Preposition Placement in English as a Second Language

A Usage-based Approach

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Abstract

According to usage-based research, language knowledge emerges from learners' experience of dealing with and using a particular language. Like all associative learning, language learning is based on learners' cross-modal abilities to discover, memorize, and recognize recurrent patterns in their experience, such as their ability to memorize linguistic usage events and perceive similarities between them, form categories, and keep track of distributions. The current thesis analyzes the acquisition of preposition placement in English as a second language from a usage-based perspective. Linguistic research suggests that the variation between preposition fronting (e.g., *the topic about which I talk*) and stranding (e.g., *the topic which I talk about*) depends on a range of contextual constraints, for example, clause type, meaning, and complexity of the surrounding structure, and usage-related factors, such as frequency distributions, cross-linguistic similarity, and specific lexical items and strings. This thesis specifically focuses on the relationship between learning and use of preposition placement in relative clauses (RCs).

In a corpus study, RCs from native and nonnative English corpora were subjected to a binary mixed-effects regression analysis with preposition placement as a dependent variable and a range of predictor variables. The results indicated that preposition placement depended on proficiency (novice vs. advanced), first language type (German, French, Italian, Spanish vs. Chinese, Japanese, Korean), specific prepositions and lexical strings, and the meaning of the RC filler. Most importantly, fronting was associated with high proficiency and the European native languages, which are typologically similar to English but only front prepositions in RCs. Surprisingly, preposition placement was not affected by the complexity of the RC and learner group (native vs. nonnative). For a better understanding of the role of proficiency, native language, and specific lexical items, a rating study was conducted. In this study, two groups of nonnative participants (German vs. Chinese) at different levels of proficiency and a group of native English speakers rated the acceptability of English fronting and stranding RCs with different prepositional verbs. The verbs were either English-German translation equivalents or not. A linear mixed-effects

regression model indicated that acceptability was dependent on interactions among preposition placement, first language, and proficiency. Acceptability of fronting and stranding developed in first-language-specific patterns with improving proficiency and converged on nativelike acceptability at the highest level of proficiency. Consistent with the corpus findings, fronting was more acceptable to German than to Chinese learners of English. Contrary to expectations, acceptability for the German participants was independent of the translation equivalence of the verb.

The results are interpreted in a cognitive usage-based framework of language learning. In line with research on the sensitivity of processing to usage, the effect of proficiency suggests that learners become attuned to the total relative frequency distribution of preposition fronting and stranding in English and that their sensitivity changes to more context-dependent distributions with increasing proficiency and experience. Concerning the role of the first language, the results suggest that cross-linguistic similarity boosts the acquisition of fronting for learners with a fronting-only first language and gives rise to a highly schematic cross-linguistic representation of fronting RCs. In addition, learners acquire lower-level representations of item-specific distributions, as evidenced by the effects of specific lexical items and strings on preposition placement. The acquired knowledge of fronting and stranding RCs is described as a dense network of overlapping representations at various levels of specificity.

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List of Abbreviations

ADV	Adverbial
AP	Adjective phrase
BNC	British National Corpus (BNC Consortium, 2007)
CL	Classifier
COCA	Corpus of Contemporary American English (Davies, 2008)
DAT	Dative case
FrameNet	FrameNet online database (Fillmore & Baker, 2010; Ruppenhofer, Ellsworth, Petruck, & Johnson, 2016)
GEN	Genitive case
ICE-GB	British part of the International Corpus of English (Greenbaum, 1996; Nelson, Wallis, & Aarts, 2002)
ICLE	International Corpus of Learner English (Granger, Dagneaux, Meunier, & Paquot, 2009)
L1	First/Native language
LCC	Leipzig Corpus Collection (Goldhahn, Eckart, & Quasthoff, 2012)
LCN	Louvain Corpus of Native English Essays (Granger, n.d.)
N	Noun
NOM	Nominative case
NP	Noun phrase
OBJ	Object
PARTC	Partitive construction
REL	Relativizer
SUBJ	Subject
V	Verb
VP	Verb phrase
YELC	Yonsei English Learner Corpus (Rhee & Jung, 2012)

This thesis conforms to the specifications of the *Publication Manual of the American Psychological Association*, 6th edition.

Chapter 1

Introduction

The current thesis examines the acquisition of preposition placement in English as a second language. As the word *prepositions* suggests, prepositions normally precede a nominal in English. For example, in the relative clause (RC) in Example 1, the preposition *on* precedes the relative pronoun *which* in a clause-initial position (1a).

Example 1

a. the sources on which they rely (BNC)

b. the sources which they rely on

As is known (Huddleston & Pullum, 2002, p. 627), however, in this particular context, the preposition might just as well surface at a point later in the clause (1b). This word order variation is known as *preposition placement* and occurs in English *wh*-RCs, *wh*-questions, preposing clauses, and exclamative clauses. In these clause types, a preposition may either be "fronted" to its common place preceding a nominal (1a) or "stranded" to a clause-noninitial position following a related lexical item like *rely* (1b). Surprisingly, in some clause types, only preposition stranding is grammatical, for instance, in non-*wh*-RCs, illustrated in Example 2.

Example 2

a. [he] slept badly, for no reason that he knew of (BNC)

b. *[he] slept badly, for no reason of that he knew

Preposition placement in English has attracted a lot of attention in linguistic research. Researchers in the field of generative linguistics have extensively studied the order of acquisition of fronting and stranding (e.g., Van Buren & Sharwood Smith, 1985; McDaniel, McKee, & Bernstein, 1998; Snyder, 2007, pp. 146-156; Sugisaki &

Snyder, 2006), their typological distribution (e.g., Hamilton, 1994; Van Riemsdijk, 1978), and the rules to derive preposition fronting and stranding from more basic structures (e.g., Chomsky, 1981, pp. 292-300; Chomsky, 1995, pp. 242-243; Dekeyser, 1990; Hornstein & Weinberg, 1981; Ross, 1967). More usage-oriented studies have described preposition placement in historical English (e.g., Bergh & Seppänen, 2000; Yáñez-Bouza, 2015), in spoken and written English (e.g., C. Johansson & Geisler, 1998), and in English as a second language (e.g., Bardovi-Harlig, 1987; Kao, 2001; Mazurkewich, 1985). More recently, researchers from cognitive linguistics have attempted to explain preposition placement within a cognitive usage-based framework (e.g., Hoffmann, 2011; Hudson, 2018; Gries, 2002). In particular, the distribution of preposition fronting and stranding in language use has been analyzed in a series of corpus studies by Hoffmann (2005, 2006, 2007, 2008, 2011), who described and compared preposition placement in British and Kenyan English. Moreover, Hoffmann (2011, 2013) conducted a series of rating tasks to assess the acceptability of fronting and stranding in different contexts for native and nonnative language users.

Continuing this line of research, the current thesis adopts a cognitive usage-based framework to investigate preposition placement in English as a second language. Proponents of a cognitive usage-based approach to language argue that linguistic structures emerge as a by-product of language use (Bybee, 2010; Diessel, 2015, 2017; Langacker, 2010; Tomasello, 2003, 2009). Learners draw on cross-modal cognitive abilities to discover and learn recurrent patterns in their experiences of language use, like their ability to memorize usage events, track frequency distributions, and recognize similarities across usage events. The emerging linguistic knowledge is described as an associative network of symbolic constructions which range from lexical items to grammatical structures (Diessel, 2018; Goldberg, 2006). On this view, learning a second language is not essentially different from learning a first language (Bybee, 2008; N. C. Ellis & Cadierno, 2009; N. C. Ellis, Römer, & O'Donnell, 2016; Robinson & Ellis, 2008). Like native learners, nonnative learners rely on cross-modal learning and processing abilities to extract constructions from their input. This is not to deny that there are differences between native and nonnative learning. Nonnative learners' input is, to be sure, of different quality and quantity than native learners' input (MacWhinney, 2015c). Moreover, in keeping with the assumption that language emerges from language use, all of learners' usage history, including their experience in the first language, is expected to play a significant role in learning a second language, leading to cross-linguistic influence, interference, and competition (N. C. Ellis, 2006b; N. C. Ellis & Sagarra, 2011; MacWhinney, 1992, 2012).

A wide range of usage-based variables has been proposed to influence learning and use of preposition placement in English, including the frequency of fronting and stranding in language use and learner input, the first language of second language learners of English, specific lexical items and strings, complexity, meaning, style, and modality (for an overview, see Hoffmann, 2011, Chapter 3). From a usage-based perspective, learners' experience of language use is an essential driving force of construction learning. Accordingly, the current thesis pursues the following questions.

1. What is the relationship between the usage distribution of fronting and stranding and the acquisition of preposition placement in English as a second language?

2. What is the role of first-language experiences in the acquisition of preposition placement in English as a second language?

3. What is the effect of specific lexical items and strings on preposition placement in native and nonnative English?

The investigation focuses on RCs, more precisely, prepositional RCs. Of all relevant clause types, these are most frequent and most variable in language use (Hoffmann, 2011, p. 148). The term *prepositional RCs* is used as an umbrella term for a group of RCs in which the relationship between the head nominal and the RC is indicated by a preposition. The group is illustrated in Example 3, and typically consists of RCs with a prepositional verb like *rely on* (3a) or prepositional adjective like *dependent on* (3b), *to*-dative RCs (3c), and adverbial RCs (3d).

Example 3 (BNC)

a. the linguistic theory on which he relies

b. one essential factor on which everything was dependent

c. a real beginner in computing to whom I lent the book

d. the winter during which I was homeless

e. the political purposes that I believe in

f. a show the like of which has never been seen

For example, the relationship between the head nominal *the linguistic theory* and the RC *he relies* is indicated by the preposition *on*, suggesting that the head nominal is to be understood as a prepositional object of the verb *rely* (3a). The anaphoric

relative pronoun *which* represents the head nominal and indicates that its referent is inanimate. In contrast, animate head nominals are represented by a form of *who* (3c). Apart from this, relative pronouns do not contribute significantly to the meaning of the clause. In both the prepositional object and *to*-dative RCs (3a to 3c), the head nominal specifies a focal participant of the event or relationship described in the RC. Together they are referred to as *oblique RCs*. When the head nominal specifies the time (3d), space, manner, or another circumstantial aspect, the RC is called an *adverbial RC*. The RCs in Examples 3a to 3d represent the prototype of the entire group, which also includes more atypical members. For example, the group includes non-*wh*-RCs where the head nominal is not overtly represented by a pronoun within the RC (3e) and more complicated structures, for instance, RCs in which the relative pronoun is part of a noun modifier (3f).

Following Hoffmann (2011), a corpus study and a rating study were conducted. In the corpus study, prepositional RCs from a series of native and nonnative English corpora were analyzed for a wide range of variables and subjected to a binary regression analysis. The purpose of the study was (a) to compare the distribution of preposition placement across different groups of writers (native vs. nonnative, novice vs. advanced), (b) to determine the influence of first languages with different types of RCs (German, French, Spanish, Italian vs. Chinese, Korean, Japanese), and (c) to explore associations between preposition placement and specific lexical items, especially prepositions, and strings (e.g., *rely on*, *on which*). In line with usage-based expectations, the results indicated that preposition placement was influenced by different input distributions depending on the level of proficiency, the first language type, specific prepositions, and the usage frequency of lexical strings, among other things. For a more thorough understanding of the role of proficiency, first language, and specific lexical items, a rating study was added. In an online magnitude estimation task, two groups of nonnative learners of English with different native languages (German vs. Chinese) and a group of native English speakers rated the acceptability of English oblique RCs. The experimental material varied preposition placement (fronting vs. stranding) and the English-German translation equivalence of the RC prepositional verb (equivalent vs. nonequivalent). Moreover, a proficiency measure was computed based on the participants' responses to filler sentences. In line with the corpus study, the results indicated that acceptability ratings changed in first-language-specific patterns which gradually approximated native ratings as proficiency improved. From a cognitive usage-based viewpoint, the results of both studies suggest that learners are sensitive to the distribution of preposition fronting and stranding in their input and that sensitivity changes with proficiency.

Consistent with a usage-based approach to second language learning, a contrastive analysis of English and the involved first languages suggests that cross-linguistic similarity results in an increase in preposition fronting for nonnative learners with a European native language. Moreover, the results suggest that learners acquire item-specific prototypes which represent the skewed distributions of lexical items and strings across fronting and stranding RCs in their input. Apart from this, a wide range of other variables is examined and discussed in a cognitive usage-based framework.

The thesis is organized as follows. Chapter 2 outlines the cognitive usage-based framework adopted for the current investigation. First, cognitive linguistics is characterized and essential concepts are introduced in Chapter 2.1. In this context, the subfields of cognitive grammar (Langacker, 2008a) and frame semantics (Fillmore, 1985) are described in detail. Of particular importance are the concepts of construction, construal, and frame. Following this, Chapter 2.2 introduces the usage-based approach to language learning in detail. By way of illustration, some empirical studies are reviewed. Moreover, Chapter 2.2.4 addresses second language learning from a usage-based perspective. Following this, Chapter 3 provides an overview of previous literature on preposition placement. The chapter surveys a wide range of variables and discusses findings of previous research from a cognitive usage-based viewpoint. Chapter 4 describes the corpus study (Chapter 4.1) and the rating study (Chapter 4.2). In each subchapter, method and results are described first, followed by an in-depth discussion of the results of each study. Chapter 5 summarizes the results of both the corpus and the rating study and then discusses the key results with respect to the overarching research questions. Moreover, the findings are related to similar research in the field and directions for future research are suggested. Chapter 6 draws a conclusion and points out some limitations of this investigation.

Chapter 2

A Cognitive Usage-Based Framework

This chapter outlines the cognitive usage-based framework adopted for this thesis. Chapter 2.1 outlines the field of cognitive linguistics and then focuses on two subfields which are of particular importance to this investigation, namely, cognitive grammar and frame semantics. Chapter 2.2 reviews the usage-based approach to language learning, with a focus on second language learning. For a better understanding, a range of relevant abilities and processes of usage-based language learning are illustrated in detail by examples and empirical studies.

2.1 Cognitive Linguistics

2.1.1 Language Is a Part of Cognition

Cognitive linguistics is the endeavor of describing and explaining language in accord with what is known about the mind and the brain from the cognitive sciences, including but not restricted to cognitive psychology, neuropsychology, philosophy, linguistics, cognitive anthropology, and computational research in artificial intelligence. Researchers in the field endorse the cognitive commitment first formulated by Lakoff (1990) in the first issue of the discipline's mothership journal *Cognitive Linguistics* and recently reinforced in the introduction to the *Handbook of Cognitive Linguistics*:

> [A]ll cognitive linguists are, or should be, committed to providing a characterization of the general principles of language that is informed by and accords with what is known about the mind and brain from other disciplines. It is this commitment that makes cognitive linguistics cognitive,

> and thus an approach which is fundamentally interdisciplinary in nature (Dąbrowska & Divjak, 2015, p. 1).

In line with the cognitive commitment, researchers in the field share the following assumptions about the nature of language. First, all of language is assumed to be symbolic, including grammar. Cognitive linguists have adopted the well-known Saussurean dyadic sign model for the description of both lexical items and grammatical structures. As a consequence, grammar is seen as meaningful. The assumption of symbolic, meaningful grammar is at the heart of the cognitive linguistic subfields of cognitive grammar (Langacker, 1987a, 1991, 2008a, 2015; Talmy, 1988) and construction grammar (Kay & Fillmore, 1999; Goldberg, 1995; Hoffmann & Trousdale, 2013). Like lexical items, grammar is described in terms of two-sided units of phonological form and semantic structure. Second, grammar is shaped by usage. Researchers in cognitive linguistics agree that the structure of a language emerges from language use. On a historical time scale, language change is explained from the emergence and propagation of novel patterns or the erosion of existent patterns in language use (Bybee, 1985; Bybee & Hopper, 2001; Bybee, 2010). On an ontogenetic time scale, usage-based research relates language learning to a learner's experiences with language use, in particular, to the processing of input (Tomasello, 2003; N. C. Ellis & Cadierno, 2009; Diessel, 2017). Third, language is not an autonomous subsystem but a by-product of cognition. On this view, learners build up a language based on their usage experiences and cross-modal cognitive abilities and processes, that is, abilities and processes which apply across different modalities of input like learning associations, tracking statistical distributions, building and entrenching categories, automatization of processing patterns, memorizing experiences, competition, focusing attention, and reading others' intentions (N. C. Ellis et al., 2016, pp. 45-68; Goldberg, 2006, pp. 67-126; MacWhinney, 2015b). Proponents of a cognitive usage-based approach to language learning believe that constructions emerge as a by-product from cross-modal abilities and processes working on linguistic input.

In the following, the cognitive usage-based framework adopted for the current investigation is outlined in more detail. Of particular importance is work on cognitive grammar (Langacker, 2008a), frame semantics (Fillmore & Baker, 2010), and the usage-based approach to language learning, in particular, to second language learning (N. C. Ellis, Römer, & O'Donnell, 2015). Some related cognitive linguistic subfields are only touched upon but not discussed at length, for example, construction grammar (Hoffmann & Trousdale, 2013) and research on learning in connectionist networks (Elman, 1993). For exhaustive reviews of the field of cog-

nitive linguistics, the reader is referred to Croft and Cruse (2004), Dąbrowska and Divjak (2015), Geeraerts and Cuyckens (2007), Robinson and Ellis (2008), and the German-language textbooks by Rickheit, Weiss, and Eikmeyer (2010) and Schwarz (2008).

2.1.2 Grammar Is a Network of Symbolic Units

Cognitive linguists assume that language is symbolic all the way down. Adopting the Saussurean two-sided sign model, they postulate that not only lexical items but also grammatical structures consist of forms associated with meanings. Approaches in generative linguistics strictly separate lexicon and grammar by assuming that only lexical items are symbolic form-meaning pairs, whereas grammar consists in a system of morphosyntactic rules which define ways to combine lexical items into more complex structures like word forms, phrases, and sentences (e.g., Pinker, 1999; Pinker & Ullman, 2002).

Cognitive linguists have abandoned the long-standing distinction between lexicon and grammar on the ground that language use is full of expressions which apparently do not observe the presumed rules of grammar but yet seem to be in good working order. For example, the idiomatic expressions in Example 4 are in part noncompositional, that is, their meaning is not predictable from the meaning of their lexical component parts and the alleged grammatical rules combining them.

Example 4 (Collins English Dictionary)

a. In New York, men making a pass were a dime a dozen.

b. fly home once in a blue moon to see his father

What New York men do, according to Example 4a, is not predictable from the meanings of the involved lexical items *men*, *make*, *pass*, *dime*, and *dozen* in a systematic way. The meanings of the strings *make a pass* ("someone attempts to begin a romantic or sexual relationship with someone else") and *a dime a dozen* ("abundant and easily obtained", here probably metaphorical for "frequent, common") must be learned by experience. Similarly, in Example 4b, the heavenly body orbiting planet earth and commonly known as *moon* is not part of the referential meaning of the sentence. Instead, the string *once in a blue moon* is associated as a whole with a particular meaning ("very rarely, almost never"). Apparently, then, idiomatic expressions are some kind of noncompositional complex symbols with fixed or semi-fixed strings of lexical items associated as a whole with particular prepackaged meanings.

To give another example of "rule-breaking" language use, only a part of the meaning of the expressions in Example 5 seems to derive from the meaning of their lexical components in a regular, rule-based way.

Example 5

a. He sneezed the napkin off the table. (Goldberg, 1995, p. 9)

b. Leith rose above her inner turmoil to smile her thanks (BNC)

The verb *sneeze* is normally used as an intransitive verb (e.g., *She sneezed twice in a row.*), yet, *sneeze* does sometimes occur with an object which is caused to move in a direction (5a). The intransitive verb *smile* (e.g., *She smiled sweetly.*) is sometimes used in a ditransitive sentence together with someone who receives something, here, an expression of gratitude (5b). Instead of assuming that *sneeze* and *smile* are polysemous, Goldberg suggests that "the main verb can be understood to combine with an argument structure construction" (2006, p. 6), for example, the caused-motion construction (5a) and the ditransitive construction (5b). The grammatical constructions associate common word order patterns (e.g., SUBJ V OBJ LOC, SUBJ V OBJ_1 OBJ_2) with schematic meanings (e.g., "someone causes something to move somewhere", "someone causes something to be transferred to someone else"). In this sense, they are symbolic. This is not to deny the importance of compositionality in language. Rather, cognitive linguists emphasize that "compositionality is a matter of degree, and constructions are also associated with holistic properties" (Diessel, 2015, p. 300) which pertain not to particular component parts or specific lexical items but to the construction as a whole.

Consequently, grammatical constructions are seen as not essentially different from lexical items. Instead of forming two autonomous systems, grammar and lexicon are rather thought of as forming a continuum which ranges from highly schematic and regular grammatical constructions to specific lexical items and irregular idiomatic expressions. The continuous space between the two poles is occupied by constructions of varying size, schematicity, and complexity. This is illustrated in Example 6, with examples ordered from more schematic and complex constructions to more specific and simple constructions.

Example 6 (Adapted from Goldberg, 2006, p. 5)

a.	SUBJ V OBJ_1 OBJ_2	e.g., *He told me a joke.*
b.	SUBJ AUX VP_{PP} (PP_{by})	e.g., *This house is haunted by ghosts.*
c.	*The* X-*er the* Y-*er*	e.g., *the sooner the better*
d.	NP *drive* NP X	e.g., *She drives me crazy / up the wall*
e.	N-*s*, V-*ed*	e.g., *ghost-s*, *ask-ed*
f.	*a dime a dozen*	e.g., *Men making a pass are a dime a dozen.*
g.	*greenish*, *apple pie*	
h.	*green*, *apple*	
i.	*pre-*, *-ing*	e.g., *pre-historic*, *sleep-ing*

Research in the cognitive linguistic subfield of construction grammar is especially dedicated to describing in detail the form-meaning pairings which make up the linguistic knowledge of language users (Goldberg, 1995, 2006; Hilpert, 2014; Hoffmann & Trousdale, 2013). They form a network in which different construction nodes are linked to each other by various types of categorizing and associative relations, similar to words in the conventional view of the mental lexicon (Diessel, 2015, 2018). Accordingly, the construction network has been named *constructicon* (Jurafsky, 1992).

An important feature of the constructicon is descriptive redundancy. Earlier grammarians attempted to provide nonredundant descriptions of a language in the sense that they postulated only a limited set of rules from which more concrete expressions are derived in language use. They reserved the term *construction* for those patterns whose form and meaning is not predictable from the meaning of their components and more abstract rules, for example, idiomatic expressions (6d, 6f) and irregular patterns like the comparative correlative construction (6c). In contrast, proponents of a construction grammar approach assume that "[i]n addition [to irregular patterns], 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, even though form and meaning of the string *haunted by ghosts* seem perfectly regular and predictable from the lexical components *haunt* and *ghost* and the schematic constructions for passive clauses (6b) and noun plurals (6e), *ghosts* follows *haunted by* probably frequently enough in language use to justify the assumption of an item-specific construction *haunted by ghosts*, along with the more general constructions which the lexical string instantiates. To give another example, while the string *the sooner the better* is an instantiation of the more schematic pattern *The* X-*er the* Y-*er* (6c), native English speakers have likely memorized the string as a whole in

addition to the more general pattern. Evidence for the existence of item-specific knowledge in grammar comes from usage-based studies on language learning and processing (Bybee, 2008; Diessel, 2016), which will be considered in detail below.

2.1.3 Grammar Is Meaningful

As grammar is seen as meaningful, proponents of cognitive linguistics attempt to describe grammatical constructions not as empty structures or abstract rules but in terms of the meaning they evoke. Cognitive linguists take a cognitive view of meaning. They assume that meaning is essentially subjective in the sense that meaning resides in conceptualizations which do not represent the world in an objective, straightforward way to the mind but in the form of a subjective interpretation. Meaning therefore comprises all kinds of relevant sensory, motor, and introspective experiences and is subject to negotiation between interlocutors, their endeavors, prior experiences, knowledge, and beliefs (L. Brandt, 2013; Lakoff, 1987). When describing the meaning of a linguistic expression, a distinction is commonly made for analytical purposes between the conceptual content which the expression evokes and the particular way in which the content is construed: "Most broadly, a meaning consists of both conceptual **content** and a particular way of **construing** that content" (Langacker, 2008a, p. 43). The conceptual content of a linguistic expression is understood as a cognizer's store of knowledge, mental images, and experiences related to the signified field of experience. Construal concerns a cognizer's ability to view something in different ways, focus on particular aspects and background others, take different points of view, and pay attention to details or coarse patterns.

2.1.3.1 Frame Semantics

For the description of the conceptual content of an expression, a frame semantic approach is adopted. Frame semantics is an attempt at a psychologically plausible way of describing the meaning of linguistic expressions which has its origins in work by Fillmore (1975, 1976, 1982, 1985). Frame semantics is different from what is sometimes called semantics of truth or objectivist semantics in that frame semantics is not concerned with the reference to extralinguistic entities and the conditions under which a sentence is considered true; rather, frame semantics focuses on a speaker's understanding and interpretation of linguistic expressions. Semantic features or descriptive statements like in dictionary entries are considered insufficient to grasp the entire meaning of a linguistic expression. The fundamental assumption of frame semantics is that understanding a linguistic expression involves the evocation

of encyclopedic knowledge, that is, knowledge about the designated entities and the world they inhabit, somewhat comparable to an article in an encyclopedia. On this view, the lexical meaning resides in the particular way in which a linguistic expression prompts or invites language users to access their theoretically infinite knowledge base. A linguistic expression is seen as a cue to access the encyclopedic knowledge base on one or another conventional path in order to attain understanding. The organized packages of knowledge which linguistic expressions evoke as their conceptual background of understanding are called *frames*: "Such a frame represents the particular organization of knowledge which stands as a prerequisite to our ability to understand the meaning of the associated words" (Fillmore, 1985, p. 224). The notion of frames is similar to other concepts in cognitive linguistics and neighboring disciplines which describe meaning as involving schematic knowledge of the environment, patterns of practices, stereotyped scenes, scripts, image schemas, domains, idealized cognitive models, and prototypes. While these concepts bring different facets of meaning and understanding into focus, they have in common that they are not exclusively linguistic in nature but rich mental images of a cognizer's sensory, motor, and introspective experiences with engaging a particular part of the world (Lakoff & Johnson, 1980; Lakoff, 1987; Langacker, 1987a; Rosch, 1978; Schank & Abelson, 1977; for a review, see Cienki, 2007; for a more dynamic model of mental representation, see Barsalou, 2009).

By way of illustration, consider the meaning of the word *hypotenuse* (Fillmore, 1985). *Hypotenuse* refers to the longest side of a right triangle, that is, the side opposite to the right angle. As is evident from the definition, *hypotenuse* does not merely refer to a line of particular length; instead, the meaning of *hypotenuse* presupposes the geometrical figure of a right triangle as a background of understanding. To give another example by Fillmore, the nouns *land* and *ground* both refer to the dry surface of the planet, yet, they evoke different frames and therefore invite different interpretations. The frame associated with *land* places *land* in opposition to *sea*, as in the sentence *We're still on land (and not at sea)*, which invites the inference that the speaker is waiting to finally leave the shore, say, at the beginning of a sea voyage. In contrast, the sentence *We're still on the ground (and not in the air)* is interpreted against the air travel frame in which *ground* is in opposition to *air* inviting the inference that the speaker is sitting in an airplane which is about to take off. Moreover, notice the differences in meaning between *shore* and *coast*, *in a plane* and *on a plane*, and the different senses of the verb *evoke* ("to call a memory or feeling", "to provoke, e.g., hostility", "to summon spirits by the use of magic charm"), all of which relate to different frames. Frames underlie the understanding and coherence

of more complex linguistic expressions, too, for example, texts and conversations. In a newspaper article, headline and picture normally activate a frame as a background against which the following text is interpreted or to which the following text is understood to contribute. For example, the headline *Workers on strike* accompanied by a picture of people marching in the streets implies that the article is about labor conflict and suggest that the following text should be interpreted along these lines as activating related frames and specifying the relevant component parts including the parties to the conflict, the workers' demands, duration and extent of the strike, time and place of the negotiations, affected third parties, and so on (Fillmore & Baker, 2001).

Frames determine the distributional and combinatorial behavior of words. A word is more likely to co-occur with words from related frames and combines with expressions which specify frame components. This is illustrated in Example 7.

Example 7 (FrameNet)

a. Now I can buy a soda and spend money.

b. I'll give you some tablets, they'll help you to relax.

For example, the verb *buy* in Example 7a evokes a commerce frame which represents the typical components of an economical exchange from the buyer's perspective. The noun *money* evokes a range of similar related commercial frames. The arguments of the verb specify components of the associated frame. The speaker fills the role of the buyer and the purchased good is specified by the noun phrase *a soda*. *Now* specifies the time when the bargain becomes possible. To give another example, the verb *give* in Example 7b activates some kind of transfer frame in which a donor transfers a theme to a recipient. Here, the speaker transfers a medical substance specified by the noun phrase *some tablets* to the addressee. The examples are taken from FrameNet (Fillmore & Baker, 2010; Ruppenhofer et al., 2016). FrameNet is a lexical database of English for human and machine readers. Each entry in the database consists of a lemma, a description of one or more associated frames, and annotated corpus examples like the ones in Example 7.

A frame description specifies the component parts of the frame, called *frame elements*, and the way they relate to each other, phrase types of the frame elements, and their grammatical roles. For example, the commerce frame associated with *buy* involves a buyer, a purchased good, the money with which, the purpose for which, and the recipient for whom something is bought, the seller, means and manner of the purchase, and so on. Frame elements are divided into core and noncore elements.

Core elements play an indispensable and prominent role in the event or scene represented by the frame and are therefore normally explicitly mentioned. They are similar to Langacker's focal participants in that they are in the focus of attention and interact with each other. In contrast, noncore frame elements contribute entities in minor roles or specify contingent meaning aspects like time, place, means, and manner, comparable to Langacker's notion of setting (Langacker, 1991, pp. 284–291, 343). For example, in the *buy* frame, the buyer and the purchased good occupy core roles, whereas the remaining component parts are noncore elements, meaning that they are not highlighted and in the focus of attention because they are not always present in a buying scene, like the recipient, or because they specify contingent aspects which change from occasion to occasion, such as manner, means, time, and space. This type of analysis is particularly suitable for describing the meaning of clause structures around verbs, however, FrameNet provides entries for essentially all types of content words including adjectives, nouns, prepositions, and quantifiers. Most recently, attempts have been made to extend the frame semantic approach to the description of the meaning of grammatical constructions and to build a FrameNet constructicon (Fillmore, Lee-Goldman, & Rhodes, 2012).

2.1.3.2 Construal

All linguistic expressions construe their conceptual content in one way or another. The meaning of grammatical constructions in particular seems to reside in a specific construal more than in a specific content: "Indeed, the meaning of many linguistic elements—especially those considered 'grammatical'—consists primarily in the construal they impose, rather than any specific content" (Langacker, 2008a, p. 43), which is not to deny that grammatical constructions, like lexical items, evoke conceptual content as part of their meaning. Construal concerns "our ability to conceive and portray the same situation in alternative ways" (Langacker, 2015, p. 120) and has often been likened metaphorically to viewing something in different ways, for example, as when examining something close up or from a distance. In cognitive grammar, a wide range of construal abilities has been described and recognized as relevant to the description of language and grammar in particular (Langacker, 1987a, 2015; Talmy, 1988; Verhagen, 2007). By way of illustration, linguistic expressions differ in the level of detail at which they describe their referents. This is particularly evident with lexical hierarchies like the one in Example 8.

Example 8 (Adapted from Langacker, 2015, p. 126)
entity > person > female > girl > girl who lives next door

The lexical items are ordered by schematicity of meaning with the more schematic items to the left of the wedges. Each of the items may be used to refer to the same referent, however, they differ in the amount of detail they provide about it. While *entity* construes a highly schematic representation which would probably be insufficient to single out the intended referent in most contexts, *person* is more specific and defines animacy and species of the referent. Next, *girl* is even more specific, adds age and sex of the referent to the representation, and evokes all kinds of relevant encyclopedic knowledge frames about this type of referent, for example, prototypical appearance and behavior. The RC *who lives next door* adds an even more detailed description of the intended referent and further narrows down the range of candidates. Metaphorically speaking, *person* construes the referent from a great distance at which one is able to discern human shapes if nothing else. In contrast, *girl* views the referent from a distance close enough to identify her as a prototypical instance of a girl.

An important part of construal is profiling. The profile of a linguistic expression is defined as the conceptual referent to which the expression refers more specifically within the conceptual content or frame evoked as a background of understanding. Once a frame is evoked, a linguistic expression focuses attention on a particular component part of the frame which is made salient or prominent and thus stands out as a figure against the conceptual background. In other words, "[p]rofiling is the intersubjective focusing of attention induced by symbolization" (Langacker, 2015, p. 128). By way of illustration, consider the meaning of *hypotenuse* again, which is diagrammed in Figure 2.1a.

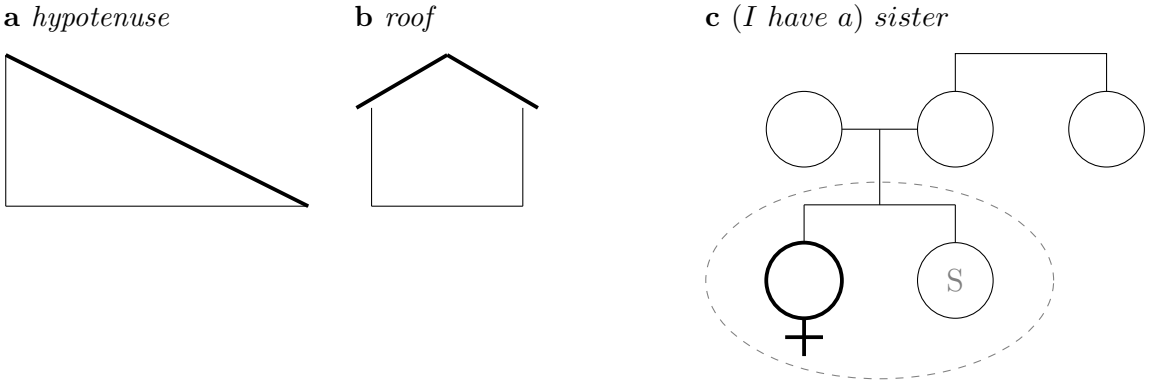


Figure 2.1: Visualization of the frames and profiles of *hypotenuse*, *roof*, *sister*, and the expression *I have a sister*

As pointed out above, the frame of a right triangle is required for the understanding of *hypotenuse*. *Hypotenuse* is understood against the background of the frame as the longest side of the triangle opposite to the right angle. In other words, *hypotenuse*

evokes the frame of a right triangle and highlights a particular component part of the frame as the focus of attention and referent proper, namely, the longest side of the triangle opposite to the right angle. The diagram depicts a schematic representation of the triangle frame evoked by *hypotenuse* with the profile printed in bold. To give another example, the word *roof* associates an architectural frame within which *roof* is understood to refer to a particular part of a building. More specifically, *roof* profiles the covering on top of the building, while the other parts of the building are backgrounded. This is illustrated in Figure 2.1b.

In cognitive grammar, the profile of a linguistic expression determines its grammatical category. In other words, the meaning of a grammatical category resides in the profile which the category members impose on their conceptual content. For example, nouns profile non-relational entities which are conceived of as conceptually independent of the events or relationships in which they participate (Langacker, 2008a, pp. 66-67). This is most evident from nouns with prototypical referents such as physical objects. However, even nouns which evoke relational frames single out non-relational entities as their profiles. This is illustrated in Figure 2.1c for the word *sister*. While *sister* evokes a kindship frame representing a family network and arguably presupposes the presence of another sibling, the nominal schema profiles only the non-relational entity in bold. The construal of non-relational entities makes use of the ability to group together contiguous or similar perceptual stimuli and conceptualize them as a higher-order unit. This is known as *reification* (Langacker, 2008a, pp. 104-108). For example, at a higher level of granularity, a hypotenuse is not a line but a straight path of points. They are grouped together to form the higher-order unit perceived as a line which is related to two other lines in such a way as to form an even higher-order unit perceived as a triangle. To give another example, a roof consists of an array of shingles which are conceptualized as forming a unitary entity which together with other entities at this particular level of granularity forms a house. A group of houses forms a neighborhood, and so on.

In contrast, verbs are seen as profiling relationships which conceptually depend on non-relational entities or participants. For example, the verb *have* as in *I have a sister* profiles the possessive relationship between two focal participants rather than the participants themselves. Blending with the frames and profiles of *I* and *sister*, the emerging conceptualization focuses attention on the possessive relationship between the speaker and her sister from the speaker's perspective against the background of the kindship frame. This is indicated by the dashed gray ellipse and the gray *S* marking the speaker in Figure 2.1c. Adjectives, adverbs, and prepositions are also seen as profiling relationships but differ in the type of their participants (Lang-

acker, 2008a, pp. 93-127). At a higher level of constituency, the type of a phrase derives from the profile of its lexical head. In other words, the lexical head imposes its profile on the composite structure. For example, the RC *who lives next door* profiles a relationship which is then overridden by the non-relational profile of the head noun *girl* with the result that the verbal relationship of the clause is backgrounded and the composite expression *girl who lives next door* profiles a non-relational entity, making this a complex noun phrase.

The apprehension of relationships is based on the ability of mental scanning. When apprehending a relationship, cognizers build up the relationship progressively as if moving along a path. This is most evident in descriptions of static scenes with motion verbs. For example, the sentences in Example 9 describe a static scenery with the motion verbs *fall* and *rise*.

Example 9

a. The cliffs fall into the sea.

b. The cliffs rise from the sea.

The motion verbs profile a path leading from the top of the cliff to the bottom where the water surges against the rocks. With *fall* the profiled path is build up mentally from top to bottom, whereas *rise* construes the path as evolving from bottom to top. In other words, the cognizer takes a perspective in the scene and traces the profiled path in downward or upward direction. When they process sentences involving fictive motion, cognizers mentally simulate motion along the profiled path (Barsalou, 2009; Langacker, 2005; Matlock, 2004).

Two different modes of scanning have been proposed to underlie the apprehension of relationships (Langacker, 1987a, 1987b, 2008b, 2015). The construal of fictive motion involves summary scanning, which imposes a holistic view on the profiled relationship such that "successive configurations are compressed into a single, simultaneously available gestalt" (Langacker, 2008b, p. 572). This mode of scanning is involved whenever a relationship is construed in an atemporal, static way, for example, in figurative use of motion verbs (9), with nonfinite verbs (e.g., *to fall* as in *Be careful not to fall!*), deverbal nouns (e.g., *rise* and *fall* as in *The rise and fall of Ziggy Stardust*), and adjectives (e.g., *falling* as in *Twenty people were injured by falling masonry.*). In contrast, sequential scanning tracks a relationship evolving through time so that successive configurations flow into each other. "[E]ach component state morphs seamlessly into the next" (Langacker, 2008b, p. 573) as the activation of the preceding component state fades with the activation of the following one producing an experience of a continuous process. For example, finite verbs profile processes

(Langacker, 2008a, p. 112). In Example 10, the cognizer traces the profiled path from the ground to the sky either in downward (10a) or upward direction (10b) with the component phases of the respective processes accessed in sequence with only one being focused at a time.

Example 10

a. Snowflakes slowly fall from the sky.

b. The hot-air balloon quickly rises from the ground.

The difference between summary and sequential scanning is illustrated for *rise* by the diagrams in Figure 2.2. The lines of dots are meant to represent the mental image of the profiled path at different points in processing time t_n as a result of summary scanning (Figure 2.2a) and sequential scanning (Figure 2.2b).

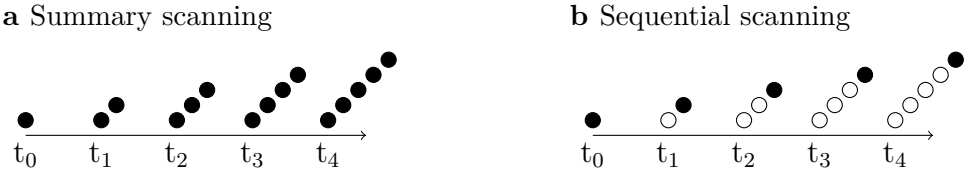


Figure 2.2: Different modes of mental scanning underlying the apprehension of relationships

The diagrams indicate that summary and sequential scanning differ in the way in which a representation is built up. In summary scanning, component phases accumulate such that at each point in processing time the construed image comprises the entire path covered up to the corresponding point in conceived time. Accordingly, the path in Figure 2.2a is represented by a growing line of filled dots. In contrast, in Figure 2.2b, component phases enter and then fade from the spotlight one by one, indicated by the succession of filled and empty dots. Langacker (2008a, pp. 110-112) further distinguishes between processing time and conceived time. Processing time refers to the span of time in which a linguistic expression is processed. Conceived time concerns time as part of the construed representation. While processing and conceived time obviously do not have to be congruent, they tend to be coaligned in the sense that the component phases of the profiled process are mentally accessed in processing time in the order in which they are conceptualized to occur in conceived time. This is known as *temporal iconicity*. To simplify matters, only conceived time has been included in Figure 2.2.

2.2 Usage-Based Linguistics

2.2.1 Constructions Generalize over Lexical Strings

Cognitive linguistics in general and cognitive grammar in particular are closely related to usage-based linguistics. Proponents of a usage-based approach to language argue that "structure emerges from usage, is immanent in usage, and is influenced by usage on an ongoing basis" (Langacker, 2010, p. 109). Language structure is seen as developing from experiences of language use in a gradual and piecemeal process. Put differently, constructions, in particular, grammatical constructions emerge as a by-product of cross-modal cognitive abilities and processes working on structured linguistic input. In line with construction grammar, the outcome of the process is commonly described as a network of overlapping and interrelated constructions (Diessel, 2015, 2018; Langacker, 2000). Originally introduced by Langacker (1988), a usage-based model has been adopted in research on first language acquisition (Diessel, 2004, 2013, 2017; Tomasello, 2003, 2009), second language acquisition (De Bot, Lowie, & Verspoor, 2007; De Bot & Larsen-Freeman, 2011; N. C. Ellis, 2008; N. C. Ellis & Cadierno, 2009; Verspoor & Behrens, 2011), language change (Bybee, 1998; Bybee & Hopper, 2001), and language evolution (MacWhinney, 2008), and is closely related to functionalist models of language comprehension and acquisition (E. Bates & MacWhinney, 1989; MacWhinney, 2012), emergentist models of language (MacWhinney, 2015a; O'Grady, 2008), and research on learning in connectionist networks (Elman, 1993). From a usage-based view, first and second language learners detect patterns in their linguistic input, memorize and schematize them, reuse them for processing similar input and producing novel output, adapt them to novel input, and forget patterns which have fallen out of use; on a historical time scale, members of language communities adhere to conventionalized patterns, streamline them in an erosionlike process, and slowly drift towards novel patterns; on an evolutionary time scale, the evolution and conspiracy of a range of nonlinguistic cognitive capacities is the prerequisite for the development of human language; in language processing, language users interpret incoming strings based on distribution-weighted cues; learning computational models adjust connection weights to their input to optimize their predictions; and so on. Generally speaking, usage-based researchers in the different fields share the assumption that the respective evolving systems (e.g., human language learners, computational models, a language, Homo sapiens) develop linguistic patterns in response to structured linguistic input, environmental conditions, and functional constraints, recruit acquired patterns to deal with similar situations, and modify their patterns to meet the requirements of novel situations

(Beckner et al., 2009). On this view, then, language learning, language change, and language evolution are inseparable from language use, they are essentially the effects of language use accumulating on different time scales (MacWhinney, 2005, 2014). In the following, the usage-based model is outlined in more detail, with a focus on language learning, in particular, second language learning.

