Something I was dealing with

Preposition placement in multilingual constructicons

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This contribution adopts a usage-based construction grammar approach to describe the word order variation between fronting (e.g., *something with which I was dealing*) and stranding (e.g., *something which I was dealing with*) in English as a second language. Using regression analysis, preposition placement in relative clauses is correlated with multiple usage-based variables, including specific lexical items and strings (e.g., *with which, deal with*). The results suggest that learners acquire a network of form-meaning constructions which represent their language use at multiple levels of schematicity, ranging from lexically specific prototypes to cross-linguistically shared representations. Moreover, effects of proficiency and lexical strings indicate that constructions remain adaptable to usage throughout learners' lifetime and involve predictive knowledge, suggesting a dynamic view of constructions.

Keywords: English as a second language, preposition placement, usage-based, construction grammar, corpus, regression

1. Introduction

There is a peculiar word order variation related to the place of prepositions in English relative clauses (RCs): prepositions are either fronted or stranded. For example, in the prepositional relative clause (PRC) in Example (1), the preposition *on* precedes the relative pronoun *which* (1a). As is known (Huddleston & Pullum, 2002, p. 627) in this particular context, the preposition might just as well surface at a point later in the clause (1b).

(1) a. the sources on which they rely
b. the sources which they rely on
(British National Corpus [BNC], BNC Consortium, 2007)

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This word order variation is known as *preposition placement* and occurs in English *wh*-RCs, *wh*-questions, preposing clauses, and exlamative clauses but suprisingly not in non-*wh*-RCs and some other clause types which force prepositions to strand, as seen for non-*wh*-RCs in Example (2).

(2) a. for no reason Ø (that) he knew of
b. *for no reason of Ø (that) he knew (BNC)

In addition to clause type, the variation is influenced by a wide range of item-, form-, and meaning-related variables, such as the meaning of the RC filler (Hoffmann, 2011, pp. 65–72), different relativizers (Guy & Bayley, 1995), modality and style (Johansson & Geisler, 1998; Yáñez-Bouza, 2015), and, in language acquisition, schooling (McDaniel, McKee, & Bernstein, 1998), relative frequency in the input (Bardovi-Harlig, 1987), and cross-linguistic similarity (Mazurkewich, 1985), among others.

This contribution targets the acquisition of fronting and stranding in PRCs in English as a second language. A corpus study is conducted to determine the role of language use, proficiency, and cross-linguistic similarity for French, German, Italian, Spanish, Chinese, Japanese, and Korean learners of English compared to native English speakers. The results indicate, among other things, that language users learn to associate fronting and stranding with specific prepositions, lexical strings, and RC fillers. Moreover, European learners benefit from cross-linguistic similarity when acquiring fronting. This is interpreted in a usage-based construction grammar framework (Diessel, 2015; Goldberg, 2006). More specifically, I argue that language users acquire a network of interrelated constructions at different levels of schematicity which represent both low-level distributional characteristics of their input and high-level cross-linguistic similarity. On the meaning side, fronting and stranding are associated with different ways of construing the RC filler. Moreover, the results suggest a more dynamic view of constructions which brings construction grammar and learning closer to psycholinguistic research on language processing, predictability, and information flow.

In the following, usage-based construction grammar is outlined and the fronting-stranding variation is introduced in more detail. Then, method and results of the current corpus study are described. The following discussion addresses the question of what construction grammar in particular contributes to the interpretation of the results. Following this, connections to psycholinguistic research are explored.

2. Preliminary considerations

2.1 Descriptive redundancy and cross-linguistic representation

There are different varieties of construction grammar (Hoffmann, 2013). Distinctions aside, most researchers in the field define constructions as two-sided symbols which link a linguistic form to a meaning representation (e.g., Goldberg, 2006, p. 5). For example, idiomatic expressions such as *a dime a dozen* ("abundant and easily obtained") or *drives me mad* ("is extremely annoying") are commonly analyzed as symbolic units which link a particular form to a specific meaning, with a low degree of compositionality. In this respect, idiomatic expressions are similar to words: both are stored "en bloc" in the mental lexicon and are learned from input. In this, construction grammar is not different from probably most linguistic grammars. What is outrageous about construction grammar is the assumption that this way of describing language extends to all of grammar. By way of illustration, construction grammarians describe perfectly unsuspicious expressions like *He slammed the door shut* not as an arrangement of words which have been put together in compliance with combinatorial rules to form a well-formed sentence but as instantiations of multiple constructions, here including the lexical items *he, slam, door*, and *shut*, the item-specific schema V-*ed*, and the highly schematic template SUBJ V OBJ XP. While they differ in size and schematicity, the constructions involved are essentially similar in that both lexical items and grammatical constructions are form-meaning units. The V-*ed* construction, for instance, adds the morpheme *-ed* to a verb and refers to an event in the past, so its meaning is something like PAST EVENT. The SUBJ V OBJ XP resultative construction, in contrast, is phonologically open and links a specific word order to a situation in which someone causes something to become something or to change its state.

Grammatical constructions are not innate but, like lexical items, acquired from input. According to usage-based research (Diessel, 2015; Langacker, 2010), constructions emerge as generalizations over strings of lexical items in language use. In other words, constructions represent the commonalities of different lexical strings (Goldberg, 2019, p. 73). In language acquisition, learners rely on their nonlinguistic abilities to perceive similarities across different linguistic experiences and to categorize them accordingly. For example, repeated exposure to different regular past verbs like *slammed, loved*, and *enjoyed* leaves memory traces of their commonalities, resulting in the V-*ed* past tense construction described above. The frequency of exposure is probably the most essential determinant of this implicit learning process. The degree of entrenchment of (parts of) a construction increases with the frequency of encounters in the input. For example, with the past tense, the morpheme *-ed* is encountered frequently and only in this form, while different

verbs occur in front of the morpheme, which results in the half-filled, half-open V-*ed* construction. As a consequence of their usage-based nature, constructions represent the distributional characteristics of the input from which they have emerged, as evidenced by the well-documented sensitivity of language processing and acquisition to frequency of use (e.g., Diessel & Hilpert, 2016). The emerging network of interrelated and overlapping constructions is commonly known as *constructicon*, an expanded mental lexicon which comprises not only words and idiomatic expressions but also grammatical constructions of different size and schematicity (Diessel, 2019).

Unlike grammarians in nonconstructionist frameworks, most construction grammarians have abandoned the long-standing norm of parsimonious grammar writing and instead adopted a model which includes both generalizations and redundant lower-level instantiations. Descriptive redundancy enables construction grammarians to capture the distributional characteristics and item-specific behavior of constructions which usage-based research has revealed are part of language users' knowledge. In line with usage-based research, they assume that "patterns are stored as constructions even if they are fully predictable [from component parts or more schematic constructions] as long as they occur with sufficient frequency" (Goldberg, 2006, p. 5). For example, the expression *the sooner the better* instantiates the more schematic comparative correlative construction *the* X-*er the* Y-*er*, which is also involved in *the uglier the better* as in *I love weird things, the uglier the better* (Corpus of Contemporary American English [COCA], Davies, 2008) and in the proverb *the bigger they are the harder they fall* (Hoffmann, 2019). Despite that, *the sooner the better* is probably used frequently enough to be stored in memory as a whole, in addition to the more general pattern and the lexical items involved. To give another example of item-specific knowledge, collostructional analysis of language use (Gries & Stefanowitsch, 2004) indicates that constructions are associated with different lexical items to varying degrees. For instance, the ditransitive construction strongly attracts the verb *give* as in *John gave Mary the book*, whereas the similar *to*-dative construction is strongly associated with the verb *send* as in *John sent the book to Mary*.

At the other end of the spectrum, usage-based construction learning results in highly schematic representations of similarities across lexical strings, for example, the SUBJ V OBJ XP resultative construction mentioned above, which is phonologically open and only specifies grammatical categories and their order. Researchers in second language acquisition and language contact have capitalized on this to describe the linguistic knowledge of multilingual and multilectal language users (Hall, Cheng, & Carlson, 2006; Hilpert & Östman, 2014; Höder, 2014a). Researchers in this field argue that cross-linguistic similarities give rise to highly schematic interlingual representations which cut across "language boundaries." In other words,

they call into question the clear-cut distinction between multiple languages or varieties in one mind and instead propose that multilingual constructicons consist of repertoires of both language-specific and language-nonspecific constructions, where *language-specific* means associated with specific domains or situations of use in a multilingual community. This view is supported by recent language processing studies which indicate between-language priming for cross-linguistically similar constructions, suggesting shared representations (Hartsuiker & Pickering, 2008; Hartsuiker & Bernolet, 2017). For example, English-Dutch bilinguals are more likely to produce a *to*-dative construction in Dutch (e.g., *De kok toont een hoed aan de bokser* "The cook shows a hat to the boxer") when they have recently heard one in English (e.g., *The dancer gives a banana to the nun*) and the other way round, suggesting a cross-linguistically shared representation of *to*-datives (Schoonbaert, Hartsuiker, & Pickering, 2007).

