammatical member of the pair (e.g. **Lisa filled the cup with water*). This is a problem, as only the latter constitutes evidence for entrenchment/pre-emption.

Ambridge, Pine and Rowland (2012) therefore conducted a final analysis looking at raw acceptability ratings (rather than difference scores) for the 40 ungrammatical sentences only (i.e. figure-locative uses of ground-only verbs and vice versa). The entrenchment hypothesis predicts a significant negative correlation between overall verb frequency and sentence acceptability. The pre-emption hypothesis predicts a significant negative correlation between the frequency of the verb in the construction in which it is grammatical and sentence acceptability. For the adults studied by Ambridge, Pine and Rowland (2012, 271 [Table 5]), the entrenchment prediction was confirmed, but the pre-emption prediction was not (although this may be more to do with the lack of variance in the pre-emption predictor than any meaningful difference between the two mechanisms).

We therefore repeated this analysis for the present dataset. Surprisingly, neither the entrenchment nor the pre-emption predictor approached significance, whether entered into the model individually or together ($t < 1$, $p = \text{n.s.}$ in all cases). Why, then, did we observe an entrenchment effect in the main, difference score analysis? Presumably we are witnessing a case of the hypothetical scenario outlined above, whereby attested uses boost the acceptability of the grammatical sentences (a garden-variety frequency effect) but do not – as would be required as evidence for entrenchment/pre-emption – reduce the acceptability of ungrammatical sentences.

To investigate this possibility, we repeated the final analysis looking only at grammatical sentences (i.e. figure-locative uses of figure-only verbs and ground-locative uses of ground-only verbs). This revealed a significant positive correlation between acceptability and (a) overall verb frequency ($B = 0.37$, $SE = 0.08$, $t = 4.21$, $p < 0.001$) and (b) verb frequency in the locative construction in which the verb is grammatical ($B = 0.38$, $SE = 0.11$, $t = 3.53$, $p < 0.001$). Note that these

predictors are respectively the “entrenchment” and “pre-emption” predictors used in the previous analysis, but that these names are inappropriate when used to test predictions regarding the relative acceptability of grammatical sentences (as opposed to the relative *unacceptability* of ungrammatical sentences).

To summarize, when an L1 German learner of English hears a sentence such as *The glass was filling up* or *Bart filled the glass with juice*, this increases the perceived acceptability of grammatical sentences such as *Lisa filled the cup with water* but does not decrease the perceived acceptability of ungrammatical sentences such as **Lisa filled water into the cup*.

4. General Discussion

In the present study, advanced L1 German learners of English completed a grammaticality judgment task previously completed by native English-speaking adults. Although somewhat less disapproving of ungrammatical sentences in general – and, in particular, of ground-locative uses of *fill* (e.g. **Lisa filled water into the cup*) and a handful of related verbs, overall, the L2 speakers generally showed a very similar pattern of judgments to the L1 speakers.

Surprisingly, however, the L2 speakers appear to have arrived at their near-native-like command of the English locative construction via a somewhat different route. For native speakers, repeated occurrences of a verb in grammatical constructions contribute to an ever-strengthening probabilistic inference that non-attested uses are ungrammatical, via two closely-related mechanisms: *entrenchment* and *pre-emption*. However, at least for the specific L2 group and constructions studied here, second language learners of English do not seem to make these inferences.

How is it possible, then, that the L2 speakers were able to show such native-like performance overall? One possibility is that they have simply rote-learned lists of figure-only and ground-only verbs. However, this would not explain why their performance is more native-like for *pour* than *fill*, particularly given that the former is only around 1/3 as frequent as the latter, in both the ICE-GB and BNC corpora. An alternative possibility is that these L2 speakers might be making use of verb and construction semantics. That is, like native English speakers, they have learned that the figure- and ground-locative constructions are associated with “manner of motion” and “state-change” respectively, and are sensitive to violations whereby verbs that do not have matching semantic properties are used in these constructions (e.g. **Lisa poured the cup with water*). This semantic learning is not perfect, however. Like young children, these L2 speakers accept – and would presumably produce – ungrammatical figure-locative sentences with *fill* (e.g. **Lisa filled water into the cup*), perhaps because they have yet to appreciate the “state-change” nature of this verb’s semantics (although, as noted above, transfer effects from the L1 are almost certainly at play, too).