In a usage-based framework, grammatical constructions emerge as generalizations over lexical strings which instantiate them. They are memory representations of the commonalities of their instantiations which are reinforced across usage events. While recurring commonalities become increasingly entrenched with each encounter, fine-grained differences between lexical strings are not reinforced and thus not stored in memory in the long run. As a consequence, the emerging constructions are partially or wholly schematic and range from lexically specific strings to highly schematic templates, depending on the lexical variability of their instantiations (Langacker, 2010).

By way of illustration, consider once more the comparative correlative construction *The* X-*er the* Y-*er* (6c). A sample of instantiations of the construction is given in Examples 11 and 12.

Example 11 (COCA)

a.	Big Data,	the	bigger	the	better
b.	“Will she sleep now?”	“The	longer	the	better,”
c.	Virgins are prized, and	the	younger	the	better.
d.	Dive-bar chicken wings –	the	spicier	the	better.
e.	I love weird things,	the	uglier	the	better
f.	But most emphatically not	the	redder	the	hotter.

Example 12 (COCA)

a. The more information people have the better.

b. The harder they pulled the louder it became.

c. the more warriors she engulfs, the hungrier she gets

Upon hearing Examples 11a through 11d, a learner memorizes the parts which invariably recur across the lexical strings but generalizes over variant parts. As a consequence, a partially item-specific, partially schematic construction is acquired: *the* ADJ-*er the better*. The invariable parts of the strings – *the*, *-er*, and *the better* – are reinforced with each encounter and thus memorized “as is.” In contrast, fine-grained differences between the strings are not reinforced. The different adjectives

encountered at the position following the initial *the* in the string – *big*, *long*, *young*, and *spicy* – are therefore not stored in memory in detail. Only what is common to them on a lower level of specificity is reinforced, here, the occurrence of adjectives forming regular comparatives, which results in a schematic position ADJ.

Once acquired, a construction is exploited to improve subsequent processing and to produce similar strings. The comparative correlative construction which has been acquired on the basis of Examples 11a through 11d contains a schematic position ADJ which may be filled with any adjective forming a regular comparative, for example, *ugly*, producing a novel string which was not part of the prior input (11e). Moreover, a construction continues to be modified by usage. Recognizing and processing the novel string in Example 11f as an instantiation of the comparative correlative construction forces the learner to expand the construction to cover adjectives other than *better* at the position following the second *the*. As a result, the position gains in schematicity: *the* ADJ-*er the* ADJ-*er*. The more item-specific construction *the* ADJ-*er the better* is stored at a lower level of schematicity and remains intact. When encountering more varied strings, as in Example 12, the construction is expanded to comprise an even wider range of lexical strings and as a result becomes more schematic. The resulting *the* X-*er the* Y-*er* construction represents the reinforced commonalities of all instantiations encountered up to this point and hence consists of two noun phrase- or clauselike components juxtaposed to express some comparative correlative relationship between an independent variable identified by the first part (*the* X-*er*) and a dependent variable identified by the second part (*the* Y-*er*) (Fillmore, Kay, & O'Connor, 1988; Goldberg, 2003).

Evidence for the usage-based emergence of schematic constructions comes from experimental and corpus studies on first language acquisition (Tomasello, 2003, pp. 113-126). At around 18 months of age, children begin to produce two-word utterances by stringing together two lexical items they have encountered in their input and learned to associate with a particular frame. Like the frames described above, the childhood precursors represent the typical aspects of different situations in a child's lifeworld, yet, presumably on a more specific level and from a more constrained view than in adulthood. For instance, in an attempt to convey the message that the quantity of something has increased or that they would wish so, English-speaking children combine words they have heard before in relevant contexts (e.g., *Would you like more cookies?*) to produce two-word utterances like in Example 13. To give another example, when indicating that something has disappeared from the immediate scene, they reuse words from relevant contexts in their prior input (e.g., *Daddy is gone.*) to produce the utterances in Example 14.

Example 13	Example 14
a. more cookies	a. Daddy gone
b. more cereal	b. juice gone
c. more fish	c. grapes gone
d. more milk	d. sticky gone
e. more grapes	e. all gone

(Tomasello, 2003, pp. 114–116, adapted from Braine and Bowerman, 1976)

At this developmental stage, two-word utterances are "totally concrete in the sense that they are comprised only of concrete pieces of language, not categories" (Tomasello, 2003, p. 114). Their only categorical import is to partition the associated frame into two symbolizable component parts. From this, more schematic templates begin to emerge around this age which consist of a specific lexical anchor or pivot and a category which generalizes over the variant parts of the two-word utterances, here, *more* X and X *gone*. While these pivot schemas are in part bound to specific lexical items, they are in part productive in the sense that they are extended to novel words. For example, in an experimental study by Tomasello, Akhtar, Dodson, and Rekau (1997), children at 22 months of age were taught nonce words (e.g., they heard: *Look! The tam, the tam!*, accompanied by a novel toy character) and in following elicitation tasks were able to combine the newly learned words with already acquired pivot schemas (e.g., when encountering two exemplars of the novel toy character and asked: *What are these?*, they replied: *More tam.*). Pivot schemas do not involve grammatical relations yet. Only later, children acquire item-specific constructions around specific verbs ("verb islands", Tomasello, 1992) which mark grammatical relations, for example, by word order (e.g., *Draw me!* is not synonymous with *Me draw!* anymore).

In line with a usage-based model of language learning, this suggests that children acquire partially schematic constructions by generalizing over similar lexical strings in their language use. Tomasello argues that when constructing two-word utterances and linguistic pivot schemas from the language they hear, children rely on domain-general cognitive and social-cognitive abilities, such as planning ahead problem-solving or goal-directed behavior and applying a behavioral strategy in different contexts. Informed by Langacker's characterization of schematization as lack of reinforcement across usage events, Tomasello metaphorically likens the process of learning schematic constructions from item-specific strings to the stacking of over-

head transparencies, "each with a stored sequence such as an utterance printed on it" so that "repeated elements can be clearly recognized through the entire stack, but the variable elements are blurred because of their variability" (2003, p. 124).

2.2.2 Language Learning is Cumulative Priming

Evidently, "becoming a fluent speaker involves a prodigious amount of actual learning" from input and experiences of language use (Langacker, 2000, p. 2). Usage-based researchers do not proceed from the assumption of an innate linguistic endowment to explain language acquisition but appeal to learners' experiences with language use and to their nonlinguistic, cross-modal cognitive learning and processing abilities, in particular, the ability to learn schematic patterns from structured input based on perception, memory, analogy, and category learning. Usage-based language learning is for the most part implicit learning, as learning is seen as the incidental outcome of input-driven processing activities below the threshold of conscious awareness and control (N. C. Ellis, 2015). This characterization makes language learning similar to priming.

Priming refers to the observation that "[w]hen people talk or write, they tend to repeat the underlying basic structures that they recently produced or experienced others produce" (Pickering & Ferreira, 2008, p. 427). For example, in a pioneering study, Bock (1986) found that English speakers were more likely to describe a picture with the *to*-dative construction (15a) (target) rather than the semantically similar ditransitive construction (15b) when they had heard the experimenter use a *to*-dative before describing a different picture (prime).

Example 15 (Bock, 1986)

a. A rock star sold some cocaine to an undercover agent.

b. A rock star sold an undercover agent some cocaine.

Bock concluded that the effect "does not seem to depend on superficial relationships between successive sentences, but on more abstract structural similarities" (Bock, 1986, p. 379). Numerous subsequent experimental and corpus studies have observed priming with a range of alternating constructions and have confirmed that the tendency to repeat recently experienced constructions is not merely due to lexical or conceptual overlap between prime and target but to similarities on a more schematic level of processing, like constituent structure, word order, and order of thematic roles (Bock & Loebell, 1990; Chang, Bock, & Goldberg, 2003; Hartsuiker,

Kolk, & Huiskamp, 1999; Pickering & Branigan, 1998; for a review, see Pickering & Ferreira, 2008).

While early research has interpreted priming as resulting from the transient activation of mental representations of already-acquired constructions (Bock & Loebell, 1990; Pickering & Branigan, 1999), more recent evidence suggests that priming reflects at least in part implicit, input-driven learning. Like implicit learning, priming is tacit, incidental, and automatic (Pickering & Ferreira, 2008). Moreover, effects of priming may be long-lived. For example, in an experiment similar to Bock (1986), Bock and Griffin (2000) found persistent priming effects with up to ten sentences intervening between prime and target. To give another example, also in a picture description task, Savage, Lieven, Theakston, and Tomasello (2006) observed priming effects for passive clauses in English-speaking four-year-old children as long as a month after initial exposure to primes. The long-lived effects suggest that priming does not merely reside in the transient activation of memory traces but leads to a more long-lasting change in linguistic representations. Notably, in Savage et al. (2006), priming persisted for up to a month only in those children who had been exposed to primes with different verbs and who had the opportunity to reinforce the primed construction in an interim description task one week after initial exposure. In contrast, priming decayed in participants who received unvaried primes and were not invited for the interim task. Adopting a usage-based framework of learning (Tomasello, 2003), the authors argued that exposure to experimental primes and rehearsing them later on contributed to learning schematic passive constructions much in the same way as in the above examples of constructions emerging from the reinforced commonalities of varied instantiations.

This seems to suggest that both priming and language learning are based on the effects of implicit, input-driven learning occurring at different time intervals. Initial exposure to a construction leaves a memory trace of the provoked processing activity which spills over to immediate subsequent processing and, if repeated, is consolidated in memory for exploitation in the long run. Put differently,

> [a]t smaller intervals, the trace might take the form of residual activation, so that the same activity can be resuscitated in apprehending the target. In such cases we can speak of priming and short-term memory. On a larger time scale, we speak instead of learning and long-term memory, where [...] the subject undergoes some adjustment or adaptation with enough permanence to affect its subsequent processing activity (Langacker, 2010, p. 115).

The lasting entrenchment of constructions from the recurrence of transient pro-

cessing activities has been described metaphorically in a variety of ways. For example, the process has been likened to connectionist network models learning to predict output from structured input. A connectionist model consists of links between nodes forming different layers. When a connectionist model is exposed to input, activation passes from an input layer through layers of hidden nodes to an output layer. The activation pattern at the output layer determines the model's response to the received input. For example, the model might attempt to predict the lexical item following in the speech stream from the previous items or predict a likely continuation given some meaning input. To be able to learn temporal sequences, the model stores the activation of the hidden nodes at one time step in a layer of context nodes and retrieves the activation pattern at the following time step. Comparing the generated to the desired output, the model learns by gradually changing connection weights and firing thresholds in such a way as to decrease the discrepancy and approximate the desired output in subsequent trials. The modelled process is supposed to simulate learning in biological systems as described by the Hebbian theory according to which learning is driven by correlated activity strengthening the synaptic connection between simultaneously activated neurons (Elman, 1990, 1993; Elman et al., 1996).

For example, Chang, Dell, Bock, and Griffin (2000) trained a network model to predict sequences of words, one word at a time, given different meaning representations (the machine correlate of different pictures in a description task). Based on input and backpropagation of error, the model learned to produce different types of constructions typically used in human priming studies like active and passive clauses, and *to*-dative and ditransitive clauses. Importantly, when sequences were produced with learning "on," the resulting weight changes "subsequently biased the production of a similar structure, yielding priming" (Chang et al., 2000, p. 222). In other words, the network model simulated structural priming effects based on the computational mechanisms responsible for implicit learning, suggesting that priming and implicit learning overlap. In line with human studies, structural priming was long-lasting and persisted over up to ten intervening sequences.

A different metaphor adopted from research on language change and particularly common in German-language literature likens the mind to a landscape and describes established constructions as *Trampelpfade*, that is, as trails or paths caused by the vegetation being constantly trodden down (Behrens, 2011). In this metaphoric frame, highly (or rather, deeply) entrenched constructions correspond to heavily trafficked routes which are deeply carved into the landscape and attract subsequent travelers. The degree of schematicity of a construction is likened to the width of a

path. Schematic constructions with highly varied instantiations are represented by wider paths, while item-specific strings form narrow ways. The knowledge acquired by a connectionist network model is also sometimes visualized as a landscape in which established categories show up as the deep wells of local error minimums, whereas vague categories form shallow basins and repellent states are represented by elevations. Yet another metaphor originating in phonetic research conceptualizes each usage event as a token or exemplar arranged in memory space with similar exemplars close to each other (Bybee, 2010; Pierrehumbert, 2003). A construction is represented by a cluster or cloud of exemplars of varying density and dispersal. While each metaphor highlights different aspects of the usage-based learning process, they are essentially equivalent (when not taken literally) and should not be seen as mutually exclusive but as complementing each other (Baayen & Ramscar, 2015; Langacker, 2010, 2009).

Two more points should be noted. First, usage events are contextually rich. To simplify matters, the preceding review has focused on lexical strings, however, usage events are not restricted to language use in the narrow sense of the word but comprise everything relevant to a language user's apprehension of a particular instance of communication, including linguistic and encyclopedic knowledge frames, short-term goals and long-term plans, and the physical, social, cultural, and linguistic context. In other words, a usage event is "an utterance characterized in all the phonetic and conceptual detail a language user is capable of apprehending" (Langacker, 2010, p. 19). Accordingly, constructions represent not only commonalities reinforced across similar lexical strings but may also embody any aspect of use which is relevant to understanding and recurs across usage events. For example, a quick search in the COCA reveals that the partially schematic string *the* X *suggest that* (e.g., *the results suggest that*, *the authors suggest that*) is more common in academic than in nonacademic genres. From a usage-based perspective, genre and style are part of a usage event, therefore, the genre-specific use becomes part of the meaning of the emerging construction (for a more elaborate example, see Bybee's take on the *What's* X *doing* Y *?* construction, Bybee, 2006, pp. 721-723). Second, usage events are "coupled activities" (Langacker, 2010, p. 117) in the sense that under normal circumstances they involve two or more language users which interact and align with each other. There is accumulating evidence from research on social cognition and communication to suggest that understanding each other crucially involves the simulation of others' experiences, establishing a common ground, and shared attention and intentionality (Clark, 1996; Tomasello & Carpenter, 2007; Tomasello, 2010).

Against this background, two more aspects of the usage-based model become ap-

parent. First, up to this point the question of what determines which construction is invoked at a particular usage event has been avoided; in other words, given a specific lexical string in a particular context of use, which of all constructions in a language user's repertoire will be adopted for categorization and processing? Different constructions compete for activation and the privilege to categorize a string (E. Bates & MacWhinney, 1989; MacWhinney, 2012). The level of activation is a function of the degree of entrenchment of a construction, contextual priming, the amount of overlap between a construction and a string, and mutual inhibition between constructions (Langacker, 2000). In a network metaphorical frame, entrenchment lowers the activation threshold of a construction (or rather, entrenched constructions have higher resting levels of activation), therefore, more entrenched constructions are more likely to be activated. Recent activation in preceding context increases the residual activation of a construction so that the activation threshold is reached more quickly. The more a construction and a string overlap, the more activation the construction receives. Finally, increasing the activation of a construction might have an inhibitory effect on the activation of neighboring constructions.

Second, and more importantly for the current investigation, if language knowledge emerges from language use in the way proposed in usage-based research, then language knowledge involves statistical knowledge and language learning and processing is sensitive to the frequency and the distribution of a construction in the input. In this sense, then, a construction is nothing but acquired knowledge about a likely continuation of a current stream of speech or line of text and the way in which the unfolding form is likely to map onto meaning. While radically different from most earlier descriptions of linguistic knowledge, this frequency-based conception of language is not entirely new. For example, corpus linguistics has long emphasized the importance of collocations and frequency-based formulas for idiomatic language use (Biber, Johansson, Leech, Conrad, & Finegan, 1999; Sinclair, 1991; Wray & Perkins, 2000). Drawing on this work and the notion of priming, Hoey developed a conception of language most akin to the usage-based model adopted here:

> Every lexical item, I want to argue, is primed for collocational use. By primed I mean that as a word is acquired through encounters with it in speech and writing, it is loaded with the cumulative effects of those encounters such that it is part of our knowledge of the word (along with its senses, its pronunciation and its relationship to other words in the same semantic set) that it regularly co-occurs with particular other words (Hoey, 2004, p. 23).

In Hoey's framework, local and global patterns emerge from the company a

word keeps (or avoids keeping) ranging from collocations and high-frequency strings to semantic associations, grammatical categories, constructions, and text-level arrangements. In line with the usage-based model of grammar, Hoey arrived at the conclusion that grammar is "a generalisation out of the multitude of primings of the vocabulary of the language" (2004, p. 39).

2.2.3 Language Learning is Sensitive to Frequency

Usage-based researchers assume that construction learning is sensitive to the frequency and distribution of a construction in language use. They assume that the degree of entrenchment is to a significant extent determined by the frequency of exposure and that constructions reflect the distributional characteristics of the language use from which they have emerged in form and meaning.

2.2.3.1 Schematicity Depends on Type-Token Frequency Distribution

In linguistic research on frequency effects, a distinction is often made between type and token frequency (Bybee, 1998, 2010, 2013). *Token frequency* refers to "the number of times a particular string occurs in a text or corpus" (Bybee, 2013, p. 59). In contrast, type frequency "is measured in the context of a construction and counts how many different items occur in the schematic slots of constructions" (Bybee, 2013, p. 61). For example, idiomatic expressions like *kick the bucket* and *a dime a dozen* have a low type/token ratio because they occur only in this form and do not exhibit any lexical type variation. In contrast, constructions with more varied instantiations like the comparative correlative construction *the* X-*er the* Y-*er* have a higher type/token ratio because they occur with different lexical types. In other words, the type/token ratio determines the schematicity of a construction. While a high type/token ratio gives rise to more schematic constructions as language users generalize over different lexical types, a low type/token ratio results in the entrenchment of item-specific strings which language users memorize as wholes. Moreover, research on language learning and change suggests that constructions with a low type/token ratio are more likely to undergo phonetic reduction, resist analogical leveling, and tend to lose analyzability and compositionality (Bybee & Hopper, 2001; Bybee, 2008).

By way of illustration, consider the development of the English future construction BE *going to* VERB, described by Bybee (2006, pp. 719-721). In Early Modern English, the string BE *going to* VERB was only one of many different instantiations of a schematic construction which specified movement through space for a particular

purpose, BE VERB(*-ing*) *to* VERB (e.g., *They are going to meet him.*, in the sense "to go somewhere in order to meet someone"). Due to its relatively high token frequency, the string BE *going to* VERB became entrenched as a whole and gradually gained independence from the parent construction. The specific meaning of movement through space was lost and instead the construction assumed the meaning of intention inferred from frequent usage contexts. As expected, the item-specific *going to* part of the construction underwent phonetic reduction to *gonna* due to routinization of the underlying processing activity. Moreover, as a result of holistic processing, the inherited constituent structure changed as *going to* was gradually reanalyzed as a phonological unit with auxiliary function. To give another example taken from Bybee (2006, pp. 728-729), the diachronically older *no*-negation (e.g., *He has nothing.*) resists analogical leveling with the younger and more productive *not*-negation (e.g., *He does not have anything.*) in sequences of high token frequency, for instance, with existential *be* (e.g., *There was no coercion on the part of the police.*), stative *have* (e.g., *We have no single origin-point.*), and copular *be* (e.g., *This is no joking matter.*). The role of type and token frequency in language learning has already been illustrated in Examples 13 and 14. When acquiring pivot schemas like *more* X and X *gone*, children generalize over different lexical types to form abstract categories, while the low type/token ratio of the pivot produces an item-specific representation.

Moreover, construction learning benefits from a skewed type-token distribution in the input (N. C. Ellis et al., 2016; Goldberg, Casenhiser, & Sethuraman, 2004). Results of corpus studies indicate that the lexical types of a sampled construction are not evenly distributed across the sample but that a high-frequency type accounts for the bulk of the sample. For example, while the ditransitive construction (SUBJ V OBJ_1 OBJ_2) occurs with a wide range of verb types in language use, the verb *give* is by far the most frequent one (Gries & Stefanowitsch, 2004). The highly frequent type forms a kind of item-specific foundation based on which a more schematic construction is built. Adopting a different metaphor, the tokens or exemplars of a highly frequent type form a dense cluster at the centre of the categorical space around which similar exemplars are arranged. The emerging construction exhibits a structure that is typical of a prototype category (Givón, 1986; Lakoff, 1987; Rosch, 1978). A prototype is the most typical and distinctive imaginary member of a category and aggregates the distinctive features of frequently encountered members. Nonprototypical members are arranged in the space around the prototype with distance depending on their degree of similarity. For example, a prototypical bird has wings, feathers, a beak, flies, lays eggs, and so on, much like a sparrow, but

much unlike a penguin. Note that even though all birds have eyes and legs, they are not reliable predictors of category membership because they are not distinctive (E. Bates & MacWhinney, 1989; MacWhinney, 2012). Corpus and experimental research suggests that learners first acquire a construction prototype from skewed input which then paves the way for a more schematic construction.

By way of illustration, Goldberg et al. (2004) analyzed verb-argument constructions in transcripts of English-language mother-infant interactions and found that each construction in child speech was dominanted by a particular verb type. For example, the intransitive motion construction SUBJ V $\text{OBL}_{\text{PATH/LOC}}$ (e.g., *She went to the library.*) most frequently occurred with the verb *go* accounting for 54% of all instances in the transcripts, while the following most common verbs *get*, *fall*, *come*, *look*, *live*, and *sit* each accounted for only 6% or less. To give another example, the caused-motion construction SUBJ V OBJ $\text{OBL}_{\text{PATH/LOC}}$ (e.g., *I put my hands in my pockets.*) mostly occurred with the verb *put* (31%), while other frequent verbs were much less common, for instance, *get* (16%), *take* (10%), *do* (6%), and *pick* (6%). A comparison of child and child-directed speech revealed that the children mirrored the distribution of verb types and constructions in their input. The authors argued that the most frequent verb types designate basic patterns of experience like moving somewhere or causing something to move somewhere and aid learners to "get a 'fix' on the construction's meaning" (Goldberg et al., 2004, p. 302). In line with this, in a follow-up training study, adult native English speakers learned novel verbs and constructions significantly better from skewed training input than from more balanced input. By now, the importance of skewed input and prototypes for usage-based learning has been confirmed by a number of subsequent corpus and experimental studies for different verb-argument constructions and learner populations (Boyd & Goldberg, 2009; Casenhiser & Goldberg, 2005; N. C. Ellis & Ferreira-Junior, 2009a, 2009b; N. C. Ellis & O'Donnell, 2012; N. C. Ellis et al., 2015; N. C. Ellis et al., 2016; N. C. Ellis & Odgen, 2017; Goldberg & Casenhiser, 2008).

2.2.3.2 Grammatical Constructions Are Item-specific

As mentioned above, an important feature of the constructicon is descriptive redundancy. Item-specific strings and partially filled constructions are assumed to be stored along with the more schematic constructions which they instantiate. More specifically, usage-based research suggests that item-specific constructions emerge from high-frequency strings with a low type variation. As a consequence, constructions are stored at various levels of schematicity and embody item-specific usage. Evidence for item-specific knowledge in grammar comes from usage-based studies

on language learning, processing, and use (for a review, see Diessel, 2016).

For example, recall that children acquire item-specific pivot schemas like *More* X and X *gone* from generalizations over strings of two-word utterances in their language use. While pivot schemas are partially schematic, they do not count as grammatical constructions in the narrow sense of the word because they do not represent grammatical relations. However, usage-based researchers assume that learning grammatical relations is not essentially different from learning pivot schemas. Like pivot schemas, grammatical relations emerge as part of item-specific constructions from a learner's input. Evidence for the item-specific character of grammatical relations comes from a training experiment by D. Matthews, Lieven, Theakston, and Tomasello (2005). In the study, groups of English-speaking children of different ages were trained to use a weird word order (SUBJ OBJ V) with verbs of high frequency, medium frequency, and low frequency. In the following elicitation task, younger children were more likely to adopt the word order with low frequency verbs. With higher frequency verbs, they tended to revert to the canonical English word order (SUBJ V OBJ) especially when they used pronominal verb arguments. In contrast, older children consistently preferred the canonical English word order. From a usage-based perspective, this suggests that English word order develops from lexically specific schemas formed around frequent, regularly distributed items.

Item-specific usage is not an anomaly of language use in childhood but survives into adulthood. Results of corpus studies indicate that schematic constructions are associated with specific lexical items in language use. For example, to measure the association between constructions and specific lexical items in a corpus, Gries and colleagues (Gries & Stefanowitsch, 2004; Gries, Hampe, & Schönefeld, 2005; Gries, 2012, 2015; Stefanowitsch & Gries, 2003) developed different computational methods under the label *collostructional analysis*. Details aside, the researchers compared observed to expected frequencies of a lexical item in the context of a construction. They reasoned that if the lexical item appeared more frequently than expected, then there was something about the construction that attracted the lexical item. For instance, the results of a corpus analysis reported in Gries and Stefanowitsch (2004) indicated that the verbs *give*, *tell*, *show*, *offer*, and *cost* occurred more frequently than expected with the ditransitive construction (e.g., *John gave Mary the book.*), whereas the verbs *send*, *bring*, *play*, *take*, and *pass* exhibited a preference for the *to*-dative construction (e.g., *John sent the book to Mary.*).

Collostructional analysis has been devised as a way to explore fine-grained meaning differences between semantically similar constructions. Accordingly, the authors suggested that the meaning of the constructions is reflected in the lexical items

they attract. For example, most verbs in the ditransitive construction share the meaning of transfer. However, there are exceptions. For instance, as Diessel (2018) points out, the ditransitive construction also occurs with nontransfer verbs like *forgive* (e.g., *I forgive you your transgression.*). Moreover, some transfer verbs such as *donate* are not acceptable in the ditransitive but only in the *to*-dative construction (e.g., **He donated the library books*, *He donated books to the library*). This suggests that item-specific usage of constructions is not only due to similar meanings of lexical items and constructions but also reflects the biased distributions of lexical items in language use.

Moreover, effects of specific items have been observed in studies on the processing of constructions. Results of priming studies indicate that the likelihood of producing the primed construction increases when prime and target share lexical items (Hartsuiker, Bernolet, Schoonbaert, Speybroeck, & Vanderelst, 2008; Pickering & Branigan, 1998; Pickering & Ferreira, 2008; Schoonbaert, Hartsuiker, & Pickering, 2007). By way of illustration, in a fragment completion task by Pickering and Branigan (1998), participants were more likely to produce ditransitive or *to*-dative constructions depending on whether they had produced a ditransitive or *to*-dative before, respectively. Importantly, the priming effect increased when prime and target shared the verb. In detail, consider the material in Example 16.

Example 16 (Pickering & Branigan, 1998)

a. The racing driver showed the torn overall...

b. The racing driver showed the helpful mechanic...

c. The racing driver gave the torn overall...

d. The racing driver gave the helpful mechanic...

e. The patient showed...

Participants read and completed prime fragments eliciting either ditransitives (16a, 16c) or *to*-datives (16b, 16d). When completing the following target fragment (16e), they were more likely to produce the primed construction if prime and target shared the verb, that is, when they had been primed by 16a or 16b rather than 16c or 16d.

This is known as *lexical boost*. The authors concluded that each lexical item in the mental lexicon is associated with combinatorial nodes which represent different constructional frames specifying the surrounding constituents. Activation of a verb along with a particular constructional frame results in the production of a ditransitive or *to*-dative clause. From a usage-based perspective, lexical boost in priming likely results from the implicit learning of item-specific constructions. Processing

the prime results in the transient activation of a link between a lexical item and a construction. When the lexical item recurs in the target, activation spreads from the item node to the construction node thereby reinforcing the established connection and increasing the activation of the primed construction. In line with this, researchers in the field have more recently interpreted lexical boost as indicating that "syntactic information is partly abstract and partly associated with particular lexical entries" (Pickering & Ferreira, 2008, p. 437). If not reinforced, the lexical boost decays over time (Hartsuiker et al., 2008) as the link between item and construction is lost.

2.2.3.3 Constructions Are Sequential Processing Routines

Above and beyond item-specific knowledge, linguistic knowledge involves sequential knowledge (Bybee, 2002, 2010; Dąbrowska, 2014; N. C. Ellis, 1996, 2003). Language users link linguistic units which are used together in sequence and combine them into longer units or "chunks" (Newell, 1990). The degree of coherence between two units is in part determined by their association strength in language use. For example, the noun *ghost* collocates with the noun *town* in language use, together forming the compound noun *ghost town*. Once entrenched as a unit in memory, *ghost town* is accessed and processed as a whole. This is evident from a loss of compositionality. A ghost town is not a town inhabited by ghosts but a town which once was bustling and wealthy but is now poor and deserted. This indicates that the meaning of the compound is not entirely constructed from the component parts *ghost* and *town* but in part associated with the compound as a whole. Compare this to the string *ghost army* which is probably not frequent enough to be stored and processed as a unit. This correlates with a higher degree of compositionality[1] (Langacker, 2008a, pp. 60–62).

Chunks emerge on all levels of language representation (for a recent review, see N. C. Ellis et al., 2016, pp. 47-57). For instance, lexical items which frequently co-occur develop into strings with different degrees of coherence like collocations (e.g., *creepy guy*, *natural beauty*), prefabs (e.g., *I'm sorry but*, *in other words*), compounds (e.g., *ghost town*), or longer strings of more or less tightly connected items (e.g., *drive* NP *crazy*). At a more schematic level, grammatical constructions emerge from generalizing over lexical strings. As a consequence, grammatical constructions involve sequential knowledge. For example, the English noun phrase involves sequential links between nouns, determiners, adjectives, and other noun modifiers (Det Adj

[1]Note that even the meaning of *ghost army* is not entirely compositional but in part idiomatic, that is, associated with the compound as a whole, ruling out alternative readings like "army to fight ghosts" along the lines of the preferred reading of *ghost hunter*.

N Mod). When encountering a determiner, the next item is likely to be a noun or an adjective. Based on constructions and context, language users are able to anticipate likely continuations of an unfolding string, which affects language processing and guides interpretation (Hale, 2001; Levy, 2008; MacDonald, Pearlmutter, & Seidenberg, 1994; Trueswell, Tanenhaus, & Garnsey, 1994).

Sequential learning and the ability to chunk sequences of units are essential to language learning. In a usage-based model, language users learn chunks bottom-up which gradually come to determine their language processing top-down which in turn leads to the formation of longer chunks and so on, bootstrapping their way into language. In this view, "phonology, lexis, and syntax develop hierarchically by repeated cycles of differentiation and integration of chunks of sequences" (N. C. Ellis, 2003, p. 81). By way of illustration, in a pioneering study by Saffran, Aslin, and Newport (1996), children at eight months of age learned word boundaries solely based on transitional probabilities between syllables. The participants were exposed to a continuous speech stream of nonsense words (*tupiro golabu bidaku padoti*). Importantly, all acoustic and prosodic cues to word boundaries were omitted. The only cue to word boundaries were transitional probabilities from syllable to syllable. Like in natural languages, transitional probabilities were higher within words (*tu-pi*, *pi-ro*, *go-la*) than between words (*ro-go*, *bu-bi*, *ku-pa*). In the following recognition task, children listened longer to novel syllable strings than to strings included in the training material, suggesting that they had extracted phonetic chunks or words from the speech stream solely based on transitional probabilities. To give another example, Bannard and Matthews (2008) extracted four-word strings from a corpus of child-directed speech and examined children's ability to repeat them in a sentence-repetition task. The results indicated that high-frequency strings (e.g., *sit in your chair*) were more likely to be repeated correctly than low-frequency strings (e.g., *sit in your truck*). Moreover, frequency correlated with duration. This suggests that the strings were processed as automated chunks with the degree of entrenchment and automatization varying as a function of frequency of exposure. String frequency has also been found to affect priming, recall rate, and correlated electrophysiological measures (Durrant & Doherty, 2010; Tremblay & Baayen, 2010). Moreover, the importance of chunk-based processing for language learning has been evidenced recently by a number of computational modeling studies (Frank & Christiansen, 2018; Chater, McCauley, & Christiansen, 2016; McCauley & Christiansen, 2011, 2014; see also Reali & Christiansen, 2009).

Importantly, on the cognitive usage-based view adopted here, constituency emerges from sequentiality (Bybee & Scheibman, 1999; Bybee, 2002; Krug, 1998). More

precisely, constituents develop from the automatization or chunking of oft-repeated sequences of linguistic units. Following Langacker (1987a, 1997), Bybee argued that constituents reflect groupings of meaning-related linguistic units. However, while meaning determines which items are used together in sequence, she proposed that "repetition is the glue that binds constituents together" (2002, p. 111). By way of illustration, she examined the immediate left and right collocations of a sample of frequent nouns in a corpus. As expected, the most frequent neighbors were items which form part of a noun phrase like determiners, adjectives, and items introducing other noun modifiers like prepositions and *that* marking the beginning of a RC. Bybee argued that frequent sequences of these units form chunks from which a more schematic noun phrase construction emerges. Moreover, left neighbors were more predictable than right neighbors suggesting a tighter connection of the noun to the preceding than the following items, [[DET ADJ N] MOD]. On this view, then, constituency is fluid, fragmented, and a matter of degree.

The emergence of constituency structure from chunking is particularly evident when chunks cut across phrase-structure boundaries and thus override semantic groupings in an utterance. For example, Bybee and Scheibman (1999) examined the phonological reduction of English *do not* to *don't* in spontaneous conversations. They found that the reduction was more likely in the context of frequent left and right neighbors such as pronouns like *I* and verbs like *know*, *think*, and *want*, respectively. Moreover, the reduction was more dependent on the preceding than the following item. This was arguably due to a difference in the type/token ratio. While the position following *don't* was populated by multiple low-frequency types such as different verbs, the preceding position was restricted to a more limited range of high-frequency types, with *I* accounting for the lion's share of instances. As seen, high-frequency sequences with little type variation tend to be stored and processed as item-specific units. As a consequence, *don't* likely united with the preceding items to form a chunk which results in a constituent structure which is incongruent with semantic groupings, [[*I don't*] V]. In line with this, earlier corpus studies found that reductions of items such as *have*, *not*, and *am* to *'ve*, *'nt*, and *'m*, respectively, are more likely in frequent strings (e.g., *I've*, *don't*, *I'm*) (Krug, 1998).

Note that a lack of congruency between constituents and semantic groupings is not inconsistent with the cognitive usage-based assumption that grammar consists of symbolic pairs of form and meaning. As Langacker pointed out, "[a] *symbolic* account of grammar does not in any way entail that grammatical structure is isomorphic to conceptual structure or even consistently iconic" (Langacker, 1997, p. 30). This extends to constituency relations between nonadjacent units such as

determiner and noun separated by an intervening adjective, as in *this crazy stuff*, or verb and verb particle separated by an intervening noun phrase, like in *make this stuff up*. When processing discontinuous constituents, the sequential procedure is temporarily suspended and then resumed due to the frequency-based predictability of the postponed part.

2.2.4 Usage-based Second Language Learning

From a cognitive usage-based viewpoint, nonnative language learning is not essentially different from native language learning. Like native learners, nonnative learners are seen as acquiring grammatical constructions from generalizing over lexical strings in their input. While overlapping parts of the strings are reinforced and form item-specific pivots, variable parts develop into more schematic categories resulting in constructions at different levels of schematicity (Bybee, 2008; N. C. Ellis, 2007; N. C. Ellis & Cadierno, 2009; N. C. Ellis et al., 2016; Goldberg & Casenhiser, 2008). This is not to deny that native and nonnative language learning differ in many respects. Needless to say, nonnative language learning is influenced by a multitude of factors which are probably of minor importance in native language learning, such as factors relating to language teaching and didactics, factors relating to individual differences in age, motivation, aptitude, attitude, cognitive maturation, learning strategies, and metalinguistic abilities, and factors relating to the social and cultural learning context. From a usage-based perspective, they are defining parts of each usage event and will inevitably find their way into the constructions which learners acquire from using a second language (Doughty & Long, 2003; Gass, Behney, & Plonsky, 2013; MacWhinney, 2015c; Robinson & Ellis, 2008).

Moreover, by the time second language exposure begins, nonnative learners have already devoted a considerable part of their lifetime to learning a first language. The circumstances are different for bilingual language learners, that is, learners who acquire two languages early in life (De Houwer, 2007, 2014, 2018). In the current investigation, the focus is on language users who grew up learning a first language from their environment and have achieved a high level of proficiency in this language when they begin to use and learn a second language. As a consequence, all else being equal, nonnative learners have received only a fraction of the input which native speakers of the language have been exposed to. On the assumption that constructions emerge from input, usage-based researchers expect differences in the amount of input to be reflected in the learning process. In particular, nonnative learners are likely to miss low-frequency constructions as they are not frequent enough in their input to be stored in memory. In line with this, recent research on formulaic

language use suggests that nonnative learners are able to extract high-frequency strings from their input but miss low-frequency strings. For example, Durrant and Schmitt (2009) compared two-word collocations in native and nonnative English corpora. They found that nonnative writers overused a handful of high-frequency collocations (e.g., *good example*, *long way*) but underused low-frequency strings of strongly associated items (e.g., *densely populated*, *preconceived notions*), compared to native writers. The authors argued that the lack of low-frequency collocations is in part responsible for the lack of idiomaticity which is characteristic for nonnative language use. With respect to input, the results suggest that, as expected, the nonnative writers have already learned frequent constructions from the input but have not (yet) had enough time and exposure to acquire infrequent constructions which are based on coherence and contextual predictability rather than total frequency.

In line with this, research on the sensitivity of processing to usage frequency suggests that nonnative language users have not (yet) tailored their constructions to fine-grained contexts of use but rely on more coarse-grained frequency distributions in their input. For example, N. C. Ellis, Simpson-Vlach, and Maynard (2008) extracted formulas from the academic parts of multiple English corpora and conducted a series of processing tasks to explore the influence of different frequency measures on native and nonnative processing. The results indicated that processing was affected by formula length, absolute frequency, and collocational strength. More importantly, while nonnative processing was determined by absolute frequency, native processing was primarily determined by collocational strength. The researchers related the difference in sensitivity to differences in the amount of input. Assuming the power law of practice (Newell, 1990), they argued that learners with little experience benefit from practice more than learners at higher levels of exposure. Accordingly, nonnative learners are more sensitive to an increase in absolute input frequency than native learners because at lower levels of experience each encounter considerably adds to the narrow experiential basis on which a construction is emerging. In contrast, native speakers have grown more insensitive to differences in the absolute frequency of constructions because at higher levels of experience most constructions have become established in memory and thus more encounters do not contribute significantly to their entrenchment. As a consequence, the effect of increased absolute frequency on learning and processing levels out and eventually reaches asymptote. Instead, native speakers over time become more attuned to collocational chunks based on the contextual predictability of items in sequence.

Additionally, first and second languages are not separated from each other but interact in the process of learning and use. Cross-linguistic influence or "trans-

fer" between the languages of a multilingual language user has attracted a lot of attention in linguistic research (Jarvis & Pavlenko, 2008; Odlin, 1989). In a usage-based framework, cross-linguistic influence is interpreted as due to first-language constructions interfering in the processing of second-language input: "[B]ecause all experiences leave a trace in the memory store, all previous experiences are a factor, either facilitating or inhibiting the learning of a new language" (N. C. Ellis, 2012b, p. 13). In particular, learners of typologically similar languages likely exploit first-language constructions for processing and producing similar strings in their second language. For example, in a recent study by N. C. Ellis and Sagarra (2011), Chinese learners of Latin acquired tense morphology to a lesser degree than Russian and Spanish learners from the same amount of Latin input presumably because their first language does not require them to pay attention to inflectional morphology on the verb to determine the time of an event. In contrast, Spanish and Russian learners seem to have benefited from the rich morphology of their first languages when processing Latin input. This is reminiscent of earlier research paradigms, notably, contrastive and error analysis, in which researchers expected to find transfer of knowledge from first to second language, influencing acquisition in facilitative or obstructive ways (R. Ellis, 1994, Chapter 8; Gass, 1979). Moreover, cross-linguistic similarity between languages and constructions is one of the earliest and most widely recognized factors determining cross-linguistic influence (Andersen, 1983; Jarvis & Pavlenko, 2008, pp. 176–182; Kellerman, 1979; Ringbom & Jarvis, 2009).

The image of multilinguals as "compound monolinguals" with two stand-alone linguistic systems in mind (De Bot, 1992) implied by this conception of transfer is, however, not adopted by usage-based researchers. Research on effects of the second language on the first suggests that the different languages in a multilingual mind are more closely intertwined than initially assumed (Cook, 1995, 2003, 2016). Based on this, usage-based researchers have recently suggested that second language learners acquire shared constructions across their languages blurring the boundaries between first and second language systems. On this view, the constructicon comprises language-specific and language-nonspecific constructions which emerge from cross-linguistic similarities (Hall, Cheng, & Carlson, 2006; Hall, 2016; Hilpert & Östman, 2014).

For example, adopting a usage-based view of language learning, Höder proposes that "multilingual speakers organise their linguistic system and, hence, their constructional network on the basis of available input by means of abstraction and categorisation, irrespectively of 'language boundaries'" (Höder, 2014b, p. 218). Inspired by early research on language contact (Weinreich, 1979), he developed the

concept of diaconstructions which represent commonalities of similar constructions from two or more languages. First evidence for the emergence of diaconstructions comes from historical language change (Höder, 2012) and interlingual productivity (Höder, 2014a). For example, multilectal speakers of standard and nonstandard varieties of German produce novel noun compounds based on the interlingual identification of lexical items and grammatical diaconstructions. For instance, based on the identification of the standard German items *Maus* and *Zeiger* with nonstandard German *Muus* and *Wieser* ("mouse" and "pointer"), respectively, and a cross-variety N N diaconstruction for forming noun compounds, multilectal speakers produce the novel nonstandard German form *Muuswieser* by analogy with standard German *Mauszeiger* ("mouse cursor").