2.2 What preposition placement depends on

Usage-based construction grammar has been adopted recently by different scholars as a framework to approach preposition placement in English, most notably, by Hoffmann (Hoffmann, 2005, 2006, 2007, 2008, 2011, 2013), who conducted a series of corpus and experimental studies to investigate fronting and stranding in British and Kenyan English. In line with the literature (e.g., Biber, Johansson, Leech, Conrad, & Finegan, 1999, p. 106; Gries, 2002; Hawkins, 1999; Huddleston & Pullum, 2002, pp. 464–466; Trotta, 2000, pp. 57–65, 182–189; Yáñez-Bouza, 2015), Hoffmann's results indicate that the place of the preposition depends on a wide range of item-, form-, and meaning-related variables, including clause type, the meaning of the filler in *wh*-clauses and its so-called extraction site, specific lexical items and strings, different relativizers, the meaning of the RC and its complexity, and text type or style.

Among other things, Hoffmann develops a complex meaning continuum which ranges from prototypical complements to adverbials of time and space and which correlates with preposition placement, as seen in Example (3): complement fillers occur with stranding (3a), while adverbial fillers tend to fronting (3b).

(3) a. your book – there's a passage which we talked about
b. the imperfect world in which we live (COCA)

In addition, in Hoffmann's study, there is a tendency for prepositions to strand when their lexical head is a verb (like *talk* in 3a) or adjective (e.g., *aware of*), while noun phrase-embedded prepositions tend to front, for instance, *of* in Example (4)

(4) the country of which you like the ambassador (Hoffmann, 2011, p. 87)

This is also known as the extraction site of the *wh*-pronoun, implying that the pronoun is first generated as part of a phrase within the clause and is then "extracted" and "moved" to the front, dragging along the preposition (Chomsky, 1981, pp. 292–300; Radford, 2009, pp. 198–206). In a more processing-oriented view, the RC filler (the head nominal or the *wh*-pronoun) is integrated into a "gap" within the RC and the processing effort increases with the distance between filler and gap (Gibson, 1998; Hawkins, 2004). I will therefore use the term *gap site*. On the assumption that stranding is more difficult to process than fronting, increased processing effort due to long filler-gap distance should promote fronting. Accordingly, researchers expect more fronting with noun and adjective-phrase embedded gaps, compared to verbal gap sites; however, the results of different studies are inconclusive (Hoffmann, 2011, p. 167; Trotta, 2000, pp. 184–185).

Moreover, collostructional analyses revealed that different types of adverbial PRCs occur with specific noun-preposition strings more often than expected by chance. For example, manner PRCs attract the strings *way in, ease with*, and *speed with* in British English, illustrated in Example (5).

(5) a. the ways in which the satire is achieved
b. the ease with which the Saxons overran […] England
c. the speed with which rainforests are being felled

(Hoffmann, 2011, p. 164)

The role of lexical strings and their collocation strength has been noticed before. For example, Biber et al. (1999, p. 106) note that "[f]orms which are typically used as stranded prepositions are those which are closely linked to a preceding word", for instance, bound prepositions of multi-word units such as *confide in, rely on*, and *part with* (Biber et al., 1999, p. 74). Adopting a usage-based construction grammar framework, Hoffmann describes the linguistic knowledge underlying the variation as a network in which fronting and stranding constructions are linked with varying degrees to different clause and meaning types (Hoffmann, 2011, pp. 264–275).

Acquisition research has focused on the order of acquisition of fronting and stranding in different learner populations. In her influential study, Bardovi-Harlig (1987) argues that acquisition is triggered by the relative salience of the constructions in learners' English input. Since stranding is more frequent than fronting in English language use, learners acquire stranding before fronting. Second language learners, in particular, develop a persistent stranding-fronting asymmetry across different clause types, while native learners at some point acquire a fronting bias for *wh*-RCs, probably due to writing conventions and style norms taught in school (McDaniel et al., 1998). Moreover, there is evidence to suggest that nonnative learners are influenced by cross-linguistically similar native-language

constructions when acquiring preposition placement in English. For instance, in a study by Mazurkewich (1985), adolescent Quebec French learners of English produced more fronted prepositions than a comparison group of nonnative learners with a typologically distant, different native language, Inuktitut, which does not have prepositions. By way of illustration, consider the French PRC in Example (6).

(6) a. *le monsieur à qui j'ai donné le document*
the gentleman to who I gave the document
'the gentleman to whom I gave the document'
(Batchelor & Chebli-Saadi, 2011, p. 474)

b. **le monsieur qui j'ai donné le document à*
the gentleman who I gave the document to
'the gentleman who I gave the document to'

English and French PRCs are similar: in both languages, RCs follow the modified noun and are introduced by a relative pronoun; the prepositional object is in clause-initial position followed by the subject followed by the verb followed by another object; and, most importantly, the preposition is fronted (6a). In contrast to English, stranding the preposition is not grammatical in French (6b). This is similar to typologically related European languages, for instance, Italian (Maiden & Robustelli, 2013, pp. 130–131) and Spanish (De Bruyne & Pountain, 1995, p. 191) but also German (Eisenberg et al., 2009, p. 1030). By comparison, the equivalent constructions in typologically more distant languages like Inuktitut are different from English RCs. Mazurkewich does unfortunately not provide an Inuktitut example. Instead, consider Chinese, which has preposition-like items but does not use them in PRC-equivalent constructions, as seen in Example (7).

(7) *wǒ xiě xìn de máobǐ*
I write letter REL brush pen
"the brush pen with which I write letters" (Li & Thompson, 1981, p. 582)

Unlike in English, Chinese PRCs precede the modified noun, have a different word order, do not use relative pronouns but the nonreferential *de* which indicates nominalization, and, most importantly, do not express oblique relationships explicitly (in other words, there is no item equivalent to English *with* used in 7). This is similar to other East Asian languages such as Japanese (Gunji, 1987, p. 180) and Korean (Sohn, 2001, pp. 310–311).

Since stranding is not grammatical in French but only fronting, this suggests that Mazurkewich's French learners transferred their first-language fronting construction into their second language and depended on cross-linguistic similarity when placing prepositions in English. In contrast, learners with typologically

more distant, different native languages such as Inuktitut or Chinese do not have available crosslinguistically similar constructions to rely on and are thus driven primarily by the relative salience of fronting and stranding in their English input (Bardovi-Harlig, 1987, pp. 388–390). While these and subsequent studies (e.g., Kao, 2001; Rezai, 2006) acknowledge the influence of input and cross-linguistic similarity on second language acquisition, they do not argue that fronting and stranding are form-meaning constructions which emerge from language use; rather, they assume that preposition placement is determined by formal rules which are rooted in an innate grammar and whose maturation is merely triggered by input and similarity (Chomsky, 1981).

3. The current study

The current study adopts a usage-based construction grammar framework to investigate preposition placement in English as a second language. More specifically, the study focuses on the acquisition of preposition placement in PRCs which of all clause types accounted for the most variation in Hoffmann's (2011) study.

3.1 Method

Corpora, Sample Extraction, and Coding. PRCs were extracted from a series of native and nonnative English corpora: the Louvain Corpus of Native English Essays (LCN, Granger, n.d.), the British part of the International Corpus of English (ICE-GB, Greenbaum, 1996; Nelson, Wallis, & Aarts, 2002), the French, German, Italian, Spanish, Chinese, and Japanese parts of the International Corpus of Learner English (ICLE, Granger, Dagneaux, Meunier, & Paquot, 2009), and the Korean Yonsei English Learner Corpus (YELC, Rhee & Jung, 2012). The nonnative corpora consist of different text types by learners at different proficiency levels and with different native languages. To ensure comparability across nonnative corpora, only argumentative essays by learners at a proficiency level between B1 and C2 of the Common European Framework of Reference for Languages were used. The nonnative ICLE and YELC materials were combined for the analysis (2,178,767 words). The LCN was designed as a native reference corpus for the ICLE and consists of argumentative essays and some literary essays by native English-speaking undergraduate and highschool students (324,399 words). The British part of ICE is a one million word sample of spoken and written material by adult native English speakers. Only the written part was used, which includes a wide range of genres, most of

which were for publication, for example, academic papers, newspaper reports, and novels, or for impersonal communication, such as business letters. Informal genres like social letters were excluded in an attempt to control for register and style across corpora (392,496 words). Hoffmann (2011, p. 155) identified informal registers as favoring stranding in native British English but not in Kenyan nonnative English, suggesting that nonnative usage is less context-sensitive or that Kenyan language users are more strongly influenced by written registers. For the current study, no informal learner texts were available and, therefore, informal registers were excluded altogether. Unlike the other corpora, the ICE-GB is human-annotated for part of speech and syntactic dependencies. All the corpora date back to the 1990s, except of YELC, which was compiled from 2011 to 2012.