The very fact that relatively common locative verbs such as *fill* and (given the right type of ground object) *pour* alternate in German but not in English

might appear to cast doubt on the claim that speakers can use verbs' semantics to determine their argument structure privileges. Of course, cross-linguistic differences are not problematic for accounts under which constructions' semantic properties are learned entirely from the input, on a language-by-language basis (e.g. Croft 2001). But is there any evidence to suggest that learners can make use of correlations between meanings and word-order patterns that are universal, or at least, valid probabilistically?

It has often been suggested (e.g. Gropen, Hollander and Goldberg 1991a) that languages with locative constructions have a tendency to put the more "affected" NP in the post-verbal position. This would explain why the English figure-locative is associated with the manner of motion of the figure (*Lisa poured water into the cup*), whilst the English ground-locative is associated with state-change on the part of the figure (*Lisa filled the cup with water*). Let us assume that the equivalent German constructions have broadly similar semantic properties. Does the fact that both *pour* and *fill* alternate in German violate the cross-linguistic pattern? Not necessarily. Given that they generally allow at least some verbs to alternate, languages are presumably free to draw the boundary where they please. So, given that a German speaker can "pour water into the cup", German does not violate the tendency for the more "affected" NP to be in the post verbal position, just because he can *additionally* "pour the flowers with water". Indeed, the fact that German is more choosy about the particular ground objects that can be used with *pour* (plants and flowers, but only marginally cups and other containers) than *fill* (pretty much anything), is consistent with this pattern.

What *would* violate this tendency is a language where one could "pour the cup with water" but *not* "pour water into the cup", or where one could "fill water into the cup" but not "fill the cup with water". Although such languages probably exist, there is certainly some evidence to suggest that the proposed cross-linguistic tendency holds as a statistical generalization, if not a universal. For example, in a study of *pour*-type verbs across 12 languages, Hunter (2008) found that 73 were figure-only (*pour water into the cup*), 14 were alternating, and just 4 (two Greek, one Polish, one Dutch) ground-only (*pour the cup with water*). Conversely, of the *fill*-type verbs, 168 were ground-only (*fill the cup with water*), 41 alternating and just 17 (mostly from Japanese, Chinese, Korean and Hebrew) figure-only (*fill water into the cup*). Indeed, the closest translational equivalents of English *fill* and *pour* conformed to the predicted pattern across all 12 languages studied. Furthermore, with a single exception (the rather obscure verb *bind*), none of the verbs used in the present study were ground-only in English and figure-only in German, or vice-versa. All other cross-linguistic differences were cases of "boundary placement", where a verb that does not alternate in one language behaves more freely in the other.

Refocusing more directly on the present study, an important question for consideration is the relationship between our findings and those of other studies that have investigated L2 learners' acquisition of verb argument structure re-

restrictions. Perhaps most relevant is Bley-Vroman and Joo's (2001) study of L1 Korean learners' knowledge of semantic constraints on the English locative construction. This study used a picture-choice paradigm. When presented with a ground-locative sentence (e.g. *Lisa sprayed the wall with paint*), both the L2 and L1 English speakers preferentially selected a picture where the ground is completely affected (i.e. the wall is completely, rather than partially, covered), showing some sensitivity to the "end-state" semantics of this construction. Unlike the L1 speakers, however, the L2 speakers chose this picture at almost identical rates regardless of verb-class (i.e. even for ungrammatical sentences such as **Lisa poured the cup with water*). Although it is not quite clear what to make of these speakers' performance with the ungrammatical English sentences, overall, the results seem to show a similar pattern to that observed in the present study: good knowledge of the general semantics of the constructions, but not-quite-native-like understanding of the more nuanced semantic properties of the constructions and of individual verbs.

Studies investigating L2 English learners' knowledge of other constructions have generally yielded similar findings. Bley-Vroman and Yoshinaga (1992) and Inagaki (1997) investigated Japanese adults' knowledge of the semantic constraints on the English dative alternation (e.g. *John said something to Sue*; **John said Sue something*). Although they showed good performance with real English verbs, participants' performance with novel verbs indicated that they had yet to learn the subtle semantic constraints on the construction. These findings echo those of the present study that L2 English learners seem to have acquired many of the semantic properties of the locative constructions, but struggle with particularly nuanced cases that are also problematic for native-speaking children (e.g. figure-locative uses of *fill*). Indeed, in a study of L1 Korean learners' knowledge of the English benefactive alternation (e.g. *John baked a cake for Mary*; *John baked Mary a cake*), Oh (2010) found that increased proficiency was characterized by better understanding of the subtle semantic constraints on the double-object construction.