The development of shared constructions has also been supported by recent results from psycholinguistic studies, indicating that priming persists across languages (Hartsuiker, Pickering, & Veltkamp, 2004; Hartsuiker & Pickering, 2008; Hartsuiker & Bernolet, 2017). For example, in a confederate scripted dialogue task (Schoonbaert et al., 2007) Dutch learners of English were more likely to produce a prepositional dative in one language after they had processed a prepositional dative in the other language. Moreover, the Dutch-to-English priming effect was boosted when prime and target included translation-equivalent verbs. Based on this and related evidence (e.g., Bernolet, Hartsuiker, & Pickering, 2007; Loebell & Bock, 2003; Meijer & Fox Tree, 2003; Shin & Christianson, 2009), Hartsuiker and Bernolet concluded that language learners develop shared representations when they perceive constructions across their languages as similar. Moreover, recent evidence from related studies indicates that cross-linguistic priming increases while lexical boost decreases with proficiency, suggesting that second-language constructions are not immediately collapsed with similar first-language representations but gradually develop from language- and item-specific representations to shared schematic representations (Bernolet, Hartsuiker, & Pickering, 2013).

Even though diaconstructions are highly schematic, they are more deeply entrenched than the language-specific constructions which instantiate them. Because diaconstructions generalize over already established constructions, they build on their representations. According to the usage-based view, the degree of entrenchment of a construction depends on the frequency of exemplars encountered in the input. Since diaconstructions are not language-specific, they attract exemplars from more than one language. Put differently, exemplars from both first and second language use contribute to the entrenchment of a diaconstruction. For example, results of a recent sentence production study with multilingual speakers (Runnqvist,

Gollan, Costa, & Ferreira, 2013) indicate that speech onset time is determined by cross-linguistic similarity and cross-linguistic cumulative frequency of the elicited construction. In detail, both monolingual English speakers and two groups of non-native learners of English were faster to produce sentences with pre-noun modifiers (e.g., *The woman's stroller is pink.*) than with post-noun modifiers (e.g., *The stroller of the woman is pink.*), arguably because of the relative frequency of the constructions in English language use. Importantly, however, the time difference was larger for Chinese learners than for monolingual participants and Spanish learners. The authors argued that this was due to frequency inheritance from the equivalent construction in Chinese which only uses pre-nominal modifiers.

Chapter 3

Preposition Placement in English

This chapter surveys a wide range of variables related to preposition placement in English. The variables are arranged in subchapters in a way convenient to this investigation. The structure of the chapter should not be understood as a rigid compartmentalization. Chapter 3.1 reviews research on learning preposition placement, highlighting the role of the distribution of preposition fronting and stranding in English and the influence of the first language. Chapter 3.2 discusses the role of complexity and constituent structure in processing RCs and develops a cognitive grammar analysis of the constituent structure of prepositional RCs. Chapter 3.3 deals with meaning-related aspects of preposition placement, in particular, the meaning of the RC filler, which is described in frame-semantic terms. Chapter 3.4 summarizes what is known about the effects of specific lexical items and strings on preposition placement. The remaining chapters briefly overview the role of different relativizers and nonfinite RCs (Chapter 3.5), modality and style (Chapter 3.6), and the meaning of the RC (Chapter 3.7).

3.1 Learning Preposition Fronting and Stranding

3.1.1 Learning from Input and Relative Frequency

Developmental research on fronting and stranding in English has mostly focused on the order of acquisition. There is evidence to suggest that stranding is learned before fronting rather than the other way around or simultaneously. This has been attributed to the relative salience or frequency of stranding in English language use and learner input. Prior studies defined salience as the relative frequency of a construction in a language. For example, in an influential study by Bardovi-Harlig (1987), nonnative learners of English at different levels of proficiency and

with different native languages completed fragments of English *wh*-RCs and *wh*-questions involving prepositional verbs like *ask for* and ditransitive verbs like *give to*. The results indicated that the participants were more likely to complete the fragments with stranded than fronted prepositions. In particular, participants at a low level of proficiency preferred stranding over fronting across clause types. With increasing proficiency, preposition fronting gradually increased and at one point outnumbered stranding in *wh*-questions. In contrast, even though fronting increased with proficiency in RCs, too, stranding was consistently more frequent than fronting across proficiency levels. Bardovi-Harlig concluded that the order of acquisition is in part determined by the relative salience of stranding in English language use. She argued that stranding is acquired before fronting because learners encounter stranding more often than fronting in their input. This is in disagreement with an innate predisposition described in generative linguistics which schedules fronting before stranding (Chomsky, 1981). The results suggested that the relatively high stranding input initiated the growth of a stranding structure ahead of time.

The importance of the relative salience of preposition stranding in learner input has been emphasized in multiple subsequent studies which put forward similar proposals for various populations of nonnative English speakers (Almahammed, Ariff, & Sidek, 2015; Kao, 2001; Phoocharoensil, 2017; Quintero, 1992; Rezai, 2006; Sadighi, Parhizgar, & Saadat, 2004). For example, in a grammaticality rating and correction task by Kao (2001), Japanese nonnative English speakers at different proficiency levels rated preposition stranding more acceptable than fronting in both *wh*-RCs and *wh*-questions involving prepositional verbs like *quarrel with* and *depend on*. The preference for stranding was more pronounced in the nonnative participants than in a control group of seven English native speakers. In line with prior studies, Kao concluded that the participants' preference for preposition stranding was due to the relative salience of stranding in their English input. Recently, this response pattern was replicated in two acceptability rating experiments by Hoffmann (2007, 2013). Two groups of German nonnative users of English and native English speakers estimated the acceptability of English oblique RCs. While the native group rated fronting on average more acceptable than stranding, the nonnative group preferred stranding over fronting.

To give another example for the relationship between occurrence in the input and learning, evidence from a recent psycholinguistic study by Conroy and Antón-Méndez (2015) suggests that preposition stranding is subject to input-driven priming and implicit learning. In a fragment completion task, nonnative learners of English at different proficiency levels and with different first languages were more likely to

produce stranded prepositions in adverbial RCs (e.g., *A pencil is something you write with*) rather than a nonprepositional response (e.g., *A pencil is something you use for writing*) when they had been primed for stranding. Moreover, participants who had been primed for stranding in the experimental task were more likely to produce stranded prepositions in a post-treatment task than in a pre-treatment task indicating that priming had led to input-driven implicit learning of preposition stranding.

This intuitively relates to a cognitive usage-based view on language learning. In this view, the findings suggest that second language users learn fronting and stranding constructions based on the instantiations they encounter in their second-language input. The stranding-fronting asymmetry in nonnative acquisition and use reflects the relative frequency distribution of preposition placement in English. In favor of a usage-based scenario, the sensitivity of stranding to priming suggests that acquisition of preposition placement is based on input-driven implicit learning. The plausibility of this proposal critically depends on the relative frequency of fronting and stranding in language use and learner input. Yet, acquisition studies have paid surprisingly little attention to the frequency distribution of fronting and stranding in English language use. The implicit reasoning seems to be that stranding outnumbers fronting in language use because there are a number of clause types which exclude fronting and require stranding, for example, passive clauses and non-*wh*-RCs. Table 3.1 provides an overview of the distribution of fronting and stranding across a range of clause types in British English, with two rows for preposition placement and columns for multiple clause types, such as *wh*-RCs, non-*wh*-RCs, free RCs, passive clauses, and *wh*-questions.

Table 3.1: Frequency distribution of fronting and stranding by clause type in English

	Clause type					
Placement	*Wh*-RCs	Non-*wh*-RCs	Free RCs	Passives	*Wh*-questions	Total
Fronting	692	0	4	0	12	708
Stranding	69	419	157	97	140	882
Total	761	419	161	97	152	1590

Note. Adapted from Hoffmann (2011, pp. 120 & 158). The exact distribution is difficult to reconstruct from Hoffmann's study. This is a good approximation and also close to the distribution reported in earlier studies (Hoffmann, 2007, pp. 165–166). RC = relative clause.

As expected, stranding is in total more frequent than fronting, as is evident from the rightmost column of Table 3.1, evidently because of a strong preference for stranding

in non-*wh*-RCs, free RCs, passive clauses, and *wh*-questions. On the assumption that learner input is sampled from or at least similar to native language use, this lends support to studies arguing that stranding gains an advantage over fronting in nonnative acquisition and language use because of higher salience. Moreover, in line with the usage-based scenario, learners likely encounter preposition stranding more often than fronting in their input, which leads to the observed asymmetry between fronting and stranding in nonnative acquisition and language use.

The argument depends on the assumption that learner input mirros native language use. This assumption is not without problems. For example, there is evidence to suggest that the distribution of constructions in English as a foreign language textbooks does not reflect their distribution in authentic native English language use (Römer, 2004). Foreign language teachers and educators have only recently begun to make use of native language corpora for designing material and preparing classroom lessons (Römer, 2011). Textbooks and teacher talk are, however, not foreign language learners' sole sources of input. For instance, learners are exposed to foreign-language fictional and nonfictional literature inside and outside the classroom (Mason & Krashen, 1997; Paran, 2008), foreign-language radio program (e.g., BBC Learning English, http://www.bbc.co.uk/learningenglish/english/, accessed September 5, 2018), television program (Kuppens, 2010), newspapers, magazins, movies, music, and so on. More recently, the internet has become an important source of authentic English input for foreign language learners (Sockett, 2014; Sockett & Kusyk, 2015). Thus, while the exact input of foreign language learners is difficult to estimate, it likely consists to a considerable extent of native or nativelike language use. It is therefore reasonable to assume that Table 3.1 provides a good enough approximation of the distribution of preposition fronting and stranding in learner input.

While Bardovi-Harlig defined salience "in terms of availability of data" (1987, p. 401) which triggers the growth of innate linguistic endowments, usage-based researchers see input as the essential driving force of language learning. As language learning is understood as the emergence of schemas from recurrent usage patterns, the acquisition of fronting and stranding is expected to be closely tied to the frequency distribution in language use and learner input. With this in mind, what is important to note is that stranding is more frequent than fronting in total, but not consistently so at the level of specific clause types. In particular, contrary to the tendency, fronting is more frequent than stranding in *wh*-RCs. This is evident from the second from left column of Table 3.1. In the 761 *wh*-RCs, the preposition is stranded in only 69 or 9%, whereas the preposition is fronted in the great majority

of 692 or 91%. This is consistent with results obtained in prior corpus studies, summarized in Table 3.2, with frequency and proportional distribution of preposition fronting and stranding in four columns and rows for multiple studies of different corpora.

The corpora are organized by modality in three groups, written corpora, spoken corpora, and a corpus including both written and spoken material. As is evident from the table, the proportion of preposition fronting in *wh*-RCs ranges from 95% to 99% in written corpora and from 69% to 86% in spoken corpora, with an average of 98% and 82% fronted prepositions, respectively. Across all corpora, preposition fronting accounts for 92% of all *wh*-RCs. Apparently, then, at the level of specific clause types, stranding is not invariably more frequent than fronting. Importantly, fronting is more frequent than stranding in *wh*-RCs.

This raises the question of granularity. Prior studies seem to assume that nonnative language learners are insensitive to specific contexts of use, such as different clause types. They "count" occurrences of fronting and stranding at a high level of schematicity at which stranding is more frequent than fronting. The figures in Table 3.1 and Table 3.2 on the other hand indicate that native English speakers use preposition placement in context-specific ways. More specifically, they apparently develop a preference for fronting in *wh*-RCs and for stranding in the context of non-*wh*- and free RCs, passives, and *wh*-questions. From a usage-based perspective, this suggests that native English speakers tailor their linguistic knowledge to more fine-grained contexts of use and establish constructions at lower levels of schematicity.

3.1.2 Cross-linguistic Similarity and Transfer

Prior research has provided evidence to suggest cross-linguistic influence on preposition placement. Especially nonnative learners of English with a native language in which only fronting but not stranding is grammatical seem to benefit from cross-linguistic similarity when acquiring fronting in English. By way of illustration, consider the similarity of prepositional RCs across different languages. For example, similar to English, Germanic languages like Danish, Swedish, and Dutch both front and strand prepositions in RCs and similar constructions (Allan, Holmes, & Lundskær-Nielsen, 2000; Donaldson, 2008; Holmes & Hinchliffe, 2013). In contrast, in German only preposition fronting is grammatical, but not stranding (Eisenberg et al., 2009, p. 1030). This is illustrated in Example 17.

Table 3.2: Frequency distribution of fronting and stranding in *wh*-RCs in different corpora of spoken and written English

	Placement				
Written corpora	Fronting	%	Stranding	%	Total
Bengtsson (1996)	62	95	3	5	65
Van den Eynden (1996)	179	97	6	3	185
C. Johansson and Geisler (1998) [LOB]	1053	97	27	3	1080
Trotta (2000) [Brown]	1054	99	12	1	1066
Total (written)	2348	98	48	2	2396
Spoken corpora	Fronting	%	Stranding	%	Total
Quirk (1957)	86	83	18	17	104
C. Johansson and Geisler (1998) [LLC]	190	79	50	21	240
C. Johansson and Geisler (1998) [spoken BIRM]	799	86	129	14	928
C. Johansson and Geisler (1998) [spoken BNC]	147	69	65	31	212
Total (spoken)	1222	82	262	18	1484
Pooled corpus	Fronting	%	Stranding	%	Total
Hoffmann (2011) [ICE-GB]	692	91	69	9	761
Total	4262	92	379	8	4641

Note. Adapted from Hoffmann (2011, p. 81), supplemented by additional data from Hoffmann (2011, pp. 120 & 158). LOB = Lancaster-Oslo/Bergen Corpus (S. Johansson, Leech, & Goodluck, 1978). Brown = Standard Corpus of Present-Day Edited American English (Francis & Kučera, 1979). LLC = London-Lund Corpus of Spoken English (Svartvik, 1990). BIRM = Birmingham Corpus (Renouf, 1992). BNC = British National Corpus (BNC Consortium, 2007). ICE-GB = British part of the International Corpus of English (Nelson, Wallis, & Aarts, 2002).

Example 17

a. *die Münze, von der ich gesprochen habe*
the coin of which I spoken have

"the coin about which I talked" (Eisenberg et al., 2009, p. 1030)

b. **die Münze, der ich von gesprochen habe*
the coin which I of spoken have

"the coin which I talked about"

As is evident from the example, there is considerable overlap in word order between English and German RCs. Like its English counterpart, the German RC *von der ich gesprochen habe* ("which I have talked about") precedes the modified nominal *die Münze* ("the coin"). The relative pronoun *der* ("which") refers to *Münze*, agrees with the modified nominal in gender, and is marked for dative case, assigned by the preposition *von*. Importantly, the preposition is fronted, that is, placed in a clause-initial position immediately preceding the relative pronoun (17a). Unlike in English, only fronting is grammatical in German, while stranding the preposition to a noninitial position would not be grammatical (17b). Thus, German and fronting English RCs share the position of the fronted preposition. Moreover, in a transitive RC like the one in the example, the clause-initial object is followed by the subject and then the verb in both English and German RC (PREP OBJ$_{\text{S}}$UBJ V).

Compare this to RCs in Romance languages. Similar to German, in Romance languages such as Italian (Maiden & Robustelli, 2013, pp. 130–131), Spanish (De Bruyne & Pountain, 1995, p. 191), and French (Batchelor & Chebli-Saadi, 2011, p. 474) prepositions are only frontable but not strandable. For instance, in French, "[p]repositions cannot be [stranded] onto the end of clauses as they can in English. They need to precede the relative pronoun or form a unit with it" (Batchelor & Chebli-Saadi, 2011, p. 474). This is illustrated in Example 18.

Example 18

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

Compare the French example to the English gloss and translation. Again, there is considerable word order overlap. The nominal *le monsieur* ("the gentleman") is modified by the post-nominal RC *à qui j'ai donné le document* ("to whom I gave the document"). The preposition *a* ("to") precedes the relative pronoun *qui* ("who") (18a). Stranding the preposition would, however, not be acceptable in French (18b). In case of a ditransitive RC like the one in the example, the clause-initial indirect object marked by the preposition is followed by the subject followed by the verb followed by the direct object (PREP OBJ_1 SUBJ V OBJ_2). To give another example, consider the Spanish RC in Example 19.

Example 19

a. *las cosas en que suelo pensar*
the things at which I usually think

"the things about which I usually think." (Vera Morales, 1995, p. 151)

b. **las cosas que suelo pensar en*
the things which I usually think at

The Spanish RC is similar to the French and the German example. The RC *en que suelo pensar* ("about which I usually think") follows the modified nominal *las cosas* ("the things") and fronts the preposition *en* ("at") to clause-initial position preceding the relative pronoun *que* ("which") (19a). Like in German and French but unlike in English, the preposition is not strandable (19b). In a transitive RC like the one in the example, the object is followed by the subject which is followed by verb (PREP OBJ_{SUBJ} V).

In contrast, some languages omit prepositions in RCs altogether, for example, Korean (Sohn, 2001, pp. 310–311), Japanese (Gunji, 1987, p. 180), and Chinese (Li & Thompson, 1981, p. 582). This is illustrated for Chinese in Example 20.

Example 20 (Li & Thompson, 1981)

a. *wǒ yòng jùzi xiūlǐ shuǐ guǎnzi*
I with saw repair water pipe

"I repair the water pipe with the saw."

b. *wǒ xiūlǐ shuǐ guǎnzi de jùzi*
I repair water pipe REL saw

"the saw with which I repair the water pipe" (p. 582)

c. *wǒ sòng gěi tā yī běn xiǎoshuō de rén*
I give to 3rd.SG one CL novel REL person

"the person to whom I gave a novel" (p. 584)

A Chinese declarative clause has the word order SUBJ V OBJ. In the declarative in Example 20a, the preverbal group *yòng jùzi* ("use saw") expresses an instrument role. The item *yòng* ("with", "utilize") denotes the instrumental relation, the noun *jùzi* ("saw") refers to the instrument. This contrasts with the RC in Example 20b. The RC *wǒ xiūlǐ shuǐ guǎnzi* ("I repair water pipe") modifies the nominal *jùzi*. Importantly, the instrumental relation between the verb *xiūlǐ* ("repair") and the head nominal *jùzi* ("saw") is not expressed explicitly. A relational expression like *yòng* would not be acceptable (Lehmann, 1984, p. 65; Li & Thompson, 1981, p. 582); hence, the question of where to place a preposition, fronted or stranded, normally does not arise in a Chinese RC. In some rare contexts, a prepositional expression is used to avoid ambiguity. For example, in (20c), the word *gěi* ("give", "for", "to") indicates the recipient. However, as Li and Thompson note, "[a]lthough they [sentences like the one in Example 20c] are not unacceptable, they appear awkward to many speakers of Chinese" (1981, p. 585). Thus, there is comparatively little cross-linguistic similarity between Chinese and English RCs. This extends to RCs in Korean and Japanese which, like Chinese, form prenominal RCs and omit prepositions. Moreover, Chinese RCs differ from English RCs in word order in that they precede the modified noun. The relativizer *de* indicates nominalization but is not pronominal, that is, does not represent the head nominal.

Research on language contrasts and transfer suggests that cross-linguistic similarity facilitates learning (Jarvis & Pavlenko, 2008, pp. 176–182). On this account, nonnative learners of English with a native fronting-only language like German, French, Italian, or Spanish likely benefit from their first-language constructions when acquiring fronting in English as a second language. In contrast, Chinese, Korean, and Japanese learners of English are not likely to transfer their first-language constructions into English for a lack of cross-linguistic similarity. Even if they do, an effect on acquiring either fronting or stranding would not be likely. In line with this, in a study by Mazurkewich (1985), adolescent Quebec French nonnative learners of English produced more fronted prepositions in *wh*-questions involving ditransitive verbs like *send to* than a comparison group of nonnative learners with a typologically distant, different native language. Moreover, the tendency to front prepositions was most pronounced in novice and intermediate Quebec French learners. The researcher

speculated that "[t]ransference from the unmarked form in French, analogous to English, might be offered as a plausible explanation for the sequence obtained" (1985, p. 30).

This kind of transfer of a first-language construction into a second language is expected in earlier research paradigms like contrastive and error analysis and is in line with a usage-based approach to language transfer. In a usage-based framework, learners of English with a fronting-only native language like French or German likely exploit similar native-language constructions to process and produce fronting in English. The cross-linguistic processing experience might result in a shared constructions which categorizes fronting exemplars in both their first and second-language input and represents cross-linguistic commonalities. By comparison, nonnative learners with a typologically distant, different first language are not likely to recruit first-language constructions when processing English input and to establish a construction shared across their languages. Instead, they probably rely on their English-language input only when learning fronting and stranding.

3.1.3 Prescription in Historical and Modern English

Preposition stranding has long been stigmatized as bad English in prescriptive grammars (Hoffmann, 2011, pp. 76–84; Huddleston & Pullum, 2002, p. 627; Yáñez-Bouza, 2015, pp. 56–105), which advise language users to avoid preposition stranding in formal and written language. This likely influences the acquisition of stranding, in particular, in the context of instructed second language learning. For example, in a description task by McDaniel et al. (1998), child and adult native English speakers produced only stranded prepositions in elicited *wh*-RCs with locative verbs like *jump over* and *sit on* (see for similar results with different populations French, 1984; Radford, Felser, & Boxell, 2012). The researchers concluded that stranding is ingrained in the participants' innate grammar and therefore precedes fronting in acquisition, which is in line with a more recent version of generative grammar (Chomsky, 1995). However, in a subsequent acceptability rating task, the acceptance of fronting increased with the age of the participants, in particular, in advanced elementary schoolers and adults. The researchers argued that the increase in acceptability reflects the adoption of stylistic norms which are observed in written language and imposed in school. In line with this, the distribution of fronting and stranding across written and spoken corpora, outlined in Table 3.2, indicates that stranding is more common in spoken than written language.

Some researchers assume that the informal and conversational character ascribed to preposition stranding in present-day English originates from the language criti-

cism by 18th-century grammarians who attempted to model English on Latin which used only fronting (Bergh & Seppänen, 2000). In Old English, preposition stranding was limited to non-*wh*-RCs, whereas fronting is attested only in *wh*-RCs (Fischer, Van Kemenade, Koopman, & Van der Wurff, 2000, pp. 66-67). Reviewing the results of a series of corpus studies based on written historical texts, Bergh and Seppänen (2000) reconstructed the distribution of fronting and stranding in *wh*-RCs from the Middle English period to present-day English. Their findings suggest that stranding in *wh*-RCs emerged in the early part of the Middle English period but remained rare. Only in the Early Modern English period became stranding more frequent in *wh*-RCs. In Late Modern English, preposition stranding apparently went out of fashion and dropped to the Late Middle English level. The researchers argued that the decline of preposition stranding in writing from Early Modern to Late Modern English was at least in part due to the influence of early grammarians who attempted to describe English in parallel to Latin. Since in Latin only fronting RCs are grammatical, they regarded preposition stranding in English *wh*-RCs as "colloquial", "imprecise", "inelegant", and "improper" (Sundby, Björge, & Haugland, 1991). Moreover, rhetorical strategies and the importance of written language for the standardization of the English language which was underway at the time contributed to the low standing of stranding with educated scribes. Ending a sentence with a "little word" like a preposition was often considered bad rhetoric (Yáñez-Bouza, 2015, p. 254). In addition, stranding was associated with spoken language (Yáñez-Bouza, 2015, pp. 134–138).

Even though modern linguists seem to agree that the prescriptive rule against stranding is "completely at variance with actual usage" and should be "dismissed as unsupported foolishness" (Huddleston & Pullum, 2002, p. 627), fronting continues to be associated with formal style and written language (Huddleston & Pullum, 2002, p. 628), which is conveyed to students of English (e.g., Greenbaum & Quirk, 1997, pp. 189, 237) and English teacher trainees (e.g., König & Gast, 2009, p. 193).

3.1.4 Common Learner Errors and Nonlinguistic Factors

A common learner error attested in prior studies is to omit prepositions. For example, participants at low and intermediate levels of proficiency in the study by Bardovi-Harlig (1987) frequently omitted prepositions. This is illustrated in Example 21.

Example 21

a. *The policeman Bill reported the accident (to)

(Bardovi-Harlig, 1987, p. 393)

b. *the exam which the student is worrying (about) (Klein, 1995, p. 98)

The first example is a ditransitive RC in which the indirect object, here, the receiver of a message, is normally indicated by a preposition, here, *to*, which was omitted (21a). The next example is a transitive RC including the verb *worry* which is commonly followed by the preposition *about*, which again was omitted (21b).

Omitting the preposition seems to be a robust pattern in nonnative language use and not due to a mere lack of vocabulary knowledge. This is evident from a rating task (Klein, 1995) in which nonnative learners rated RCs with a missing preposition acceptable, even though they had demonstrated relevant vocabulary knowledge in a preceding control task. Moreover, in the priming experiment by Conroy and Antón-Méndez (2015), participants were as likely to omit prepositions before as after the experimental treatment, despite the effect of priming and implicit learning on placing a preposition, suggesting that producing a preposition or not was not subject to implicit learning. The researchers concluded that missing prepositions indicate not mistakes but an established pattern of nonnative language use. In line with this, results from a recent rating study by Radford et al. (2012) indicate that native English speakers find *wh*-RCs with missing prepositions unacceptable. In contrast, Kao argued that with prepositional verbs like *worry about* the preposition is "communicational redundant" (2001, p. 203). Kao seems to reason that the meaning of a prepositional verb is to a considerable degree noncompositional in that the preposition does not contribute significantly to the meaning of the complex verb as a whole. Therefore, omitting the preposition is unlikely to impede the conveyance of the message.

Moreover, nonnative learners frequently double prepositions. This is illustrated in Example 22.

Example 22 (Bardovi-Harlig, 1987, p. 399)

a. *To whom did Allen lend a dollar to?

b. *For whom did Isabel make a sweater for?

Like omitting the preposition, doubling the preposition in both fronted and stranded position is not acceptable in standard English. Bardovi-Harlig interpreted doubled prepositions as a "transitional construction" by means of which nonnative learners "experiment" with fronting and stranding in the course of acquiring preposition placement (1987, p. 399). In line with this, native English speakers find doubled

prepositions acceptable and treat them as merely redundant rather than ungrammatical (Radford et al., 2012). Notably, RCs with doubled prepositions emerged together with stranding during the Middle English period and were particularly frequent during the transition period from Late Middle English to Early Modern English (Bergh, 1998; Yáñez-Bouza, 2015, pp. 121–122).

Last, a wide range of nonlinguistic factors potentially influence the nonnative learning of fronting and stranding but are difficult to pin down. For example, Hoffmann (2011) outlined social, educational, and motivational aspects specific to the learning and use of English as a second language in Kenya. For instance, because of an alleged tendency of African societies to value written language more than spoken language (Schmied, 1991), Kenyan speakers of English were expected to use more fronting than native English speakers.

3.2 Constituent Structure and Complexity

Before moving on to the discussion of constituent structure and complexity in the context of fronting and stranding RCs, some background on the processing of subject and object RCs is required, which is given below.

3.2.1 Object Are More Complex than Subject Relatives

In most grammars, RCs are analyzed as involving a filler-gap relation. The metaphor is adopted from processing literature (Gibson, Desmet, Grodner, Watson, & Ko, 2005, e.g.,) and suggests that there is a "hole" or "gap" in the RC which is "filled in" by the head nominal or the pronominal relativizer. When processing RCs, language users integrate the filler into the RC. The gap depends on the grammatical role of the filler within the RC. This is illustrated in Example 23.

Example 23 (Gibson et al., 2005, p. 316)

a. the reporter who _____ attacked the senator

b. the reporter who the senator attacked _____

In a subject RC, the filler is related to the subject position within the RC. For example, in Example 23a, the relative pronoun *who* referring to the head nominal *reporter* is the subject of the RC and thus fills the subject position preceding the verb. The RC has the implicit meaning "the reporter attacked the senator". In the example the gap is indicated by a blank space. In contrast, in object RCs like in Example 23b, the subject position is filled by a nominal within the RC, here, by

the noun phrase *the senator*, and the relative pronoun *who* instead fills the object position following the verb. The meaning underlying the RC is thus "the senator attacked the reporter".

In the last three decades or so, a substantial amount of research in psycholinguistics has been devoted to the incremental processing of subject and object RCs and possible effects on acquisition. There is good evidence to suggest that in English object RCs are more difficult to process and acquired after subject RCs in various populations (e.g., Diessel & Tomasello, 2005; Doughty, 1991; Eckman, Bell, & Nelson, 1988; Gass, 1979; E. Keenan & Hawkins, 1987; J. King & Just, 1991; J. W. King & Kutas, 1995; Sheldon, 1974; Tavakolian, 1981; for a review, see Gibson, 1998). In line with this, typological research has arrived at an implicational hierarchy according to which subject RCs are more common than object RCs in the languages of the world (E. L. Keenan & Comrie, 1977). The subject-object asymmetry in processing, learning, and typology suggests that object RCs are more complex than subject RCs.

Complexity is, however, not a one-dimensional phenomenon but has multiple layers. Different researchers defined complexity in different ways and thus employed different measures of complexity. For example, O'Grady proposed that "[a] structure's complexity increases with the number of XP categories (S, VP, etc.) between a gap and the element with which it is associated" (1997, p. 136). A simplified analysis of the constituent structure of the RCs in (23) is given in the common form of phrase-structure trees in Figure 3.1.

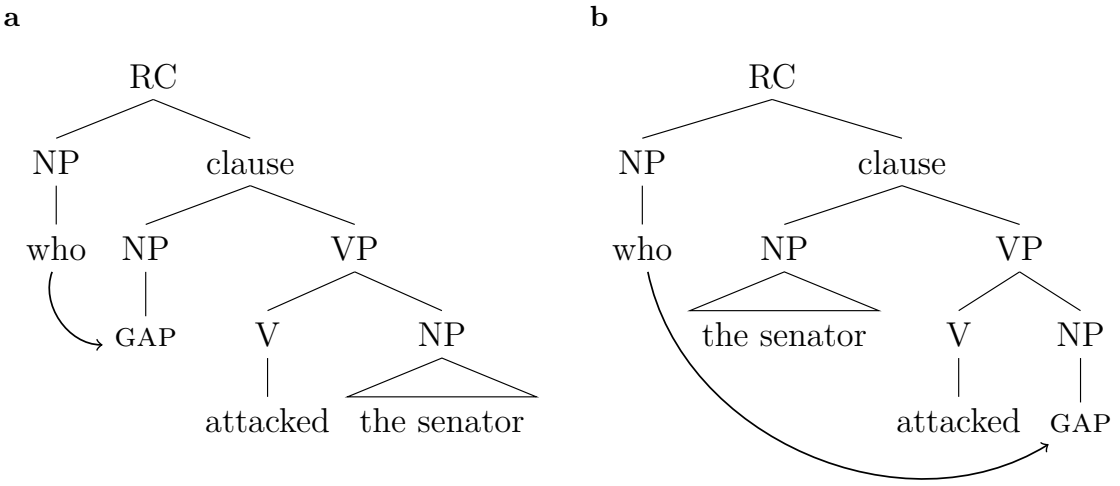


Figure 3.1: Analysis of the constituent structure of the subject and object RCs in Example 23

As is evident from comparing trees a and b, the number of syntactic nodes between

the gap and the *wh*-pronoun increases from subject to object RCs. Thus, structural distance approaches predict a universal subject advantage in processing RCs (Clifton & Frazier, 1989; J. A. Hawkins, 2004). In comparison, Gibson developed a resource-based approach to processing filler-gap dependency relations (Gibson, 1998, 2000; Gibson et al., 2005). On the assumption that cognitive resources like working memory are limited, he argued that "the cost of integrating two elements (such as a head and a dependent, or a pronominal referent to its antecedent) depends on the distance between the two" (2000, pp. 95-96). In this framework, the distance increases with each open-class referential item which intervenes between the filler and the gap. When processing a distant filler-gap relation, the filler is first stored in memory and then retrieved when the gap is reached. As more items come in and more incomplete dependencies are tracked, working memory load increases and the activation of the filler decays. As a consequence, retrieving the filler from memory when the gap is encountered becomes more difficult. As is evident from Example 23, the linear distance between filler and gap is longer in object RCs (23b) than subject RCs (23a) because in object RCs the subject intervenes between filler and gap.

3.2.2 Stranding Is More Complex than Fronting

By analogy, a gap is postulated in prepositional RCs. This is illustrated in Example 24.

Example 24

a. the party to which the senator belongs _____

b. the party which the senator belongs to _____

In stranding RCs, the gap is filled by the head nominal or the relative pronoun (24b). By comparison, in fronting RCs, the gap is filled by the relative pronoun together with the preposition (24a). The difference is also evident from the phrase-structure trees, given in Figure 3.2. In the tree underlying the fronting RC, the preposition phrase under the verb phrase is empty (3.2a). In contrast, in the stranding tree, the noun phrase under the preposition phrase node is empty (3.2b).

Concerning complexity, some researchers argued that stranding is more complex than fronting, in particular, in a phrase-structure framework (J. A. Hawkins, 1999, 2004). First, the phrase-structure distance between filler and gap increases when the preposition is stranded. As is evident from comparing the respective phrase-structure trees in Figure 3.2, the number of syntactic nodes between filler and gap increases from fronting to stranding. Moreover, J. A. Hawkins (1999) argued that

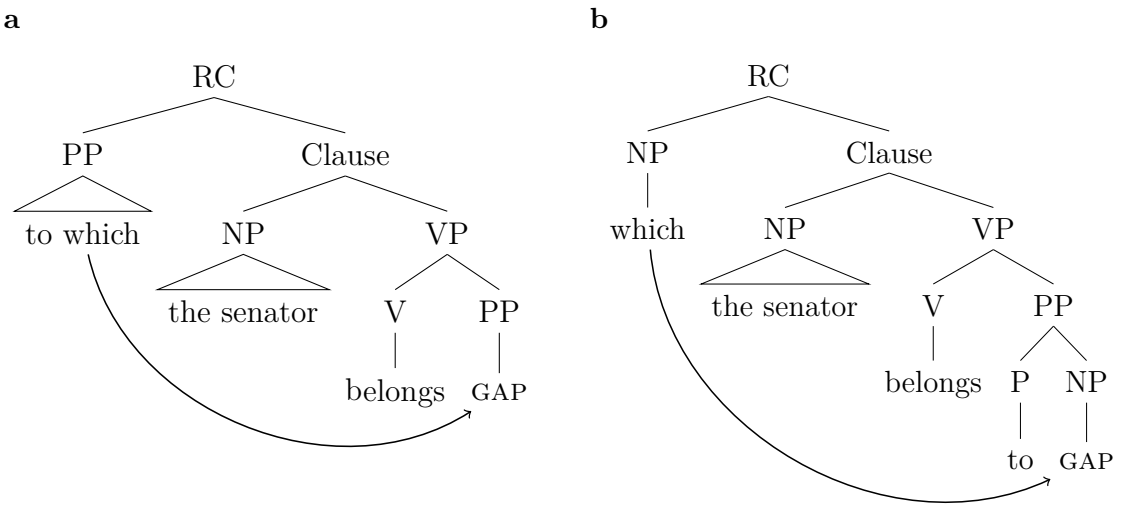


Figure 3.2: Analysis of the constituent structure of the fronting and stranding RCs in Example 24

with stranded prepositions there is the risk of misparsing an oblique RC as a subject RC because the parser might attempt to relate the filler to the earliest possible gap. With the preposition being fronted, however, the filler is not a likely candidate for the subject role and the parser thus unlikely to be garden-pathed. By way of illustration, consider Example 24 again. When the preposition is stranded, the relative pronoun *which* seems likely to be mistaken for the RC subject initially, like in *the party which lost the election*. Only when the parser arrives at the RC subject *the senator*, the initial parse turns out to be wrong. By comparison, when the preposition is fronted, the filler *to which* is a preposition phrase and thus not likely to fit into a subject gap.

In a linear distance framework, only open-class referential items intervening between the filler and the gap increase complexity. Thus, if the preposition is considered a referential item whose meaning is represented in working memory during processing, then stranding the preposition increases the linear distance between filler and gap. In Example 24, the preposition *to* is a lexicalized part of the prepositional verb *belong to* and arguably contributes little to the meaning of the RC. Thus, stranding the preposition would not be expected to increase the linear distance between filler and gap. This is different with prepositions in adverbial RCs. For example, there is an important difference in meaning between *the lecture after which I slept* and *the lecture during which I slept* which results from the use of different prepositions. Here, then, the preposition is likely to be processed as an open-class referential item which when stranded would increase the linear distance between

the filler and the gap. Thus, whether stranding a preposition increases the working memory load and the linear filler-gap distance in a RC depends on the degree to which a preposition contributes to the compositional meaning of a RC.

On the assumption that stranding is more complex than fronting, some researchers expected that fronting would be favored with increasing filler-gap distance, suggesting a trade-off between the complexity of preposition placement and the surrounding structure. In a phrase-structure framework, complexity increases with phrase-structure nodes intervening between the filler and the gap, that is, with the depth of embedding of the gap. This relates to what is known as *gap site*. Prior research noted that gaps are either embedded in a verb phrase or an adjective phrase or a noun phrase inside a verb phrase (Hoffmann, 2011, pp. 84–93; Quintero, 1992; Trotta, 2000, pp. 184–185). This is illustrated in Example 25.

Example 25 (Trotta, 2000)

a. poverty and hardship into which young Americans [$_{\text{VP}}$ run _____] (p. 182)

b. the style, of which Beethoven [$_{\text{VP}}$ was [$_{\text{AP}}$ capable _____]] (p. 184)

c. a government in which Moscow [$_{\text{VP}}$ had [$_{\text{NP}}$ confidence _____]] (p. 185)

The relevant parts of the constituent structures are indicated by square brackets. In Example 25a, the gap is embedded in a verb phrase headed by *run*. In contrast, in the following two examples, the gap is more deeply embedded. The gap is either part of an adjective phrase headed by *capable* which is in turn embedded in a verb phrase headed by *was* (25b); or the gap is part of a noun phrase headed by *confidence* which is in turn embedded in a verb phrase headed by *had* (25c). Moreover, the gap may be part of a partitive construction (Huddleston & Pullum, 2002, p. 1041), illustrated in Example 26.

Example 26 (Huddleston & Pullum, 2002, p. 1041)

such complaints, of which we [$_{\text{VP}}$ receive [$_{\text{PARTC}}$ many _____]]

Here, the gap is part of the partitive construction headed by *many*, indicated by square brackets. A partitive construction consists of a quantifier like *all*, *most*, *each*, *both*, and *one*, followed by the preposition *of*, followed by a nominal. Semantically, a partitive construction describes a part-whole relation: a part denoted by the quantifier is singled out of a whole denoted by the nominal (Michaelis, 2003; Huddleston & Pullum, 2002, p. 411). In RCs like in Example 26, the partitive construction singles out a part of the whole denoted by the head nominal. The part is then commented on in the RC. The partitive construction has not been discussed in detail in the

empirical literature on preposition placement and might have been subsumed under embedding in noun phrases at least sometimes. Phrase-structurally, the partitive phrase in Example 26 is embedded in the verb phrase headed by *receive*.

Against this background, some researchers hypothesized that if stranding is more complex than fronting and is therefore disfavored when the complexity of the surrounding structure increases, then stranding would be disfavored with more deeply embedded adjectival, nominal, and partitive gap sites, compared to verbal gap sites (Hoffmann, 2011, pp. 84–93; Trotta, 2000, pp. 187–188). In line with this, Huddleston and Pullum noted that "[p]artitive *of* resists stranding" (2002, p. 1041). Moreover, in a sentence formation task by Quintero (1992), Japanese learners of English produced stranding RCs with a verbal gap more accurately than RCs with a more deeply embedded nominal gap site. Moreover, they frequently produced RCs with shallow embedding when deep embedding had been elicited, but never the other way around. This suggests that, as hypothesized, complexity increases with the depth of embedding of the gap. Similar patterns were obtained from native participants (see also Hildebrand, 1987; O'Grady, 1987). The interaction between preposition placement and depth of embedding was, however, not examined. In two corpus studies (Hoffmann, 2011; Trotta, 2000), fronting was more common when the gap was embedded in a noun phrase rather than a verb phrase, suggesting that language users tend to front prepositions more when the gap site is more deeply embedded. However, with the gap embedded in an adjective phrase, results were mixed. In Trotta's data, prepositions were only fronted. This is compatible with phrase-structure predictions. However, the researcher submits that stranding would have been a "syntactically valid option" (2000, p. 185) and was probably avoided entirely only because of prescriptive rules against stranding and editorial policies. In Hoffmann's data, gaps in adjective phrases patterned with verb phrase-embedded gaps in favoring stranding. Inconsistent with the phrase-structure analysis proposed here, Hoffmann argued that this was due to the depth of embedding of the gap site: "[noun phrase]-contained [preposition phrases] are more deeply embedded within a clause than [verb phrase]- and [adjective phrase]-contained ones, which explains why stranding is disfavoured with the former type of phrase" (2011, p. 172). This is not easily understood and even seems to be in disagreement with a preceding analysis of the depth of embedding (2011, pp. 85-87).

Two more points should be noted with respect to the gap site. First, consider Example 27.

Example 27 (Huddleston & Pullum, 2002)

a. such complaints, [$_{\text{PARTC}}$ many of which] I investigate _____ myself (p. 1041)

b. her final exam, [$_{\text{NP}}$ the result of which] we expect _____ next week (p. 1040)

c. a wide range of functions, [$_{\text{AP}}$ prominent among which] _____ is sexual attraction (p. 1042)

With partitive gap sites, the quantifier is commonly fronted along with the preposition (27a). This is also common with nominal gap sites (27b) and, to a lesser extent, with adjectival gap sites (27c) (Huddleston & Pullum, 2002, pp. 1039–1044).

Last, note that most researchers seem to have implicitly assumed that the gap follows the verb in the RC, as seen in Examples 25 and 26. To the best of my knowledge, most research on preposition placement ignored the possibility of the gap being embedded in a noun phrase or partitive construction preceding the RC verb, with the exception of Hoffmann (2011, p. 92), who discussed the RCs in Example 28, adopted from Grewendorf (2002).

Example 28 (Grewendorf, 2002, p. 17, cited in Hoffmann, 2011, p. 92)

a. *The man who [$_{\text{NP}}$ pictures [$_{\text{PP}}$ of _____]] are on the table

b. The man of whom [$_{\text{NP}}$ pictures _____] are on the table

The gap site is embedded in a noun phrase headed by the noun *pictures*. Importantly, the embedding noun phrase precedes the RC verb *are*. According to Hoffmann, stranding would be unacceptable in this context (28a). In contrast, the RC seems acceptable when the preposition is fronted (28b). Importantly, the ban of stranding from preverbal noun phrases does not seem to follow from the depth of embedding of the gap nor from the linear filler-gap distance. This is evident from a comparison to Example 24b. Concerning the depth of embedding, the filler-gap relation in Example 28a crosses as many nodes in the underlying phrase-structure tree as in Example 24b. The linear filler-gap distance in Example 28a is even shorter than in Example 24b. Hoffmann made no attempt to explain why stranding seems acceptable in Example 24b but not in Example 28a, apart from noting a general tendency of noun phrase-embedded gaps to co-occur with fronting. He instead concluded that "for the current study it is only relevant that prepositions cannot be stranded in subject [noun phrases]" (2011, pp. 92-93).