The ICE-GB had already been tagged for parts of speech and parsed for syntactic dependencies manually. The corpus exploration program ICECUP was used to extract all noun phrases with a preposition immediately followed by a *wh*-pronoun and all noun phrases which included a stranded preposition. Conveniently, all prepositions not followed by a dependent noun phrase had been tagged as *stranded*. The ICLE, YELC, and LCN material was automatically parsed for parts of speech and dependencies using the open source parser Parsey McParseface, which is available for download online (Andor et al., 2016). The outcome of the parsing process was imported into the computing software R (R Core Team, 2013) and was searched automatically for all RC modifiers, infinitive modifiers, and sentences which included prepositions immediately followed by a *wh*-pronoun.

To assess precision and recall of the automated parse-and-search procedure, random 10% of the German part of the ICLE material, 5% of the Chinese part, and 10% of the native LCN material were searched manually and the results were compared to the outcome of the automated search. Overall, 71 instances of PRCs were extracted manually from the subsample, 35 fronting and 32 stranding, as well as 4 PRCs with doubled prepositions (e.g., *the world in which you're living in*, ICLE) which were excluded from the analysis. The outcome of the Parsey-and-R solution to data extraction was compared to the outcome of a parse-and-search solution based on the Stanford parser (Chen & Manning, 2014) and Stanford Tregex (Levy & Andrew, 2006). For the Stanford-and-Tregex solution, the test sample was parsed automatically and then multiple tree patterns were defined to extract instances of fronting and stranding PRCs. The precision of the different procedures is summarized in Table 1, with two columns for preposition placement and two rows indicating the number of instances extracted (Hit) and not extracted (Miss) by the respective automated parse-and-search solution.

Table 1. Precision and recall of the two automated parse-and-search procedures

a Parsey-and-R solution				b Stanford-and-Tregex solution			
	Fronting	**Stranding**	**Sum**		**Fronting**	**Stranding**	**Sum**
Hit	35	30	65	Hit	34	16	50
Miss	0	2	2	Miss	1	16	17
Sum	35	32	67	Sum	35	32	67

As is evident from Table 1, the hit ratio of the Parsey-and-R solution was considerably higher than that of the alternative Stanford-and-Tregex solution. The Parsey-and-R solution returned 97% of all PRCs identified in the subsample and missed only the stranding PRCs in Example (8).

(8) a. without anything new for the moment to cling to (ICLE)
b. the vital funds charitable organisations relied upon (LCN)

The obtained sample was analyzed for preposition placement (fronting vs. stranding) as the dependent variable and a wide range of meaning- and form-related predictor variables, including learner group (native vs. nonnative), level of proficiency (novice vs. advanced), native language group (European vs. East Asian), the frequency of use of specific lexical strings in English as a measure of their collocation strength, the meaning of the RC filler, and the gap site (VP vs. AP vs. NP) (for an exhaustive list and discussion of all predictor variables, see Jach, 2018b, pp. 99–103). Concerning proficiency, the ICE-GB material was considered more advanced than the LCN, ICLE, and YELC. Hoffmann characterizes the ICE-GB as a sample "of the most educated end of the British English sociolect" (2011, p. 16) which includes publications by highly literate writers, for example, academic papers, newspaper reports, and novels. The LCN, ICLE, and YELC, in contrast, include texts by highschool and undergraduate students who had by the time arguably acquired a lower level of literacy and education than most of the ICE-GB writers. As regards native language group, nonnative writers with a European native language (French, German, Italian, Spanish) were contrasted with nonnative writers with an East Asian native language (Chinese, Japanese, Korean). As illustrated above, while the European languages in the sample use only fronting in PRCs, the East Asian languages avoid prepositions in equivalent constructions. The frequency of use of specific lexical strings (e.g., *talk about, about which*) was estimated based on the logarithmized absolute frequency of occurrence in the BNC. By way of illustration, consider Example (9).

(9) a. problem, which the community may not be aware of
b. type of fiction, […] which she cannot give a name to
c. a father with whom he can play and learn (ICLE)

Example (9a) was assigned frequency values for the item-preposition string *aware of*, and the preposition-item string *of which*. While *aware of* is included in (9a), *of which* is part of its fictive fronted counterpart. The two strings compete with each other and the outcome of the competition is hypothesized to influence preposition placement. Therefore, for each PRC, the frequency of both strings was recorded. When the stranded preposition was not adjacent to its lexical head within the RC (9b), the frequency of the respective item-preposition string was recorded anyway (here, *give to*). Moreover, when there were two or more lexical heads (9c), string frequencies were averaged (here, *play with* and *learn with*).

Moreover, following Hoffmann (2011), the meaning of RC fillers was recorded. This is illustrated in Example (10).

(10) a. something I was dealing with (ICE-GB)
b. quickness with which you work (ICLE)
c. buildings in which thousands of people breathe (YELC)

Adopting a frame semantic approach (Fillmore, 1982; Fillmore & Baker, 2010), RC fillers were categorized as participants, supplements, or environment of the RC event. For instance, in (10a), the RC filler *something* specifies a component of the *deal* event within the RC. According to the description on the FrameNet online database (Ruppenhofer, Ellsworth, Petruck, & Johnson, 2016), the verb *deal* in (10a) evokes the RESOLVE PROBLEM frame which consists of multiple core and noncore components such as AGENT, CAUSE, PROBLEM, CIRCUMSTANCES, MEANS, MANNER, and so on. The RC filler *something* specifies the PROBLEM component, which is a core component. All core components were categorized as participants. By comparison, *quickness* specifies MANNER in the *work* frame (10b). Fillers which referred to manner, means, reason, purpose, result, instruments, and respect were categorized as supplement fillers. In contrast, fillers describing space, time, and circumstances of the RC event such as *buildings* (10c) were counted as environment fillers.

Different gap sites are illustrated in Example (11), with the embedding phrase and gap marked by labeled square brackets and lines, respectively.

(11) a. a religion that they do not [$_{VP}$ believe in ___] (LCN)
b. the things people are [$_{AP}$ interested in ___] (ICLE)
c. people we know and come in [$_{NP}$ contact with ___] (LCN)

In (11a), the preposition *in* is part of a verb phrase headed by *believe*. In contrast, in (11b), *in* is dependent on the adjective *interested*. Last, in (11c), the preposition *with* is embedded in a noun phrase headed by *contact*.

Statistical Modeling. The annotated data were subjected to a binary logistic regression analysis. Note that learner group, level of proficiency, and native language group were collinear, which poses a problem for multivariate logistic approaches

(e.g., Field, Miles, & Field, 2012, pp. 274–276). Therefore, a variable writer group was created for the regression analysis, with three levels representing advanced native writers (ICE-GB), novice native writers (LCN), and novice nonnative writers (ICLE, YELC). Then, two models were fitted to the data: one including writer group and one including native language group and proficiency as predictor variables. The models were fitted in a top-down procedure. First, a beyond-optimal model was computed including all relevant variables and relevant two-way and three-way interactions. Then, terms were dropped one by one. If the difference in deviance between the original and the resulting model was not significant in an ANOVA, the term in question was excluded from following models, until only significant terms remained. Prior inspection of the data and evaluation diagnostics of the final models indicated no problematic degrees of multicollinearity of predictor variables (meaning that the different predictor variables were not strongly associated with each other) or nonlinear relationships between continuous predictor variables and the log of the outcome variable. Standardized residuals were nearly normally distributed and no influential observations were identified based on Cook's distance. Refitting the final models 2,000 times on random samples indicated robust confidence intervals for all significant effects. To account for subject- and item-specific variance, the final models were refitted with random intercepts for prepositions and corpus files as an approximation of individual writers (Baayen, 2008; Gries & Kootstra, 2017). Coefficients and significance levels were consistent across models. The statistical analysis was carried out in R (R Core Team, 2013). Mixed effects models were fitted with the lme4 package (Bates, Mächler, Bolker, & Walker, 2015).