Other studies on L2 acquisition of verbs' argument structure restrictions have focused on L1 transfer effects. Inagaki (1997) and White (1987) found that Chinese learners of English, and English learners of French, accepted ungrammatical double-object dative sentences (e.g. **I pushed him the box*) whose translational equivalents are grammatical in the L1. Whong-Barr and Schwartz (2002) reported similar findings for L1 Japanese and L1 Korean learners of English. Montrul (2001) showed differential transfer effects between L1 Spanish and L1 Turkish learners of English. Specifically, L1 Spanish speakers incorrectly rejected English intransitive inchoative sentences (e.g. *The window opened*), presumably because the Spanish equivalent (*La puerta se abrió*) requires a reflexive marker ('The window opened itself'). The L1 Turkish speakers correctly accepted these sentences, presumably because many (but not all) Turkish verbs are like English verbs in requiring no morphological inchoative marker.

Transfer effects in the present study were modest, presumably because (a) many of the relevant verbs have similar privileges in English and German and (b) the participants were relatively advanced English learners. However, the L1 German speakers did display a small tendency towards allowing some English figure-only verbs to alternate, presumably because they alternate in German (at least if one adds a prefix). There was also some evidence of L1 transfer for *fill*, and a handful of semantically-related verbs, which are ground-only in English, but alternate in German.

Although there are few studies that directly investigate entrenchment and pre-emption in L2 learning, the findings of one study of pre-emption amongst L1 French learners of English (Trahey and White 1993) strike an intriguing parallel with those of the present study. The focus of the study was adverb placement. Whilst French allows SVAO order but not SAV (e.g. *John kisses often Mary*; **John often kisses Mary*), the reverse is true for English (e.g. **John kisses often Mary*; *John often kisses Mary*). A two-week “flood” of naturalistic English input resulted in significantly increased use of the correct English word-order (e.g. *John often kisses Mary*), but this was not accompanied by decreased use of the incorrect order (**John kisses often Mary*). This parallels the finding of the present study that increased verb frequency in permitted constructions (e.g. *Bart filled the glass with juice*) appears to increase the acceptability of similar grammatical sentences (e.g. *Lisa filled the cup with water*), but does not seem to reduce the acceptability of alternative ungrammatical forms (e.g. **Lisa filled water into the cup*).

What, then, are the implications of the present finding for L1 German learners of English, in terms of strategies for learning and teaching? Some suggestions follow, though it must be borne in mind that we are novices, rather than experts, in the field of L2 acquisition.

- Although advanced learners have largely overcome damaging transfer effects, some may remain. Learners could therefore be encouraged to focus explicitly on verbs that behave differently in the L1 and L2 (e.g. *fill*). Explicit instruction at the level of the language and construction may also be beneficial (e.g. “English locative constructions are fussier than their German equivalents, so watch out for verbs that alternate in German but not in English”). In this area, examples of positive transfer can also be found.
- Transfer effects need not always be damaging; many constructions, including the figure- and ground-locative, show broadly similar behaviour cross-linguistically. In such cases, it may be beneficial for teachers to explicitly point out cross-linguistic similarities, as well as differences, at the construction level.
- Unlike for L1 learning, repeated presentation of grammatical forms (e.g. *Lisa filled the cup with water*) may be insufficient to block use or acceptance of competing ungrammatical forms (e.g. **Lisa filled water into the cup*). Thus, explicit negative evidence may be required, particularly

for persistent errors.

- Relatedly, since learners do not seem to use entrenchment or pre-emption spontaneously (at least in this case), there may be some value in encouraging L2 learners to adopt them as specific strategies (e.g. “If you have heard a verb many times in only one of the two locative constructions, it is probably ungrammatical in the other”).
- Finally, there is some preliminary evidence to suggest that L2 learners use the semantic fit between verbs and constructions to determine verbs’ argument structure privileges, and even that this strategy is a hallmark of advanced learning (Oh 2010). Thus it may be beneficial to encourage learners to focus on the semantic properties shared by all verbs that appear in a particular construction, or even to provide learners with explicit training (e.g. use the figure-locative with motion verbs and the ground-locative with state-change verbs).