Moreover, some researchers noted that fronting is favored with increasing linear distance between filler and gap. For example, Trotta (2000) noted that the acceptability of stranding decreases with increasing distance between *wh*-pronoun and gap. This is illustrated in Example 29.

Example 29 (Trotta, 2000, p. 188)

a. questions with which committee members [$_{VP_1}$ [$_{VP_2}$ taunted [$_{NP}$ bankers appearing as witnesses]] [$_{PP}$ _____]]

b. *questions which committee members [$_{VP_1}$ [$_{VP_2}$ taunted [$_{NP}$ bankers appearing as witnesses]] [$_{PP}$ with [$_{NP}$ _____]]]

c. questions which he [$_{VP_1}$ [$_{VP_2}$ taunted [$_{NP}$ us]] [$_{PP}$ with [$_{NP}$ _____]]]

With a lot of material intervening between *wh*-pronoun and gap, only fronting seems acceptable (29a), whereas stranding seems unacceptable (29b). Importantly, the difference is not due to phrase-structure but linear distance. This is evident from Example 29c, where the gap is as deeply embedded as in Example 29b, yet, preposition stranding seems acceptable. According to Trotta, the tendency to front is most pronounced with adverbial RCs, presumably because "the function of the [prepositional phrase] is clearer if the prepositional phrase is a continuous phrase" (2000, p. 188), whereas discontinuous prepositional phrases become more difficult to process as a single constituent with increasing linear distance between the *wh*-pronoun and the stranded preposition. In line with this, C. Johansson and Geisler (1998) claimed that in Example 30 only fronting seems acceptable.

Example 30 (C. Johansson & Geisler, 1998, p. 75)

a. Fast Breeder Reactors in which more fissile material is produced than is consumed _____

b. ?Fast Breeder Reactors which more fissile material is produced than is consumed in _____

A similar argument was put forward by Takami (1988, 1992). He noticed with respect to *wh*-questions that "acceptable sentences with stranded prepositions often turn out to be unacceptable if additional elements are inserted before the [prepositional phrases]" (1992, p. 40). This is illustrated in Example 31.

Example 31 (Takami, 1992, p. 40)

a. Which attack did the pirates bury the treasure after _____ ?

b. *Which attack did the pirates bury the treasure on the island after _____ ?

While preposition stranding seems acceptable (31a), adding the component *on the island* yields an unacceptable question (31b), arguably because "the hearer is left in suspense about the meaning" (1992, p. 253) for too long.

In an attempt to quantify the effect of complexity on preposition placement, Gries (2002) counted the number of syllables between the *wh*-pronoun and the gap in *wh*-questions. Moreover, he adopted the concept of semantic barrierhood which increases with intervening "[o]pen-class, low-frequency, referentially specific constituents" (Kluender, 1990, p. 188). Both measures of complexity had significant effects on preposition placement. As expected, the odds of fronting increased with complexity. While Gries' complexity measures seem to approximate the linear distance between filler and gap, Hoffmann attempted to investigate "purely structural complexity effects" (2011, p. 97) by adding up the number of phrase-structural "chunks" kept in memory while processing filler-gap relations. The expected correlation between preposition placement and complexity was not significant. The results of a post-hoc analysis indicated, however, that the proportion of fronting decreased with increasing complexity in RCs with prepositional verbs, whereas no effect of complexity was observed on preposition placement in adverbial RCs. In a follow-up acceptability rating experiment with oblique RCs with prepositional verbs (e.g., *the teacher that Jane relied on*), the acceptability of stranding increased with complexity (e.g., *the teacher that you claimed Jane relied on*).

In sum, there is evidence from experimental and corpus studies to suggest that preposition placement is influenced by the complexity of the surrounding structure and the associated processing load. On the assumption that complexity increases with the phrase-structure or linear distance between filler and gap in a *wh*-clause, researchers have argued that fronting is preferred in more complex contexts because stranding the preposition would increase the filler-gap distance.

3.2.3 A Cognitive Usage-based Account of Constituency

Cognitive grammarians treat discontinuous filler-gap relations not as a matter of phrase-structure gaps receiving a displaced filler constituent but as a semantic overlap or correspondence relation between nonadjacent components. In this view, then, a correspondence relation is established between the head nominal of a RC and an associated component within the RC. For example, consider the RC in Example 24b again. Following Langacker (2008a, pp. 423-429), the following analysis is proposed. The verbal component *belongs to* profiles a schematic relationship between two focal participants, known as *trajector* and *landmark* in cognitive grammar, the more prominent of which, the trajector, corresponds to the profile of the nominal compo-

nent *the senator*. The relative pronoun *which* corresponds to the landmark of the *belong to* relationship and profiles an inanimate nonrelational entity. The assembled composite structure *which the senator belongs to* profiles a relationship between a trajector specified by *the senator* and an inanimate landmark which is at this point underspecified. Next, a correspondence relation is established between the landmark of the *belong to* relationship and the profile of the nonadjacent head nominal *the party*, producing the composite structure *the party which the senator belongs to*. The analysis is diagrammed in Figure 3.3, adapted from Langacker (2008a, p. 424).

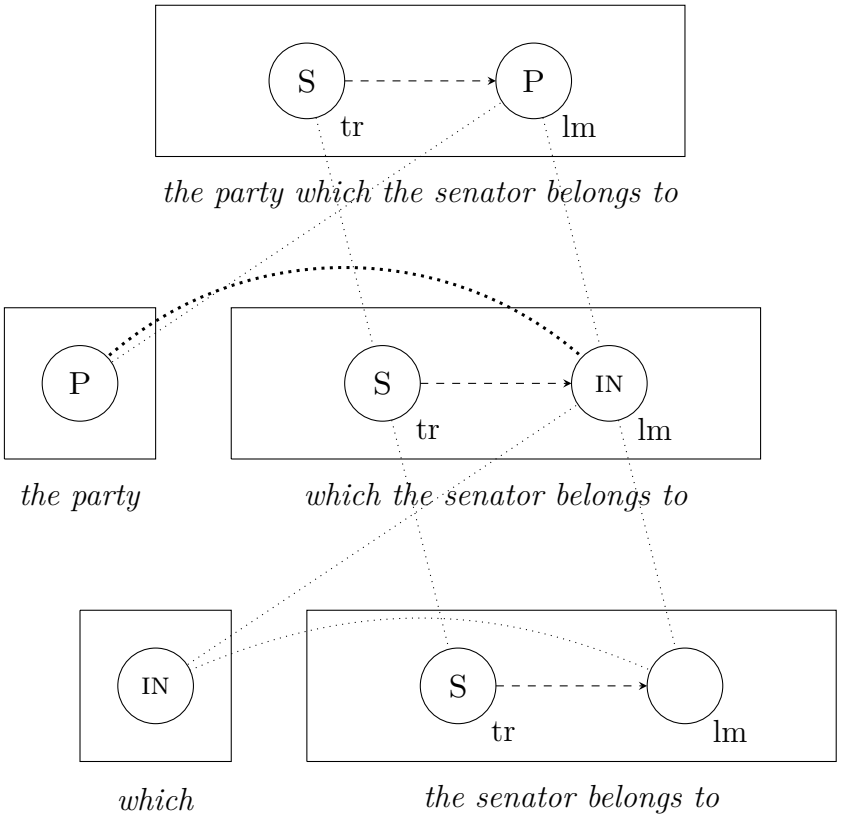


Figure 3.3: Cognitive grammar analysis of the constituent structure of the stranding RC in Example 24b.

The component *the senator belongs to* and the relative pronoun *which* are represented by the bottom squares. The profiled *belong to* relationship between trajector and landmark is symbolized by dashed arrows between two circles labeled *tr* and *lm*, respectively. Correspondence relations are indicated by dotted lines. The profile of the relative pronoun *which* specifies an inanimate entity which corresponds to the schematic landmark of the *belong to* relationship. At the next higher level, the left square symbolizes the head nominal *the party*. The concept profiled by the head nominal is represented by a capital *P* in a circle inside the square. For the current discussion, the most important correspondence relation is the one in bold

which links the profile of the head nominal to the schematic landmark of the relationship profiled by the RC verb. The correspondence relation equates the concept referred to by *the party* with the schematic landmark of the relationship designated by the RC verb *belong to* and provides the basis for their integration. A similar analysis is proposed for the fronting RC in Example 24a, with the only difference being that the preposition *to* and the relative pronoun *which* are integrated before a correspondence relation is established between the composite structure *to which* and the schematic landmark of the *belong* relationship. This difference is of minor importance from a cognitive grammar viewpoint. What is important is the semantic overlap or meaning correspondence between the head nominal and the relationship profiled inside the RC.

Against this background, reconsider the effect of different gap sites on preposition placement, illustrated in Example 25 and Example 26. Prior research suggested that stranding is more complex than fronting and therefore avoided with adjectival, nominal, and partitive gap sites, since they are more deeply embedded and therefore more difficult to process than verbal gap sites. In a cognitive grammar framework, the essential difference between different gap sites is not their depth of embedding but their profiles. Recall that in cognitive grammar verbs and adjectives are defined as profiling relationships, whereas nouns and quantifiers construe nonrelational entities. Moreover, lexical heads impose their profiles onto composite structures. With respect to different gap sites, this means that with verbal and adjectival gap sites the filler is integrated into the RC as part of a relationship, whereas with nominal and partitive gap sites as part of a nonrelational entity. For example, when the gap is embedded in the verb phrase headed by *run* (25a), the head nominal *poverty and hardship* is integrated into the RC on the basis of a correspondence relation which equates the profile of the head nominal with the landmark of the *run* relationship. In contrast, with the gap embedded in a noun phrase headed by *confidence* (25c), the head nominal *a government* is integrated into the RC as part of a nonrelational entity. Thus, the difference in profiles correlates with the tendency to strand prepositions with verbal and adjectival gap sites on the one hand and to front them with nominal and partitive gap sites on the other hand. This leaves open the question of why preposition placement apparently interacts with the profile of the gap site. The question is revisited below in relation to the corpus study.

Recent usage-based research on the processing of RCs has made additional observations which complicate the picture and suggest a multivariate concept of complexity (for a recent review, see Gordon & Lowder, 2012). In particular, there is evidence to suggest that the processing load associated with RCs depends on the

animacy of the head nominal and the form of the RC subject.

In an early corpus study, Fox and Thompson (1990) analyzed usage patterns of 414 RCs in English conversations. Among other things, they found that object RCs are often headed by an inanimate nominal which introduces a new referent to the discourse. The function of the RC is then to ground the new referent in the discourse by relating the new referent to one which is known and relevant to the discourse. This is illustrated in Example 32.

Example 32 (Fox & Thompson, 1990, p. 300)
the uh heater thing we put in I think was a hundred uh five six hundred dollars

The head nominal *the heater thing* introduces an inanimate referent into the discourse whose role and importance is not yet known to the addressee. The RC *we put in* relates the new referent to a group designated by the pronominal RC subject *we* which the speaker belongs to and which is probably already known to the hearer. This way, the relevance of the new referent becomes apparent to the addressee. Based on this, Fox and Thompson concluded that "there are clear cognitive and interactional pressures at work to favor constructions in which nonhuman Subject Heads have RCs with pronominal subjects" (1990, p. 304). Multiple subsequent corpus studies have confirmed that most object RCs have inanimate head nominals and pronominal subjects (e.g., Reali & Christiansen, 2007a; Roland, Dick, & Elman, 2007; Roland, Mauner, O'Meara, & Yun, 2012).

In line with this, inanimate head nominals facilitate the processing of object RCs. For example, in a series of eye tracking experiments by Traxler and colleagues (Traxler, Morris, & Seely, 2002; Traxler, Williams, Blozis, & Morris, 2005), the processing difficulty associated with object RCs was reduced when the head nominal was inanimate. Similar results were obtained in a different series of reading time experiments with Dutch RCs conducted by Mak, Vonk, and Schriefers (2002, 2006). Different explanations have been proposed. Traxler and colleagues argued that readers initially assume a subject RC and have an easier time recovering from this assumption when the head nominal is inanimate and therefore open to reanalysis as RC object. In contrast, following Trueswell et al. (1994), Mak and colleagues proposed that readers anticipate upcoming structures depending on various contextual constraints including the animacy of the head nominal and the RC subject. This suggests that readers have learned from language use to expect object RCs following inanimate head nominals.

In addition to inanimate head nominals, pronominal subjects have been found to facilitate the processing of object RCs (e.g., Gordon, Hendrick, & Johnson, 2001,

2004; Mak, Vonk, & Schriefers, 2008; Reali & Christiansen, 2007a; Roland et al., 2012; Warren & Gibson, 2002). For example, in a series of complexity rating and self-paced reading tasks with English native speakers by Reali and Christiansen (Reali & Christiansen, 2007a, 2007b; Reali, 2014), complexity ratings and reading times of object RCs were higher with nominal than pronominal subjects. With pronominal subjects, the dependent processing load measures decreased and even dropped below those of subject RCs. Moreover, based on the results of prior corpus studies, the researchers manipulated the usage frequency of pronouns and pronoun-verb strings in their experimental materials. The results indicated that responses mirrored the frequency distributions in the corpora. For example, the facilitative effect of pronominal subjects was most pronounced with the pronoun *I*, followed by *you* and *they*, which is in accordance with their frequency distribution. To give another example, object RCs including highly frequent pronoun-verb sequences, for instance, *the attorney who I met*, were processed more quickly and rated less complex than RCs including infrequent pronoun-verb sequences, like *the attorney who I distrusted*. Following usage-based work by Bybee (Bybee, 2002; Bybee & Scheibman, 1999), the researchers argued that frequent pronoun-verb sequences are formed into chunks from recurrent usage. The more frequently pronoun and verb have been processed in a sequence, the more likely they fuse into amalgamated processing units, with different degrees of coherence depending on collocational strength. Subsequently, the learned chunks are retrieved and processed as prepackaged wholes.

This branch of research has focused on subject and object RCs, while, to the best of my knowledge, little attention has been paid to oblique and adverbial RCs. However, following Traxler and colleagues, one might suspect that the initial misanalysis of an oblique RC as a subject RC is easier to revise with inanimate than animate head nominals. While adverbial RCs do not seem as likely to be misparsed as subject RCs, the reanalysis of misparsed adverbial head nominals might nonetheless be easier when the head nominal is inanimate rather than animate. Moreover, usage-based researchers might reason with Mak and colleagues (2002, 2006) that language users have learned to anticipate a nonsubject RC when encountering an inanimate head nominal. When encountering an inanimate head nominal, language users likely anticipate candidates for upcoming constructions including oblique and adverbial RCs. Moreover, following Reali and Christiansen (Reali & Christiansen, 2007a, 2007b), the processing of both oblique and adverbial RCs should benefit from chunking high-frequency sequences like pronoun-verb strings. Thus, concerning preposition placement, on the hypothesis that stranding is more complex to process than fronting, one would expect that the likelihood of stranding would in-

crease with inanimate head nominals and pronominal RC subjects, whereas fronting would become more likely with animate head nominals and nominal RC subjects.

3.3 The Meaning of the RC Filler

Prior research on preposition placement has pointed out that the place of the preposition depends on the meaning of the RC filler. As a rule, stranding is associated with fillers which denote participants of the RC relationship, whereas fronting tends to co-occur with adverbial fillers which specify the means, manner, space, time, and situational context of the relationship.

3.3.1 The Complement-Adjunct Cline

In early research, generative grammarians proposed that preposition placement is determined by whether the filler is a complement or an adjunct of the RC verb. They suggested that only prepositions heading complements may be stranded, whereas stranding is not grammatical with prepositions heading adjuncts (Chomsky, 1981, pp. 292–293; Hornstein & Weinberg, 1981; Stowell, 1981). This is illustrated in Example 33.

Example 33 (Hornstein & Weinberg, 1981)

a. Who did John talk to Harry about? (p. 62)

b. *Which city did you sleep in your bed in? (p. 81)

The pronoun *who* is a complement of the verb *talk* and asks about the topic of the conversation (33a). In contrast, the pronoun *which* is an example of an adjunct which asks about the location where the described event took place (33b). According to the researchers, stranding with adjuncts is not grammatical. Details aside, it was proposed that with complements the verb phrase is reanalyzed to include the preposition as a component part, which allows the *wh*-pronoun to be placed in clause-initial position, while the preposition is grouped with the verb and is therefore unable to "move" along with the preposition. As a consequence, the preposition is left in stranded position.

More specifically, Hornstein and Weinberg proposed a three-step process to derive stranding with complement fillers. This is illustrated in Example 34.

Example 34 (Hornstein & Weinberg, 1981, p. 62)

a. John [$_{VP}$ [$_{V}$ talk] [$_{PP}$ to Harry] [$_{PP}$ about who]]

b. John [$_{VP}$ [$_{V}$ talk to Harry about] who]

c. who John [$_{VP}$ [$_{V}$ talk to Harry about] t]

Proponents of this version of generative grammar (Chomsky, 1981) commonly assume that first a covert deep structure is generated with the *wh*-pronoun in the position the relativized nominal would occupy in a declarative clause (34a). Before the *wh*-pronoun is moved to the clause-initial position in the third step (34c), the verb-preposition sequence needs to be reanalyzed as a complex verb phrase including the preposition but excluding the *wh*-pronoun (34b). The whole process leaves behind a trace *t*. Reanalysis and regrouping with the verb is assumed to apply only to prepositions heading complements but not adjuncts because only with complements the preposition is immediately governed by the verb. As a consequence, they argued that the question in Example 35 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 fronted (35a), whereas stranding the preposition rules out the adjunct reading and is compatible only with the complement reading (35b).

Example 35 (Hornstein & Weinberg, 1981, p. 58)

a. A: On what did John decide? B: On the boat.

b. A: What did John decide on? B: On the boat.

Empirically, too, there is a strong association between stranding and complement fillers on the one hand and fronting and adjunct fillers on the other hand. This is evident from the results of a corpus study by C. Johansson and Geisler (1998), who analyzed *which* RCs in different corpora of spoken and written English. The results of their analysis are included in Table 3.2. Among other things, the researchers investigated whether preposition placement in *which* RCs depends on whether the filler is an object or an adverbial in the RC, which roughly corresponds to the distinction between complements and adjuncts. This is illustrated in Example 36.

Example 36 (C. Johansson & Geisler, 1998, p. 69)

a. tools which you're familiar with

b. the cardboard shoebox in which we used to keep the money

The filler *which*, which refers back to the head nominal *tools*, is the object of the verbal component *be familiar with* (36a). By comparison, the filler *in which*, which refers to the head nominal *the cardboard shoebox*, is not the object of the verbal component *use to keep* but an adverbial specifying the location of the event described in the RC (36b). To be sure, fronting would not be unacceptable in Example (36a), and stranding the preposition might sound awkward but would not be completely unacceptable either in Example (36b). However, the results of the corpus study indicated that fronting was strongly associated with adverbial fillers, whereas stranding was favored with object fillers. Across the spoken English corpora, between 82% and 85% of all fronted prepositions were part of adverbials, whereas 86% to 94% of all stranded prepositions headed object fillers. Examples from the written part of the sample were not analyzed for the meaning of the filler.

Other studies criticized that a binary distinction between objects and adverbials or complement and adjuncts, respectively, is not fine-grained enough to capture the effect of different filler meanings on preposition placement. For instance, Takami (1988, 1992) pointed out that contrary to expectations stranding is acceptable with adjuncts of instrument, agent, purpose, and accompaniment. This is illustrated in Example 37.

Example 37 (Takami, 1992)

a. What did the gang open the safe with? (p. 10)

b. Who did Mike travel around the world with? (p. 10)

c. What day did she arrive on? (p. 14)

d. Which library do you usually study at? (p. 14)

In Examples 37a and 37b, the *wh*-pronouns do not qualify as complements based on established linguistic tests (Huddleston & Pullum, 2002, pp. 219-228) but are adjuncts asking about the instrument involved in the event and the accompanying participant, respectively. Despite that, stranding the prepositions is acceptable. Moreover, generative syntacticians predicted that preposition stranding would be ruled out with adjuncts, in particular, with temporal and spatial adjuncts, which is "far from true" (Takami, 1992, p. 14), as is evident from Examples 37c and 37d. Takami suggested instead that stranding is only acceptable with "a [preposition phrase] which may be interpreted as being more important (newer) than the rest of the sentence" (1992, p. 43).

Takami's critique is backed up by results of a corpus study by Trotta (2000), who found that the distinction between complement and adjunct is scalar rather

than binary and involves a range of semantic subtypes which influence whether a preposition is strandable or not. Trotta concluded that "[a]ny account of stranding [...] must [...] not only be sensitive to the [scalar] adjunct/complement distinction [...], but it must also take into account the specific semantic type ([i.e.] Time, Place, Manner, etc) of the [preposition phrase] adverbial involved" (2000, p. 59). A methodologically more sophisticated attempt in this direction was undertaken by Gries (2002). According to Quirk, Greenbaum, Leech, and Svartvik (1985, p. 664), stranding is most common with prepositions of spatial adverbials. Moreover, a list of commonly stranded prepositions provided by Biber et al. (1999, p. 106) seems to include mostly prepositions which are often used with spatial adverbials, for example, *at*, *from*, *in*, and *on*. Following up on these observations, Gries (2002) hypothesized that fronting would be more common with temporal and abstract meanings, whereas spatial and other adverbial meanings would tend to induce preposition stranding. However, the hypothesis was not supported by his corpus data.

More recently, Hoffmann (2006, 2011) has developed a more fine-grained coding scheme, illustrated in Example 38.

Example 38 (Hoffmann, 2006, p. 176)

a.	Complements of idioms	*get rid of*
b.	C. of prepositional verbs	*rely on*
c.	C. of locative verbs	*put something in/on*
d.	Optional complements	*work at*, *talk to*
e.	Affected locations	*He sat on the chair.*
f.	Goal of movement	*He rushed to the church.*
g.	Direction of movement	*He ran along the road.*
h.	Instruments	*He killed him with a knife.*
i.	Accompaniment	*He came with Bill.*
j.	Respect	*She states in the article that...*
k.	Place, time, and so on	*he killed the cat in the garden*

The scheme ranges from obligatory complements of prepositional verbs, idiomatic multi-word expressions, and locative verbs to optional adjuncts specifying time, place, manner, degree, and other adverbial aspects, with a number of intermediate categories in between. The outcome of a logistic regression analysis of preposition placement in a corpus sample indicated a significant association between preposition placement and the complement-adjunct cline. As expected, the odds of stranding were highest with obligatory complements of prepositional verbs and multi-word expressions followed by locative verb complements followed by optional complements

and complementlike adjuncts specifying movement and accompaniment followed by adverbial adjuncts. Hoffmann proposed that the distinction between complement and adjunct is a continuum rather than a dichotomy and thus has a gradual rather than a binary effect on preposition placement. He concluded that "a preposition can only be stranded if it heads a [preposition phrase] which contributes interpretable thematic information to the predicate" (2011, p. 182), which is a matter of degree rather than a clear-cut distinction.

3.3.2 A Frame Semantic Approach to the Filler

For the current investigation a frame semantic approach (Fillmore, 1975, 1982) is adopted to describe the meaning of the RC filler. The meaning of the filler is described as part of a frame underlying the RC or the component structure of the RC into which the filler is integrated. The frame is established as the conceptual background against which the filler is interpreted. Commonly, the filler specifies a participant or another focal component part of the event or situation described in the RC. This is illustrated in Example 39. Frame descriptions are taken from FrameNet (Fillmore & Baker, 2010; Ruppenhofer et al., 2016)

Example 39 (FrameNet)

a. a trap into which the creature walked

b. the person against whom the criminal enterprise was directed

c. a metaphor that everyone is familiar with

For instance, in Example 39a, the verb *walk* evokes the prototypical representation of a situation of someone moving under her own control towards a goal. The verb designates the movement and profiles two focal participants, the self-mover and the goal. The nominal *the creature* fills the slot for the self-mover. The *wh*-pronoun refers to the head nominal *a trap* and specifies the goal of the movement. In the following Example 39b, the meaning of the RC is structured by the frame evoked by the verb *direct* which profiles an agent who adjusts an instrument to target an entity. The passive construction backgrounds the agent who is not explicitly mentioned and instead foregrounds the instrument which is specified by the nominal *the criminal enterprise*. The head nominal *the person* provides the frame element in the role of the targeted entity. There is no essential difference when the frame-evoking word is not a verb but an adjective, as seen in Example 39c. Here, the adjective *familiar* frames a relationship between someone whose knowledge is assessed, here, *everyone*, and some piece of knowledge, here, *a metaphor*. The copula verb *is* does not contribute

essentially to the meaning of the RC but merely combines with the adjective to form a verbal component.

In the RCs discussed so far, the fillers add participants and are thus essential to the meaning of the associated frame. In contrast, adverbial fillers contribute noncore frame elements. This is illustrated in Example 40.

Example 40 (FrameNet)

North Korea, for whom mere survival appears to be the priority

Here, the verb *appear* evokes the impression frame as the basis of the meaning of the RC: a phenomenon is described based on some perceptual property, appraisal, or an inference drawn by a perceiver. The phenomenon is specified by the RC subject *mere survival* which is described as *the priority* for the perceiver *North Korea*. While the phenomenon and the description are considered core elements of the impression frame, the perceiver is described as a noncore frame element. The distinction between core and noncore frame elements is reminiscent of the complement-adjunct dichotomy but purely meaning-based and only partially congruent. Note that some fillers do not contribute to the RC frame but rather to a frame underlying a component structure of the RC, especially, a nominal or partitive gap site. For instance, in Example 41, the meaning of the RC is structured by the posture frame activated by the verb *stand* in which an agent, here, *the foundation*, supports its body in a particular location which is not explicitly mentioned here. Importantly, the head nominal *Jaffa Gate* is not directly associated with the verbal posture frame but enters as part into a part-whole relationship designated by the noun *foundation*.

Example 41 (FrameNet)

Jaffa Gate, the foundation of which still stand

Previous research tended to confound meaning- and form-related aspects. For example, Hoffmann's complement-adjunct continuum included different degrees of lexicalization or collocational strength, for instance, prepositional verbs with a fixed preposition such as *rely on* and locative verbs with variable prepositions like *put something in/on/under*. The frame semantic approach adopted for the current investigation captures only differences in meaning. Moreover, compared to earlier approaches, the outlined frame semantic approach allows for a more fine-grained description of the meaning of the filler.

3.4 Items, Strings, and Speakers

This is not to say that specific prepositions, lexical strings, and their collocational strength are irrelevant to preposition placement. On the opposite, there is evidence to suggest that preposition placement depends on the individual behavior of specific lexical items and strings of lexical items. Anecdotal evidence and examples are scattered across the literature (Bergh & Seppänen, 2000; C. Johansson & Geisler, 1998; Quirk et al., 1985; Trotta, 2000). On the one hand, with some prepositions only fronting is acceptable. For example, the prepositions *besides*, *except*, *during*, *since*, *throughout*, *beyond*, and *underneath* have been noted to require fronting, whereas stranding them is not acceptable. This is illustrated in Example 42.

Example 42

a. limitations beyond which it is not possible to go (BNC)

b. *limitations which it is not possible to go beyond

While fronting *beyond* is acceptable (42a), stranding it is not (42b), despite the typical stranding context of a *wh*-RC with a participant filler, pronominal RC subject, inanimate head nominal, verbal gap site, and a lexicalized prepositional verb *go beyond*. Some researchers assume that the length and usage frequency of the preposition are responsible for individual placement preferences, with shorter and more frequent prepositions favoring stranding (Gries, 2002; Quirk et al., 1985). For example, Quirk et al. claimed that "it is the most common and the short prepositions which can be [stranded], in particular spatial prepositions" (1985, p. 664). By way of illustration, consider Example 43.

Example 43 (Quirk et al., 1985, p. 664)

a. the car he left his coat in

b. *the election results he left politics because of

According to the authors, stranding is acceptable with common and short spatial preposition like *in* (43a), but sounds odd with uncommon and long prepositions like *because of* (43b). Moreover, a number of head nouns induces fronting and excludes stranding, for example, *way*, *extent*, *point*, *sense*, *degree*, *time*, and *moment*. More recently, Hoffmann (2011) subjected adverbial RCs to a collostructional analysis and found significant associations between fronting and strings like *way in*, *ease with*, *speed with*, *frequency with*, *period for*, *rate of*, *extent to*, *amount by*, and *degree to*, some of which are illustrated in Example 44.

Example 44 (Hoffmann, 2011, p. 164)

a. the ways in which the satire is achieved

b. the ease with which the Saxons overran lowland England

c. the speed with which rainforests are being felled

From a usage-based point of view, this suggests that items and strings which are frequently encountered in fronting RCs have been incorporated through reinforcement into the emerging item-specific construction. Moreover, strings of specific head nominals and prepositions have been lexicalized and fused into chunks which are activated and processed holistically. As a consequence, the preposition immediately follows the head nominal, resulting in preposition fronting. In contrast, Jespersen (1927, p. 189) argued that head nominals and prepositions form meaning units in adverbial RCs. Stranding prepositions would then produce a discontinuous constituent which is difficult to process and interpret and is therefore avoided.

On the other hand, with some items and strings stranding is the favored choice. Biber et al. (1999) noted that "[f]orms which are typically used as stranded prepositions are those which are closely linked to a preceding word" (1999, p. 106). In particular, prepositions which are part of prepositional verbs, adjectives, and idiomatic multi-word expressions strongly tend to be stranded, for example, *confide in*, *rely on*, *capable of*, *familiar with*, *get rid of*, and *do away with*, respectively. In line with this, Jespersen pointed out that sometimes "the preposition is naturally placed at the end of the clause, because it is felt to be less intimately connected with the relative than with some verb or other word in the clause" (1927, p. 185). This is illustrated with *wh*-questions in Example 45.

Example 45 (Biber et al., 1999, p. 106)

a. Who are you looking for?

b. Who do you hang around with?

c. What else can we depend on?

Since the prepositions *for*, *with*, and *on* are bound in the sense that they form a lexicalized unit with the preceding item, they preserve adjacency by stranding.

The hypothesis is tentatively supported by results by Hoffmann (2011) and Gries (2002), indicating that the odds of stranding increase with the collocational strength of the item-preposition strings in a stranding question or RC. However, the associative measures employed in both studies were rather coarse-grained. Gries

distinguished between a handful of verb types depending on the assumed collocational strength of verb and preposition, for example, prepositional and phrasal-prepositional verbs, intransitive and transitive verbs. Similarly, Hoffmann intuitively included item-preposition strings with different degrees of lexicalization like prepositional verbs (e.g., *rely on*), multi-word expressions (e.g., *let go of*), and locative verbs (e.g., *go to*) in his complement-adjunct continuum. Moreover, there is tentative evidence from experimental studies to suggest that language users are more likely to strand prepositions when they perceive them as belonging to the RC verb. For example, in a follow-up task to her grammaticality rating and correction task, Kao (2001) asked a different group of Japanese learners of English to divide the predicates of sentences involving prepositional verbs, adjectives, and phrasal verbs into two groups of words, for example, *The student is worrying about the exam.* At least a part of the participants grouped the prepositions with the preceding item (here, *worrying about*), suggesting that they perceived them as units. This might plausibly be expected to lead to stranding in RCs.

From a usage-based perspective, the effect of collocation strength on preposition placement is the result of combining frequent item-preposition strings into automated processing units, with the likelihood of stranding increasing with the collocational strength of a string. In contrast, Hawkins reasoned that since the prepositions in prepositional verbs depend to a considerable degree on the verb for their interpretation and processing, "the ratio of stranding to [fronting] in English should be proportional to the degree of dependency between [verb] and [preposition]" (1999, p. 260). Similar to Jespersen, he argued that stranding does not result from chunking frequent item-preposition strings but rather is due to attempts to avoid the emergence of discontinuous constituents which are difficult to parse and would increase processing load.

Some researchers have suggested that stranding is part of a conventionalized pattern in clauses which consist of only the RC subject, the verb *to be*, and a preposition (Hoffmann, 2011, pp. 137–141). This is illustrated in Example 46.

Example 46 (Hoffmann, 2011, p. 139)

a. Which school were you in?

b. the guy I was with

For example, among the 102 *be* RCs in Hoffmann's data, all but three nonnative English examples included stranded prepositions. Of the three exceptions, two included doubled prepositions in both fronted and stranded position. Hoffmann argued that

"a lexically stored constraint must be assumed that requires *be* to co-occur with stranded prepositions only" (2011, p. 139).

Moreover, preposition placement is in part a matter of individual choice. While studies on preposition fronting and stranding in present-day English have paid little attention to speaker-specific effects, historical studies have emphasized the importance of placement preferences of individual speakers. For example, Yáñez-Bouza (2015, pp. 106-152) analyzed the development of preposition placement during the early and late Modern English periods from around 1500 to 1900 based on a sample of private and official letters, diaries, plays, sermons, science and medicine journals, and legal texts from two corpora of historical English. Comparing her results to Hoffmann's (2011), she found that preposition placement in historical English was determined by similar factors as in present-day English. Moreover, preposition placement was subject to considerations of style and "proper" English in prescriptive work from this period. In particular, the attitude towards stranding varied from writer to writer. While some treated stranding as a legitimate part of the English language and even advocated its use, critics such as the poet John Dryden (1631-1700) recommended and tried to avoid stranding prepositions in their writings, which led to an overall decline in stranding. In contrast, in Yáñez-Bouza's corpus, the preacher Joseph Butler (1692-1752) "stands out as the most 'enthusiastic' strander in the entire corpus of [Modern English]" (Yáñez-Bouza, 2015, p. 150).

3.5 Relativizers and Nonfinite Relatives

As is well-known, English uses the following relativizers to form RCs: *which*, *who*, *whom*, *whose*, *that*, *where*, *when*, and *why* (Biber et al., 1999, p. 608). The last three relativizers are restricted to adverbial RCs. Moreover, nonsubject RCs regularly omit the relativizer. In addition, *what* and composite relativizers like *whatever*, *whichever*, and *whoever* are used in free RCs. Grammars of standard English have long noted that preposition placement in RCs depends on the type of relativizer (e.g., Huddleston & Pullum, 2002, pp. 464–466). This is backed up by prior corpus studies (Guy & Bayley, 1995; Hoffmann, 2011, p. 149), indicating the following distribution. All *wh*-pronouns co-occur with both preposition fronting and stranding, with only two exceptions, illustrated in Examples 47 and 48.

Example 47 (Hoffmann, 2011)

a. the person who he talked about (p. 41)

b. *the person about who he talked (p. 42)

Example 48 (Huddleston & Pullum, 2002, p. 1067)

a. an essay question with which to challenge the brighter students

b. *an essay question which to challenge the brighter student with

First, in standard English, *who* requires stranding (47a), while fronting is not acceptable (47b). Second, in nonfinite *wh*-RCs, prepositions are forced to front (48a), stranding is excluded from this context (48b). In contrast, as is evident from Example 49, non-*wh*-RCs with *that* or zero relativizers require stranding (49a) but exclude fronting (49b).

Example 49 (Huddleston & Pullum, 2002, p. 627)

a. the one (that) I bought it from

b. *the one from (that) I bought it

The relativizers *where*, *when*, and *why* only introduce RCs with an adverbial gap of space, time, and reason, respectively. They normally replace the pronoun *which* along with the preposition. This is illustrated in Example 50 where the complex relativizer phrase *in which* (50a) is replaced by *where* (50b).

Example 50

a. the apartments in which no one lives (Dick, 1976, p. 21)

b. the apartments where no one lives

c. the government building where she works at (Quirk et al., 1985, p. 1255)

d. *the place where she works at

Stranding the preposition seems to be acceptable with specific head nominals (50c) but is else unacceptable (50d) (Quirk et al., 1985, p. 1255). The pronoun *what* and the *-ever* series are limited to free RCs (C. L. Baker, 1995, pp. 203–224), illustrated in Example 51.

Example 51 (Huddleston & Pullum, 2002, p. 629)

a. Somebody has to clean what graffiti artists write on.

b. Somebody has to clean that which graffiti artists write on.

c. *Somebody has to clean on what graffiti artists write.

In free RCs, the *wh*-pronoun functions as head nominal and relativizer simultaneously (51a). This is evident from the paraphrase, in which *what* is replaced by the

the pronoun *that* and the relativizer *which* (51b). This might be the reason why fronting is not acceptable in free RCs (51c), as placing the preposition at a position preceding *what* would mean to place the preposition before the antecedent noun (Huddleston & Pullum, 2002, p. 629; Van Riemsdijk, 2006).

3.6 Modality and Style

Prior research suggests that preposition placement depends on modality and style. Concerning modality, in a number of corpus studies, fronting was associated with written language, whereas stranding was more typical of spoken language. For instance, Quirk (1957) counted 96 stranded but only 86 fronted prepositions in a sample of 1300 RCs from educated spoken English. To give another example, in the corpus study by C. Johansson and Geisler (1998), there was a distinct preference for fronting over stranding in the written London-Oslo/Bergen corpus (3% stranding) but a considerably higher proportion of stranding in the spoken sample (up to 31%), suggesting that stranding is more typical of spoken than written language. Bergh and Seppänen (2000) provided a summary of counts from a series of studies including Quirk (1957), C. Johansson and Geisler (1998), Trotta (2000), Van den Eynden (1996), and unpublished material. Across all studies, the proportion of stranding in *wh*-RCs was considerably higher in spoken than in written English (20% vs. 2%). Table 3.2 provides a summary of counts of fronting and stranding in *which* RCs across written and spoken corpora. As is evident from the total proportions, stranding is considerably more frequent in spoken material than in written material (18% vs. 2%).

Moreover, concerning style, preposition fronting is most prevalent in formal registers, whereas stranding is more characteristic of informal registers. For instance, in a follow-up analysis of a subpart of their spoken material, C. Johansson and Geisler (1998) found considerably higher proportions of stranding in informal dialogues than in formal monologues (46% vs. 25%). This is consistent with results by Hoffmann (2011) indicating higher odds of stranding in informal text types. One reason for this might be the stigmatization of stranding during Late Modern English. In line with usage, most grammars of modern standard English mention the informal character of stranding and a tendency to use stranding in spoken language (Biber et al., 1999, p. 106; Huddleston & Pullum, 2002, p. 628; Quirk et al., 1985, pp. 1251-1253). To complicate the picture, related research suggests that modality and style also influence the selection of the relativizer in RCs which in turn has an influence on preposition placement. For instance, an analysis by Guy and Bayley

(1995) indicated that non-*wh*-RCs are more frequent than *wh*-RCs in informal conversations but not in academic articles. The observed effect of modality and style on preposition placement might thus be due to the selection of different relativizers.

3.7 Integrated and Supplementary RCs

Last, there is evidence to suggest that integrated RCs favor fronting, whereas supplementary RCs are associated with stranding (Hoffmann, 2011, pp. 47–51, 167). As the name implies, the meaning of an integrated RC is interpreted as an integral part of the meaning of the higher clause. In contrast, the meaning of supplementary RCs is processed as separate from the meaning of the clause containing them (Huddleston & Pullum, 2002, pp. 1058–1066). By way of illustration, consider Example 52.

Example 52 (Huddleston & Pullum, 2002, p. 1058)

a. They interviewed every student who had lent money to the victim.

b. They interviewed Jill, who had lent money to the victim.

The integrated RC restricts the denotation of the head nominal *every student* to a particular subset of referents (52a). Omitting the RC would change the meaning of the noun phrase and, as a consequence, the meaning of the sentence as a whole. In contrast, in the supplementary RC, the head nominal is a proper noun, *Jill*, which identifies a specific definite referent (52b). The RC does not express a distinguishing property but provides additional information about the referent of the head nominal. As a consequence, omitting the RC would not affect the meaning of the remainder. The difference in meaning is reflected in prosody and punctuation. Supplementary RCs tend to have a separate intonation contour and are separated from the rest of the sentence by a pause represented in writing as a comma or other punctuation mark. In contrast, integrated RCs are prosodically bound to the head nominal and are usually spoken within the same intonation contour, without a separating pause or comma. Moreover, *that* and zero relativizers occur only with integrated RCs (Huddleston & Pullum, 2002, pp. 1058-1068). Integrated RCs favor fronting possibly because of increased processing complexity due to the dependency relation and the strong semantic tie between the RC and the head nominal (Hoffmann, 2011, pp. 169-170).

Chapter 4

The Current Investigation

In the previous chapters, the cognitive usage-based framework adopted for this thesis was outlined (Chapter 2) and a wide range of variables known to influence use and learning of preposition placement was surveyed (Chapter 3). Against this background, two studies were conducted to examine the relationship between learners' experiences of preposition fronting and stranding and learning preposition placement in English as a second language. Following Hoffmann (2011, 2013), a corpus study was conducted first to examine the role of a wide range of variables in native and nonnative English, including proficiency as a measure of experience, first language, and specific lexical items and strings, among others. The corpus study is reported and discussed in Chapter 4.1. Following this, a rating study was conducted to better understand the role of proficiency, first language, and specific lexical items. The rating study is reported and discussed in Chapter 4.2.

4.1 Corpus Study

This chapter describes the corpus study. To determine the role of a wide range of different variables, a sample of prepositional RCs was extracted from native and nonnative English corpora, analyzed, and subjected to a multivariate regression analysis. In Chapter 4.1.1, the variables and statistical modeling are described in detail. Following this, Chapter 4.1.2 provides the results of the analysis. In Chapter 4.1.3, the results are discussed in relation to literature on preposition placement and from a cognitive usage-based perspective.

4.1.1 Methods

4.1.1.1 Corpora

Prepositional RCs were extracted from four different English corpora, two nonnative corpora: the International Corpus of Learner English (ICLE, Granger et al., 2009) and the Yonsei English Learner Corpus (YELC, Rhee & Jung, 2012); and two native corpora: the Louvain Corpus of Native English Essays (LCN, Granger, n.d.) and the British part of the International Corpus of English (ICE-GB, Greenbaum, 1996; Nelson et al., 2002). For the analysis, the ICLE corpus and the YELC corpus were grouped together.

The ICLE corpus represents the English of nonnative learners with 16 different native languages and at different levels of proficiency. The 4.5 million word corpus was compiled during the 1990s and consists of argumentative essays and some literary exam papers which the learners produced as part of an exam or at home and in which they expressed their opinions on topics like the role of science, technology, and religion in modern societies, advantages and disadvantages of controversial laws, provocative statements and quotes from literary works, and the like. All learners were university undergraduate students and had acquired English in a nonnative context. For the study, the German, Spanish, Italian, French, Japanese, and Chinese parts of the corpus were analyzed. The sample comprised 1,567,831 words. The writers were on average in their early twenties and mostly female (age in years M = 21.99, SD = 1.72, female M = 80.17%, SD = 10.52). Learner proficiency ranged from higher intermediate to advanced levels but is poorly documented. A random sample of 20 essays from each subcorpus had been rated by a "professional rater" (Granger et al., 2009, p. 11) on the basis of the Common European Framework of Reference for Languages. The ratings indicated proficiency levels between "B2 (and lower)" to "C2" (Granger et al., 2009, p. 12) with considerable variance across subcorpora. This was also evident from the high standard deviation in the words/essay ratio (M = 597.17, SD = 107.9). Because proficiency had been assessed on the level of subcorpora only but not on individual learner level, it was not possible to reliably control for individual learner proficiency in the statistical analysis.