3.2 Results

Exploration of the Data. There were 2,298 PRCs in the sample, 1,481 fronted and 817 stranded. In addition, the search yielded 15 PRCs with doubled prepositions, such as Examples (12a) and (12b), from both native and nonnative corpora.

(12) a. the city to which Candide was sailing to (LCN)
b. a series of disasters, in which Rome failed to […] intervene in (ICE-GB)
c. formal learning […] the synthesis of which you get acquainted with (ICLE)

Note that this is different from PRCs with two prepositions which are dependent on two different lexical heads, like in (12c): the stranded preposition *with* depends on *acquainted* as a lexical head, whereas the fronted preposition *of* is related to *synthesis*. Examples with doubled prepositions like (12a) and (12b) were excluded from further analysis, while PRCs with two prepositions like (12c) were included twice.

Concerning different learner groups (native vs. nonnative), initial exploration indicated that native English speakers used more fronting than nonnative learners of English (71.53% vs. 60.07%). The difference was significant in a Pearson's chi-squared test, $X^2(1) = 30.58$, $p \leq .001$. The distribution of fronting and stranding across learner groups is tabulated in Table 2, with two rows for different learner groups and two columns for fronting and stranding. Even though the nonnative learners contributed more PRCs to the sample than the native English speakers, given the different sizes of the corpora, the likelihood of coming across a PRC was considerably higher in the native than in the nonnative material (12.25 vs. 6.52 in 10,000 words).

Table 2. Distribution of fronting and stranding across learner groups

	Fronting	Stranding	Sum
Native English speakers (ICE-GB, LCN)	628	250	878
Nonnative learners (ICLE, YELC)	853	567	1420
Sum	1481	817	2298

Note: $X^2(1) = 30.58$, $p \leq .001$

With respect to different proficiency levels (novice vs. advanced), initial analysis revealed that novice writers stranded more than advanced writers (40.99% vs. 15.76%). According to a Pearson's chi-squared test, the difference was significant, $X^2(1) = 106.8$, $p \leq .001$. The distribution is outlined in Table 3.

Table 3. Distribution of fronting and stranding across levels of proficiency

	Fronting	Stranding	Sum
Advanced writers (ICE-GB)	417	78	495
Novice writers (LCN, ICLE, YELC)	1064	739	1803
Sum	1481	817	2298

Note: $X^2(1) = 106.8$, $p \leq .001$

The lion's share of the sample came from the novice writers (78.46%) but not surprisingly, PRCs more likely occurred in the advanced than in the novice material (12.61 vs. 7.2 in 10,000 words).

Next, the effect of different native languages (European, East Asian) was targeted. The distribution is given in Table 4.[1]

1. The collinearity of learner group, proficiency, and native language mentioned above becomes apparent when comparing the corpus notes in parentheses in Tables 2 to 4.

Table 4. Distribution of fronting and stranding across native language groups

	Fronting	Stranding	Sum
Native English speakers (ICE-GB, LNC)	628	250	878
European learners (ICLE)	727	378	1105
East Asian learners (ICLE, YELC)	126	189	315
Sum	1481	817	2298

Note: $X^2(2) = 102.24$, $p \leq .001$.

European learners fronted more than East Asian learners (65.79% vs. 40%) but less than native speakers of English (71.53%). The effect was significant in a Pearson's chi-squared test, $X^2(2) = 102.24$, $p \leq .001$. According to multiple post hoc pairwise comparisons using Pearson's chi-squared test with Bonferroni correction, all three level contrasts were significant: native English speakers vs. European learners, adjusted $p \leq .05$; native English speakers vs. East Asian learners, adjusted $p \leq .001$; and European vs. East Asian learners, adjusted $p \leq .001$.

Next, consider the distribution of string frequencies (not of strings) across fronting and stranding PRCs in the sample, represented in Figure 1 in the form of grouped density plots (Baayen, 2008, pp. 25–26; Levshina, 2015, pp. 10–11). Recall that string frequencies were estimated not based on the sample but on the BNC to assess the collocation strengthes of the strings. A density plot is similar to a histogram but smoothes the distribution into a line. The shaded area under the curves represents the probability of a frequency interval in the sample in fronted PRCs (dark) and stranded PRCs (light). Dashed vertical lines indicate mean frequencies. Lexical strings were added to exemplify different frequencies. As is evident from the left panel, stranding PRCs were more densely populated by highly frequent item-preposition strings than fronting PRCs. The mean difference of 1,210.86 was significant according to a *t*-test, $t(1, 936.33) = -2.03$, $p \leq .05$, $d = -0.08$. The panel on the right suggests that fronting PRCs were populated by highly frequent preposition-item strings, especially, *in which*. In addition, there were some low-frequency strings like *on which* and *to which* in fronting PRCs, too. The lightshaded peak at string frequencies between 0 and 10,000 indicates that low frequency sequences were more likely in stranding than in fronting PRCs. In other words, most prepositions and relativizers of the stranding PRCs in the sample commonly do not combine into preposition-item strings in English, as evidenced by low string frequency in the BNC. The mean difference between fronting and stranding PRCs was 11,430.14 and significant in a *t*-test, $t(903.18) = 24.05$, $p \leq .001$, $d = 0.97$. Note that the light-shaded peak labeled *of-that* in the right-hand panel does not indicate frequent fronting with *that* in the sample, which was attested only once (see below). Rather, the peak resulted from the high frequency of preposition-*that* strings in the BNC where *that* is often used as demonstrative (e.g., *A separate leaflet gives details of that scheme*, BNC) or conjunction

(e.g., *He's typical in that he's very reserved*, BNC). In other words, the peak indicates that *that*RELATIVIZER occurred primarily in stranding PRCs in the sample despite the high frequency of preposition-*that*DEMONSTRATIVE/CONJUNCTION strings in the BNC.

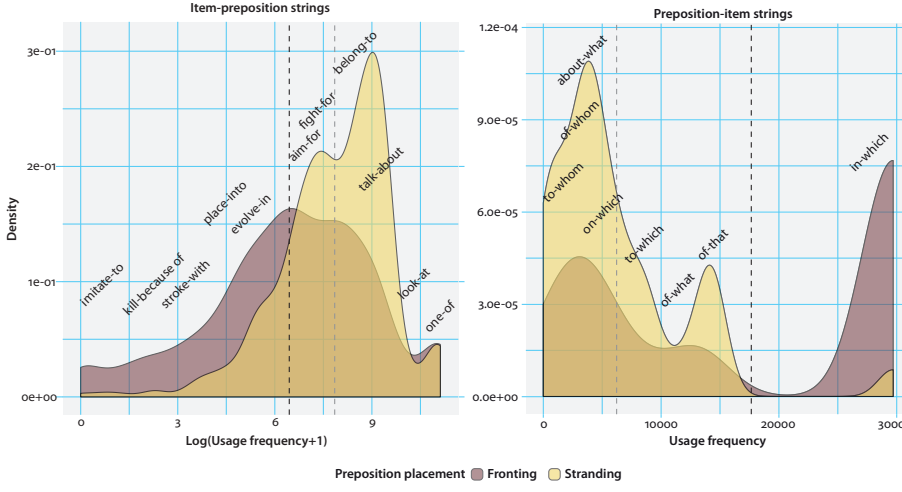

Figure 1. Distribution of string frequencies across fronting and stranding PRCs

Moreover, the distribution of fronting and stranding was dependent on the meaning of the RC filler. The distribution is given in Table 5, with preposition placement in two columns tabulated against different filler meanings in three rows.

Table 5. Distribution of fronting and stranding across different filler meanings

	Fronting	Stranding	Sum
Participant	555	763	1318
Supplement	354	29	383
Environment	566	24	590
Sum	1475	816	2291

Note: $X^2(2) = 672.61$, $p \leq .001$

Initial analysis revealed that participant fillers tended to strand more than both supplement and environment fillers (57.89% vs. 7.57% vs. 4.07%). The difference was significant, according to a Pearson's chi-squared test, $X^2(2) = 672.61$, $p \leq .001$. Multiple post hoc pairwise comparisons using Pearson's chi-squared test with Bonferroni correction indicated significant contrasts between participant and environment fillers, adjusted $p \leq .001$, and participant and supplement fillers, adjusted $p \leq .001$. The contrast between supplement and environment fillers was not significant, adjusted $p \leq .1$.