In conclusion, although there exist extensive literatures on (a) the acquisition of verbs’ argument structure restrictions in L1 acquisition and (b) learning and teaching strategies in L2 acquisition, there have – to our knowledge – been few attempts to unite the two. Our hope in conducting this preliminary investigation is that we have been able to contribute in some way to the process by which findings from the L1 acquisition literature are put to practical use in the service of second language learning.

Appendix 1. Verbs and their locative argument-structure properties. Verbs with different properties in English and German are shown in bold type.

Verb	English	Verb	German
	Type		Type
brush	Alternates	(leer)feigen/harken, (voll)pinseln	Alternates*
dab	Alternates	(be)tupfen	Alternates*
rub	Alternates	(ab/ein)reiben	Alternates*
smudge	Alternates	(be)schmieren	Alternates*
heap	Alternates	(über)häufen	Alternates*
splash	Alternates	(be)spritzen	Alternates*
splatter	Alternates	(be)spritzen	Alternates*
spray	Alternates	(be)sprühen	Alternates*
sprinkle	Alternates	(be)sprengen, (be)streuen	Alternates*
squirt	Alternates	(be)spritzen	Alternates*
scatter	Alternates	(be/ver)streuen	Alternates*
cram	Alternates	(voll)stopfen	Alternates*

jam	Alternates	(voll)stopfen	Alternates*
load	Alternates	(be/voll)laden, (be/voll)packen	Alternates*
pack	Alternates	(be/voll)packen	Alternates*
spread	Alternates	(be)streichen	Alternates*
spread	Alternates	verteilen	Figure_Only
pile	Alternates	stapeln	Figure_Only
stack	Alternates	stapeln	Figure_Only
crowd	Alternates	zusammendrängen	Figure_Only
stock	Alternates	(ein)lagern	Figure_Only
dribble	Figure_Only	(be)träufeln	Alternates*
drip	Figure_Only	(be)tröpfeln	Alternates*
drizzle	Figure_Only	(be)träufeln	Alternates*
pour	Figure_Only	(be)gießen	Alternates*
spill	Figure_Only	(be)schütten	Alternates*
spill	Figure_Only	verschütten	Figure_Only
spew	Figure_Only	(be/voll)spucken	Alternates*
vomit	Figure_Only	(be/voll)kotzen	Alternates*
glue	Figure_Only	(be/voll)kleben	Alternates*
paste	Figure_Only	(be/voll)kleben	Alternates*
staple	Figure_Only	(voll)tackern	Alternates*
stick	Figure_Only	(be/voll)kleben	Alternates*
dump	Figure_Only	abladen	Figure_Only
coil	Figure_Only	spulen, wickeln	Figure_Only
twirl	Figure_Only	zwirbeln	Figure_Only
whirl	Figure_Only	drehen, wirbeln	Figure_Only
attach	Figure_Only	anbringen	Figure_Only
fasten	Figure_Only	anheften, festmachen	Figure_Only
nail	Figure_Only	(fest)nageln	Figure_Only
pin	Figure_Only	anheften	Figure_Only
tape	Figure_Only	festkleben	Figure_Only
fill	Ground_Only	(be)füllen	Alternates
splotch	Ground_Only	(be)klecksen	Alternates*
bind	Ground_Only	(fest)binden	Figure_Only
flood	Ground_Only	(über)fluten	Ground_Only

bandage	Ground_Only	verbinden	Ground_Only
coat	Ground_Only	bestreichen, bestreuen	Ground_Only
cover	Ground_Only	bedecken	Ground_Only
clutter	Ground_Only	überhäufen, vollstopfen	Ground_Only
dirty	Ground_Only	beschmutzen	Ground_Only
infect	Ground_Only	infizieren	Ground_Only
stain	Ground_Only	beflecken	Ground_Only
ripple	Ground_Only	berieseln	Ground_Only
drench	Ground_Only	durchnässen	Ground_Only
saturate	Ground_Only	tränken	Ground_Only
soak	Ground_Only	einweichen, tränken	Ground_Only
stain	Ground_Only	beflecken	Ground_Only
block	Ground_Only	blockieren	Ground_Only
clog	Ground_Only	verstopfen	Ground_Only
entangle	Ground_Only	verheddern, verwirren	Ground_Only
litter	Ground_Only	vollmüllen#	Ground_Only#

= An alternative translational equivalent – wegwerfen is figure-only

* = Ground only if the prefix shown in parentheses is added

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