The YELC corpus collects 6,572 free-writing essays and argumentative essays by Korean learners of English which were elicited as part of the Yonsei English Placement Test for university freshmen. The corpus was compiled from 2011 to 2012 and is approximately one million words in size. Learner proficiency is documented in detail for each learner based on the Common European Framework of Reference for Languages. For the current study, only argumentative essays by learners with

a proficiency level between B1 and C2 were used to be comparable to the ICLE corpus. The sample consisted of 610,936 words. The age of the participants was not documented. Compared to the ICLE sample, sex is more equally distributed in the YELC material, with 43% female writers. However, the lower words/essay ratio indicated that the YELC essays were considerably shorter than the ICLE essays (M = 257.13, SD = 57.59), suggesting lower proficiency levels.

The LCN corpus is designed as a native reference corpus for the nonnative ICLE corpus and consists of argumentative essays and some literary essays by American and British university students and A-level argumentative essays by British highschool students, dating from 1991 and 1995. The corpus comprises 324,399 words. Learner and corpus characteristics are documented poorly. The relatively high words/essay ratio (M = 732.28, SD = 387.7) suggested that the native LCN writers were at higher proficiency levels in their native tongue than the nonnative ICLE and YELC writers.

The British part of ICE corpus is a one million word corpus of spoken and written material by adult native English speakers dating from 1990 to 1993. All participants had completed at least secondary-level schooling, some tertiary education. For the study, 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, for example, business letters. Informal genres such as social letters were excluded from the sample in an attempt to control for register and style across corpora. The sample included 392,496 words. Unlike all other corpora used in the current study, the ICE-GB corpus is human-annotated for part of speech and syntactic dependencies.

Last, the British National Corpus (BNC, BNC Consortium, 2007) was used to assess the usage frequency of lexical items and item strings. The BNC is a 100 million word corpus collecting samples of written and spoken language dating from 1991 to 1994. The corpus comprises a wide range of genres and styles and represents a wide cross-section of British English from this period. The BNC is human-annotated for lemmas and part of speech and is available for download for computational processing.

4.1.1.2 Sample Extraction

The ICLE, YELC, and LCN corpus samples were automatically parsed for parts of speech and dependencies using the open source parser Parsey McParseface (Andor et al., 2016) available for download online. The parser is based on a novel type of neural network model for part-of-speech tagging, dependency parsing, and sentence

comprehension and had been pretrained on the standard corpora of the Penn Treebank, OntoNotes, and the English Web Treebank. The output 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 include prepositions immediately followed by a *wh*-pronoun. The ICE-GB corpus sample 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 which included a preposition immediately followed by a *wh*-pronoun and all noun phrases which included a stranded preposition. Conveniently, all prepositions not followed by a noun phrase complement had been tagged as stranded.

To assess precision and recall of the automated parse-and-search procedure, a random sample of 10% of the German part of the ICLE sample, 5% of the Chinese part, and 10% of the LCN corpus sample were searched manually and the results were compared to the outcome of the automated search. Overall, 71 instances of prepositional RCs were extracted manually from the test sample, 35 fronting and 32 stranding RCs, as well as 4 nonstandard RCs in which the preposition was doubled in a single clause. The examples with doubled prepositions were excluded. Moreover, 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 (D. Chen & Manning, 2014) and Stanford Tregex (Levy & Andrew, 2006). For the Stanford-and-Tregex solution, the sample was parsed automatically and then multiple tree patterns were defined to extract instances of fronting and stranding RCs. The learner data proved to be challenging to both machine parsers because the learner data included incomplete sentences and in many respects differed from the English data on which the parsers had been trained. The precision of the different procedures is summarized in Table 4.1, 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 4.1: Precision and recall of the two automated parse-and-search procedures

a Parsey-and-R solution

	Fronting	Stranding	Sum
Hit	35	30	65
Miss	0	2	2
Sum	35	32	67

b Stanford-and-Tregex solution

	Fronting	Stranding	Sum
Hit	34	16	50
Miss	1	16	17
Sum	35	32	67

As is evident from Table 4.1, the Parsey-and-R solution returned 97% of all

prepositional RCs in the test sample. The solution missed only the stranding RCs in Example 53.

Example 53

a. without anything new for the moment to cling to (ICLE)

b. the vital funds charitable organisations relied upon (LCN)

The RC *anything new for the moment to cling to* was wrongly parsed as an adverbial clause (53a). Moreover, the noun phrase *the vital funds charitable organisations relied upon* was misparsed with *organisations* as the head noun followed by a participle modifier *relied upon* (53b). By comparison, the return rate of the Stanford-and-Tregex solution was considerably lower. The solution returned only 75% of all prepositional RCs in the test sample and in particular missed 50% of all stranding RCs. In conclusion, the Parsey-and-R solution extracted most of the examples of fronting and stranding which were manually identified in a random test sample of the corpus data and only failed to extract two nonprototypical examples of stranding RCs. The hit ratio of the Parsey-and-R solution was considerably higher than that of the alternative Stanford-and-Tregex solution. Therefore, the Parsey-and-R solution was adopted for automated sample extraction.

The outcome of the automated searches was then searched manually by a student assistant. All prepositional RCs were included in the sample. The following constructions were excluded. First, subject RCs in passive voice were excluded. This type of RC is illustrated in Example 54.

Example 54

a. a form of suicide which is referred to as euthanasia (LCN)

b. *a form of suicide to which is referred as euthanasia

In a subject RCs like in (54a), the *wh*-pronoun is the subject of the RC, here, *is referred to as euthanasia*. The RC is in passive voice and thus requires preposition stranding; fronting the preposition is not acceptable (54b) (Huddleston & Pullum, 2002, p. 627). In contrast, prepositional RCs in passive voice allow both preposition fronting and stranding, as evident from Example 55.

Example 55

a. those humourous shows in which sex is being addressed (ICLE)

b. The second challenge Europe is faced with (ICLE)

Moreover, prepositional RCs with a clausal head, illustrated in Example 56, were excluded from the sample.

Example 56

a. Marx once said that religion was the opium of the masses. By which he meant that (ICLE)

b. I suddenly noticed that I lost my blue scarf in that Burger King, which I was very sad about. (ICLE)

In this type of RCs, the RC head is not a nominal but a clause. For example, in Example 56a, the relative pronoun *which* refers to the preceding clause *religion was the opium of the masses*. To give another example, in Example 56b, the RC *I was very sad about* modifies the preceding clause *I lost my blue scarf in that Burger King* as a whole. RCs with a clausal head were infrequent in the ICLE, YELC, and LCN material. Moreover, extraction from the ICE-GB corpus was not reliable. Therefore, they were excluded from the sample.

In addition, prepositional RCs with a resumptive pronoun were weeded out. An example is given in Example 57.

Example 57

a. a line that we can't jump across it (YELC)

b. a line across which we can't jump it

The RC *we can't jump across it* modifies the nominal *a line* which is represented in the RC by the pronoun *it*. A plausible assumption seems to be that the anaphoric pronoun is placed at a position in the RC where one would expect *a line* in a declarative clause, that is, following the verb. The nonstandard use of resumptive pronouns in learner language is well documented for RCs in general and prepositional RCs in particular (Contemori & Belletti, 2014, e.g., Diessel & Tomasello, 2005; Gass, 1979; Hoffmann, 2011, p. 113; Hsu, Hermon, & Zukowski, 2009; Hu, Gavarro, & Guasti, 2015; Uslu, 2010; Yip & Matthews, 2007). Some researchers have argued that resumptive pronouns facilitate processing (O'Grady, 1997, pp. 178–180; J. A. Hawkins, 2004, pp. 36–37). With respect to preposition placement, their classification is problematic. The preposition *across* is followed by a complementing component and thus by definition not stranded (57a). Moreover, an equivalent fronting structure (57b) was not attested in the data at all, suggesting that preposition placement is not an issue in RCs with resumptive pronouns. Therefore, prepositional RCs including a resumptive pronoun were excluded.

Moreover, past-participial modifiers like the one illustrated in Example 58 were removed from the sample.

Example 58 (ICLE)
a small cultural elite, admired by some, laughed at by many others.

In the example, the past-participials *admired* and *laughed at* modify the nominal *a small cultural elite*, similar to the RC in *a small cultural elite which was admired by some, laughed at by many others*. However, participial modifiers do not accept a relative pronoun (e.g., **a small cultural elite, which admired by some, laughed at by many others*) which is why they were not counted as RCs and excluded from the sample (Huddleston & Pullum, 2002, pp. 1264-1265).

Last, note that *it*-clefts were not included in the sample, even though they may be considered some kind of RC and allow both preposition fronting and stranding. An *it*-cleft consists of the pronoun *it*, followed by the verb *be*, a focused component, and some RC-like dependent clause (Biber et al., 1999, p. 959; Huddleston & Pullum, 2002, p. 1418). This is illustrated in Example 59.

Example 59 (Hoffmann, 2011, p. 39)

a. It was John who I talked to.

b. It was John to whom I talked.

The meaning of the clefts in Example 59 is "The one to whom I talked was John". No clefts were in the data extracted from the ICLE corpus, therefore, the structure was entirely excluded from the investigation.

4.1.1.3 Variables

The data were coded for preposition placement (fronting, stranding) as the dependent variable and the following predictor variables: learner group (native, nonnative), level of proficiency (novice, advanced), native language group (European, East Asian), gap site (verbal, adjectival, nominal, partitive), animacy of the head nominal (animate, inanimate), form of the RC subject (pronominal, nonpronominal), meaning of the RC filler (participant, supplement, space and time, circumstances, medium), usage frequencies of prepositions and strings, finiteness (finite, nonfinite), length of the preposition in number of syllables, relativizer, and specific prepositions and corpus files as an approximation to individual writers. The variables modality and style were kept constant across corpora. The meaning type of the RC, integrated or supplementary, was not included in the investigation.

Different learner groups (native, nonnative) were formed based on whether English was the writer's native language or not. Accordingly, the parts of the sample from the ICE-GB and LCN corpora were annotated as native. In contrast, the ICLE and YELC parts of the sample were annotated as nonnative.

Concerning the level of proficiency (novice, advanced), the ICE-GB writers were arguably on a higher level of literacy and more advanced language users than the LCN, ICLE, and YELC writers. First, the ICE-GB material included mostly texts for publication which had been written by educated and highly literate writers, for example, academic papers, newspaper reports, and novels. Hoffmann characterizes the ICE-GB corpus as a sample "of the most educated end of the British English sociolect" (2011, p. 16). In contrast, the LCN, ICLE, and YELC material consisted of school essays and exam papers written by highschool and undergraduate university students who had by the time arguably acquired a lower level of literacy and education than most of the ICE-GB writers. Moreover, since most of the ICE-GB writers had completed secondary and tertiary education, they were probably on average older and therefore in general more experienced language users than the highschool and undergraduate writers of the LCN, ICLE, and YELC corpora. All this suggested that the ICE-GB writers were more experienced language users who had acquired higher levels of proficiency and literacy than the LCN, ICLE, and YELC writers.

Next, the data were coded for the native language group of the writers (European, East Asian). The first languages represented in the nonnative data were sorted into two groups: first languages which only front but do not strand prepositions in prepositional RCs; and first languages which neither front nor strand but omit prepositions in prepositional RCs. The first group consisted of nonnative writers with a European first language in which only preposition fronting is grammatical in prepositional RCs, namely, German, French, Italian, and Spanish. The second group was comprised of nonnative writers with East Asian first languages which have different word orders and omit prepositions in equivalent noun modifier constructions, namely, Chinese, Japanese, and Korean.

Next, the data were coded for three variables related to complexity, namely, gap site (verbal, adjectival, nominal, partitive), form of the RC subject (pronominal, nonpronominal), and animacy of the head nominal (animate, inanimate). The variables are illustrated in Example 60.

Example 60

a. the stuff of which fairy-tales are [$_{\text{VP}}$ made ____] (ICE-GB)

b. somebody we [$_{VP}$ are [$_{AP}$ important for ____]] (ICLE)

c. AIDS, which we [$_{VP}$ have [$_{NP}$ no cure for ____]] (LCN)

d. Existing netting schemes of which there [$_{VP}$ are [$_{PartC}$ several ____]] (ICE-GB)

Consider the variable gap site first, which captures the type of phrase into which the RC filler is integrated or which is gapped. The filler was integrated into either a verb phrase (60a), an adjective phrase (60b), a noun phrase (60c), or a partitive construction (60d). The form of the RC subject was either pronominal (60b, 60c, 60d) or nonpronominal (60a). In addition to personal pronouns, existential *there* and dummy pronouns like *it* which arguably form chunks with the following verb (e.g., *there is*, *it was*) were treated as pronominal subjects. Last, the head nominal was coded as either animate (60b) or inanimate (60a, 60c, 60d).

The meaning of the RC filler was described in a frame semantic approach as the type of frame element which the filler adds to an associated frame in the RC. All fillers were annotated as either core or noncore frame elements. Next, a random sample of 300 RCs was coded based on the frame descriptions in the online FrameNet database (Fillmore & Baker, 2010; Ruppenhofer et al., 2016). From this, a more fine-grained coding scheme was developed by grouping together similar frame elements. The coding scheme is illustrated in Example 61.

Example 61

a. something I was dealing with this afternoon (ICE-GB)

b. quickness with which you work (ICLE)

c. buildings in which thousands of people breathe (YELC)

d. a climate in which safety was not put first (ICE-GB)

e. those humourous shows in which sex is being addressed (ICLE)

All core frame elements were coded as participants (61a). All noncore frame elements were divided into four categories of different adverbial meanings (Biber et al., 1999, see; Quirk et al., 1985): supplement fillers, including manner, means, reason, purpose, result, instruments, and respect (61b); space and time, including all space- and time-related meanings like position, direction, duration, and frequency if they were not considered core frame elements (61c); circumstances, including fillers denoting contextual conditions other than space and time, for example, ecological, economical, social, and cultural living conditions, situational contexts, and psychological and emotional states (61d); and medium, including fillers which specified

all kinds of source references like quoted texts, theatrical performances, philosophical systems, language, and laws (61e). Frame elements specifying a medium were considered extrathematic in the sense that "they introduce information that is not a necessary part of the description of the central frame" (Fillmore & Baker, 2010, p. 326). Unlike circumstances (61d), medium fillers do not specify a (peripheral) part of a frame but are external to the represented situation or event.

Next, each RC was annotated with the usage frequencies of its preposition and of two sequences, item-preposition and preposition-item strings. The item-preposition strings consisted of the preposition and the head of the gap site. The preposition-item strings consisted of the preposition and the relativizer. Usage frequencies were obtained from the BNC and were measured at the level of lemmas. By way of illustration, consider the RCs in Example 62.

Example 62

a. a serious waste problem, which the community may not be aware of (ICLE)

b. a subject on which they had never been able to agree (ICE-GB)

c. a new type of fiction, [...] which she cannot give a name to (ICLE)

d. protests in which two people were killed and more than 80 injured (ICE-GB)

e. the human being they are going to give life to (ICLE)

For instance, the relevant items in Example 62a are the preposition *of*, the relativizer *which*, and the gap site head *aware*. What was recorded was the usage frequencies of *of*, *of which*, and *aware of*. To give another example, for the RC in Example 62b, the usage frequencies of the preposition *on*, the preposition-item string *on which*, and the item-preposition string *agree on* were recorded. Note that both string frequencies were recorded independent of preposition placement. This was because usage frequency was used as a predictor, not a dependent variable. Even though *of* is stranded, the frequency of the fronting string *of which* was recorded (62a). Likewise, even though *on* is fronted, the frequency of the stranding string *agree on* was recorded. Moreover and importantly, note that *usage frequency* refers to the frequency of occurrence of a lemma or string of lemmas in the BNC, *not* the frequency of occurrence in the sample of the current study. The frequency of occurrence in the BNC is used as an approximation of relative input frequency and, for the strings, as a measure of coherence and collocation strength. While conditional relative frequency measures like mutual information might be better predictors of co-occurrence than

absolute frequency (Church & Hanks, 1990), results of corpus and psycholinguistic studies suggest that processing behavior is influenced by absolute frequency and that absolute frequency is a valid measure of coherence and a convenient approximation of collocation strength, in particular, for nonnative language users (e.g., N. C. Ellis et al., 2008; Schmitt, 2012).

There were a few special cases. In a ditransitive RC, the preposition and its nonadjacent head form an item-preposition string, for instance, *to* and *give* form *give to* (62c). One might object that ditransitive verbs like *give* commonly occur with an object intervening between verb and prepositional object, as in *give a name to*. Searching for *give to* in a corpus will therefore produce a lower frequency than searching for, say, *give * to*, where the asterisk is a placeholder for any intervening item. While this is true, the lower frequency better reflects the lower collocation strength between *give* and *to*, compared to, say, *talk* and *to*. When there were two or more associated gap site heads, like *kill* and *injure* in Example 62d, usage frequencies of all item-preposition sequences were averaged. Last, zero RCs do not have an overt relativizer to form a preposition-item string with the preposition (62e), so zero RCs received only annotations for the usage frequencies of their prepositions and item-preposition strings.

The finiteness of the RC was determined, which was either finite or nonfinite, illustrated in Example 63.

Example 63

a. someone [...] for whom I am an important person (ICLE)

b. someone to go to (ICLE)

The length of the preposition was measured by the number of syllables (Gries, 2002). In addition, individual relativizers and prepositions were recorded. Modality and style were kept constant across corpora. There was only written material in the sample and all informal text types, for example, social letters, had been excluded. Last, whether a RC was integrated or supplementary was not taken into account because punctuation was not a reliable guide, in particular, in the learner data, and meaning-based diagnostic criteria proposed in grammars (e.g., "The supplementary relatives [...] can be omitted without affecting the meaning of the remainder", Huddleston & Pullum, 2002, p. 1059) might work well with artifical or selected authentic examples but proved to be rather imprecise and vague when applied to large amounts of real-world data, as has been acknowledged elsewhere (e.g., Quirk et al., 1985, p. 1257).

4.1.1.4 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 binary logistic regression models were fitted to the data, one including writer group and one including native language group as a variable.

The results of the first analysis indicated that preposition placement correlated with writer group such that both novice native and nonnative writers were estimated to be more likely to strand than advanced native writers. This suggested that preposition placement was affected by the level of proficiency (novice, advanced) more than by learner group (native, nonnative). Consistent with this outcome, level of proficiency was included in the second analysis as a predictor variable, which in addition included native language group (European, East Asian).

The models were fitted in a top-down procedure. First, a beyond-optimal model was computed including all relevant variables and relevant interactions. Interactions with writer group were included to determine whether possible effects would be different across writer groups and corpora. Then, interactions and variables were dropped one by one and the resulting models were compared to each other based on residual deviance, probability of deviance in an ANOVA, AIC values, and Nagelkerke's R^2. Moreover, the predictive power of each model was computed based on classification accuracy (Gries, 2013, p. 302). When the difference in deviance between two models was not significant in the ANOVA, the variable or interaction in question was dropped. Evaluation diagnostics of the final models indicated no problematic degrees of multicollinearity of predictor variables or nonlinear relationships between continuous predictor variables and the log of the outcome variable. Moreover, standardized residuals were 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.

The data points were, however, not independent of each other. First, corpus file names were used to approximate individual writers or subjects. While most writers contributed only one data point to the sample, around 40% of the corpus files included two or more prepositional RCs. This is evident from Figure 4.1.
In the figure, the number of observations in a corpus file is plotted against frequency

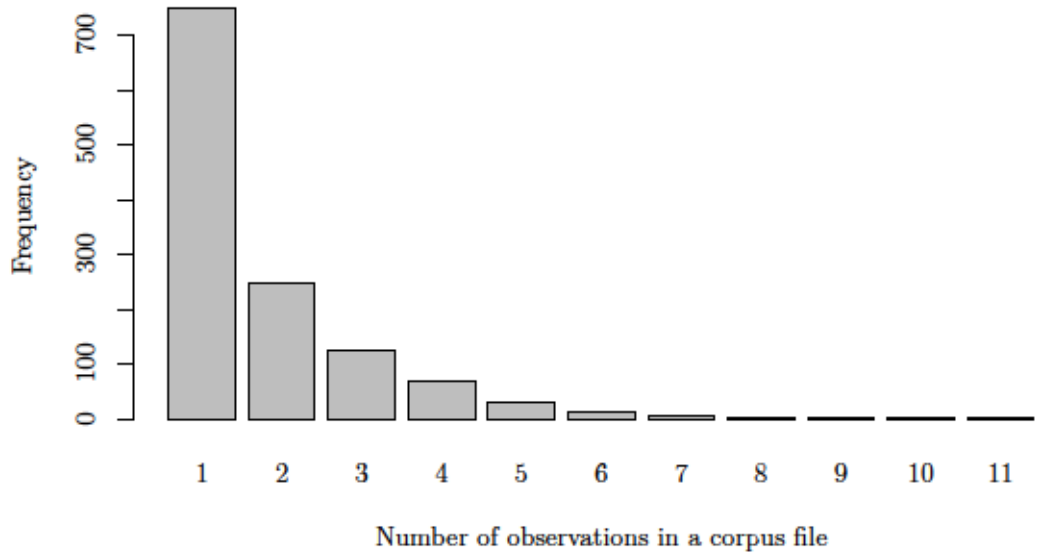


Figure 4.1: Distribution of the number of observations per corpus file in the sample

of occurrence in the sample. For example, the left-most bar indicates that 751 of 1,259 corpus files in the sample included only one instance of preposition placement. In other words, 32.68% of altogether 2,298 data points were likely to come from different writers. However, as the bars following on the right indicate, a number of corpus files included more than one prepositional RC. For instance, the second bar from left indicates that 249 subjects contributed two RCs to the sample. The right-most bar represents two writers who each contributed 11 RCs to the sample.

Second, data points share linguistic material across predictor levels, in particular, specific prepositions. This is problematic because specific prepositions exhibit an individual tendency to front or strand. Thus, there was a good deal of data points which were not independent of each other, which poses a problem to the estimation of coefficients in regression models. In simplified terms, when comparing odds across predictor levels, the model potentially overlooks effects of subject- and item-specific preferences for fronting or stranding (Bresnan, Cueni, Nikitina, & Baayen, 2007; Gries, 2011; Gries & Kootstra, 2017; Gries, 2017).

To account for subject- and item-specific variance, the final models were refitted as generalized binary mixed-effects regression models. This type of model captured subject- and item-specific variance in a random component. Variance due to the predictor variables was captured in a fixed component. The final models were refitted with random intercepts for prepositions and corpus files (for details on mixed-effects

models, see Baayen, 2008; Zuur, Ieno, Walker, Saveliev, & Smith, 2009). By and large, 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 (D. Bates, Mächler, Bolker, & Walker, 2015).

4.1.2 Results

4.1.2.1 Exploration of the Data

Altogether, 2,298 prepositional RCs were extracted from the corpora, including 1,481 with fronted and 817 with stranded prepositions. Moreover, there were 15 RCs in which the preposition appeared in both fronted and stranded position simultaneously. This is illustrated in Example 64.

Example 64

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. any disability of which they have no control over (ICE-GB)

In each RC in Example 64, the respective preposition is produced twice. For instance, the preposition *to* surfaces in fronted position before the relativizer *which* and then again in stranded position following the RC verb *sailing* (64a). To give another example, the preposition *in* is fronted to clause-initial position before *which* and then repeated in clause-final position following the RC verb *intervene* (64b). In two instances, two different prepositions appeared in fronted and stranded position. For instance, in Example 64c, the fronted position is filled by the preposition *of*, while the stranded position is filled by the preposition *over*. This is different from RCs which include both a fronted and stranded preposition but in which the prepositions are part of two different gap sites, as in Example 65.

Example 65

formal learning [...] the synthesis of which you get acquainted with (ICLE)

While the RC includes two prepositions, *of* and *with*, the fronted preposition *of* is part of the noun phrase *the synthesis of which*, whereas the stranded preposition *with* is part of the verb phrase *get acquainted with*. In contrast, in the RCs in Example 64, the two prepositions are associated with only one gap site. Surprisingly, doubled prepositions were not only attested in the nonnative sample but also surfaced in the

native sample. What is also noteworthy about the examples with doubled prepositions is that all but one involved lexicalized or nearly lexicalized strings like *speak to*, *pay for*, *live in*, *control over*, *conscious of*, and *involved in*, the only exception being the high-frequency string *be in*. Examples with doubled prepositions were excluded from the following analysis.

The effect of learner group (native, nonnative) on preposition placement was targeted first. The distribution of fronting and stranding in the sample across different learner groups is represented in Table 4.2, with two rows for different learner groups and two columns for preposition placement.

Table 4.2: Distribution of fronting and stranding across learner groups

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

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

In total, 878 RCs were extracted from the native corpora ICE-GB and LCN and 1,420 from the nonnative corpora ICLE and YELC. Even though a greater proportion of the sample came from the nonnative corpora (62%), given the different sizes of the corpora, the likelihood of coming across a prepositional RC in 10,000 words was considerably higher in the native corpora than in the nonnative corpora (12.25 vs. 6.52 in 10,000 words). With respect to preposition placement, the proportion of stranding was higher in the nonnative sample than in the native sample (39.93% vs. 28.47%). The results of a Pearson's chi-squared test indicated a significant difference between different learner groups, $X^2(1) = 30.58, p \leq .001$.

Next, the role of level of proficiency (novice, advanced) was analyzed. Table 4.3 outlines the distribution of fronting and stranding as a function of level of proficiency, with two rows for level of proficiency and two columns for preposition placement.

Table 4.3: 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%). However,

not surprisingly, the likelihood of finding a prepositional RC in 10,000 words was higher in the advanced ICE-GB corpus (12.61) than in the novice LCN, ICLE, and YELC corpora (7.2). Concerning preposition placement, the proportion of stranding was higher in the novice sample (40.99%) than in the advanced sample (15.76%). According to a Pearson's chi-squared test, the difference in preposition placement between novice and advanced writers was significant, $X^2(1) = 106.8, p \leq .001$.

Next, consider the effect of native language groups (European, East Asian) on preposition placement. Table 4.4 details the distribution of fronting and stranding as a function of different native language groups, with three rows for nonnative groups compared to native English speakers and two columns for preposition fronting and stranding.

Table 4.4: Distribution of fronting and stranding across native language groups

	Fronting	Stranding	Sum
English	628	250	878
European	727	378	1105
East Asian	126	189	315
Sum	1481	817	2298

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

As the figures indicate, the nonnative writers with a European native language contributed more RCs to the sample (48.09%) than both the East Asian nonnative writers (13.71%) and the native English writers (38.21%). Moreover and surprisingly, the nonnative writers with a European native language produced most prepositional RCs in 10,000 words (12.57) followed by the native English writers (12.25) followed by the East Asian nonnative writers (2.42). Concerning preposition placement, the proportion of stranding was highest in the East Asian subsample (60%) followed by the European subsample (34.21%) followed by the native English subsample (28.47%). The difference in preposition placement across native language groups was significant, as indicated by the results of a Pearson's chi-squared test, $X^2(2) = 102.24, p \leq .001$. Multiple post hoc pairwise comparisons using Pearson's chi-squared test with Bonferroni correction revealed significant contrasts between all levels, native English compared to European (adjusted $p \leq .05$), native English compared to East Asian (adjusted $p \leq .001$), and European compared to East Asian (adjusted $p \leq .001$).

Moreover, literature suggests that preposition placement is influenced by complexity. The data were coded for three such variables: the gap site of the filler in the RC as a correlate of the depth of embedding; the animacy of the head nominal;

and the form of the RC subject, in particular, whether the subject was pronominal or not. The influence of different gap sites (verbal, adjectival, nominal, partitive) on the distribution of fronting and stranding is summarized in Table 4.5, with four rows for different gap sites and two columns for preposition placement. In six RCs, the gap site was missing because the RC was incomplete or incomprehensible.

Table 4.5: Distribution of fronting and stranding as a function of different gap sites

	Fronting	Stranding	Sum
VP	1237	718	1955
AP	52	78	130
NP	117	19	136
PartC	69	2	71
Sum	1475	817	2292

Note. $X^2(3) = 95.82, p \leq .001$. VP = Verb phrase, AP = Adjective phrase, NP = Noun phrase, PartC = Partitive construction

As is apparent from the table, there was a trend to strand prepositions when the gap was embedded in an adjective phrase, compared to when the gap was part of a verb phrase, noun phrase, or partitive construction. In detail, the proportion of stranding was considerably higher with adjectival gap sites (60%) than with verbal, nominal, and partitive gap sites. The proportion of stranding was second highest with verb phrase-embedded gaps (36.73%) followed by noun-phrase embedded gaps (13.97%) followed by gaps embedded in partitive constructions (2.82%). According to a Pearson's chi-squared test, the association between preposition placement and gap site was significant, $X^2(3) = 95.82, p \leq .001$. Bonferroni-corrected pairwise comparisons indicated significant contrasts between all types of gap sites (all adjusted $p \leq .001$), except between noun phrases and partitive constructions (adjusted $p \geq .1$).

The exceptionally high proportion of stranding in the context of adjective phrases was due at least in part to lexicalized item-preposition strings like *interested in*, *concerned about*, and *proud of*, illustrated in Example 66.

Example 66

a. the things people are [$_{\text{AP}}$ interested in ____] (ICLE)

b. The only thing this type is [$_{\text{AP}}$ concerned about ____] (ICLE)

c. something to feel [$_{\text{AP}}$ proud of ____] (LCN)

In contrast, in the context of both noun phrases and partitive constructions, stranding was strongly disfavored, with only a few exceptions, illustrated in Examples 67

and 68.

Example 67
people we know and come in [$_{NP}$ contact with ____] (LCN)

Example 68

a. one of those protest by-elections we have seen [$_{PartC}$ so many of ____] in recent years (ICE-GB)

b. the earing you do not want to lose [$_{PartC}$ one of ____] (LCN)

Stranding was rare in the context of noun phrase-embedded gaps, even though not impossible (67). Stranding was apparently favored with collocations like *contact with*, *description of*, and *part of*. Stranding was virtually excluded from partitive constructions, with the exception of two RCs (68).

In addition, what is noteworthy here is the position of the gap relative to the RC verb. This is illustrated in Example 69.

Example 69

a. gentlemen of noble birth to which the Prince of Wales is [$_{NP}$ heir ____] (ICE-GB)

b. the type of woman I tried to give you a realistic [$_{NP}$ description of ____] (ICLE)

c. some products of which [$_{NP}$ the production ____] causes air pollution (ICLE)

While verbal and adjectival gap sites only followed the RC verb, nominal and partitive gap sites either followed (69a, 69b) or preceded (69c) the RC verb. With postverbal gaps, both fronting (69a) and stranding (69b) were common. However, preverbal gaps excluded stranding and were only attested with fronting (69c).

Moreover, one last thing to note with respect to nominal and partitive gap sites is that their heads and preceding material were often fronted along with the prepositions to clause-initial position. By way of illustration, consider the extreme example in Example 70.

Example 70
our so-called high-literature, [$_{NP}$ the 20th century variety of which] ____ tends to be so high indeed that it is virtually impossible for most of us to grasp it at all (ICLE)

Here, the gap is part of a prepositional modifier in a complex noun phrase headed by the ad hoc nominal compound *the 20th century variety*. The noun phrase is fronted as a whole, this way preserving the common linear order of noun and postnominal *of* modifier. While this is an extreme example, fronting material in addition to the preposition was common with nominal gap sites (32.35%). With partitive gap sites, the writers fronted the quantifier along with the preposition even more often than not (81.69%). Two more ordinary examples of extended fronting with a noun phrase and a partitive gap site are given in Example 71a and 71b, respectively.

Example 71

a. a brutality [$_{\text{NP}}$ the sheer thought of which] ____ ought to make every reasonable being tremble? (ICLE)

b. the young, [$_{\text{PartC}}$ most of whom] ____ are immature and have bad temper (ICLE)

In addition to different gap sites, complexity was measured by the animacy of the head nominal of the RC (animate, inanimate). As discussed above, the animacy of the head nominal is presumably related to the processing load associated with prepositional RCs such that the processing load is lower with inanimate than with animate head nominals. Therefore, animacy is treated here as a complexity-related variable. The distribution of fronting and stranding is tabulated in relation to the animacy of the head nominal in Table 4.6, with two rows for animacy and two columns for preposition placement.

Table 4.6: Distribution of fronting and stranding dependent on the animacy of the RC head nominal

	Fronting	Stranding	Sum
Inanimate	1385	716	2101
Animate	94	101	195
Sum	1479	817	2296

Note. $X^2(1) = 23.67, p \leq .001$

As is evident from the figures, stranding was associated with animate head nominals. The proportion of stranding increased from 34.08% with inanimate to 51.79% with animate head nominals. The association between preposition placement and animacy of the RC head nominal was significant in a Pearson's chi-squared test, $X^2(1) = 23.67, p \leq .001$. What is more, as expected, there were considerably more RCs with inanimate than animate head nominal in the sample (91.51%). Moreover, two incomplete RCs were missing a head.

Last, preposition placement was expected to be related to the form of the RC subject (pronominal, nonpronominal) as a measure of complexity. Moreover, three RC fragments without subjects had been extracted from the corpora. The distribution is detailed in Table 4.7, with two columns for preposition placement and two rows for RCs with pronominal and nonpronominal subjects, respectively.

Table 4.7: Distribution of fronting and stranding as a function of the form of the RC subject

	Fronting	Stranding	Sum
Pronominal subject	478	488	966
Nonpronominal subject	1000	329	1329
Sum	1478	817	2295

Note. $X^2(1) = 160.82, p \leq .001$

As is evident from the table, the majority of RCs in the sample had nonpronominal subjects (57.91%). With respect to preposition placement, stranding was considerably more frequent than fronting when the RC subject was pronominal than when the subject was not pronominal (50.52% vs. 24.76%). The association between preposition placement and the form of the RC subject was significant according to a Pearson's chi-squared test, $X^2(1) = 160.82, p \leq .001$.

Following complexity-related variables, the influence of the meaning of the filler (participant, supplement, space and time, circumstances, medium) on preposition placement was considered. The distribution of fronting and stranding relative to the meaning of the filler is given in Table 4.8, with preposition placement in two columns tabulated against different filler meanings in five rows.

Table 4.8: Distribution of fronting and stranding across different filler meanings

	Fronting	Stranding	Sum
Participant	555	763	1318
Supplement	354	29	383
Space and time	249	14	263
Circumstances	211	10	221
Medium	106	0	106
Sum	1475	816	2291

Note. $X^2(4) = 673.57, p \leq .001$

The distribution indicated that the majority of RC fillers in the sample were core frame elements specifying participants in the events or situations framed in the RCs (57.53%). Hence, 42.47% of the RCs in the sample were adverbial RCs in

which the filler designated all types of noncore elements of an associated frame: supplementary aspects like contingent properties of an entity or processual aspects like means and manner (16.72%); space and time (11.48%); circumstances (9.65%); or source medium (4.63%). Moreover, in seven RCs, the meaning of the filler was incomprehensible.

With respect to preposition placement, the distribution indicated that stranding was associated with core fillers, whereas fronting was associated with noncore fillers. More precisely, 57.89% of all core participant fillers occurred with stranded prepositions, while the proportion of stranded prepositions dropped to 7.57% with supplementary fillers, 5.32% with space and time fillers, and 4.52% with circumstances fillers. With medium fillers, stranding was not attested in the sample. The results of a Pearson's chi-squared test indicated that the association between preposition placement and filler meaning was significant, $X^2(4) = 673.57, p \leq .001$. For post hoc pairwise comparisons, a Fisher's exact test with Bonferroni correction was used. The results indicated that the effect of core participant fillers on preposition placement was significantly different from the influence of all types of noncore fillers (all adjusted $p \leq .001$). Moreover, the contrast between supplement fillers and medium fillers came out significant (adjusted $p \leq .01$). All remaining contrasts were nonsignificant (all adjusted $p \geq .1$).

Based on the outcome of the post hoc pairwise comparisons, the noncore fillers space and time, circumstances, and medium were combined into one level for the statistical analysis, called *environment*. In support of this, the few instances of stranding with space, time, and circumstances fillers were in part due to intervening factors, in particular, the type of relativizer. By way of illustration, consider Example 72.

Example 72

a. various surroundings which one grows in (ICLE)

b. the surrounding environment the speech is being produced in (ICE-GB)

c. a little place that smokers can smoke in (YELC)

d. the world where they were born in (ICLE)

Of the 24 stranding RCs of this type, only three were *which* RCs (72a). By comparison, 14 had a zero relativizer (72b), four included *that* as a relativizer (72c), and three *where* (72d), all of which force prepositions to strand. Thus, stranding in these RCs was probably not related to the meaning of the filler but due to specific relativizers, suggesting that there was little difference between space, time, circum-

stances, and medium fillers, all of which favored fronting to the (virtual) exclusion of stranding.

Moreover, meaning of the filler was collinear with gap site. Table 4.9 outlines the distribution of the meaning types of the filler across different gap sites, with five rows for meaning types tabulated against four columns for gap sites.

Table 4.9: Interaction of meaning and gap site of the filler

	VP	AP	NP	PartC	Sum
Participant	1004	107	136	71	1318
Supplement	374	9	0	0	383
Space and time	256	6	0	0	262
Circumstances	216	5	0	0	221
Medium	101	3	0	0	104
Sum	1951	130	136	71	2288

Note. VP = Verb phrase, AP = Adjective phrase, NP = Noun phrase, PartC = Partitive construction

As is evident, there was a perfect correlation between gap site and filler meaning such that all fillers which were integrated into a noun phrase or partitive construction specified participants. Adverbial meanings were excluded from these contexts. To avoid collinearity of predictor variables in the logistic regression analysis, RCs with gapped noun phrases or partitive constructions were excluded from the sample. The trimmed sample thus only included RCs with verbal and adjectival gap sites. Since no differences had been predicted for this contrast, the variable was dropped from the regression analysis.

Next, the usage frequencies of items and strings were explored. The distribution of usage frequencies is represented in Figure 4.2 in the form of grouped density plots. A density plot is similar to a histogram but smoothes the distribution into a line. As usage frequency is a continuous variable, a density curve is both a more appropriate and a more accurate way of representation (Baayen, 2008, pp. 25-26; Levshina, 2015, pp. 10-11). In each panel of Figure 4.2, two density curves have been plotted on top of each other. Roughly speaking, the usage frequencies of items and strings have been plotted against the probability with which they occurred in fronting or stranding RCs in the sample. The horizontal axes represent usage frequencies ranging from the lowest to the highest usage frequency. The vertical axes indicate probability density, which is computed based on the frequencies of observations, here, usage frequencies. In simplified terms, the lines indicate the probability of a particular usage frequency in the sample in fronting and stranding RCs, respectively. However, strictly speaking, probability density is not about the probability of a single point

on the horizontal axis but rather about the probability of an interval between two points represented by the shaded area under the curve between these two points. The entire area under a curve represents a probability of 1. By way of illustration, consider the upper left panel of Figure 4.2, which represents the distribution of usage frequencies among fronted and stranded prepositions. The dark curve peaks at a usage frequency around two million, indicating that usage frequencies around two million had a high probability in fronting RCs. In contrast, the peak of the light curve at this point is much lower. This indicates that prepositions with a usage frequency around two million had a higher probability to occur in fronting than in stranding RCs in the sample. Instead, the light peak to the left suggests that usage frequencies of less than a million were more common in stranding RCs. In other words, the chance of randomly drawing a fronted preposition with a usage frequency around two million would be high. In contrast, the chance of picking a stranded preposition with a usage frequency around two million would be relatively low. Chances would be higher to draw a stranded preposition with a usage frequency of less than a million. Dashed vertical lines were added to the panels to represent mean usage frequencies. Moreover, items and strings were added to exemplify different usage frequencies.

First, consider the usage frequency of prepositions, represented in the upper left panel of Figure 4.2. Usage frequency ranged from 946 (*aboard*) to 3,041,843 (*of*). With respect to preposition placement, the dashed vertical lines indicate that fronted prepositions had on average a higher usage frequency than stranded prepositions, with a mean difference of 288,331. The mean difference was significant according to a t-test, $t(1,535.43) = 6.98, p \leq .001, d = 0.31$. The usage frequency of fronted prepositions ranged from 946 to 3,041,843. Prepositions with usage frequencies around two million were considerably more frequent than any other preposition in fronting RCs, resulting in the density peak in the fronting curve. This was due to a single high-frequency preposition (*in*). Moreover, there were some fronting RCs with prepositions of a usage frequency of less than a million. In addition, there was an increase in density at usage frequencies around three million, due to the frequent use of fronted *of*. By comparison, the usage frequency of prepositions in stranding RCs ranged from 22,767 to 3,041,843. When compared to the fronting curve, what is noteworthy is that stranding RCs were more densely populated with prepositions of a usage frequency of less than a million. Moreover, high-frequency prepositions with hits around two million in the BNC, e.g., *in*, were much less likely in stranding RCs. The slight increase in density between usage frequencies of two million and three million was due to the frequent use of stranded *to*. Overall, the distribution

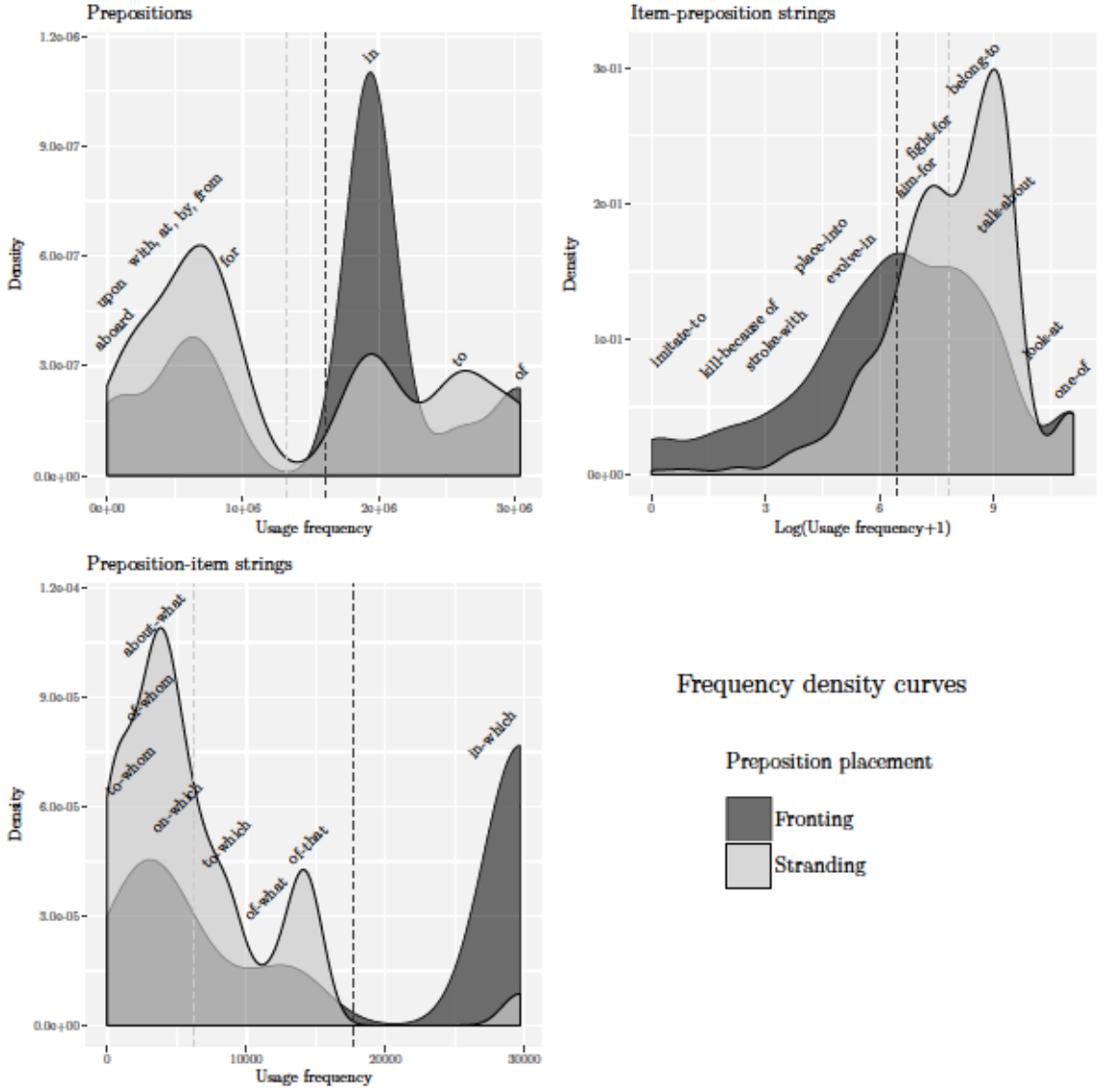


Figure 4.2: Distribution of usage frequencies of prepositions, and sequences item-preposition and preposition-item

of usage frequencies of prepositions indicated that stranding RCs were populated by prepositions of low usage frequencies more densely than fronting RCs, whereas fronting RCs were dominated by the high-frequency preposition *on*. The even more frequent prepositions *to* and *of* were more common in stranding and fronting RCs, respectively.