Next, consider the distribution across different gap sites, tabulated in Table 6, with columns for preposition placement and rows for different gap sites. As is evident from the distribution, there was a strong tendency to front with noun phrase-embedded gaps compared to verb phrase- and adjective phrase-embedded gaps (89.86% vs. 63.27% vs. 40%).

Table 6. Distribution of fronting and stranding as a function of different gap sites

	Fronting	Stranding	Sum
VP	1237	718	1955
AP	52	78	130
NP	186	21	207
Sum	1475	817	2292

Note: $X^2(2) = 93.29$, $p \leq .001$. VP = Verb phrase, AP = Adjective phrase, NP = Noun phrase, PartC = Partitive construction

The difference was significant in a Pearson's chi-squared test, $X^2(2) = 93.29$, $p \leq .001$. Post-hoc pairwise comparisons using Pearson's chi-squared test with Bonferroni correction indicated significant contrasts between all three levels, with all adjusted $p \leq .001$. Moreover, RC filler meaning and gap site interacted such that nominal sites had almost only participant fillers.

Last, collostructional analysis indicated associations between specific prepositions and fronting and stranding. The results are listed in Table 7, with rows for preposition types and columns for collocation strength (-log10[p] of Fisher-Yates exact test) and association strength (conditional probability ΔP of fronting/stranding, given the preposition) (Gries & Ellis, 2015).

Table 7. Ten most distinctive preposition types in fronting and stranding PRCs

a Fronting			b Stranding		
Preposition	**-log10(p)**	**ΔP**	**Preposition**	**-log10(p)**	**ΔP**
in	54.80	0.31	about	32.93	−0.59
by	3.65	0.22	with	12.39	−0.26
accord to	2.49	0.36	to	11.89	−0.26
during	2.49	0.36	for	11.43	−0.27
within	2.10	0.36	on	1.70	−0.10
among	1.91	0.36	over	1.24	−0.31
under	1.25	0.27	into	0.91	−0.18
of	0.94	0.04	from	0.70	−0.05
upon	0.68	0.14	through	0.58	−0.06
thanks to	0.57	0.36	off	0.45	−0.64

Note: -log10(p) = Collocation strength. ΔP = Association strength.

Preposition types were ordered by collocation strength. The higher the collocation strength value, the more distinctive the preposition type is for one of the two constructions. A value greater than or equal to 1.3 indicates statistical significance below or at the conventional level of $p \leq .05$. The association strength value ranged from −0.64 to 0.36, with high values indicating strong association with fronting and low values indicating repulsion of fronting and attraction to stranding.

Regression analysis. Multivariate logistic regression models were fitted to the data to estimate the influence of each variable while keeping the other variables constant. In addition to learner group, proficiency, native language group, and string frequencies, a wide range of meaning- and form-related variables which are known to influence preposition placement was included. A considerable part of the data had to be excluded to avoid (quasi-)complete separation. For example, zero PRCs such as Example (2) above force prepositions to strand and were therefore excluded. There was, however, one case of nonstandard fronting with *that*-PRCs (e.g., *a world in that not everybody has the right to choose his / her belief*, ICLE). Despite risks of singularity, *that* PRCs were kept in the sample not to loose a substantial part of the stranding PRCs for the analysis. Moreover, PRCs with nominal gap sites like in Examples (4) and (11c) above, including partitive constructions (e.g., *the young, most of whom are immature and have bad temper*, ICLE), were excluded because their distribution was heavily skewed towards fronting and virtually restricted to participant fillers. Eventually, 1,536 PRCs were included in the regression sample, 1,256 fronting and 280 stranding.

Recall that, because of collinearity, two models had to be created: one including writer group (advanced native vs. novice native vs. novice nonnative) and one including native language group (English vs. European [French, German, Italian, Spanish] vs. East Asian [Chinese, Japanese, Korean]) as a variable. In addition, random slopes for prepositions and corpus files were included to control for item- and subject-specific variance. The final models are summarized in Table 8.

As seen in Table 8a, there was a significant effect of writer group. The figures indicate that advanced native English speakers were significantly less likely to strand prepositions than novice native English speakers. Moreover and importantly, novice nonnative learners were not significantly different from novice native English speakers, suggesting that the effect of writer group was due to differences in proficiency (novice vs. advanced) rather than learner group (native vs. nonnative). In addition, the model predicted increasing odds of stranding with increasing item-preposition string frequency, whereas estimated odds decreased with increasing preposition-item string frequency. In addition, as is evident from Table 8b, there was an effect of native language group such that stranding estimates were significantly lower for European learners than for both East Asian learners and native English speakers, for whom in turn estimates were not significantly different

Table 8. Mixed-effects regression models with (a) writer group or (b) native language group and proficiency as predictor variables

a	
Intercept	−3.45*** (0.79)
Advanced native	−1.58** (0.53)
Novice nonnative	−0.62 (0.40)
Freq. prep.-item	−1.39*** (0.32)
Freq. item-prep.	0.91*** (0.21)
Freq. preposition	1.23** (0.45)
That	7.95*** (1.11)
What/-ever	4.76*** (0.72)
Where	1.86 (1.14)
Whom/Who/Whose	−1.70** (0.59)
Participant	1.97** (0.64)
Supplement	−0.79 (0.84)
Marginal R^2	0.75
Conditional R^2	0.83
Observations	1,536
b	
Intercept	−5.92*** (1.60)
European	−1.34* (0.64)
East Asian	1.10 (0.73)
Novice	1.83* (0.77)
Freq. prep.-item	−1.53** (0.56)
Freq. item-prep.	1.06** (0.32)
Freq. preposition	1.36* (0.61)
That	9.10*** (2.39)
What/-ever	5.72*** (1.70)
Where	1.67 (1.47)
Whom/Who/Whose	−2.04* (0.96)
Participant	2.27** (0.77)
Supplement	−0.83 (0.99)
Marginal R^2	0.75
Conditional R^2	0.88
Observations	1,536

Note: * $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

from each other. Based on the outcome of the first model, only proficiency but not learner group was included in the second model. As expected, novice writers were more likely to strand than advanced writers. Moreover, preposition placement was influenced by the frequency of the preposition, different types of relativizers, and

the meaning of the RC filler (participant vs. supplement vs. environment). Note that the contrast between supplement and environment fillers was not significant. Recall that the effects were independent of each other (no multicollinearity among predictor variables). In other words, the preference patterns of different learner groups and native language speakers were not merely correlates of the linguistic variables in the models but independent effects. The R^2 values indicate the proportion of the total variance explained by the models: marginal R^2 represents the proportion explained by the predictor variables only, while conditional R^2 represents the proportion explained when item- and subject-specific effects are in addition taken into account (Nakagawa, Johnson, & Schielzeth, 2017). The intercept adjustments for specific prepositions of the model in Table 8a are plotted in Figure 2. The intercept for each preposition was adjusted depending on its preference, with positive adjustments indicating preference for stranding, negative for fronting.

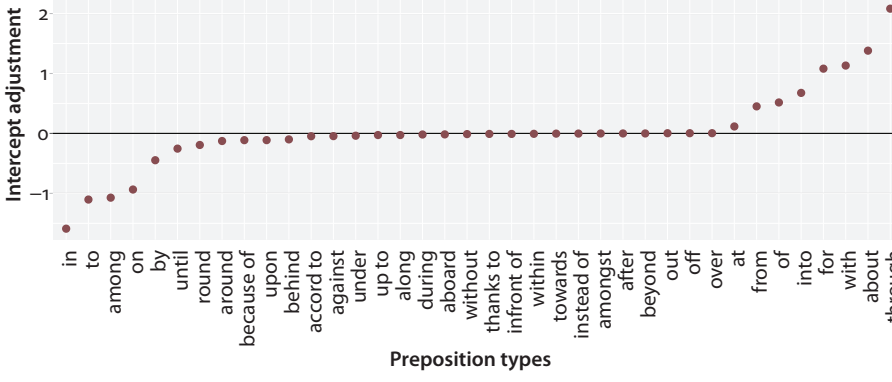

Figure 2. Random intercepts of preposition types

4. Discussion

4.1 Summary of findings

The analysis of a sample of PRCs from native and nonnative English corpora (ICE-GB, LCN, ICLE, YELC) indicated that the place of the preposition (fronting vs. stranding) was dependent on the writers' proficiency (novice vs. advanced) and native language (European vs. East Asian), string frequency, the meaning of the RC filler (participant vs. supplement vs. environment), different types of relativizers, and the frequency of the preposition. Initial exploration of the data suggested that novice writers (ICLE, YELC, LCN) stranded prepositions more than advanced writers (ICE-GB). This association was confounded by learner group (native vs.

nonnative) which influenced preposition placement such that nonnative learners (ICLE, YELC) used more stranding than native English speakers (ICE-GB, LCN). A three-level variable writer group was thus included in the regression analysis which indicated a significant contrast between advanced native English speakers and novice nonnative learners but not between novice native English speakers and novice nonnative learners, suggesting an effect of proficiency but not of learner group. Moreover, as expected based on initial exploration, the regression analysis indicated that European learners were more likely to front than native English speakers, while East Asian learners were not significantly different from the natives. The odds of stranding increased with the usage frequency of item-preposition strings (e.g., *aim for, belong to*) but decreased with increasing preposition-item string frequency (e.g., *to which, in which*). In addition, stranding was more likely with participant fillers than with both supplement and environment fillers. Concerning different gap sites, nominal sites strongly tended to front prepositions and occurred almost only with participant fillers (and were therefore excluded from the regression analyses). Not surprisingly, the relativizers *that, what*, and *where* increased the odds of stranding, whereas *which* and *who*(*m/se*) were associated with fronting. The regression analysis revealed in addition a correlation between the place and the frequency of use of a preposition: more frequent prepositions were more inclined to strand. Last, collostructional analysis and estimated item-specific effects indicated associations of fronting and stranding with specific prepositions. For instance, *in* and *by* attracted fronting, while *about* and *with* were associated with stranding.

The results are in good agreement with the literature. In line with acquisition research (Bardovi-Harlig, 1987; McDaniel et al., 1998), nonnative learners were more inclined to strand prepositions than native English speakers, even though this was probably due to a correlated difference in proficiency rather than different learner groups. As expected based on cross-linguistic research (Mazurkewich, 1985), European learners tended to front more than East Asian learners and native English speakers, suggesting that their language use was influenced by cross-linguistic similarity of fronting constructions in their languages. Moreover, lexical string frequency as a measure of collocation strength had a significant effect on preposition placement. As suggested elsewhere (Biber et al., 1999, p. 106; Gries, 2002; Hawkins, 1999), prepositions were more likely to strand with increasing dependence on their lexical heads within the RC (e.g., *rely on, belong to*). Prepositions were likewise more likely to front when the preposition-item string frequency increased (e.g., *in which*). Item-construction associations between specific prepositions and fronting and stranding have already been documented anecdotally elsewhere (Bergh & Seppänen, 2000; Johansson & Geisler, 1998; Trotta, 2000, p. 185) but, to the best of my knowledge, lack a proper explanation. Some have related this to the length and

frequency of prepositions. As noted by Quirk, Greenbaum, Leech, and Svartvik (1985, p. 664), more frequent prepositions are more likely to strand. Even though consistent with the literature, this comes as a surprise, first, because the underlying reasoning in the literature seems to be that length and frequency of a preposition correlate such that more frequent prepositions tend to be shorter and together establish a preference for stranding; however, length was not a significant predictor of place in the current analysis. And, second, because the effect of frequency dropped out as statistically nonsignificant in a multivariate analysis of another study (Gries, 2002). Additionally, the regression analysis indicated independent of length and frequency individual preferences of specific prepositions for either fronting or stranding.

In line with Hoffmann (2011), participant fillers (roughly equivalent to complement fillers) were associated with stranding, whereas environment fillers (in other words, prototypical adverbial fillers) were associated with fronting. Contrary to Hoffmann's results the current analysis does not suggest a continuum of meaning types but a dichotomy: There was no significant contrast between environment and supplement fillers but only between participant fillers on the one hand and supplement and environment fillers on the other hand. This is consistent with formal approaches to preposition placement (Hornstein & Weinberg, 1981) but inconsistent with results of more recent functional studies which propose a multi-level or continuous meaning effect (Takami, 1992, p. 14; Trotta, 2000, p. 59). There were at least two reasons for this. First, some of the fillers which had been assigned to intermediate meaning types in prior studies were classified as participant fillers in the current study. For example, *the seat* in *the seat that I sat in* (LCN) was treated as a participant filler in the current study because the lexical head verb *sit* implies a particular location as a prominent part of the associated posture frame. Second and probably more importantly, the graded influence of meaning on preposition placement in other studies was at least in part due to correlated differences in collocation strength between prepositions and their lexical heads. By way of illustration, consider Hoffmann's meaning continuum which ranged from complements of prepositional verbs and idiomatic multi-word expressions (e.g., *rely on, get rid of*) over in-between categories like affected locations (e.g., *sit on*) and goals of movement (e.g., *rush to*) to adjuncts specifying time, place, and other adverbial aspects (e.g., *kill in, watch on*). As is evident from the examples in parentheses, the collocation strength between preposition and lexical head gradually decreases from complements to adjuncts. Once collocation strength is controlled for by factoring in different string frequencies, the effect of intermediate meaning types is probably not significant anymore. Last, as for different gap sites, in line with Hoffmann's results, nominal sites strongly favored fronting, whereas verbal and adjectival sites were more equally distributed and favored stranding, respectively.

4.2 Usage-based construction grammar view

Usage-based construction grammar is a suitable framework for describing the complex interplay of multiple item-, form-, and meaning-related variables which influence preposition placement. The results suggest that the writers have acquired fronting and stranding constructions with different meanings and at different levels of schematicity. Because of its descriptive redundancy and cross-linguistic representational format outlined above, the constructicon is able to capture representations at multiple levels of schematicity which account for different effects. Moreover, unlike nonconstructionist frameworks, construction grammar acknowledges that grammatical structures are meaningful and thus describes constructions as units of both form and meaning. In this view, form and meaning are closely interlinked, which opens a new and unexpected perspective on the effect of the RC filler meaning on preposition placement.

First, different prepositions were attracted to different places. For instance, everything else being equal, the prepositions *in, to, on, among*, and *by* were more strongly attracted to fronting than other prepositions, whereas the prepositions *through, about, with, for*, and *into* were more inclined to strand. Moreover, preposition placement was affected by the frequency of use of specific lexical strings such as *talk to* and *in which*. The effects of both lexical items and strings suggest that the writers have acquired lexically specific representations of fronting and stranding at a low level of schematicity. From a usage-based perspective, language users extract item-specific prototypes of a construction from highly frequent and invariant patterns in their input. For instance, Bybee (2010) thinks of constructions as clouds of similar exemplars which learners have encountered in language use and which cluster together in memory. The degree of entrenchment of a construction depends on its frequency of occurrence and the similarity of its instantiations. Highly frequent and similar exemplars establish deeply entrenched prototypes around which more atypical exemplars crowd. By now, there is abundant evidence for the item-specific nature of grammar knowledge (Diessel, 2016; Hilpert & Diessel, 2017).

In the current sample, 93.45% of all fronting PRCs had *which* as a relativizer, 54.05% of which with the preposition *in*. The second most frequent preposition of this group, *of*, covers only 10.19%, the third, *to*, only 4.91%, and so on, the proportions rapidly shrinking with increasing frequency rank. This suggests that the writers have acquired an item-specific fronting prototype of the form N *in which* SUBJ V (OBJ), which is represented in the constructicon at a low level of schematicity. Concerning stranding, 80.78% of all stranding PRCs in the current sample were either *that*- or zero RCs, with prepositions more equally distributed than in

fronting PRCs: *in* (20%), *to* (15.61%), *with* (14.7%), *about* (10.76%), *for* (10.76%), *of* (8.79%), *on* (6.97%), and so on. This suggests that two stranding prototypes have evolved, one around the relativizer *that* and one with no overt relativizer: N *that*/Ø SUBJ V (OBJ) PREP. Both stranding prototypes do not seem to be as strongly bound to specific prepositions as the fronting prototype but the effect of string frequency suggests that they are associated with specific high-frequency lexical strings such as *go to, talk about*, and *aware of*.