Next, the usage frequencies of item-preposition strings were analyzed. The distribution across preposition placement is represented in the upper right panel of Figure 4.2. Usage frequency ranged from strings which were not attested in the BNC, for example, *blossom within* and *exalt of*, and low-frequency strings, for example, nonidiomatic combinations like *distinguish of* and *imitate to*, to high-frequency strings like *belong to*, *talk about*, *look at*, *go to*, and *one of*, the most frequent of which was, somewhat surprisingly, *be in* (67,211). Examples of item-preposition strings with intermediate usage frequencies were *kill because of*, *stroke with*, *place into*, *evolve in*, *aim for*, and *fight for*. As the dashed vertical lines indicate, the mean usage frequency of item-preposition strings was higher in stranding than in fronting RCs, with a mean difference of 1,210.86. The mean difference came out significant in a t-test, $t(1,936.33) = -2.03, p \leq .05, d = -0.08$. As is evident from the light-shaded area, the bulk of stranding RCs was populated by items which combine into high-frequency item-preposition strings, with usage frequencies between 1,096 and 8,102. Some of these were also attested in fronting RCs, however, as the left shift of the dark-shaded curve indicates, most fronting RCs included combinations with usage frequencies between 19 and 1,096. Moreover, virtually all item-preposition strings with usage frequencies lower than 19 were attested in fronting RCs. All in all, this indicated that stranding RCs in the sample were populated more densely than fronting RCs by items and prepositions which frequently combine into item-preposition strings in language use.

Last, consider the usage frequencies of preposition-item strings, illustrated in the lower left panel of Figure 4.2. Usage frequencies ranged from zero hits in the BNC for *among who* and *until which* to 29,695 hits for *in which*. Examples of relatively infrequent strings include *to whom*, *of whom*, *about what*, *on which*, and *to which*, with usage frequencies of less than 10,000. Note that preposition-*that* strings like *of that*, *in that*, and *to that* reached relatively high usage frequencies because of the frequent use of *that* outside of RCs (for example, as demonstrative like in *A separate leaflet gives details of that scheme.*, or conjunction as in *He's typical in that he's very reserved.*). Concerning preposition placement, as is evident from the vertical dashed lines, the usage frequency of preposition-item strings was on average higher in fronting than in stranding RCs, with a mean difference of 11,430.14, which was

significant in a t-test, $t(903.18) = 24.05, p \leq .001, d = 0.97$. The binomial-like distribution of usage frequencies in fronting RCs indicated that fronting RCs were populated by both low-frequency strings like *to whom* and *of whom*, and high-frequency strings, in particular, *in which*. However, as seen from the light-shaded area under the stranding curve, low-frequency preposition-item strings had a high probability in stranding RCs and were considerably more likely in stranding than in fronting RCs. Thus, the distribution of usage frequencies suggested that fronting RCs in the sample were populated by both high-frequency and low-frequency preposition-item strings, whereas items and prepositions populating stranding RCs were unlikely to form preposition-item strings in language use.

Next, the relationship between place and length of a preposition was analyzed. Table 4.10 summarizes the number of syllables of fronted and stranded prepositions, with two columns for preposition placement and four rows for the number of syllables, which was treated as a continuous variable.

Table 4.10: Length of prepositions in syllables

	Fronting	Stranding	Sum
1	1367	700	2067
2	97	117	214
3	4	0	4
4	13	0	13
Sum	1481	817	2298

Apparently, prepositions with one or two syllables like *in*, *on*, *through*, and *about* were common with both fronting and stranding, whereas long prepositions with more than two syllables like *because of*, *in front of*, and *according to* surfaced in fronting RCs only. This suggested that longer prepositions tended to front. Contrary to the alleged tendency, however, two-syllable prepositions were more frequent than expected in stranding RCs. Moreover, a Mann-Whitney test indicated a significant median length difference between fronted and stranded prepositions ($Mdn = 55$ and $Mdn = 58.5$, respectively, $U = 565,913.5, p \leq .001$).

Following this, the influence of different relativizers on preposition placement was targeted. The distribution of the most frequent relativizers across fronting and stranding is summarized in Table 4.11, with columns for preposition placement and multiple rows for different relativizers.

In addition to the relativizers in Table 4.11, the sample included two examples of *whatever*, three *whichever*, and one *whoever*, all in stranding RCs, one fronting RC with *whereby*, three fronting and five stranding *who* RCs, and two fronting and three

Table 4.11: Distribution of fronting and stranding across different relativizers

	Fronting	Stranding	Sum
That	1	135	136
What	4	65	69
Where	2	9	11
Which	1384	63	1447
Whom	84	6	90
Zero	0	525	525
Sum	1475	803	2278

stranding *whose* RCs. As is evident from the table, the effects of relativizers were as described in grammars of English (Huddleston & Pullum, 2002, pp. 464–466), with few exceptions, illustrated in Examples 73 to 76.

Example 73

a world in that not everybody has the right to choose his/her belief (ICLE)

Example 74

a. They concentrate just about what they talk (YELC)

b. something about what there is no doubt (ICLE)

Example 75

a. their sort of jail in where they were obliged to live (ICLE)

b. the famous place in where, or where they can buy some cheap goods (ICLE)

Example 76

a. those characters in who a strong morality remains intact (ICLE)

b. the three musicians, among who I am (ICLE)

First, a nonnative German writer had produced a fronting *that*-RC, given in Example 73. Here, the preposition *in* is fronted to the clause-initial position preceding the relativizer *that*. Recall that fronting is not grammatical in *that*-RCs. Apart from the nonstandard position of the preposition, however, nothing suggested that the RC was strange in any way and should be excluded from the sample. In addition,

four nonnative writers had produced each one fronting *what* RC, illustrated in Example 74. The use of *what* as a relativizer is restricted to free RCs which require stranding. On closer inspection, however, only one turned out to be a free RC (74a). The remaining three were bound RCs headed by nominals, which do not allow *what* as a relativizer (74b). Moreover, two nonnative writers each fronted the preposition in a *where* RC, given in Example 75. The replacement of the expectable *which* by *where* as relativizer might have been motivated by the spatial meaning of the head nominal. In addition, there were three nonstandard instances of fronting in *who* RCs, illustrated in Example 76. Again, all three instances came from nonnative writers. Last, note that *which* and *whose* had sometimes been used as determiners, as illustrated in Example 77.

Example 77

a. Sisyphus is a demigod [...] on whose orders his wife throws his body into the street without burial. (LCN)

b. Howe will yet be prevailed on to run, in which case the field would by general consent be opened to all-comers (ICE-GB)

For the regression analysis, zero RCs were excluded from the sample because a zero relativizer forced prepositions to strand. In contrast, *that*-RCs were included. Even though preposition fronting is not grammatical in this context according to grammars of English, the structure seemed to be not completely ruled out in learner language, as Example 73 suggested. Moreover, a *whereby* RC was excluded from the regression sample. The relativizers *who*, *whose*, and *whom* were grouped together. The complex relativizers *whatever*, *whichever*, and *whoever* were combined with *what*. Moreover, there was an interaction between relativizer and finiteness of the RC such that stranding was excluded from nonfinite *wh*-RCs. With the zero RCs already excluded, there were only 34 nonfinite RCs left, which were excluded, too.

Last, item-specific effects on preposition placement were analyzed. In particular, the behavior of specific prepositions was targeted. Table 4.12 lists the ten most frequent prepositions in fronting and stranding RCs in the sample, with ten rows for preposition types and columns for joint frequency rank and token frequency.
As is evident from the table, fronting and stranding RCs were populated by similar prepositions. In both fronting and stranding RCs, the most frequent preposition was *in*, which occurred in 754 fronting and in 151 stranding RCs. The prepositions *of*, *to*, *with*, *for*, *on*, *from*, *at*, and *through* were among the most common prepositions in both fronting and stranding RCs, albeit ranked in different orders. Moreover, the type-token distribution of prepositions in fronting RCs was heavily skewed and

Table 4.12: Frequency rank and token frequency of the ten most common preposition types in fronting and stranding RCs

a Fronting			**b** Stranding		
Preposition	Rank	Frequency	Preposition	Rank	Frequency
in	1	754	in	1	151
of	2	159	with	2	120
to	4	82	to	3	118
with	4	82	for	4	105
for	5	69	about	5	92
on	6	62	of	6	74
from	7	55	on	7	51
by	8	49	from	8	37
at	9	30	at	10	17
through	10	24	through	10	17

strongly dominated by the most frequent preposition *in*. On contrast, the type-token distribution of stranded prepositions was more equally distributed and dominated by a handful of prepositions with similar frequencies, with *in* taking the lead, closely followed by *with*, *to*, and *for*. Last, only the fronting list included the preposition *by*, whereas *about* was only included in the list of frequent stranded prepositions.

Two methods were adopted from corpus and psycholinguistic research to determine the degree of association between preposition placement and specific prepositions. First, collostructional analysis. Collostructional analysis is a widely used method in usage-based corpus linguistics to compute the collocation strength between items and constructions in language use (Gries & Stefanowitsch, 2004; Gries, 2012; Stefanowitsch & Gries, 2003). For each preposition, a contingency table was created with the following frequencies: frequency of fronting with the preposition, frequency of stranding with the preposition, frequency of fronting with other prepositions, and frequency of stranding with other prepositions. For example, the preposition *in* occurred 754 times fronted and 151 times stranded in the sample. The remaining 727 fronting and 666 stranding RCs included different prepositions. Arranged in a two-by-two contingency table, expected frequencies were calculated and compared to observed frequencies in a Fisher's exact test. The p-value is commonly used as an indicator of collocation strength, which however has been criticized recently (Bybee, 2010; Gries, 2012, 2015; Schmid & Küchenhoff, 2013). In response to this critique, a second measure was adopted from psycholinguistic research on associative learning known as ΔP. The measure captures the strength of the associative relationship between a cue and an outcome (N. C. Ellis, 2006a; N. C. Ellis

& Ferreira-Junior, 2009a, 2009b). ΔP indicates the degree to which a particular item cues or signalizes a particular construction, or the other way around. In other words, while collostructional analysis outputs a measure of the two-way dependency between an item and a construction, ΔP expresses one-way associations. Since the focus here was on effects of specific prepositions on preposition placement, only the degree to which particular prepositions cued fronting or stranding was computed. ΔP was thus defined as the probability of fronting or stranding given a particular preposition minus the probability of fronting or stranding not given the preposition, and was computed for each preposition based on two-by-two contingency tables like the one described earlier.

The prepositions which were most strongly associated with fronting and stranding, respectively, are listed in Table 4.13, with rows for preposition types and columns for collocation strength and association strength.

Table 4.13: Ten most distinctive preposition types in fronting and stranding RCs

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 -log10(p), the more distinctive the preposition type was 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 ΔP 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.

Next, following Hoffmann (2011, pp. 75, 163–165), strings of head nominals and prepositions of adverbial RCs were subjected to the procedure to extract strings which were statistically linked with fronting adverbial RCs. Table 4.14 details the strings which came out as most distinctive, ordered by collocation strength. Asso-

ciation strength ΔP ranged from 0.02 to 0.06.

Table 4.14: Collocation and association strength between noun-preposition strings and fronting for adverbial RCs

Preposition	-log10(p)	ΔP
way in	0.91	0.05
case in	0.83	0.06
world in	0.43	0.03
moment in	0.41	0.06
extent to	0.36	0.06
one in	0.33	0.06
family in	0.30	0.06
period in	0.30	0.06
country in	0.25	0.06
society in	0.23	0.02

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

Last, RCs which consisted of only the RC subject, the verb *to be*, and a preposition were attested 35 times in the sample, illustrated in Example 78.

Example 78

a. the situation they are in (LCN)

b. the humiliation and neglect in which I was (ICE-GB)

c. thousands of millions of audience among who their potential customers are (ICLE)

In 29 out of 35 cases, prepositions were stranded (78a), however, contrary to prior research (Hoffmann, 2011, p. 139), prepositions were fronted in the remaining six instances (78b, 78c).

4.1.2.2 Results of the Regression Analyses

Following the initial exploration of the data, multivariate logistic regression models were fitted to the data to estimate the influence of each variable while keeping the other variables constant. To avoid (quasi-)complete separation, only a part of the sample was subjected to regression analyses. Preposition placement was (almost) perfectly predictable from different gap sites. Fronting was (nearly) obligatory when the filler was integrated into a noun phrase or a partitive construction in the RC. Moreover and more importantly, gap site was collinear with filler meaning such that

all fillers which were integrated into a nominal or partitive gap site were participants of the associated frame. Therefore, RCs with a nominal or partitive gap site were excluded and the variable gap site was left out of the models. Moreover, fronting was not attested in zero RCs, that is, RCs without an overt relativizer, which forced prepositions to strand and were therefore excluded. In addition, a low number of nonfinite RCs were eliminated from the regression sample because in combination with *wh*-relativizers they forced prepositions to front. Last, three incomplete RCs were removed. The regression sample included 1,536 prepositional RCs, including 1,256 fronting and 280 stranding RCs. Note that approximately 81.18% of the RCs in the regression sample were *wh*-RCs.

Since learner group and level of proficiency were collinear, 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). Two binary logistic regression models were fitted to the data. The first analysis compared the distribution of fronting and stranding across different writer groups. The results indicated a significant correlation between preposition placement and level of proficiency (advanced, novice), while the learner group contrast (native, nonnative) was not significant. Therefore, only level of proficiency was included in the second analysis. The second analysis targeted the effect of different native language groups on preposition placement and compared nonnative groups to native English speakers. Then, both models were refitted with random intercepts for prepositions and corpus files to control for item- and writer-specific effects.

The first analysis aimed to compare preposition placement across three different writer groups: advanced native writers (ICE-GB), novice native writers (LCN), and novice nonnative writers (ICLE, YELC). The model is summarized in the first column of Table 4.15.

In generalized logistic regression models, the estimates are commonly expressed in the form of log odds and log odds ratios. By way of illustration, consider the estimates of the current model in the first column of Table 4.15. The first estimate belongs to the intercept. The value -4.6 is the estimated log odds of stranding with all variables at their reference levels or equal to zero. The reference levels were the novice native writers of the LCN corpus, environment fillers, and the relativizer *which*, respectively. Odds lower than one indicate that fronting would be more frequent than stranding, whereas odds higher than one indicate more stranding than fronting. Because the odds had been logarithmized, a negative value lower than zero indicates that the model predicted more fronted than stranded prepositions. Exponentiating the coefficients produces odds. Thus, the model estimated that

Table 4.15: Output of a binary regression model (1) and a binary mixed-effects regression model with random intercepts for prepositions and corpus files (2), including writer group as a predictor variable

	(1)	(2)
Intercept	-4.60^{***} (0.64)	-3.45^{***} (0.79)
Participant	2.95^{***} (0.57)	1.97^{**} (0.64)
Supplement	0.16 (0.78)	-0.79 (0.84)
That	7.59^{***} (1.08)	7.95^{***} (1.11)
What/-ever	4.62^{***} (0.65)	4.76^{***} (0.72)
Where	2.00 (1.04)	1.86 (1.14)
Whom/Who/Whose	-1.38^{*} (0.55)	-1.70^{**} (0.59)
Advanced native writers (ICE-GB)	-1.19^{*} (0.50)	-1.58^{**} (0.53)
Novice nonnative writers (ICLE, YELC)	-0.37 (0.37)	-0.62 (0.40)
Frequency preposition	0.64^{**} (0.24)	1.23^{**} (0.45)
Frequency preposition-item	-1.32^{***} (0.25)	-1.39^{***} (0.32)
Frequency item-preposition	0.69^{***} (0.19)	0.91^{***} (0.21)
Observations	1,536	1,536

Note. $^{*}p \leq .05$; $^{**}p \leq .01$; $^{***}p \leq .001$.

at the intercept stranding was only 0.01 times as likely as fronting. Each of the following values belongs to a different level of the predictor variables. They compare the outcome for each level with the intercept in the form of log odds ratios. For example, the value 2.95 indicates that the odds of stranding with participant instead of environment fillers and all other variables held constant at their intercept level were around 19.15 times greater than at the intercept. Asterisks indicate significance at levels .05, .01, and .001. The values in parentheses indicate standard errors.

As is evident from Table 4.15, the binary logistic regression model indicated significant correlations between the place of prepositions and a range of predictor variables including writer group, the meaning of the filler, relativizer, and the usage frequencies of prepositions and of the sequences preposition-item and item-preposition ($G = 1{,}025.98$, $df = 11$, $p \leq .001$, $R^2 = 0.79$, $C = 0.98$). The place of 95% of all prepositions was predicted correctly, compared to a chance accuracy of 82%.

The effects are visualized in Figure 4.3 in the form of conditional plots. Instead of log odds ratios, the vertical axis represents estimated log odds for stranding. The dark gray lines indicate the estimated value at the level specified on the horizontal axis with all other variables in the model at their median or most common category. Log odds lower than zero indicate that the model predicted more fronting than stranding at the specified level. Log odds higher than zero indicate that the model

expected prepositions to strand more often than to front. Gray bands represent confidence intervals, dark gray dots partial residuals. First, consider the effect of different writer groups, illustrated in the top left panel of Figure 4.3. The model estimated that the novice native writers of the LCN corpus would strand more than both the advanced native writers of the ICE-GB corpus and the novice nonnative writers of the ICLE and YELC corpora. However, as is evident from Table 4.15, only the difference between the novice native and the advanced native writers was significant, whereas the estimated odds of stranding were not significantly different between the novice native and novice nonnative writers. In other words, the model predicted a significant difference between different levels of proficiency (novice, advanced), but not between different learner groups (native, nonnative). Next, the effect of the meaning of the filler is illustrated in the top center panel of Figure 4.3. The model predicted that prepositions would prefer to strand with participant fillers considerably more than with environment and supplement fillers. In contrast, the estimated difference between supplement and environment fillers was not significant. In addition, as seen in the upper right panel, the model predicted a strong tendency of prepositions to strand in the context of *that* and *what/-ever* relativizers, compared to *which*. The relativizer *where* was estimated to increase the odds of stranding, too, however, the estimated effect was not significantly different from the intercept *which*. In contrast, the model predicted that prepositions would tend to front most strongly in RCs with the relativizers *whom*, *who*, and *whose*. Last, the model indicated significant correlations between preposition placement and the frequency variables, illustrated in the lower panels of Figure 4.3. The estimated odds of stranding increased with the frequency of the preposition. Moreover, with increasing frequency of item-preposition strings, the estimated odds of stranding the preposition increased, too. In contrast, the model predicted that the tendency of prepositions to strand would decrease with the frequency of the preposition-item string increasing.

The second analysis targeted the effect of different native language groups on preposition placement. Based on the outcome of the first analysis, level of proficiency was included as a predictor variable. The model is summarized the first column of Table 4.16.

The binary logistic regression model indicated significant correlations between the place of prepositions and a range of predictor variables including native language group, level of proficiency, the meaning of the filler, relativizer, and the usage frequencies of prepositions and of preposition-item and item-preposition strings (G = 1,053.62, df = 12, $p \leq .001$, R^2 = 0.81, C = 0.98). The place of 95% of all

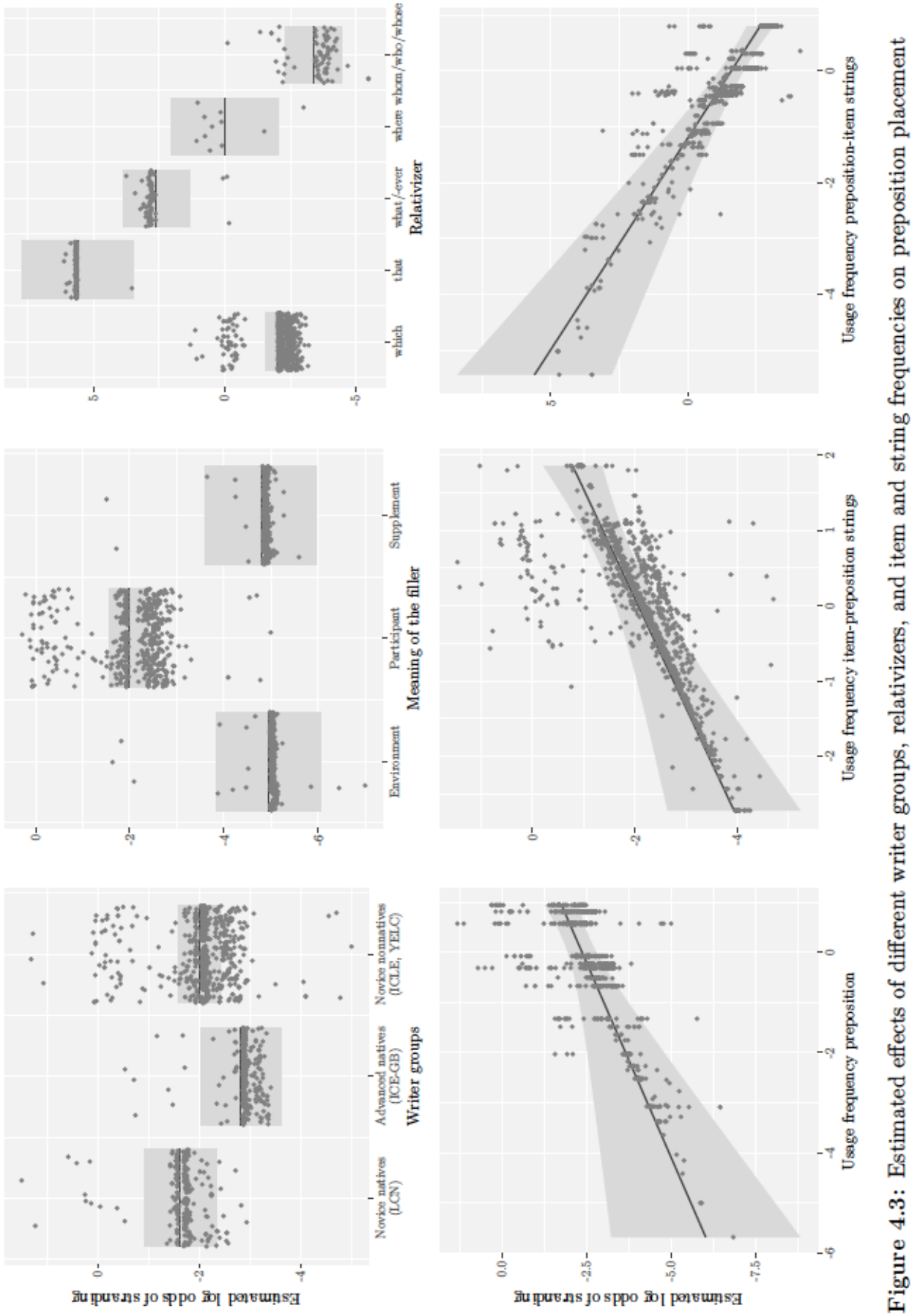


Figure 4.3: Estimated effects of different writer groups, relativizers, and item and string frequencies on preposition placement

Table 4.16: Output of a binary regression model (1) and a binary mixed-effects regression model with random intercepts for prepositions and corpus files (2), including native language group and proficiency as predictor variables

	(1)	(2)
Intercept	−5.89*** (0.67)	−5.92*** (1.60)
European	−0.84* (0.39)	−1.34* (0.64)
East Asian	0.96* (0.44)	1.10 (0.73)
Participant	3.09*** (0.59)	2.27** (0.77)
Supplement	0.32 (0.81)	−0.83 (0.99)
That	7.38*** (1.10)	9.10*** (2.39)
What/-ever	4.61*** (0.65)	5.72*** (1.70)
Where	1.33 (1.04)	1.67 (1.47)
Whom/Who/Whose	−1.45* (0.59)	−2.04* (0.96)
Novice writers (ICLE, YELC, LNC)	1.17* (0.50)	1.83* (0.77)
Frequency preposition	0.66** (0.25)	1.36* (0.61)
Frequency preposition-item	−1.30*** (0.26)	−1.53** (0.56)
Frequency item-preposition	0.69*** (0.20)	1.06** (0.32)
Observations	1,536	1,536

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

prepositions was predicted correctly. The effects of native language group and level of proficiency are visualized by conditional plots in Figure 4.4.

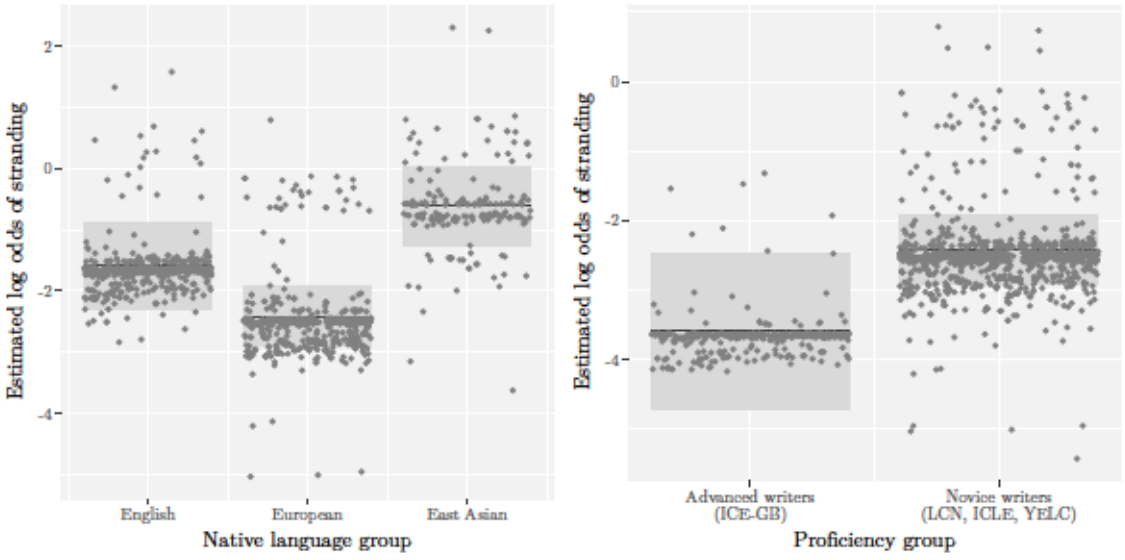


Figure 4.4: Estimated effects of different native language groups and levels of proficiency on preposition placement

As seen in the left panel of Figure 4.4, the model predicted that nonnative writers with a European fronting-only native language would tend to front prepositions more

than native English writers. In contrast, nonnative writers with an East Asian native language were expected to strand prepositions more than the native English writers. Moreover, in line with the results of the first analysis, the current model estimated a tendency of prepositions to strand for novice writers of the combined ICLE, YELC, and LCN corpora compared to the advanced writers of the ICE-GB corpus. This is illustrated in the right panel. The estimated effects of the remaining levels were consistent with the estimations in the first analysis.

To control for subject- and item-specific effects, the final models were refitted with random intercepts for corpus files and prepositions. The models are represented in the second columns of Table 4.15 and Table 4.16, respectively. As is evident from comparing the first to the second column of each table, the estimated effects were consistent and significant across levels, with only two exceptions. First, the direction of the effect of supplement fillers was not consistent across models, indicating that the estimated effect was confounded by subject- and item-specific variance. Second, the effect of an East Asian native language increased across models but lost significance, as expected.

The mixed-effects models assumed different random intercepts for corpus files and preposition types. The estimated random effects of preposition types are visualized in Figure 4.5, with preposition types on the vertical axis and the amount of adjustment for specific prepositions to the intercept on the horizontal axis. Prepositions with a preference for stranding have positive adjustments, prepositions with a preference for fronting negative. The amount of adjustment increases with the estimated strength of the preference. Thus, the adjustments suggested that the prepositions *through*, *with*, *for*, *about*, *into*, *of*, and *from* favored stranding, whereas the prepositions *in*, *among*, *to*, *on*, *by*, and *behind* were associated with fronting, with the degree of association decreasing in that order. The intercepts of the remaining prepositions were only slightly adjusted or not adjusted at all, indicating that the model predicted that they would prefer neither fronting nor stranding.

4.1.3 Discussion

4.1.3.1 Summary of Findings

All variables except gap site and finiteness were subjected to a multivariate analysis. A series of binary logistic regression models detected significant correlations between the place of the prepositions and level of proficiency, native language group, filler meaning, usage frequency of prepositions and strings, and specific prepositions and relativizers. The results indicated that novice writers were more likely to strand

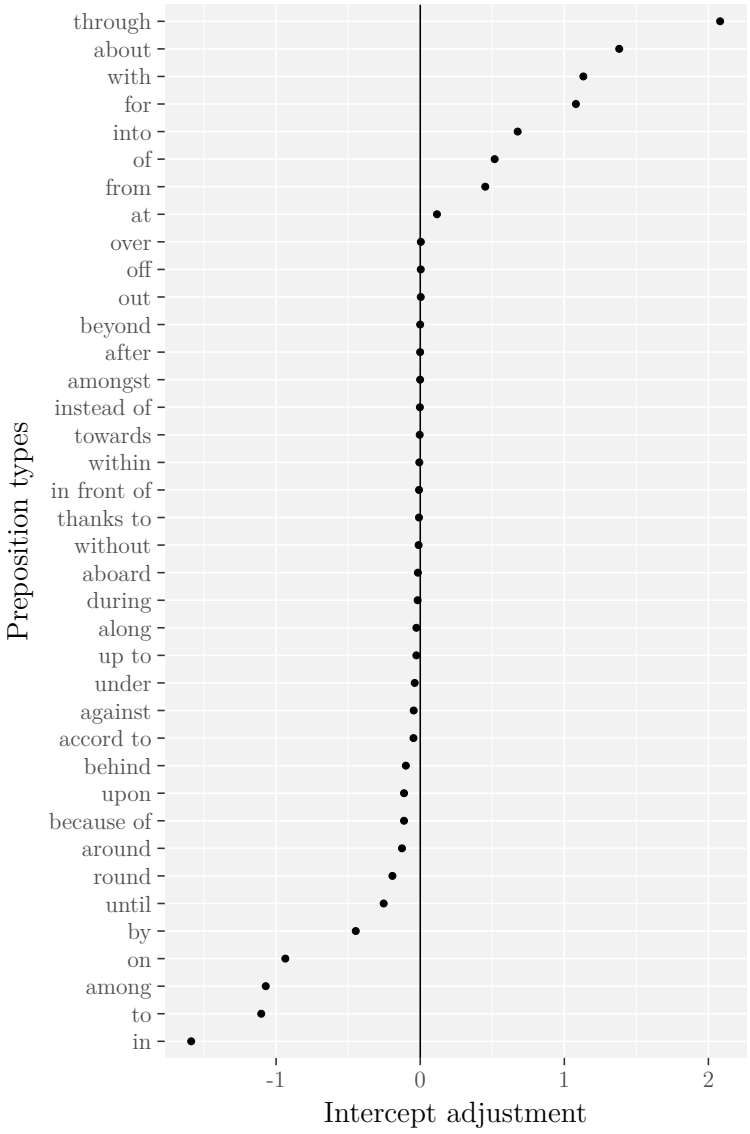


Figure 4.5: Random intercepts of preposition types

than advanced writers. Moreover, nonnative writers with a European fronting-only native language were more likely to front prepositions than both nonnative writers with a typologically distant and different East Asian native language and native English writers. There was also a tendency for the East Asian writers to strand more than the native English writers, which was, however, not significant across models. More stranding was predicted with participant fillers than with environment fillers. The expected contrasts with supplement fillers were not significant. High-frequency prepositions and item-preposition strings increased the likelihood of stranding, while high-frequency preposition-item strings were associated with fronting and had an inhibitory effect on stranding. Last, stranding was associated with specific items, for instance, specific prepositions (e.g., *through*, *about*, *with*) and relativizers (e.g., *that*, *what*), whereas stranding was repelled by specific prepositions (e.g., *in*, *among*, and *to*) and relativizers (e.g., *which*, *who*(*m*), and *whose*) which attracted fronting instead. Contrary to expectations, the complexity-related variables animacy of the head nominal and form of the RC subject were not significant and were dropped from the models, including the expected interactions between animacy, form, and meaning of the filler. Neither a correlation between preposition placement and preposition length was detected. Bootstrapping the final models and refitting them with random intercepts for prepositions and corpus files, as an approximation of individual writers, indicated robust coefficients and *p*-values.

4.1.3.2 Sensitivity to Input Distribution Changes with Proficiency

Most prior research (e.g., Bardovi-Harlig, 1987; Kao, 2001) has suggested that nonnative writers develop a preference for stranding because of the relative frequency of fronting and stranding in language use and learner input, boosting stranding in nonnative learning. By comparison, native language learning has been more susceptible to prescription and schooling which, in conjunction with an alleged innate disposition, favors preposition fronting from an early age on (McDaniel et al., 1998). Consistent with these findings, the nonnative writers in the ICLE and YELC corpora stranded prepositions more than the native writers in the ICE-GB corpus. The distribution of fronting and stranding in English across multiple clause types is outlined in Table 3.1. Moreover, Table 3.2 outlines the distribution of preposition placement in *wh*-RCs. The figures indicate that, as expected, stranding is in total more frequent than fronting in English. On the assumption that learner input is similar to native language use, this suggests that nonnative learners mirror the relative frequency distribution of fronting and stranding in English, whereas native speakers observe prescriptive standards for formal language use acquired in school. Contrary

to this explanation, however, the results of the regression analysis indicated that the native LCN writers stranded more than the native writers in the ICE-GB corpus and were not significantly different from the nonnative ICLE and YELC writers. One might suspect that schooling and prescription had not yet affected the LCN writers' language use to a sufficient degree to bring them closer to the ICE-GB writers. This seems unlikely though, given evidence for effects of schooling and prescription at a young age (McDaniel et al., 1998). Thus, in other words, while earlier research gave reason to expect a difference between native and nonnative language users, this was not borne out by the results of the corpus analysis, which instead indicated significant contrasts between the advanced native writers of the ICE-GB corpus on the one hand and the novice native and nonnative writers of the LCN, ICLE, and YELC corpora on the other hand. This suggests that preposition placement was primarily dependent not on different learner groups (native, nonnative) but on different levels of proficiency (novice, advanced).

The usage-based approach to language learning provides a straightforward explanation. On a usage-based view (Bybee, 2010; Diessel, 2016; Langacker, 2010), language learning is driven by input. Language users keep track of their input and memorize usage patterns which become more entrenched with each encounter and gradually develop into constructions. As a consequence, constructions are tailored to the distributional characteristics of the input from which they emerged. Following this line of thought, the corpus writers had likely become attuned to the distribution of preposition fronting and stranding in their input. The input distribution would then be expected to be mirrored in their output distribution, that is, in the distribution of fronting and stranding in the sample. In this view, the different preferences of novice and advanced writers indicate that the different groups had become attuned to different distributions of fronting and stranding.

As pointed out above, stranding is in total more common than fronting in English. From a usage-based viewpoint, the novice writers had likely become attuned to the total relative frequency of fronting and stranding in language use. The skewed input distribution was reflected in the novice writers' preference for stranding. In contrast, while stranding is in total more common than fronting, fronting is more frequent than stranding in the context of *wh*-RCs, as is evident from the second from left column of Table 3.1 and from Table 3.2. In this more fine-grained distribution, fronting is associated with *wh*-RCs. This was also reflected in the regression results, which indicated a preference for fronting for advanced writers. Recall that the regression sample consisted to approximately 81.18% of *wh*-RCs. This suggests that the advanced writers had become attuned not to the total relative frequency but

to the conditional relative frequency of fronting and stranding. While the novice writers had developed a general preference for stranding independent of context, the advanced writers had learned to front prepositions in the context of *wh*-RCs. The difference emerged because the groups of writers had weighted their constructions in accordance with different usage distributions of fronting and stranding. The novice writers' general preference for stranding mirrored the total relative frequency of fronting and stranding in their input, whereas the advanced writers's preference for fronting in *wh*-RCs matched the conditional relative frequency of fronting and stranding in the context of *wh*-RCs.

From a usage-based perspective, this suggests that language users become attuned to different usage distributions at different levels of proficiency. While novice learners rely on total frequency counts in their input and tailor their constructions to more coarse-grained distributions, advanced speakers become sensitive to contextual constraints and adjust their language use to more fine-grained contexts of use. This raises the question of why learners at different levels of proficiency process input at different levels of granularity. A plausible explanation is the power law of practice (Newell, 1990), according to which the improving effect of more practice on behavior gradually levels out and eventually plateaus with increasing experience. For example, an assembly line worker will gain speed rapidly during the first days on the job and each workpiece will contribute greatly to the improvement. However, at high levels of experience and skill, the learning curve levels out and eventually the worker does not improve anymore. By analogy, each time novice language learners encounter a construction in their input greatly contributes to learning the construction. Once a construction is entrenched and established to a high degree, however, little is learned from more exposure. Accordingly, since stranding is in total more frequent than fronting in language use and since each encounter contributes greatly to learning and entrenchment at low levels of experience, the novice writers in the study had learned to strand prepositions more rapidly than to front them and developed a general preference for stranding across contexts. In contrast, at higher levels of experience, both fronting and stranding constructions had been established and therefore each additional encounter contributed little to learning. As a result, the advanced writers of the study had become insensitive to differences in the total frequency of fronting and stranding in their input. Instead, based on the greater amount of input and experience, they had weighted their constructions in accordance with contextual predictability and collocational strength, leading to the entrenchment of more specific constructions and a preference for fronting in the context of *wh*-RCs.

In this view, then, sensitivity to different input distributions was due to different levels of proficiency and experience. At a low level of experience, preposition placement had been determined by the total relative frequency of fronting and stranding in a language user's input, leading to a preference for stranding for the novice writers. At a high level of experience, the effect of increased total frequency of stranding leveled out. Instead, the advanced writers had become attuned to more fine-grained distributions and learned to associate *wh*-RCs with fronting. This is in line with the power law of practice (Newell, 1990) and consistent with recent psycholinguistic research indicating sensitivity of processing to input and a development in sensitivity from more coarse-grained to more fine-grained input distributions with increasing experience (e.g., Durrant & Schmitt, 2009; N. C. Ellis et al., 2008).

Alternatively, one might suspect that the distribution of fronting and stranding across corpora was skewed because of differences in style and text types. Prior findings associated fronted prepositions with formal style and stranded prepositions with informal style (Biber et al., 1999, p. 106; Huddleston & Pullum, 2002, p. 628). The ICE-GB material in the sample might have included more formal texts or text types than the LCN, ICLE, and YELC material. However, the LCN, ICLE, and YELC material consisted of examination essays by advanced high school and undergraduate university students in which the writers likely attempted to produce a formal and educated-sounding style. Thus, material from different corpora was similar in style or, at least, comparable in the writers' attempts to produce a formal rather than an informal style. Cross-corpus differences in style were therefore probably not responsible for the fronting preference of the advanced writers. Despite all that, cross-corpus differences in style and text type likely undermine at least to some extent the validity of the results. A different approach is needed to better control for excluded and extraneous variables.

4.1.3.3 Cross-linguistic Similarity Boosts Fronting in European Learners

The results indicated a correlation between the place of the preposition and a writer's native language (European, East Asian) such that nonnative writers with a European fronting-only native language fronted prepositions more than native English writers. This suggests cross-linguistic influence. More precisely, the increase in fronting for European writers was probably due to cross-linguistic similarity, which facilitated learning and use of fronting. As illustrated above, European languages like German, French, and Spanish front prepositions in RCs and have a similar word order like English. This is exemplified again for German in Example 79.

Example 79 (Zifonun, 2001, p. 84)

a. *die Frau, an die wir denken*
the woman at who(m) we think

"the woman of whom we think"

b. **die Frau, die wir an denken*
the woman who(m) we at think

Like in its English counterpart, the RC *an die wir denken* ("at who(m) we think") follows the modified noun *Frau* ("woman") and has OBJ SUBJ V word order. As regards preposition placement, German only fronts prepositions in RCs to clause-initial position (79a). Stranding the preposition is not grammatical (79b).

Accordingly, the advantage of fronting in the nonnative group of European writers was likely due to cross-linguistic word order similarity between their native-language and English fronting RCs. This is in line with previous research indicating increased fronting for nonnative learners of English with fronting-only native languages, for instance, French (Mazurkewich, 1985). Moreover, this is consistent with a long line of research emphasizing the importance of cross-linguistic similarity for the emergence of interlingual transfer (e.g., Andersen, 1983; Odlin, 1989; Ringbom & Jarvis, 2009). According to Odlin, nonnative learners benefit from cross-linguistic similarity as "[l]earners speaking a language with a syntax similar to that of the target language tend to have less difficulty with articles, word order, and RCs" (Odlin, 1989, p. 36). In line with this, the nonnative writers with a European fronting-only native language were more inclined to front prepositions than their East Asian counterparts. This was arguably due to a facilitative effect of cross-linguistic similarity on learning and producing fronting. However, positive transfer is expected to result in "convergence of behaviors of native and non-native speakers of a language" (Odlin, 1989, p. 168). Contrary to this expectation, this group of writers fronted prepositions more than the native English writers in the sample. In other words, they overgeneralized fronting to contexts in which native writers would strand prepositions. This was likely due to cross-linguistic differences in the meaning of fronting. While fronting co-occurs with both participant and adverbial fillers in their native languages, fronting competes with stranding in the context of participant fillers in English. This type of negative meaning transfer is particularly likely between typologically related languages which learners perceive as similar and closely related and thus apparently tend to assume by default meaning equivalence of similar constructions (Jarvis & Pavlenko, 2008, p. 181).