The lexically specific prototypes are redundant in the sense that the writers have stored them in addition to more schematic constructions which the prototypes instantiate. This is evident, for example, from the effect of different relativizers on preposition placement. This effect suggests that, in addition to low-level prototypes, the writers have stored more schematic representations at a superordinate level of the constructicon. For example, they have likely acquired at least two fronting representations associated with specific relativizers, *which* and *who*(*m*), but with open slots for different prepositions. Because of their higher specificity the lower-level prototypes are at a processing advantage over their more schematic parent constructions (Langacker, 1999, pp. 104–107). Likewise, when competing for activation with stranding constructions, lower-level fronting prototypes outpace stranding competitors at higher levels. In other words, fronting prototypes have a higher chance of winning out over competing stranding constructions. For instance, 98.94% of all PRCs with the relativizer *which* and the preposition *in* fronted the preposition, compared to only 92.04% of all *which*-RCs with different prepositions. Put differently, in 7.96% of all *which*-RCs with prepositions other than *in*, the writers decided to strand the preposition, compared to only 1.06% when the preposition was *in*. Apparently, a lexically specific *in which*-construction has evolved and survived, which places *in* in front of *which* before any stranding construction is activated. This is also evident from the model predictions: the five PRCs which were most strongly predicted to front (in other words, which the model felt most confident would front their prepositions) are instantiations of the fronting prototype, as seen in Example (13).

(13) a. Arthur Machen's "The Bowmen" in which the spirits of St George and his archers repel a German attack
b. The Ribble Valley result, in which the Liberal Democrats snatched the 10th safest Tory seat
c. a short period in which the child cannot be roused
d. the world in which Tom Jones inhabits
e. the more informative rotating arm tests in which the model is towed not only on the oblique path but (ICE-GB)

In addition to these lower-level representations, the effect of native language group suggests that the European learners in the current sample have acquired a higher-level construction which represents the cross-linguistic similarity of fronting. The cross-linguistic similarity of fronting in English and the different European native languages was illustrated by the French Example (6) above. As was evident from the example, English and French fronting PRCs overlap in word order. In contrast, there is relatively little overlap between English PRCs and the equivalent East Asian constructions, illustrated by the Chinese Example (7) above. Following Mazurkewich (1985), European learners of English probably relied on similar native-language constructions when placing a preposition in English. Since they have established a fronting but no stranding construction in their native languages, they were likely to front prepositions in English, too, compared to East Asian learners, who do not use prepositions in equivalent native-language constructions and who were not significantly different from the native English speakers in the sample, suggesting that for them preposition placement in English was not influenced by their native languages. This is in line with a recent acceptability rating experiment (Jach, 2018a), which indicates that fronting in English PRCs is more acceptable to German than to Chinese learners.

On the assumption that constructions emerge from similar exemplars in language use, multilingual language users probably generalize across similar exemplars from different languages in their multilingual input and establish representations which span two (or more) languages. The emerging high-level constructions capture the cross-linguistic similarity of the language-specific constructions, more specifically, the overlap in the word order of fronting PRCs in the native language and English. This lends support to recent attempts to incorporate multilingual or, rather, language-nonspecific knowledge into the constructicon (Hall et al., 2006; Hilpert & Östman, 2014; Höder, 2014a). For instance, in a series of publications, Höder (2012, 2014a, 2014b) has developed the concept of diaconstructions. Diaconstructions establish interlingual or diasystematic links between constructions from two (or more) different languages or varieties which language users perceive as similar in form and equivalent in function. This is in line with recent cross-language priming studies which suggest that bilinguals acquire shared representations if they perceive constructions from their different languages as sufficiently similar (Hartsuiker & Pickering, 2008; Hartsuiker & Bernolet, 2017). With respect to preposition placement, this suggests that the European learners have acquired an interlingual fronting construction which represents the overlap of fronting PRCs in English and their respective native language and which they use as a highly schematic template for placing prepositions in English. As a consequence, the acquisition of English fronting was probably boosted. Once established, the diaconstruction is reinforced

by fronting exemplars from different languages. In other words, the diaconstruction "inherits" the frequency of fronting constructions across languages (Runnqvist, Gollan, Costa, & Ferreira, 2013). Given the monopoly of fronting in the European native languages in the sample, this led to the preference for fronting in English.

To sum up, while researchers in nonconstructionist frameworks strive for parsimonious and reductionist descriptions of grammar, construction grammarians assume descriptive redundancy and are therefore able to take into consideration item-specific effects. In addition, proponents of usage-based construction grammar have questioned the long-standing view of different languages as monolithic blocks in a multilingual mind and have instead proposed that multilinguals acquire interlingual representations or diaconstructions which capture cross-linguistic similarities and account for transfer effects. From this perspective, the results suggest that the language users have acquired a network of constructions at different levels of schematicity. The network ranges from low-level lexically specific prototypes which represent highly frequent and invariant usage patterns to high-level schematic constructions which capture the cross-linguistically similar word order of fronting PRCs from different languages. In addition, the writers have likely acquired partially filled, partially open constructions at intermediate levels of schematicity.

Next, the results of the current analysis indicate that stranding was associated with participant fillers, whereas fronting co-occured with supplement and environment fillers. This is similar to the two-way distinction between complements and adjuncts common in more formal approaches to preposition placement (Hornstein & Weinberg, 1981). For instance, adopting a generative grammar framework (Chomsky, 1981; Van Riemsdijk, 1978), Hornstein and Weinberg propose that stranding is only grammatical with prepositions heading complements because of a complex interaction of reanalysis of the constituent structure of the RC verb phrase, the assignment of case features to constituents, covered transformational operations like *wh*-movement, and the application of a universal filter which blocks movement out of prepositional phrases. The presupposed generative approach to grammar is no longer considered psychologically plausible in cognitive linguistics (Tomasello, 1998, 2003). Instead, as mentioned above, construction grammarians conceive of grammar as an inventory of form-meaning units. Like lexical items, grammatical constructions consist of both a linguistic form and an associated meaning representation. More specifically, some proponents of usage-based construction grammar assume that the meaning of grammatical constructions resides in specific ways of viewing or construing the conceptual content evoked by lexical items (Diessel, 2019, pp. 107–111; Langacker, 2008, p. 43). In this view, the correlation between the place of the preposition and the meaning of the RC filler suggests that fronting and stranding were associated with two different ways of construing the RC filler:

fronting construes the filler as backgrounded or out of focus, whereas stranding indicates that the filler is to be viewed as a focal participant of the RC event.

Why is that? I suggest that this is due to temporal iconicity. Temporal iconicity results from "a natural tendency for conceived time and processing time to be coaligned, such that the order in which events are conceived as occurring dovetails with the order in which they are conceptualized and described" (Langacker, 2008, p. 79). In other words, the linear order of linguistic forms tends to match the order of the experience they describe, like in *Socrates took hemlock and died*, where poisoning precedes death both linguistically and experientially. Following this line of thought, I propose that in PRCs the linear proximity of the preposition to its lexical head within the RC indicates the conceptual proximity of the RC filler to the head. Put differently, since the RC filler is immobile (i.e. the modified noun or the *wh*-pronoun do not "move" in any sense of the word), the preposition is used to indicate when or where the filler should be integrated into the RC during processing. Stranding places the preposition late in the RC and close to its lexical head. This indicates high conceptual proximity of the filler to the associated frame and late integration. In contrast, fronting places the preposition early in the RC and increases the linear distance between the preposition and its lexical head in the RC, indicating low conceptual proximity of the filler to the associated frame and early integration. By way of illustration, consider Example (14), adapted from Hornstein and Weinberg (1981, p. 58).

(14) a. the boat on which John decided
b. the boat which John decided on

According to Hornstein and Weinberg, the fronted version of the PRC (14a) is ambiguous between a complement reading ("John decided to buy or look at the boat.") and an adjunct reading ("John decided while standing on the boat."). When the preposition is stranded (14b) they argue that the adjunct reading is ruled out because of reanalysis of the underlying structure and covered movement of components. In contrast, according to the current proposal, the preposition marks the site where the filler is integrated into the RC. Stranded *on* indicates an integration site close to the verb *decide*. An integration site close to the frame-evoking verb suggests that the filler specifies a participant or core component of the nearby frame. Construing the filler as a core component results in a participant or complement reading. In contrast, fronting *on* places the preposition early in the clause and increases the linear distance to *decide*. Accordingly, the filler is integrated early and tends to be construed not as a core component but as a background component of the verb frame, which more likely results in an adjunct or environment/supplement reading.

More precisely, fronting construes RC fillers as out of focus, stranding as focal participants *at the level of the RC*. This explains why prepositions were mostly

fronted in nonprototypical contexts with nominal gap sites: here, the preposition and RC filler form a modifier which is conceptually closely linked to its head noun but which is conceptually out of focus on the clause level. By way of illustration, consider Example (15).

(15) some products of which the production causes air pollution (ICLE)

The RC filler *some products* is integrated into the relative clause as part of a noun phrase, more precisely, as a modifier of the noun *production*. While conceptually focal at this level of construal (the filler *some products* specifies a core component of the *production* frame), the filler is backgrounded at clause level (the causer of pollution is the production process, not the products themselves) and, thus, the preposition is fronted.