In a usage-based framework (Hall et al., 2006; Höder, 2012), cross-linguistic

influence is not conceptualized as transfer between two standalone linguistic systems coexisting in the minds of second language learners. Instead, second language learners are seen as acquiring a complex constructicon in which sub-networks of language-specific constructions are weaved together by interlingual constructions emerging from cross-linguistic similarity. Interlingual constructions emerge because nonnative language users exploit native-language constructions to process similar strings in their nonnative input. In this view, then, the writers with a European fronting-only native language in the sample likely drew on their native-language construction to process and produce fronting in English. As a consequence, a fronting diaconstruction had emerged which generalized over instantiations of fronting in their native and English input. Moreover, the emerging diaconstruction was built upon the native-language construction and therefore inherited its frequency across languages, resulting in a high degree of entrenchment (Runnqvist et al., 2013). This was reflected in the European writer's preference to front prepositions. Since fronting does not compete with stranding in their native input but co-occurs with both participant and adverbial fillers, the emerging interlingual construction was more schematic than the native English construction and overgeneralized fronting compared to the native English distribution.

By comparison, the East Asian writers likely perceived English prepositional RCs as different from their native language constructions. As is illustrated above, East Asian languages place RCs before the modified noun and do not overtly indicate the role of the filler other than by different word orders. For further illustration, consider the Korean RC in Example 80.

Example 80 (Sohn, 2001, p. 311)

ney ka	*ka-n*,	*kukcang*
you NOM	go-REL	theatre

"the theatre you went to"

The RC *ney ka ka-n* ("you go to") consists of a nominative marked subject followed by a verb suffixed with a RC marker. The following modified noun *kukcang* ("theatre") is not overtly represented inside the RC but gapped, along with the particle normally marking the oblique relation: "Notice that the nouns coreferential to the head noun are omitted with the case particle, unlike in English where prepositions like *to* and *in* appear before a relative pronoun or at the end of the RC" (Sohn, 2001, p. 311).

Accordingly, East Asian learners of English in this study were unlikely to draw on their native-language constructions when learning English RCs. Thus, they probably

built English constructions based on English input only, which is why they developed a preference for stranding. Note that the contrast between East Asian writers and native English writers was only significant in the first regression analysis but lost significance in the second analysis which controlled for writer-specific variance. This is consistent with the usage-based interpretation. The East Asian writers were on a relatively low level of proficiency, suggesting a low level of experience, which was associated with stranding. Once individual differences in experience were controlled for, the East Asian writers were not significantly different from native English writers anymore. This indicates that, as expected, their native language had little influence on preposition placement which, undistorted by cross-linguistic influence, mirrored the native English distribution.

On closer inspection, however, there were considerable differences in proficiency across corpora, suggesting that the East Asian writers were on a much lower level of experience than the European writers. This was evident, for example, from the corpus documentations, according to which 93.32% of the East Asian writers in the sample were at a proficiency level of B2 or lower, whereas 67.5% of the European writers were on a level higher than B2. Moreover, the texts by the East Asian writers in the sample were on average 202.21 words shorter than those by the European writers. All this suggests that the East Asian writers were on a considerably lower level of proficiency and experience than the European writers. The level of proficiency was associated with preposition placement such that fronting increased with proficiency. Thus, the European writers' preference for fronting might not have been due to cross-linguistic influence but to a higher level of proficiency compared to the East Asian writers. Again, a more controlled approach is required to distinguish between the effects of proficiency and native language.

4.1.3.4 Stranding Indicates Construal of the Filler as Core Participant

In a cognitive usage-based framework (e.g., Diessel, 2016, 2018), grammar consists of a network of form-meaning pairs or constructions which emerge from and, once established, determine language use. The results of the corpus study indicated that the use of preposition fronting and stranding was determined by a range of form- and meaning-related variables such as the meaning of the RC filler, the relativizer, and specific lexical items and strings. Moreover, the lack of interactions with different writer groups indicated that the effects were consistent across writer groups and corpora, suggesting that the writers had acquired constructions similar in form and meaning.

The results of the corpus analysis indicated that preposition placement was de-

pendent on the meaning of the RC filler such that stranding was associated with participant fillers, whereas fronting was associated with two types of adverbial fillers (supplement, environment). Contrary to predictions, the contrast between supplement and environment fillers was not significant. In frame semantic terms, this suggests that prepositions are more likely to strand when the filler specifies a core rather than a noncore frame element of an associated frame within the RC. More precisely, in a frame semantic approach, core frame elements are defined as entities playing an indispensable and prominent participant role in the event or situation represented by the associated frame. In contrast, noncore frame elements are understood as contributing entities in minor roles or contingent meaning aspects to a frame. This is not entirely different from thematic roles (Fillmore, 2003). This is in line with research indicating a relationship between stranding and a high degree of centrality of the filler to the meaning of the RC ("thematicity", Hoffmann, 2011; Hornstein & Weinberg, 1981; C. Johansson & Geisler, 1998; "importance", Takami, 1992). The results seem most consistent with Hoffmann's proposal that prepositions are strandable when the filler contributes "interpretable thematic information to the predicate" (2011, p. 182). However, while Hoffmann has proposed a multi-level meaning continuum with graded effects on preposition placement, the results of the current study suggest only two levels of meaning.

There were at least two reasons why a graded effect of meaning was not observed in the current study. First, some of the RC fillers which were sorted into intermediate categories in prior studies were classified as core fillers in the current analysis. For example, the posture frame evoked by the verb *sit* (e.g., *the chair which I sit on*) implies a particular location as a prominent part of the represented scene which was thus classified as a core frame element rather than an instance of some intermediate category between complement and adjunct (Hoffmann, 2011, p. 72). Second, the graded influence of meaning on preposition placement observed in prior studies seems to have been at least in part due to correlated differences in collocation strength between prepositions and preceding items. By way of illustration, recall the complement-adjunct continuum developed by Hoffmann (2006, 2011). The continuum 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 the prepositions and the preceding items gradually decreases from complements to adjuncts. The results of the current study suggest that the effect of intermediate meaning categories ceases

to be significant once collocation strength is controlled for, for example, by factoring in differences in string frequency or other measures of mutual association.

The core-noncore distinction seems to be more akin to the binary distinction between complement and adjunct common in earlier literature (Hornstein & Weinberg, 1981; C. Johansson & Geisler, 1998). Adopting a generative grammar framework (Chomsky, 1981; Van Riemsdijk, 1978), Hornstein and Weinberg proposed 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, transformational operations like *wh*-movement, and the application of a universal filter which blocks movement out of prepositional phrases. While the predictions of this account seem to be compatible with the results of the current study, the presupposed generative approach to grammar is no longer considered psychologically plausible in cognitive linguistics (Tomasello, 1998, 2003).

Instead, the relationship between filler meaning and preposition placement is readily explained in terms of cognitive grammar (Langacker, 2008a, 2015). Proponents of cognitive grammar hold that the meaning of grammatical constructions resides in specific ways of viewing or construing the conceptual content or frames evoked by lexical items. Accordingly, the correlation between preposition placement and filler meaning suggests that fronting and stranding were associated with two different ways of construing the RC filler. While fillers were construed as participants at the core of the RC scene when the preposition was stranded, they were out of focus and construed as background to the RC scene when the preposition was fronted. Put differently, in a cognitive grammar view, the results suggest that the stranding construction evokes the construal of the RC filler as core participant in the RC, whereas the fronting construction provokes viewing the filler as background to the RC event.

This was most evident when the filler was related to the RC verb or adjective. For example, *give* in *the human being they are going to give life to* (ICLE) evokes a transfer frame. The filler is construed as a particular core frame element, namely, the recipient. In line with the hypothesis, the preposition is stranded. However, contrary to the hypothesis, prepositions strongly tended to front in the context of nominal and partitive gap sites, even though fillers in these contexts specified core frame elements of the underlying frames. For example, in *primates are gibbons, of which there are several species* (ICE-GB), the filler relates to the noun *species*, evoking a biological classification frame. In this frame, the filler specifies the core frame element of a higher-order rank in the classification hierarchy. Despite that,

the preposition is fronted. This suggests that the correlation between preposition stranding and the construal of the filler as a core participant only holds for verbal and adjectival gap sites but is suspended or overwritten in the context of nominal and partitive gap sites.

Moreover, this leaves open the questions why stranding foregrounds fillers and why fronting backgrounds them. It is suggested that the linear proximity of the preposition to a related lexical item in the RC indicates the conceptual proximity of the filler to the item. Put differently, the place of the preposition indicates when or where the filler is integrated into the RC. Recall that from a cognitive grammar perspective a RC is not characterized by a phrase-structure gap which receives a displaced filler constituent; rather, the essential feature of a RC is a semantic overlap or correspondence relation between nonadjacent components, namely, the head nominal and a relationship framed by a lexical item within the RC. Since the head nominal is immobile, the preposition takes over the task of indicating conceptual proximity to the related lexical item. Stranding places a preposition late in the RC and close to the related lexical item. This indicates high conceptual proximity of the filler to the associated frame and late integration. In contrast, fronting places the preposition early in the relative claues and increases the linear distance between preposition and related lexical item, indicating low conceptual proximity of the filler to the associated frame and early integration.

By way of illustration, consider Example 81, reminiscent of Example 35 by Hornstein and Weinberg (1981).

Example 81

a. the boat on which John decided

b. the boat which John decided on

According to Hornstein and Weinberg, RCs of this type are 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 fronted (81a), but the adjunct reading is ruled out when the preposition is stranded (81b). They reasoned that this is because stranding the preposition would lead to reanalysis of the constituent structure of the verb phrase such that the preposition would be grouped with the verb leaving an empty nominal node immediately goverend by the complex verb. In the cognitive grammar framework adopted here, stranding the preposition *on* indicates conceptual proximity between the RC verb *decided* and the head nominal filler *the boat*. As a consequence, the filler is construed as a core frame element of the *decide* frame, resulting in the complement reading. When the

preposition is fronted, the increased linear distance between *on* and *decided* indicates that *the boat* is to be interpreted as a noncore frame element of the *decide* frame, resulting in the adjunct reading. Even though the fronting indicates low conceptual proximity between filler and frame, suggesting an adjunct reading, the complement reading seems plausible, too, because *decide* and *on* are strongly associated in language use and therefore tend to be perceived as a unit, independent of the place of the preposition.

In a cognitive grammar analysis (Langacker, 2008a, pp. 202–205), the different readings are associated with different construal processes. Recall that in cognitive grammar verbs, adjectives, and prepositions profile relationships between two prominent schematic roles, named *trajector* and *landmark*. There are two different modes of mental scanning underlying the apprehension of relationships. They may either be scanned sequentially and are then viewed as processes evolving through time. Or they may be scanned in summary fashion and are then represented in a cumulative way as atemporal relationships. In both complement and adjunct reading, the *decide* relationship is scanned sequentially and construed as evolving through time. In a complement reading, the nominal filler elaborates or characterizes the landmark of the *decide* relationship. The preposition *on* is processed as part of the verb. By comparison, in an adjunct reading, neither does the filler elaborate a salient part of the *decide* relationship nor the other way around (which would define a modifier). Instead, the preposition *on* profiles an atemporal relationship whose trajector corresponds to a nonsalient subpart of the wider *decide* frame representing space and whose landmark is elaborated by the filler.

This relates 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 occuring dovetails with the order in which they are conceptualized and described" (Langacker, 2008a, p. 79). In other words, the linear order of linguistic forms tends to match the order of experience they describe, like in *Socrates took hemlock and died*, where poisoning oneself precedes death both linguistically and experientially. Different orders of encoding imply different ways of construing conceptual content, "linear order always has some effect on meaning—a difference in word order always implies a semantic contrast" (Langacker, 2008a, p. 82). Thus, in keeping with the assumption that different orders of encoding imply different ways of construing conceptual content, this suggests that preposition fronting and stranding indicate two different ways of integrating the filler into the RC. When the preposition is stranded, the filler is integrated into the RC as part of a time-evolving relationship profiled by the RC verb or adjective and thus construed as

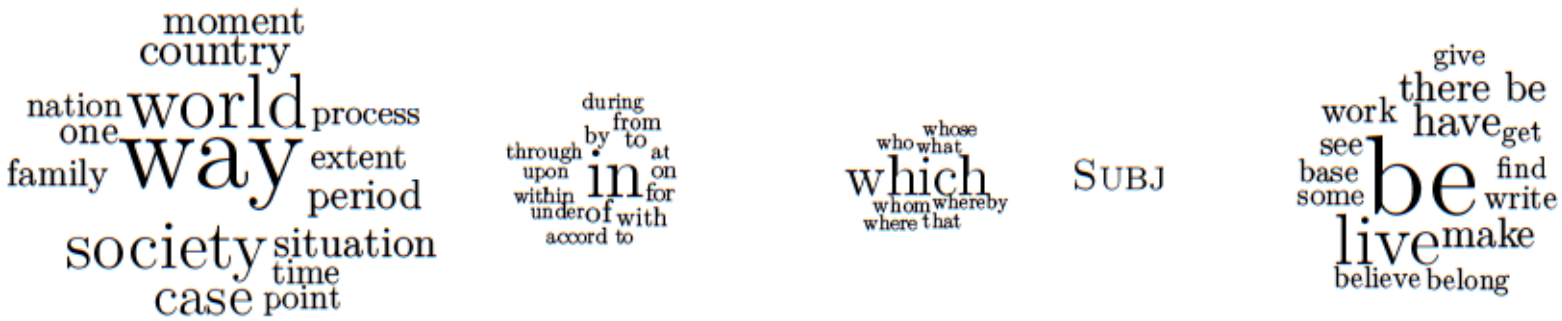
a complement or participant. When the preposition is fronted, the filler is integrated as part of the atemporal relationship profiled by the preposition, which is then as a whole related to the RC verb or adjective, resulting in an adjunct or adverbial reading.

While this is consistent with the results of the current study, there is little direct evidence for conceptual proximity and mental scanning underlying preposition placement. Moreover, even though Langacker has repeatedly emphasized that "the mere existence of sequential and summary scanning as conceptual phenomena is hardly problematic" (2008b, p. 572), empirical evidence for their role in language processing is sparse (but see Matlock, 2004). This should be addressed in future studies. For example, if preposition placement indicates conceptual proximity of the filler to the RC verb, then reading time should increase when the hypothesized correlation is violated, for instance, when a noncore filler co-occurs with a stranded preposition. If stranding is associated with sequential scanning, then motion verbs should attract stranding. In line with this, previous research has indicated that stranding is more likely with adverbial fillers which specify the source or goal of movement (Hoffmann, 2011, pp. 155, 167). Moreover, tracking eye movements during processing might be a way to gain insight into conceptual proximity and underlying modes of mental scanning.

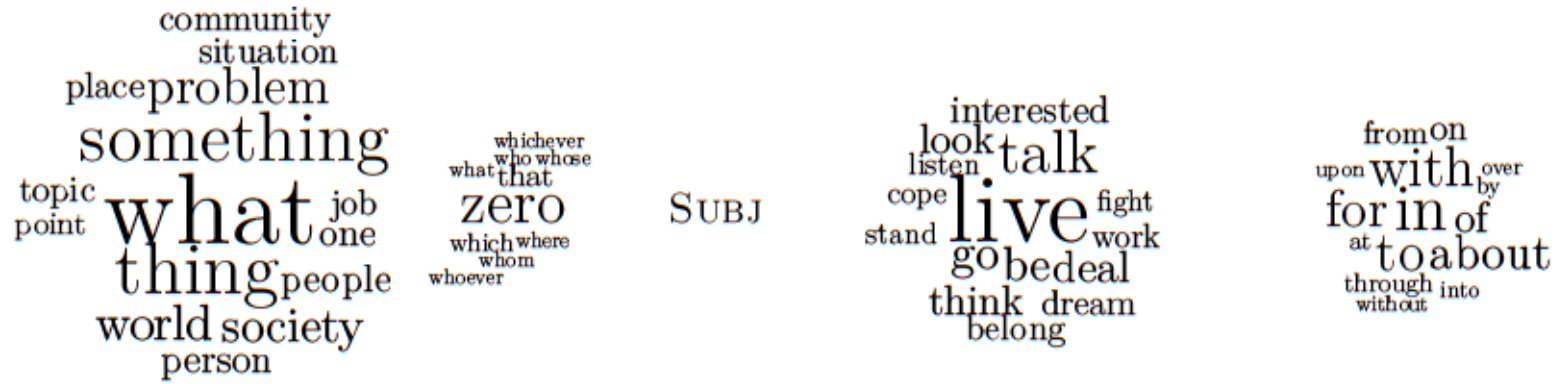
4.1.3.5 Item-specific Prototypes and the Effect of String Frequency

In some usage-based work (Bybee, 2010; Pierrehumbert, 2003), constructions are thought of as clusters or clouds of memorized exemplars. Each exemplar is stored in memory and attracted by groups of similar exemplars which together form a category. Frequent and distinctive exemplars mass together to form prototypes. The level of entrenchment of a category or construction is represented by the density of the exemplar cloud, the degree of schematicity by the dispersal of exemplars. In this framework, fronting and stranding constructions are represented by clouds or clusters of item-specific exemplars. Initial exploration of the data discovered skewed distributions of lexical items and strings across the two constructions. This is illustrated by the sequences of word clouds in Figure 4.6, with font size indicating frequency of an item and cloud size indicating type variation. This way of representing the type-token distribution in the sample suggests that fronting and stranding constructions emerged from item-specific prototypes with high token frequency and low type variation.

The type-token distribution of the fronting construction is illustrated in Subfigure 4.6a. The head nominal of the fronting construction was populated by a wide



a Fronting



b Stranding

Figure 4.6: Distribution of items across fronting and stranding RCs

range of different types. However, the distribution was heavily skewed and dominated by the item type *way*, followed by *world*, *society*, *case*, and *situation*. The preposition cluster of the fronting construction was strongly dominated by *in* and the most common relativizer was the pronoun *which*. The RC verb was instantiated by a wide range of types in fronting RCs. The relatively high frequency of the verb type *be* is probably not significant, given the high total frequency of *be* in English language use. Moreover, the relatively high frequency of *live* was in part due to the essay topics in the nonnative corpora and is probably not more characteristic for fronting RCs than any of the less frequent verb types. All this indicates that the writers had acquired an item-specific construction of the form *way in which* SUBJ V (OBJ) as a prototype of fronting RCs.

By comparison, the type-token distribution of the stranding construction is illustrated in Subfigure 4.6b. A wide range of types populated the head nominal of the stranding construction. The relatively high frequency of *what* as a head nominal suggests that the writers had acquired an item-specific free RC construction. The remaining types were more equally distributed, although abstract nouns like *thing*, *something*, and *problem* to some extent dominated the head nominal. The most common relativizers were zero and *that*, followed by *which*. The RC verb and the preposition were instantiated by a wide range of types. The most common types were part of lexicalized item-preposition strings like *live in*, *interested in*, *talk about*, *go to*, *look for*, and *stand on*. Like in fronting RCs, *be* was relatively frequent, probably due to high total frequency in English. All in all, the distribution suggests two more broadly defined prototypes of the form N *that*/∅ SUBJ X (OBJ) PREP, which are strongly associated with common lexicalized item-preposition strings like *live in*, *interested in*, and *talk about*.

In line with this, the results of the regression analyses indicated that preposition fronting and stranding were associated with specific lexical items and strings. By way of illustration, consider the RCs in Example 82, which were estimated to be most likely to strand.

Example 82

a. Japanese students, whichever grade or level they are in (ICLE)

b. And whichever country a foreigner comes from (ICLE)

c. the United Staes enters which ever fight they are [...] interested in (ICLE)

d. a bowl that a college goes to (LCN)

e. Voltaire attacks every country that he goes to (LCN)

f. the trials and hardships that they went through (LCN)

g. the way that I go to (YELC)

h. a situation that readers can relate to and sympathize with (LCN)

i. experiences that the world can relate to (LCN)

j. a box filled with moving images and sounds, that not a single family in modern world can afford to be without (ICLE)

As seen in the examples, stranding was associated with specific prepositions, for instance, *from*, *through*, and *with*, and specific relativizers, for instance, *whichever* and *that*. Keep in mind that zero RCs were not part of the regression analysis. Moreover, as noted elsewhere (Hoffmann, 2011, p. 139), RCs which consisted of only the RC subject, the verb *to be*, and a preposition were among the prototypical stranding exemplars (82a). By comparison, the RCs in Example 83 were predicted to be most likely to front.

Example 83

a. Arthur Machen's "The Bowmen" in which the spirits of St George and his archers repel a German attack (ICE-GB)

b. The Ribble Valley result, in which the Liberal Democrats snatched the 10th safest Tory seat (ICE-GB)

c. a short period in which the child cannot be roused (ICE-GB)

d. the world in which Tom Jones inhabits (ICE-GB)

e. the more informative rotating arm tests in which the model is towed not only on the oblique path but (ICE-GB)

f. the framework within which nationalism and politics could blossom (ICE-GB)

g. a veritable cat's cradle of enquiries, within which mind-body problems became inextricably knotted (ICE-GB)

h. the latest case in which he has been entwined (ICE-GB)

i. the first primitive societies in which they adored the natural events (ICLE)

j. dark offices in which a group of obscure civil servants armed with enormous scissors, got rid of anything that could remind us of freedom. (ICLE)

The examples illustrate that fronting was strongly associated with the preposition *in* and the relativizer *which*. Moreover, a collostructional analysis revealed that specific strings of nouns and prepositions occurred more frequently with fronting than expected, for instance, *period in*, *world in*, *case in*, and *society in*.

This is in line with prior findings of idiosyncratic placing behavior of specific lexical items, in particular, prepositions and item-preposition collocations (e.g., Biber et al., 1999, p. 106; Hoffmann, 2011, pp. 72–75, 137–140; Trotta, 2000, p. 185). More generally, this is consistent with a usage-based theory of language learning (Bybee, 2002; Diessel, 2016; N. C. Ellis et al., 2016; Langacker, 2010). Usage-based theory holds that constructions emerge at multiple levels of specificity ranging from item-specific patterns to highly schematic constructions. Schematicity and entrenchment are driven by the type-token distribution of the constructions in language use. Recurring items are reinforced across usage events and as a consequence incorporated into the emerging constructions at high levels of specificity. From this, a network of item-specific constructions emerges which are partially schematic and partially tied to specific items and strings. More schematic constructions emerge driven by type variation as generalizations across similar item-specific exemplars and constructions which instantiate but do not resolve into higher-level representations and retain a processing advantage over them because of their relatively high token frequency and specificity.

Next, consider the effect of string frequency in more detail. The results indicated that the ratio of stranding to fronting varied with string frequency as a measure of coherence of item-preposition and preposition-item sequences. Initial exploration of the data revealed that stranding RCs were densely populated by high-frequency item-preposition strings, while most of the fronting RCs contained high-frequency preposition-item strings, in particular, *in which*. In line with this, the results of the regression analysis indicated increasing stranding with increasing item-preposition frequency and decreasing preposition-item frequency. This is in good agreement with corpus-based approaches to language which have long emphasized the importance of collocations and frequency-based prefabs for language use in general and preposition placement in particular (Biber et al., 1999; Guy & Bayley, 1995; Hoffmann, 2011; Sinclair, 1991; Wray & Perkins, 2000). However, this seems to be inconsistent with proposals that preposition stranding involves the reanalysis of the constituent structure of the gapped phrase such that the preposition is grouped with the preceding lexical head (Hornstein & Weinberg, 1981; Stowell, 1981).

The different views are reconcilable in a cognitive usage-based framework in which constituency is assumed to emerge from sequentiality (Bybee, 2002; Diessel

& Hilpert, 2016). Usage-based researchers hold the view that constituents emerge from oft-repeated sequences of linguistic units which language users string together as units or chunks in memory. This view is predicated on the assumption that items merge with their left and right neighbors into longer automated processing units which are stored and subsequently retrieved as a whole, with the degree of coherence depending on the frequency of co-occurrence in language use. As a consequence, constituency is expected to be fluid, fragmented, and a matter of degree. In support of this view, corpus studies found that string frequency is higher within than between constituents and that coalescence across phrase-structure boundaries is more likely with high-frequency strings (Bybee & Scheibman, 1999; Bybee, 2002; Krug, 1998). Consistent with these findings, high-frequency item-preposition and preposition-item strings were likely stored and processed as prepackaged units which cut across phrase-structure boundaries and determine the place of the preposition in the RC. By way of illustration, consider the fronting and stranding prototypes again. The distribution of string frequencies across the fronting prototype suggests the following constituent structure, indicated by square brackets: [[*way* [*in which*]] [SUBJ [V [(OBJ)]]]]. Items are grouped together based on their string frequency. The high-frequency string *in which* forms a chunk which is embedded in the longer chunk *way in which*. The chunks are stored as coherent wholes and likely retrieved from memory as units. As a consequence, the preposition ends up in fronted position. The emergent constituent boundaries cut across the phrase-structure boundary between head nominal and RC. By comparison, the stranding prototypes were associated with high-frequency item-preposition strings, suggesting the following constituent structure: [N [(*that*) [SUBJ [[V (OBJ) PREP]]]]]. This is close to the constituent structure analysis proposed by Hornstein and Weinberg (1981). However, instead of assuming reanalysis, constituent structure is seen as emerging from sequential learning: with increasing string frequency, item-preposition strings are increasingly likely to be chunked and subsequently retrieved as units, which leads to stranding.

In contrast, the results were inconsistent with explanations relating to complexity (J. A. Hawkins, 1999, 2004; Jespersen, 1927). Proponents of this approach have argued that stranding prepositions is not a consequence of chunking high-frequency item-preposition strings in memory and using them as prepackaged wholes but results from an attempt to compensate for increased processing load. They have reasoned that the prepositions of prepositional verbs and adjectives like *look for* and *interested in* depend strongly on the preceding lexical item for their interpretation and processing. Stranding them in RCs therefore appears to be a way to avoid the creation of long-distance dependencies which would be difficult to parse

and interpret. This argument, however, does not seem to apply in equal measure to prepositions in high-frequency strings like *be in* and *go to*. The prepositions tend to strand, even though they do not rely as strongly on the preceding item for interpretation. Instead, following Jespersen (1927, p. 189), one would expect them to front because they seem more closely related to the head nominal of a RC with which they seem to form some kind of adverbial meaning, as in *the mood I am in* and *the place which I like to go to*. This is somewhat reminiscent of the hypothesis that preposition placement indicates conceptual proximity between the filler and the framing item in the RC. However, chunking high-frequency item-preposition strings seems to counteract and, in some contexts, overwrite the meaning-based effect.

4.1.3.6 Why Complexity Does Not Matter

Contrary to expectations, the results of the corpus study indicated that complexity had little influence on preposition placement. Some researchers have argued that stranding is more complex than fronting (Gries, 2002; J. A. Hawkins, 1999, p. 260; Hoffmann, 2011, pp. 96–98; Trotta, 2000, pp. 187–188). They seem to reason that if stranding is more complex then fronting, then fronting would be preferred when the surrounding structure increases in complexity, suggesting a trade-off between the complexity of preposition placement and the surrounding structure. Prior corpus studies have adopted different measures of complexity, in particlar, the structural or linear distance between the filler and the gap, with contradictory and inconclusive results. For the current study, three complexity variables were adopted from the literature: the depth of embedding of the gap as a function of the gap site (verbal, adjectival, nominal, partitive); the form of the RC subject (pronominal, nonpronominal); and the animacy of the head nominal (animate, inanimate). While the initial exploration of the data tentatively suggested that fronting increased with increasing complexity, the effect of different gap sites was only in part consistent with the predictions and the regression analysis indicated that preposition placement was not significantly correlated with the form of the subject or the animacy of the head nominal of the RC.

Consider the form of the RC subject and the animacy of the head nominal first. Both nonpronominal subjects and animate head nominals are known to increase the processing load of nonsubject RCs (e.g., Gordon & Lowder, 2012). Moreover, stranding is commonly assumed to be more complex than fronting. Thus, the likelihood of stranding was predicted to be lower with nonpronominal subjects and animate head nominals than with pronominal subjects and inanimate head nominals, respectively. The reasoning was that the increased processing load due to nonpronominal subjects

and animate head nominals would make preposition fronting more likely. However, contrary to predictions, the results of the regression analysis indicated that preposition placement was independent of both the form of the subject and the animacy of the head nominal. This is consistent with the outcome of Hoffmann's regression analysis (2011, pp. 166-167), which indicated that preposition placement was not significantly influenced by the structural distance between filler and gap. In a post-hoc analysis, Hoffmann collapsed his continuous measure of complexity into a binary measure and inspected the effect separately for three different types of filler meaning. Eyeballing the data, he tentatively concluded that "if the preposition [...] or the [preposition phrase] [...] is lexically associated with the main verb then increasing complexity leads to a decrease in [fronting]" (Hoffmann, 2011, pp. 167-168), suggesting an interaction of complexity with filler meaning and item-preposition string frequency. Adopting a linear distance measure of complexity (Gibson, 1998), one would instead expect an interaction between complexity and filler meaning such that fronting would be favored in complex adverbial RCs. However, all interactions were statistically nonsignificant in the regression analysis. All in all, this seems to suggest that preposition placement was independent of the complexity of the RC, suggesting that stranding is not more complex than fronting. This casts doubt in particular on a phrase-structure conception of complexity, which strongly predicts a processing asymmetry between fronting and stranding.

Next, initial data exploration suggested an effect of different gap sites (verbal, adjectival, nominal, partitive) on preposition placement. Based on the assumption processing load increases with the depth of embedding of the gap, stranding was expected to be more likely with verb phrase-embedded gaps compared to gaps embedded in adjective phrases, noun phrases, or partitive constructions (Quintero, 1992; Trotta, 2000, pp. 184–185). In line with expectations, the writers in this study were inclined to strand prepositions more with verbal gap sites than with nominal and partitive gap sites. However, contrary to expectations, there was a tendency to strand prepositions with gaps embedded in adjective phrases. This is consistent with more recent research which found a preference for stranding in this context in the British part of the ICE corpus (Hoffmann, 2011, pp. 155, 167). In contrast, Trotta (2000) found only fronting with adjectival gap sites in material from the Brown corpus. He predicted that stranding would be disfavored with adjective gap sites due to the increased depth of embedding. This was borne out by the results of his analysis of RCs (but not by his analysis of *wh*-questions). Even though the distribution turned out to be in line with his prediction, Trotta pointed out that stranding would have been acceptable in most instances. He argued that

the complete lack of stranding with adjectival gap sites was probably in part due to prescriptive rules and editorial policies against stranding. This might be responsible for the inconsistency with the current sample, only the ICE-GB part of which had been subjected to extensive editing. However, there was a strong tendency to strand with adjectival gap sites in the material from the LCN, ICLE, and YELC corpora, which seems difficult to attribute entirely to lack of extensive editing. Moreover, preverbal nominal and partitive gap sites were only attested with fronting despite the structural and linear proximity of filler and gap.

Instead, the results were consistent with what was expected on the basis of a cognitive grammar analysis of constituent structure and different gap sites. Cognitive grammarians (Langacker, 2008a) hold that verbs and adjectives profile relationships, while nouns and quantifiers profile nonrelational entities. Moreover, they assume that heads impose their profiles on composite structures. On this assumption, a filler is integrated into the RC as part of a relationship when the gap is embedded in a verb phrase or adjective phrase, but as part of a nonrelational entity when the gap site is a noun phrase or a partitive construction. This correlated with the tendency of prepositions to strand in the context of verbal and adjectival gap sites on the one hand and to front with nominal and partitive gap sites on the other hand, suggesting that preposition placement dependend on the profiles of the gap sites rather than their depth of embedding. This is reminiscent of the proposal that preposition placement indicates the conceptual proximity of the filler to the frame-evoking lexical item in the RC and the mode of mental scanning during integration. In particular, fronting construes the filler as out of focus at the level of the RC, whereas stranding elicits a construal as core participant in a clause-level relationship. With nominal and partitive gap sites, the filler is integrated into the RC at a lower (in other words, more deeply embedded) level of the constituent structure. The filler therefore disappears from view at the clause level. In line with this, prepositions strongly tended to front with nominal and partitive gap sites because the filler was construed as an out-of-focus modifier of a nonrelational entity. By way of illustration, consider Example 84.

Example 84

a. the approaching cyclist, a crash with whom would probably be the worst of all eventualities (ICLE)

b. slums and shanty towns, many of which lack running water, sanitary facilities and electricity (ICE-GB)

The head nominal *cyclist* is construed as a modifier of the nonrelational entity profiled by *crash* (84a). The meaning of the filler pertains to the lower-level nominal structure and does not figure prominently in the meaning of the higher-level RC structure. At the level of the RC, the filler is backgrounded. To give another example, the partitive gap site *many of which* profiles a subgroup of a group of entities designated by *which* referring back to *slums and shanty towns* (84b). While the subgroup is foregrounded and mentally accessed through the filler group, the filler group is backgrounded (Langacker, 2008a, pp. 292-296; Radden & Dirven, 2007, pp. 134-145).

Note in passing that this might explain why stranding was excluded from preverbal nominal and partitive gap sites. Since the writers had acquired clause-level constructions of prepositional RCs, with the preposition at either clause-initial or clause-final place depending on the meaning of the filler in the RC, stranding with preverbal gaps would put the preposition in a place not compatible with the clause-level construction. This is illustrated in Example 85.

Example 85

a. an economic challenge of which the aim is to build up a place of free trade (ICLE)

b. *an economic challenge which the aim of is to build up a place of free trade

The filler *an economic challenge* relates to the noun *aim* in the RC. Fronting places the preposition *of* in clause-initial position (85a). In contrast, stranding would place the preposition neither in clause-initial nor clause-final position but at a point following the head of the preverbal gap site (85b). Since this is not compatible with the clause-level construction, the result is ungrammatical. Compare this to a relative clause with a postverbal nominal or partitive gap site. An example is given in Example 86

Example 86

AIDS, which we have no cure for (LCN)

Here, the head nominal *AIDS* relates to the noun *cure* in the RC and is integrated into the RC as part of the nominal gap site *cure for*. Unlike with preverbal gap sites as in Example 85, stranding places the preposition *for* in a position which matches with the clause-level stranding construction and is therefore grammatical.

Moreover, in most RCs with a nominal or partitive gap site, the prepositions were parts of longer chunks, which influenced their place in the RC. This is illustrated in Example 87.

Example 87

a. the weedy rivulet we never learned the name of (ICE-GB)

b. millions of tiny nerve cells, each of which has long arms or tendrils (ICE-GB)

For one thing, stranding surfaced only with postverbal gap sites, suggesting that the preposition was stranded to keep together collocational item-preposition strings, for example, *name of* (87a). For another thing, nouns and quantifiers which were part of high-frequency item-preposition strings like *each of* were often fronted together with the prepositions to clause-initial position (87b).

4.1.3.7 Preposition Length, Frequency, and Doubled Prepositions

The initial exploration of the data revealed a tendency of long prepositions with three or more syllables to front, for example, *instead of*, *because of*, and *according to*. In contrast, prepositions with one or two syllables like *in*, *on*, *through*, and *about* frequently surfaced in both fronted and stranded position, even though two-syllable prepositions were stranded more frequently than expected. However, the effect was not significant in the regression analysis. This is in line with prior research which expected long prepositions to front but was not able to detect a significant effect once additional variables were factored in (Gries, 2002). This suggests that preposition placement is independent of the length of the preposition and that the apparent preference of long prepositions to front is due to confounding variables, for example, the meaning of the filler.

Moreover, stranding was significantly associated with frequent prepositions. Even though this was predicted from literature (Quirk et al., 1985, p. 664), this comes as a surprise, first, because the visual exploration of the distribution of frequencies across fronting and stranding indicated a higher proportion of low-frequency prepositions in stranding RCs; second, 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 (Quirk et al., 1985, p. 664); and, third, because like length the effect of frequency dropped out as statistically nonsignificant in a multivariate analysis of another study (Gries, 2002). This result is puzzling and requires further exploration in future research.

Last, there were 15 RCs with doubled prepositions in the sample, illustrated again in Example 88.

Example 88

a. the city to which Candide was sailing to (LCN)

b. a series of disasters, in which Rome failed to [...] intervene in (ICE-GB)

Doubled prepositions were also attested in prior research on nonnative English (Bardovi-Harlig, 1987; Kao, 2001), native English (Hoffmann, 2011), and historical English (Yáñez-Bouza, 2015). Developmental and historical linguists seem to agree that doubled prepositions emerge as a kind of transitional construction during a time when language users have not established distinct fronting and stranding constructions yet. Contrary to this conception, however, doubled prepositions were not only attested in the nonnative material but also surfaced in the native material of the current corpus study. On closer examination, what is noteworthy about the RCs with doubled prepositions in the current sample is that all included item-preposition collocations like *speak to*, *control over*, and *conscious of*, which were likely to be chunked and retrieved from memory as units. On the other hand, at least some of the RCs included the high-frequency preposition-item strings *in which* and *to which* or collocational *to whom*, all of which are equally likely to form chunks in memory. On a usage-based view, then, this suggests that doubled prepositions result from a lack of inhibitory control rather than a lack of entrenchment.

4.2 Acceptability Rating Study

The results of the corpus study reported in the previous chapter suggest that preposition placement in English as a second language is contingent on the level of proficiency, the first language, and specific lexicalitems. This chapter reports the rating study, which examines the interplay of proficiency, first language, and specific lexical items more closely. In a magnitude estimation experiment, two groups of German and Chinese learners of English and a group of native English speakers rated the acceptability of fronting and stranding relative clauses with different prepositional verbs. Chapter 4.2.1 describes the participants, experimental material, procedure, and statistical modeling. Chapter 4.2.2 reports the results of the rating task. In Chapter 4.2.3, the results are discussed in relation to prior literature and from a cognitive usage-based perspective.

4.2.1 Methods

Subjects. For the task, 251 participants were recruited online; 11 participants were excluded because English was not their dominant native or nonnative language or

because they were not native Chinese speakers. One participant was eliminated because he entered identical values for all sentences which rendered his ratings statistically irrelevant. As shown in Table 4.17, which summarizes participants' background characteristics, participants were sampled from comparable populations.

Table 4.17: Summary of participants' background characteristics and proficiency measure

Variable	German L1	Chinese L1	English L1
n	100	69	70
Sex (female): n	69	46	45
Age in years: $M(SD)$	25.95 (5.49)	25.32 (3.61)	29.99 (12.99)
English use daily: $M(SD)$[a]	5.13 (1.66)	4.36 (1.91)	6.95 (0.26)
English experience in years: $M(SD)$	15.56 (5.14)	11.55 (4.41)	–
English class recently: n	32	46	–
English level: $M(SD)$[a]	4.77 (1.06)	4.06 (1.25)	7.00 (0.00)
Filler rating: $M(SD)$[b]	11.74 (2.21)	11.80 (1.95)	12.34 (1.26)

[a] Based on 7-point Likert-type scale.
[b] Maximum score = 16.
Note. L1 = first language

However, the German participants reported more daily use of English and longer exposure to English, compared to the Chinese participants. According to self-ratings, the German participants were more proficient users of English than the Chinese participants. Self-reported proficiency levels may, however, not be a reliable measure of language ability because self-reports are known to be influenced by subjective factors such as self-perception, language anxiety, beliefs about language learning, and usage. For example, the daily use of a nonnative language increases self-rated proficiency (Luk & Bialystok, 2013). Accordingly, the German participants felt more confident about their English proficiency than the Chinese participants. Moreover, more of the Chinese than of the German participants had recently taken English foreign language classes, a learning context which is known to raise language anxiety (Horwitz, 2001), which in turn influences self-rated proficiency (MacIntyre, Noels, & Clément, 1997). Therefore, another measure of proficiency was computed based on the participants' responses to filler sentences. This measure likely captured participants' ability to rate filler sentences accurately and, at least to some extent, their degree of commitment to the experimental task (more details below). The groups of German and Chinese participants performed similarly on this measure, $t(3, 813.99) = -0.87, p \geq .05, d = -0.03$, but worse than the English participants, $t(3, 937.96) = -11.04, p \leq .001, d = -0.32$ for German compared to

English participants, and $t(2,828.07) = 9.57, p \leq .001, d = 0.33$ for Chinese compared to English participants.

Material. The target materials included 32 experimental sentences (eight sets of four sentences) and 16 filler sentences. The materials were adopted in part from Hoffmann (2011) to ensure comparability of results. Four lists were compiled and randomized using a Latin-square design. Participants' response to linguistic material is influenced by all kinds of semantic, syntactic, and pragmatic properties of the material. A Latin-square design ensures that all confounding factors are uniformly spread across all experimental conditions. The lists were randomized to counteract fatigue, boredom, and response strategies that the participants may develop over the course of the experiment. The experimental sentences included oblique *wh*-RCs with participant fillers and verbal gap sites, because this type of prepositional RCs has the highest variation in preposition placement in language use (Hoffmann, 2011, p. 148). The experimental sentences systematically varied preposition placement (fronting vs. stranding) and German-English translation equivalence of the prepositional verb (equivalent vs. nonequivalent). This is illustrated in Example 89.

Example 89

a. I know the man on whom Jane relied.

b. I know the man who Jane relied on.

c. I know the man in whom Jane believes.

d. I know the man who Jane believes in.

The preposition was either fronted (89a, 89c) or stranded (89b, 89d). The RC verb was either a prepositional verb with an equivalent translation in German (89a, 89b) or a nonequivalent prepositional verb (89c, 89d). The English prepositional verb *to rely on* is a translation equivalent of German *vertrauen auf*, whereas *to believe in* corresponds to *glauben an*, where German *an* does not match English *in*. When reading *rely on*, German participants might associate the English verb with multiple German verbs, for instance, *verlassen*, *bauen*, *vertrauen*, *sich stützen*, *angewiesen sein*, which for this meaning all combine with the preposition *auf* which in turn is a frequent translation of English *on*. In contrast, English *believe in* translates to German as *glauben an*, where *believe* is equivalent to *glauben* but English *in* rarely corresponds to German *an*. Consequently, a translation equivalent verb would highlight the similarity between German and English RCs, thereby increasing possible effects of cross-linguistic influence for the German participants. This was expected to increase the acceptability of fronting for German learners of English. To

control for potentially confounding influences such as verb frequency and sentence plausibility, verb-specific effects were included as part of item-specific variance in statistical modeling. Moreover, in light of the results of the corpus study, the usage frequencies of specific prepositions and strings were extracted from the BNC, logarithmized, and included for control.