4.3 Predictability and adaptability of constructions

In addition to item-, form-, and meaning-related aspects, preposition placement was influenced by lexical string frequency: the odds of stranding increased with increasing item-preposition string frequency (e.g., *aim for, belong to*) but decreased with increasing preposition-item string frequency (e.g., *in which, on whom*). This has already been addressed in the context of item-specific prototypes. The writers have likely acquired lexically specific prototypes of fronting and stranding which are associated with high-frequency preposition-item and item-preposition strings, respectively. In addition to this, the effect of string frequency suggests that the acquired constructions involve sequential, predictive knowledge. Usage-based research has convincingly demonstrated that linguistic knowledge on all levels of analysis involves sequential knowledge, as evidenced by studies on constituency structure and coalescence (Bybee & Scheibman, 1999; Bybee, 2002; Krug, 1998), word learning (Saffran, Aslin, & Newport, 1996), string processing (Bannard & Matthews, 2008; Durrant & Doherty, 2010; Tremblay & Baayen, 2010), and by a range of computational modeling studies on language parsing and learning (Frank & Christiansen, 2018; Chater, McCauley, & Christiansen, 2016; McCauley & Christiansen, 2011, 2014; see also Reali & Christiansen, 2009). These studies suggest that language users implicitly make predictions about likely continuations of a language stream based on the preceding context, which contributes to fluent and idiomatic language use (Levy, 2008).

The ability to predict upcoming linguistic items relies on, among other things, chunking. A chunk is a unit of memory organization: two items are strung together in memory because they tend to co-occur in language use (Newell, 1990, p. 7). High-frequency lexical strings are therefore likely to be chunked (Bybee, 2010, pp. 97–101). For example, items such as *have, not*, and *am* are commonly contracted

to *'ve, n't*, and *'m* in high-frequency strings like *I have* (*I've*), *do not* (*don't*), and *I am* (*I'm*), respectively. This suggests that they are stored and processed as parts of larger, routinized chunks (Krug, 1998).

In this view, high-frequency item-preposition and preposition-item strings have likely been chunked. For example, the verb *belong* is frequently followed by the preposition *to* (e.g., *A lightsaber belongs to the person who constructed it*, COCA). As a consequence, language users tend to store and retrieve them as a unit. Therefore, given *belong*, they strongly expect the next item to be *to*. An unexpected, low-frequency neighbor slows processing down (e.g., *with* as in *This child belongs with her*, COCA). When assembling a PRC, high-frequency item-preposition strings like *belong to* are retrieved and used as prepackaged wholes, which leads to stranding. In contrast, high-frequency preposition-item strings such as *in which* likely form complex relativizers in memory which are used "in one piece," leading to fronting. Like with other constructions, the entrenchment of chunks is a matter of degree and depends on the frequency of use: the more often the items occur with each other in language use, the stronger they become associated in memory. As a consequence, the effect of chunking on preposition placement is gradual, with the odds of stranding gradually increasing with the frequency of co-occurrence of lexical head and preposition but gradually decreasing with increasing preposition-relativizer string frequency. Many PRCs with doubled prepositions such as in Examples (12a) and (12b) above occurred with both chunked complex relativizers (e.g., *in which, of which*) and item-preposition collocations (e.g., *intervene in, conscious of*), suggesting that the doubling resulted from a lack of inhibitory control.

Last, on usage-based assumptions, the difference between proficiency groups (novice vs. advanced) suggests that fronting and stranding constructions are continuously adapted to language use throughout the learners' lifetime. Novice writers have developed a stranding bias probably because stranding is more frequent than fronting in English. This is similar to Bardovi-Harlig (1987), who argues that the nonnative acquisition order of stranding before fronting depends on relative salience which triggers acquisition, as outlined above. From a usage-based perspective input does not trigger but is the prime driver of acquisition. In this view, constructions emerge from language use and the frequency of exposure determines their degree of entrenchment. Since stranding is more common than fronting in English, it has emerged before and has been more deeply entrenched than fronting.

In contrast, more advanced language users have acquired a preference for fronting. While some argue that this is due to schooling (McDaniel et al., 1998), a usage-based approach suggests that advanced learners have become attuned to more fine-grained distributions of fronting and stranding in English. More specifically, there is corpus evidence to suggest that, while stranding is more frequent than fronting in English in total, this is primarily due to specific clause types which

(virtually) force prepositions to strand (e.g., *that*-PRCs, *wh*-questions, passives), whereas in *wh*-RCs fronting is more common than stranding (Hoffmann, 2011, p. 81). Note that the regression sample consisted largely of *wh*-RCs (81.18%). The novice writers might have been insensitive to specific contexts of use and therefore tended to strand prepositions independent of clause type. In contrast, the more experienced writers have probably fine-tuned their constructions to specific contexts of use in which they have experienced them most often and thus learned to associate fronting with *wh*-RCs more strongly than novice writers. The interaction of proficiency and relativizers was not included in the regression analysis because of rank deficiency (not all proficiency groups used all relativizers, in particular, *that*, with both fronting and stranding) but a recent acceptability rating experiment with English *wh*-PRCs confirms the influence of proficiency on preposition placement (Jach, 2018a). In this study, ratings for fronting gradually increased with the raters' proficiency and converged across learner groups (native vs. nonnative) and native language groups (German vs. Chinese) on mean native ratings at the highest level of proficiency. This is also in good agreement with recent psycholinguistic research which indicates that language users become sensitive to more fine-grained and context-dependent distributions with increasing experience (Ellis, Simpson-Vlach, & Maynard, 2008; Schmitt, 2012).

Both their predictability and adaptability to usage highlight the dynamic and processing-related nature of constructions. From this perspective, constructions should be considered as cognitive routines or "trails" (German "Trampelpfade", Behrens, 2011; Schmid, 2018) rather than fixed units akin to idioms or dense clouds of exemplars. This conceptualization links constructions and construction learning to connectionist networks, complex adaptive systems, which learn to predict a language stream by strengthening activation patterns during input processing (Beckner et al., 2009; Diessel, 2019; Elman et al., 1996). Moreover, predictability relates to information flow, which is known to influence preposition placement (Takami, 1988, 1992) but which has received little attention in the current study. Takami suggests that stranding occurs with more informative prepositional phrases. In general, the distribution of information seems to be an important factor determining the emergence of constructions. For example, in a recent study, Bannard, Rosner, and Matthews (2017) argue based on experimental data that children acquire collocations or chunks not only from frequent but also from informative lexical strings. In line with Gries, who views a construction as "an entropy-reducing spike of a distribution in an area in multidimensional space where formal and functional dimensions intersect" (2012, p. 504), future studies on preposition placement and on construction learning in general should take these aspects into consideration.

5. Conclusion

Adopting a usage-based construction grammar framework, this contribution has described preposition placement in English as a second language. More specifically, based on the analysis of native and nonnative corpus samples, I have argued that the variation between fronting and stranding in PRCs (e.g., *the topic about which I wrote* vs. *which I wrote about*) depends on a multitude of item-, form-, and meaning-related factors, including specific prepositions and lexical strings, their frequency of use, the meaning of the RC filler, proficiency, and different native languages. Construction grammar has proven to be a suitable tool to describe the underlying linguistic knowledge. Unlike with nonconstructionist models of grammar, descriptive redundancy and cross-linguistic representations are essential to the (multilingual) constructicon. In this view, the results suggest that the language users in the current study have acquired a network of constructions at different levels of schematicity, ranging from lexically specific prototypes which represent frequent and invariant instantiations of more schematic patterns to high-level representations which capture cross-linguistically similar word orders of fronting PRCs in English and other European languages. On the meaning side, the results suggest that fronting and stranding constructions construe the RC filler differently: while stranding indicates conceptual proximity to the lexical head within the RC and therefore leads to a participant construal, fronting construes the RC filler as conceptually out of focus and thus triggers an adverbial or environment interpretation.

Last, effects of string frequency and proficiency indicate that the constructions involve sequential, predictive knowledge and remain sensitive to and are shaped by usage throughout language users' lifetime. I have argued that this brings construction grammar closer to psycholinguistic research on language processing and highlights the role of predictability and information flow in construction learning. An important task for future work in usage-based construction grammar is to take this into consideration. What is perceived as a construction is not only a matter of exposure-driven entrenchment but also of relevance, predictability, informativity, and probably higher-level organizational processes like communicative purpose and genre.

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