The filler sentences included subject and object RCs, illustrated in Example 90, and were included to disguise the exact purpose of the experiment from the participants.

Example 90

a. There's a bug which has caused major problems.

b. *I does not know anyone else who could does it.

c. *We visited a wood in the morning was an oak wood.

d. **Enjoyed I the time which was I given.

Moreover, the filler sentences were designed to elicit three higher-order levels of acceptability: high level (90a), intermediate level (90b, 90c), and low level (90d). The first type of fillers was grammatical and idiomatic and was intended to elicit high acceptability ratings. Fillers of the second type included subject-verb agreement errors (90b) or omitted the subject of a RC (90c) and were intended to elicit intermediate or low acceptability ratings. The least acceptable fillers of the third type included blatantly obvious word order errors and were intended to elicit low acceptability ratings. The participants' ability to rate fillers according to their acceptability level was conceived of as a measure of their ability to detect and evaluate errors and to cope with the experimental task in general. Between-group differences on this measure were taken as an indicator of differences in proficiency level, as discussed previously in relation to participant groups. Each participant's ratings were divided into tertiles, and an accuracy measure was computed based on the number of accurately ranked fillers. Filler sentences of the first type were considered to be accurately ranked when their scores were in the upper tertile of the respective participant's ratings; the scores for filler sentences of the second type were considered accurate when they fell either within the intermediate tertile or within the bottom tertile; and the scores for filler sentences of the third type were considered accurate if they fell within the bottom tertile. The resulting measure ranged between 0 (i.e., no filler accurately ranked) and 16 (i.e., all fillers accurately ranked) and was factored into the statistical model.

Experimental task and procedure. The acceptability judgment task was adopted

from a procedure used in psychometric research, known as *magnitude estimation*, in which participants estimate some perceptual quality of a stimulus, for example, light intensity, in proportion to a reference stimulus, for example, twice as intense as previous light (see Stevens, 1975). While magnitude estimation might seem overly complicated, compared to categorical scaling through Likert-type scales or other rank-order scales, it is common in linguistic research (e.g., Bard, Robertson, & Sorace, 1996; Cowart, 1997; Featherston, 2005; Hoffmann, 2011, 2013; Sorace & Keller, 2005). Magnitude estimation also avoids some limitations of categorical scaling, such as limited resolution and elicitation of ordinal rather than interval data (K. Johnson, 2008, p. 218; Sorace, 2010). Most importantly, magnitude estimation produces infinitely fine-grained, open-ended scales that pose no restrictions on linguistic intuitions, thus allowing researchers to measure responses to subtle changes in language form and meaning. This is particularly suited for usage-based research that emphasizes the experience-based and dynamic nature of language development. From a usage-based view of language, acceptability is indicative of the degree to which a rated item is prototypical for the exemplified construction with more prototypical exemplars receiving higher acceptability ratings (Hoffmann, 2011, p. 31).

In this study, participants were asked to estimate the acceptability of sentences in proportion to a reference sentence and to express their judgment as multiples or fractions of the reference sentence value. As shown in Example 91, the reference sentence (91a) was preassigned an arbitrary value of 100.

Example 91

a.	I would like to meet people who love to party.	Preassigned:	100
b.	Enjoyed I the time which was I given.	Rating:	*33*
c.	I know the man who Jane relied on.	Rating:	*75*
d.	There's a bug which has caused major problems.	Rating:	*200*

Participants were instructed to indicate the acceptability of each sentence based on their feeling of what sounded idiomatic and acceptable rather than on plausibility or knowledge of school grammar (see Appendix). For example, a participant might consider the sentences shown in Examples 91b through 91d a third, three-quarters, and twice as acceptable as the reference sentence (91a), respectively. To express her intuition, she would assign 33 ($^1/_3 \times 100$), 75 ($^3/_4 \times 100$), and 200 (2×100) to each sentence.

The single reference sentence (91a) remained on screen throughout the experiment. The target sentences were displayed below the reference sentence at self-paced

speed, and only the reference sentence and the currently rated sentence were visible on screen. Participants were not allowed to go back and change previous ratings. Each participant completed a randomized list of eight experimental sentences (one sentence per set) and 16 filler sentences, for a total of 24 sentences (see Appendix). Before the experiment, they completed a questionnaire and six practice trials that were different from the experimental materials. The time required to complete the entire experiment was not recorded. In offline pilot studies, participants took around 30 minutes to complete the entire task. The experiment was conducted online following guidelines for online experiments (Reips, 2002) and using the Ibex farm software and server (Drummond, 2013). The link to the experiment was distributed online through social networks and lists. As a reward for their participation, all participants took part in a raffle to win several prizes.

Statistical modeling. For statistical analysis, ratings were log- and z-transformed. In a repeated-measures design, two linear mixed-effects regression models were fitted to the data: one compared responses of different participant groups (native vs. nonnative) to determine the difference between first and second language acquisition; and one compared responses by nonnative participants with different first languages (German vs. Chinese) to examine the effect of different native languages in nonnative language learning. This type of model captured subject- and item-specific variance in the dependent variable in a random component and was therefore suitable for a repeated-measures design. Experimental variance was captured in a fixed component, and the optimal configuration of the components was determined in a top-down procedure in which different models were compared based on successive likelihood ratio tests, AIC-, and BIC-values (Zuur et al., 2009). First, a beyond-optimal model was computed including all experimental variables, learner background and control variables, and their interactions in the fixed component. In addition, trial number was included to control for fatigue and order effects. Then, to determine the optimal configuration of the random component, multiple beyond-optimal models with random components of varying complexity were compared while keeping the fixed component constant. In addition to random intercepts for subjects and items required by the repeated-measures design, random slopes for the by-subject effects of preposition placement and translation equivalence were required for optimal fit. Following this, to determine the optimal configuration of the fixed component, interactions and variables were dropped one by one, and each resulting model was compared to the previous one while keeping the random component constant. For cross-validation, the final models were refitted 100 times on random samples yielding robust R^2 and RMS error values (K. Johnson, 2008, pp. 239-240).

The statistical analysis was carried out in R (R Core Team, 2013). The linear mixed-effects regression models were fitted with the lme4 package (D. Bates et al., 2015); p values and degrees of freedom were computed with the lmerTest package based on Satterthwaite's approximations (Kuznetsova, Brockhoff, & Christensen, 2016). As a measure of explained variance, two types of R^2 were computed with the MuMIn package (Bartoń, 2016): marginal R^2, which is concerned with variance explained by the fixed component of the model, and conditional R^2, which is concerned with variance explained by both fixed and random components, that is, the complete model (Nakagawa & Schielzeth, 2013).

4.2.2 Results

The first (preliminary) analysis targeted the proficiency variable, to determine similarities and differences across the three native language groups (English, German, Chinese). Proficiency was computed based on each participant's ability to rank three types of filler sentences accurately. Three higher-order levels of acceptability emerged from the distribution of the participants' acceptability ratings across filler types, as anticipated. This is illustrated in Figure 4.7.

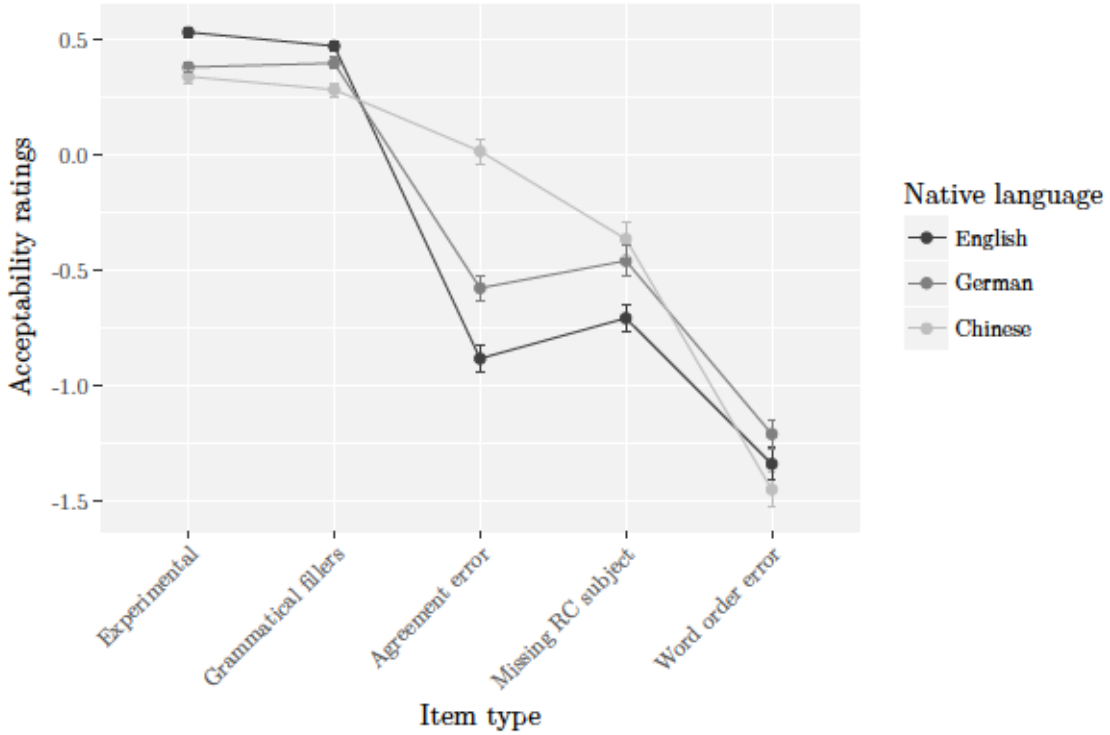


Figure 4.7: Mean acceptability ratings by item type and native language. Error bars represent ±1 standard error. RC = relative clause

The first type of filler sentences (grammatical) elicited high acceptability ratings

($M = 0.39$), the second type (agreement error, missing RC subject) elicited intermediate to low acceptability ratings ($M = -0.49$), and the third type (word order error) was associated with even lower acceptability ratings ($M = -1.33$). The three levels of acceptability were confirmed by a series of t tests. There were significant mean differences in acceptability ratings between the first and second type of filler sentences, $t(996.8) = 23.36, p \leq .001, d = 1.19$, and between the third and the fourth type, $t(1,157.1) = 14.62, p \leq .001, d = 0.82$, but not between the second and the third type, $t(1,082.88) = 0.18, p \geq .05, d = 0.01$. Moreover, grammatical fillers were on par with experimental sentences, $t(3,809.12) = 1.28, p \geq .05, d = 0.04$.

This suggested that on average participants were able to rate filler sentences accurately according to their acceptability and that, therefore, rating ability was a valid way to approximate each participant's level of proficiency. Moreover, native English speakers were more sensitive than the nonnative participants to agreement errors, $t(442.45) = -7.89, p \leq .001, d = -0.61$, and to missing RC subjects, $t(352.61) = -3.88, p \leq .001, d = -0.34$. Grammatical fillers were also significantly more acceptable to the native speakers than to the nonnative participants, $t(1,251.19) = 3.99, p \leq .001, d = 0.19$, and grammatical fillers were more acceptable to the German than to the Chinese participants, $t(1,189.68) = 3.04, p \leq .01, d = 0.17$. These between-group differences in responses to grammatical fillers were, however, of negligible size ($d < 0.2$). Last, the German participants rated the filler sentences with agreement errors significantly lower than the Chinese participants, $t(487.81) = -7.72, p \leq .001, d = -0.67$, whereas the Chinese participants were more sensitive to word order errors than the German participants, $t(429.73) = 2.45, p \leq .05, d = 0.22$. To summarize, even though the nonnative learners in this study were at similar proficiency levels and on average performed in a nativelike manner on grammatical filler sentences, they responded to the target materials in first-language-specific ways.

The next analysis compared the findings for different learner groups (native vs. nonnative), that is, native English speakers and nonnative participants, thus exploring the question of whether response patterns were different between native and nonnative language users. Averaging across learner groups, stranding received higher acceptability ratings than fronting ($M = 0.47$ for stranding and $M = 0.36$ for fronting), $t(1,889.49) = -3.73, p \leq .001, d = 0.17$. Stranding was, however, more acceptable than fronting for the nonnative participants, while no distinct preference was observed for the native speakers, who slightly favored fronting over stranding. Moreover, there was an effect of learner group, such that the acceptability of oblique RCs in general was lower in the nonnative learners than in the native speakers. Fig-

ure 4.8 illustrates this finding graphically. While the plot suggests a slight preference for fronting over stranding for the native speakers, the statistical model indicated that preposition placement had no significant effect on their ratings. The interaction between participant group and preposition placement was significant, and the acceptability of oblique RCs in general increased with daily use of English and English proficiency. The model is summarized in Table 4.18.

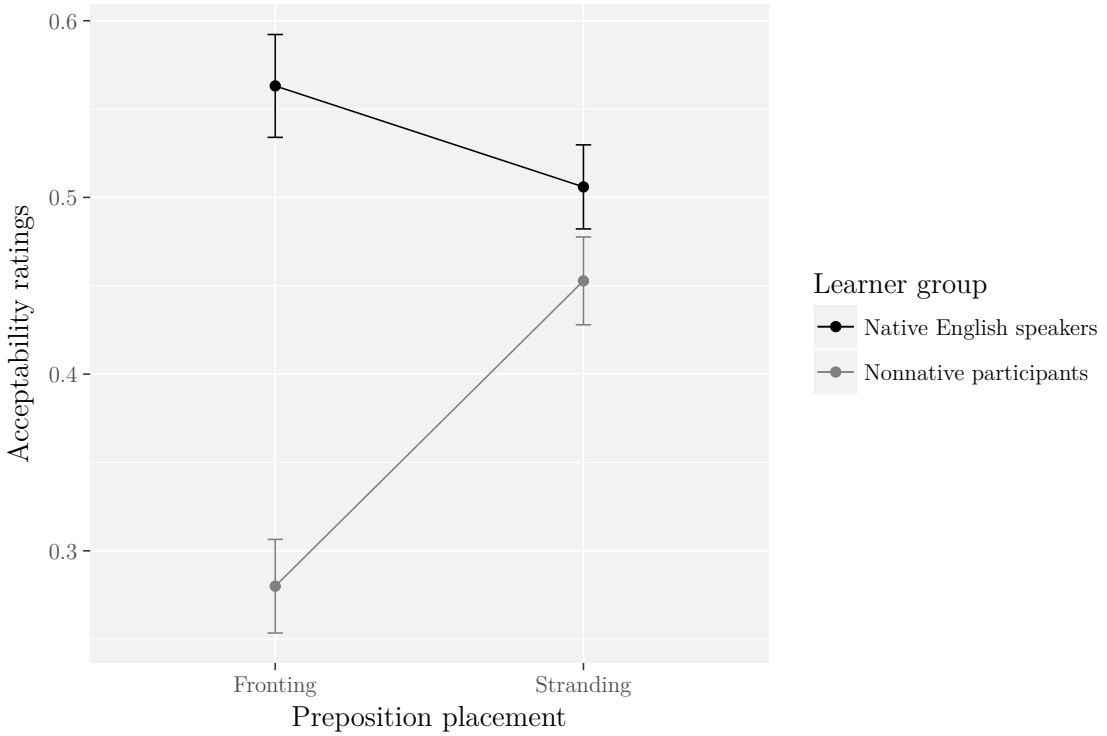


Figure 4.8: Mean acceptability rating of preposition fronting and stranding for native English speakers and nonnative participants. Error bars represent ±1 standard error.

The final analysis targeted the ratings provided by the German and Chinese learners of English. Fronting was on average more acceptable for the German than for the Chinese participants. Moreover, the two-way interaction between preposition placement and native language was influenced by the measure of proficiency, that is, participants' ability to rate filler sentences accurately, which is illustrated in Figure 4.9. Solid lines represent means, gray bands confidence intervals, and dark gray dots partial residuals.

For the Chinese participants (left column panels), stranding evinced high levels of acceptability in low-proficiency participants, but acceptability decreased with increasing proficiency (upper left panel); fronting was associated with low levels of acceptability for low-proficiency participants, but acceptability increased with increas-

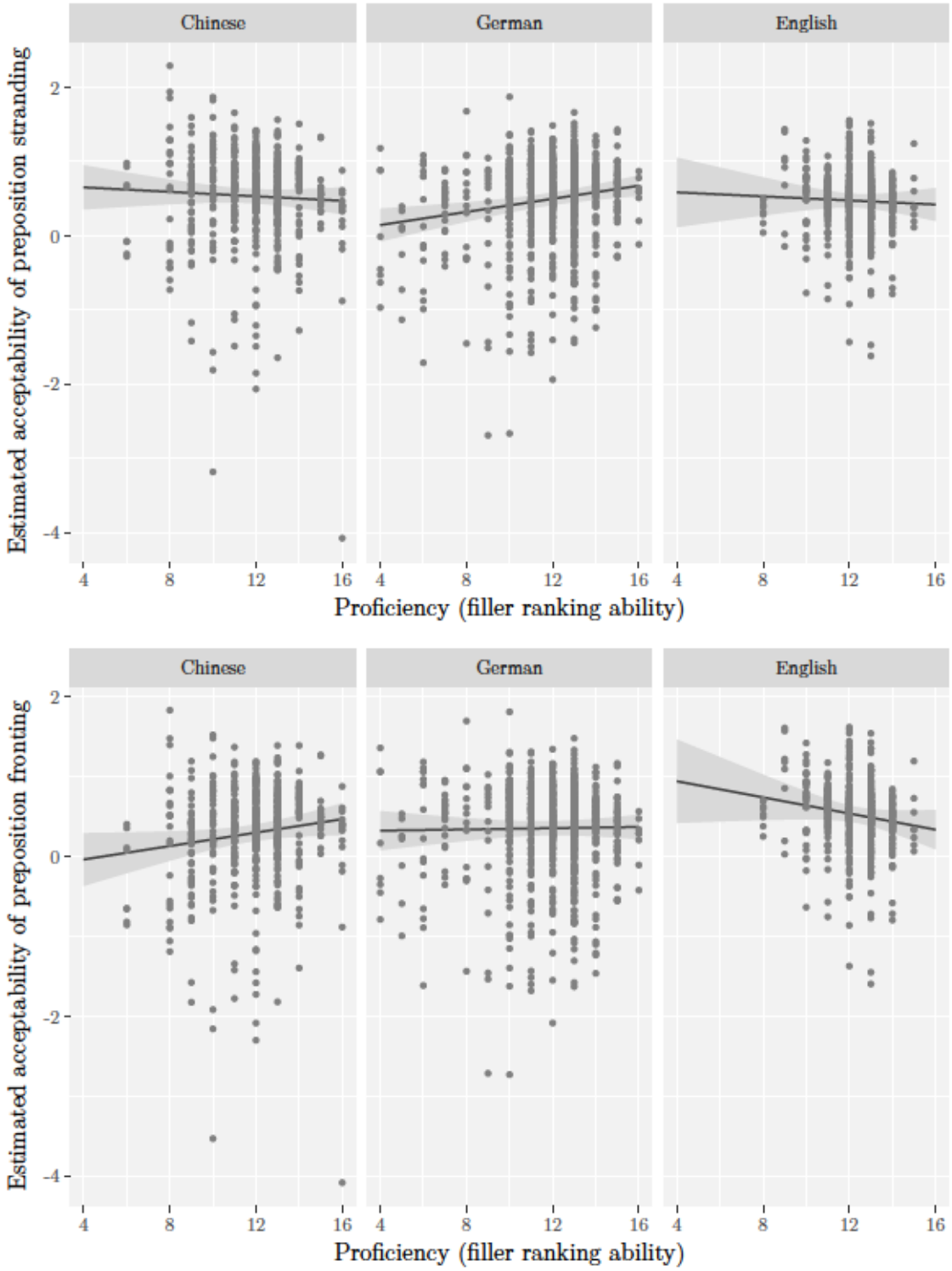


Figure 4.9: Acceptability ratings by preposition placement, native language, and proficiency/commitment (filler rating).

Table 4.18: Linear mixed-effects regression model for acceptability ratings by preposition placement and learner group (native vs. nonnative)

Intercept	0.08 (0.12)
Stranding	−0.05 (0.06)
Nonnative learners	−0.18*** (0.05)
Daily use of English	0.04*** (0.01)
Proficiency (filler ranking ability)	0.01 (0.01)
Stranding × Nonnative learners	0.23*** (0.07)
Marginal R^2	0.04
Conditional R^2	0.16
Observations	1,912

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

ing proficiency (lower left panel). In contrast, for the German participants (middle column panels), stranding evinced low levels of acceptability for low-proficiency participants, and increased in acceptability with increasing proficiency (upper middle panel), whereas fronting received invariably high levels of acceptability (lower middle panel). These results contrasted with the response pattern obtained from the native English speakers (right column panels), for whom the ability to rate filler sentences accurately was likely more indicative of their degree of commitment to the experimental task than of their proficiency level. Notably, the proficiency measure still had an effect on the acceptability of fronting and stranding. While stranding was consistently associated with low levels of acceptability (upper right panel), fronting was linked to high levels of acceptability for participants with low commitment, and decreased in acceptability with increasing commitment (lower right panel). At the highest level of proficiency/commitment, acceptability estimates tended to converge across the participant groups. The statistical model indicated that the two- and three-way interactions between preposition placement, native language, and proficiency/commitment were significant or approached significance. Moreover, as in the first model, the acceptability of oblique RCs in general significantly increased with daily use of English. The predicted effect of translation equivalence was not significant, and so this variable was dropped from the model. The final model is summarized in Table 4.19.

Table 4.19: Linear mixed-effects regression model for acceptability ratings by preposition placement, native language, and proficiency (filler rating)

Intercept	−0.46 (0.25)
Proficiency (filler rating ability)	0.04* (0.02)
Stranding	0.92** (0.34)
German L1	0.51 (0.30)
English L1	1.35** (0.46)
Daily use of English	0.04*** (0.01)
Proficiency × Stranding	−0.06* (0.03)
Proficiency × German L1	−0.04 (0.03)
Proficiency × English L1	−0.09* (0.04)
Stranding × German L1	−1.26** (0.42)
Stranding × English L1	−1.42* (0.63)
Proficiency × Stranding × German L1	0.10** (0.04)
Proficiency × Stranding × English L1	0.09 (0.05)
Marginal R^2	0.05
Conditional R^2	0.16
Observations	1,912

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

4.2.3 Discussion

4.2.3.1 Summary of Findings

In a magnitude estimation task, groups of German and Chinese nonnative speakers of English and a group of native speakers of English rated the acceptability of English oblique *wh*-RCs. The RCs varied in preposition placement and the English-German translation equivalence of the verb. On average, stranding was more acceptable than fronting. However, acceptability was influenced by a range of interacting variables. Two linear mixed-effects regression models were fitted to the data to determine the effects of preposition placement (fronting vs. stranding), learner group (native vs. nonnative), and nonnative learners' first language (German vs. Chinese) on acceptability. The participants' rating of filler sentences – as a measure of proficiency and commitment to the experimental task – was factored into the statistical models, along with a series of learner background variables, trial number, and interactions among preposition placement and usage frequencies of prepositions and lexical strings. The results indicated an effect of learner group such that stranding was more acceptable than fronting for the nonnative participants while the native participants exhibited a noticeable but nonsignificant preference for fronting. Moreover, acceptability was contingent on an interaction between preposition placement,

learners' first language, and their proficiency.

For the German participants, fronting was consistently associated with high acceptability levels, whereas stranding elicited low acceptability levels in low-proficiency participants but improved as proficiency increased. In contrast, for the Chinese participants, fronting evinced low levels of acceptability in low-proficiency participants and increased in acceptability as they became more proficient, whereas stranding elicited high acceptability levels in low-proficiency participants and decreased as their proficiency increased. Importantly, fronting was on average more acceptable to the German than to the Chinese participants. For the native English speakers, the ability to rate filler sentences likely indicated only the degree of their commitment to the experimental task rather than proficiency. For them, fronting was associated with high levels of acceptability for low-commitment participants and decreased with increasing commitment, whereas stranding received comparatively low levels of acceptability at all levels of commitment. At the highest level of proficiency/commitment, mean acceptability estimates of all participant groups tended to converge. Moreover, the acceptability of oblique RCs in general tended to increase with daily use of English. The German participants were particularly sensitive to agreement errors in the filler sentences, whereas the Chinese participants were sensitive to word order errors.

In line with the majority of prior research (Bardovi-Harlig, 1987; Kao, 2001; Rezai, 2006; Sadighi et al., 2004), the nonnative learners in this study tended to favor stranding over fronting. However, contrary to other research (McDaniel et al., 1998), no distinct preference for stranding was observed for the native English speakers. These findings align well with the results of two experiments by Hoffmann (2007, 2013) that were similar in method, materials, and procedure[1]. Hoffmann asked 36 German learners of English and 36 native English speakers to estimate the acceptability of English oblique RCs varying in preposition placement, relativizer, and the meaning of the filler within the RC. As summarized in Table 4.20, German nonnative learners of English appeared to produce similar acceptability ratings in the current study and Hoffmann's experiments, and native English speakers favored fronting over stranding across both sets of studies. However, the preference for fronting was more pronounced in Hoffmann's native speakers, and acceptability ratings were on average higher.

[1]Thanks to Thomas Hoffmann for making his data available.

Table 4.20: Comparison of acceptability ratings (means, standard deviations) for English preposition placement from Hoffmann (2007, 2013) and the current study

	Hoffmann studies		Current study		
Placement	English L1	German L1	English L1	German L1	Chinese L1
Fronting	0.90 (0.74)	0.31 (0.93)	0.56 (0.49)	0.31 (0.67)	0.21 (0.76)
Stranding	0.79 (0.50)	0.50 (0.80)	0.51 (0.40)	0.45 (0.62)	0.49 (0.57)

4.2.3.2 Acceptability Changes with Input Frequency and Proficiency

Taken together, the current findings suggest that the acceptability of oblique RCs depends on interactions among preposition placement, learner group (native, nonnative), and learners' first language (German, Chinese). Acceptability changes with proficiency following first-language-specific developmental patterns and tend to converge at the highest level of proficiency. The gradual development of acceptability with improving proficiency implies that the acquisition of preposition placement is influenced by learners' accumulating experience of language use. According to usage-based researchers (Bybee, 2010; Diessel, 2016; N. C. Ellis, 2012a), constructions emerge from language use and therefore retain traces of their distribution in learner input. More specifically, linguistic constructions represent patterns within and across forms and meanings recurring in learners' input. Constructions become entrenched more deeply in memory each time a learner experiences and processes them. With time and experience, language learners gradually become attuned to the distributional characteristics of their input and tailor their constructions to more fine-grained contexts of use. On this view, the nonnative learners and native speakers in this study likely became attuned to the distribution of fronting and stranding in their English input. The distribution of fronting and stranding in native English is outlined in Table 3.1 and in Table 3.2. As the figures in the tables indicate, stranding is in total more common than fronting in English but the distribution is reversed in the context of *wh*-RCs where fronting is more common than stranding. On the assumption that the figures approximate the distribution of fronting and stranding in learner input, this suggests that the different learner groups in this study had become attuned to different frequency distributions in their input and weighted their constructions accordingly. The nonnative learners had likely become attuned to the total relative frequencies of fronting and stranding, which was reflected in their acceptability ratings. Because they had experienced stranding more often than fronting across all clause type contexts in their input, stranding had become more entrenched and also more acceptable to them than fronting. In contrast,

the native English speakers had likely become attuned to conditional relative frequencies, resulting in a preference for fronting in *wh*-RCs. Since the experimental materials only included *wh*-RCs, fronting was more acceptable than stranding for this group.

However, this view captures only part of the picture. Importantly, the interaction with proficiency indicated that the nonnative learners became more nativelike with increasing proficiency, suggesting that they gradually adjust their constructions from total to conditional relative frequencies. At a low level of proficiency, the nonnative participants in the current study favored stranding over fronting, comparable to the young learners acquiring English as their native language in another rating study (McDaniel et al., 1998). Despite the association of *wh*-RCs with fronting in English, both groups of novice learners (nonnative and native) rated stranding as more acceptable than fronting in *wh*-RCs, arguably because they relied on the total rather than the conditional relative frequency of fronting and stranding in their input which is skewed in favor of stranding. This suggests that novice learners model their constructions in accordance with the total relative frequency of instantiations in their input. With increasing proficiency and experience, learners gradually adjust their constructions to more fine-grained contexts of use in their input and learn to associate fronting with *wh*-RCs. This was evident from the native ratings in this study. Fronting was on average more acceptable than stranding for the native participants, who were adult native speakers of English and hence on a high level of proficiency and experience. Moreover and importantly, while stranding was on average more acceptable than fronting for nonnative participants, the nonnative ratings approximated mean native ratings at high levels of proficiency, indicating that the advanced nonnative participants had fine-tuned their constructions to align their language use more closely with specific contexts of use in their input.

The usage-based interpretation of native speaker and nonnative learner behavior in this study aligns well with research on the sensitivity of processing to usage frequency, suggesting that nonnative language use reflects relatively coarse-grained frequency distributions. For example, results from a psycholinguistic processing experiment by N. C. Ellis et al. (2008) indicated that nonnative language users were more sensitive to total string frequency than native language users, who in turn had become attuned to the collocational strength of strings. Moreover, analyzing native and nonnative corpus samples, Durrant and Schmitt (2009) found that nonnative language users heavily relied on high-frequency collocations but underused low-frequency strings of strongly associated items. In line with the power law of practice (Newell, 1990), N. C. Ellis et al. (2008) argued that the difference is due

to different amounts of experience and input. Nonnative language learners are at a low level of experience and therefore heavily rely on total counts when acquiring constructions. In contrast, the effect of increased total frequency on learning levels out and eventually reaches asymptote at high levels of exposure. As a consequence, native language users who are at a high level of experience become more insensitive to differences in total frequency and instead become attuned to collocational patterns and more fine-grained contexts.

In a similar way, the nonnative learners in this study had acquired fronting and stranding based on total relative frequencies, that is, based on total counts of fronting and stranding across all clause type contexts in their input, resulting in an advantage of stranding over fronting. For the native English speakers, the effect of increasing exposure to stranding had likely leveled out and instead they had learned to associate constructions with particular contexts where they had experienced them most frequently. Therefore they favored fronting over stranding in the context of *wh*-RCs. The difference was most pronounced between native speakers and nonnative learners at a low level of proficiency. With increasing proficiency, the nonnative learners approximated mean native ratings of fronting and stranding. On the assumption that proficiency correlates with experience and input, this indicates a change in sensitivity of behavior to usage frequency with increasing experience, as predicted by the power law of learning. More experienced learners become sensitive to more fine-grained usage patterns in their input and gradually adjust their constructions from total relative frequency to conditional relative frequency distributions of fronting and stranding.

This is also in line with the results of the corpus study reported above. The distribution of fronting and stranding across different corpora suggests that the advanced writers of the ICE-GB corpus favored fronting in *wh*-RCs, while the novice writers of the LCN, ICLE, and YELC corpora were more inclined to strand prepositions. This was arguably due to different levels of proficiency and experience. However, the association was confounded by differences in style and text type across corpora, which might have been responsible for more fronting in the ICE-GB corpus. Moreover, proficiency had not been reliably documented. In the current rating study, confounding factors were controlled for by a Latin-square design. Concerning proficiency and experience, different measures of experience were elicited by a questionnaire and a more elaborate subject-specific proficiency measure was computed based on each participant's ability to rate filler sentences accurately. Thus, following up on the corpus study, the rating study ruled out that observed differences between native and nonnative language users are due to confounding variables such as style and

text type. Together, the corpus and the rating study suggest that both native and nonnative language learners attune their constructions to distributional patterns in their input and with increasing experience and proficiency gradually shift from context-independent to more context-dependent distributions.

Given the distribution of fronting and stranding in *wh*-RCs, the native speakers of English were expected to have developed a distinct preference for fronting, similar to the preference reported for native speakers by Hoffmann (2007, 2013). However, for the sample of native speakers in this study, their preference for fronting was noticeable but weak and nonsignificant. This was likely due to the effects of specific experimental materials, register, and test modality, all of which disfavored fronting or favored stranding. First, with respect to the experimental materials, preposition placement was influenced by the meaning of the filler within a RC. In particular, fronting is favored in the context of adverbial but disfavored in the context of oblique RCs with participant fillers (Hoffmann, 2011, p. 167; C. Johansson & Geisler, 1998). For example, the higher frequency of fronting in *wh*-RCs in Table 3.1 is to a great extent due to fronting-only adverbial RCs (336 of 761 *wh*-RCs), such as those of respect, manner, or frequency (Hoffmann, 2011, p. 161). Because the experimental materials included only oblique RCs, the native speakers may have rated stranding in *wh*-RCs as being more acceptable than expected or substantially lowered their ratings for fronting.

Second, with respect to register, fronting is disfavored in stylistically informal contexts (Hoffmann, 2011, p. 167). For example, C. Johansson and Geisler (1998, p. 72) found a distinct preference for fronting over stranding in formal monologues (76% vs. 25%)[2] but only a slight preference in informal dialogues (54% vs. 46%). Stylistically low and informal registers are typical of all social networks where the participants of this study had been recruited, so this effect probably contributed to the unexpectedly low ratings for fronting in the current sample of native speakers. Third, with respect to modality, fronting is more common in written than in spoken language. Johansson and Geisler (1998, p. 79) also found a distinct preference for fronting over stranding in the written London-Oslo/Bergen corpus (97% vs. 3%) but a considerably higher proportion of stranding in the spoken London-Lund corpus (79% vs. 21%). Moreover, prepositional RCs were about twice as frequent in the written as in the spoken corpus. These differences seem likely to be at least in part due to correlated effects of register and style. Thus, language users with a higher amount of reading experience and more exposure to (formal) writing would be expected to develop an above-average preference for fronting and prepositional

[2]Rounding error in the original.

RCs in general. In this regard, only about half of the native speakers in this study (36 out of 70) were university employees and students or worked in a field that requires a lot of reading (e.g., text editing). In contrast, all native speakers tested by Hoffmann (2007, 2013) were university students and lecturers, which might explain the differences in native speaker performance across the studies. To summarize, the native English speakers in this study likely had become attuned to conditional relative frequencies of finer-grained contexts of RC use than had been expected initially.

Last, independent of preposition placement, the acceptability of oblique *wh*-RCs increased with daily use of English and proficiency. From a usage-based view, this is likely due to the effect of increased exposure. Experienced learners of English had processed oblique RCs more frequently than inexperienced learners, so the construction had become more deeply entrenched and thereby gradually increased in acceptability.

4.2.3.3 Acceptability Increases with Cross-linguistic Similarity

With increasing experience, as they "figure language out" (N. C. Ellis et al., 2008, p. 373), nonnative learners likely become attuned to the conditional relative frequencies of preposition placement in English and gradually approach native English speakers in their acceptability ratings. This was most evident in the ratings obtained from the Chinese participants. For the low-proficiency Chinese participants, stranding was considerably more acceptable than fronting, reflecting total relative frequencies in their input. With increasing proficiency, these learners gradually became more nativelike in their acceptability ratings as they adjusted their constructions to conditional relative frequencies in their input. Like the Chinese participants, the German participants gradually became more nativelike in their ratings as their proficiency improved. However, their response pattern deviated from what one would expect based on input frequency alone. Contrary to expectations, stranding elicited low acceptability levels for the low-proficiency German participants, which increased with greater proficiency, whereas fronting was consistently associated with high levels of acceptability.

Following previous cross-language studies (Mazurkewich, 1985), the difference in the responses of the Chinese and German participants was likely due to cross-linguistic influence based on word order similarity between English and German fronting RCs. Put differently, the German learners of English probably relied on their first-language experience of using fronting in RCs when acquiring preposition placement in English as a second language. Recall that in German RCs only fronting

is grammatical. Prototypical English and German RCs with fronted prepositions have a similar word order, with shared grammatical roles, as illustrated above. This is exemplified again in Example 92.

Example 92 (LCC)

a. *die Zeit, in der du bereust, dass...*
the time in which you regret that

"the time during which you regret that..."

b. *den ganzen Prunk, an den ich nicht glaube*
this all splendor at which I not believe

"all this splendor in which I do not believe?"

c. **den ganzen Prunk, den ich nicht an glaube*
this all splendor which I not at believe

The German RCs overlap with their English translations in word order. In Example 92a the RC *in der du bereust* ("during which you regret") modifies the head noun *Zeit* ("time"). In Example 92b the RC *an den ich nicht glaube* ("in which I do not believe") modifies the nominal *ganzen Prunk* ("all [this] splendor"). Both German RCs, like their English counterparts, follow the modified nouns and front prepositions to a clause-initial position preceding their relative pronouns. The word order is Adv Subj V and Obj Subj V, respectively. In German, the meaning of the filler in fronting RCs ranges from participant fillers playing the object role in the RC (92b) to adverbial fillers of time (as in 92a), place, and manner. In English, there is a tendency to strand the preposition in the context of participant fillers, which does not completely override the opposing tendency to front prepositions in *wh*-RCs (Hoffmann, 2011, p. 167). Moreover, stranding is not grammatical in German RCs (92c).

Thus, one reason why fronting was more acceptable to the German than to the Chinese participants concerns the similarity between German and English fronting in RCs. On a usage-based account, German learners of English likely draw on their first-language construction to process similar RCs in their second-language English input. Each encounter of fronting in RCs in their input strengthens the memory representation of fronting. From reinforcement of commonalities across exemplars and languages, German learners of English acquire an interlingual diaconstruction (Höder, 2012, 2014a) which links their existing German construction to the emerging English construction of RCs with fronting. The emerging diaconstruction generalizes

over exemplars of prepositional RCs in their German and English input and represents overlapping properties, in particular, the fronted preposition and the OBJ SUBJ V word order of the RCs. The frequency of fronting accumulates across languages resulting in a high degree of entrenchment (Runnqvist et al., 2013) which was reflected in the high acceptability of fronting in the ratings by the German participants. Because such a diaconstruction is built upon an already entrenched German structure, increased input of fronting in English RCs may reinforce the emerging diaconstruction but has little effect on learning fronting, which levels out at high levels of exposure. As a consequence, the acceptability of fronting was invariably high across proficiency levels for the German participants. With learner processing being tuned to fronting, the effect of higher frequency of stranding in learner input is attenuated and delayed. As a result, the acceptability of stranding was low in low-proficiency learners and only gradually increased with proficiency and exposure.

In contrast, in Chinese, neither preposition fronting nor stranding is grammatical. This is illustrated above and is exemplified again in Example 93.

Example 93 (Li & Thompson, 1981, p. 582)

wǒ	*xiě*	*xìn*	*de*	*máobǐ*
I	write	letter	REL	brush pen

"the brush pen with which I write letters"

The RC *wǒ xiě xìn* ("I write letters") precedes the modified noun *máobǐ* ("brush pen") and is marked by the relativizer *de* as a nominalization. Importantly, unlike in the English translation, the instrument filler is not marked by an item equivalent to English *with*. Accordingly, in contrast to German learners, Chinese learners of English are not likely to draw on their first-language experience when acquiring preposition placement in English RCs. Their development is instead driven only by the distribution of fronting and stranding in their English input. As expected, then, Chinese learners developed a preference for preposition stranding early in their learning, which reflected the total relative frequency distribution of fronting and stranding in their input, and then gradually, with increasing experience, approximated the native acceptability ratings, suggesting that they acquired a context-specific preference for preposition fronting in *wh*-RCs.

This is also consistent with the findings of the corpus study. The findings suggested that writers with a European fronting-only native language like German are more likely to front prepositions than native English writers, arguably due to cross-linguistic similarity between fronting RCs in English and their native language. By

comparison, writers with a typologically distant and different East Asian native language like Chinese were not significantly different from the native English writers, suggesting that their language use directly mirrored the distribution of fronting and stranding in their English input. Confounding variables, in particular, proficiency, were controlled for in the rating study, indicating that the effect of native language group was consistent across both studies. Together, the corpus and the rating study strongly suggest that nonnative learners draw on similar constructions from their first language when acquiring preposition placement in English as a second language, which leads to a gain of fronting for learners who have already established a fronting construction in their native language.

The effect of learners' first language on their acceptability ratings was also evident in their responses to filler sentences. To determine grammatical relations in their native language, German speakers should demonstrate high sensitivity to inflectional cues marked on the verb (and nominals). In line with this language-specific prediction, the German participants were particularly sensitive to subject-verb agreement errors in the filler sentences. In contrast, speakers of an isolating language like Chinese should have comparatively little experience processing inflectional cues but should rely on word order to mark grammatical relations in their native language. Consequently, the Chinese participants were relatively insensitive to agreement errors in the filler sentences but rated word order violations lower than the other participant groups.

4.2.3.4 Translation Equivalence and Interlingual Diaconstructions

The German participants in this study had arguably acquired a highly schematic, abstract diaconstruction representing word order in prepositional RCs across their languages. This does, however, not rule out the existence of constructions at a more specific level of representation. Usage-based researchers not only argue that constructions retain traces of their use, but they also assume that learners acquire a network of item-based, partially schematic constructions (Diessel, 2016). As was evident from the corpus study, the distribution of fronting and stranding in language use depends on various factors, for example, the meaning of the RC filler, the relativizer, the gap site, and item-specific effects of particular prepositions and lexical strings. In a usage-based view, this suggests that language users have established fronting and stranding constructions at different levels of specificity to represent both item-specific distributions and more schematic usage constraints. For instance, Hoffmann (2011, p. 73) found that specific manner, degree, and frequency adverbial head nominal-preposition strings such as *way in*, *frequency with*, and *rate at* were

strongly associated with fronting. Some prepositions only occurred with fronting, for example, *during*, *beyond*, *by means of*, and *because of*. Fronting is also generally required in *wh*-RCs when the RC is nonfinite, as in *the day on which to arrive* (Hoffmann, 2011, p. 38), and with nominal gap sites, as in *to the left is a door to which* [$_{\text{NP}}$ *the key* ____] *has been lost* (Huddleston & Pullum, 2002, p. 630). Similar findings were obtained from the corpus study. None of these construction types were part of the experimental materials though; instead, the material systematically varied the English-German translation equivalence of the prepositional verb within the RCs (equivalent vs. nonequivalent).

On this account, translation-equivalent verbs were anticipated to activate fronting constructions on an item- and language-specific level of representation, thereby highlighting the similarity between German and English constructions of oblique RCs and increasing the acceptability of fronting for German learners of English. However, contrary to expectations, translation-equivalent verbs had no significant effect on the acceptability of fronting. This type of item-specific use was apparently not represented in the learners' construction, which implies that the fronting diaconstruction acquired by the German learners of English was highly schematic. However, before definitive conclusions are reached, a more careful operationalization of translation equivalence of prepositional verbs is needed in future studies so that cross-linguistic similarity between verbs is controlled more carefully.

As regards the meaning of the RC filler, the results of the rating study are consistent with findings that stranding is associated with participant fillers. The experimental material included only this type of RCs. Moreover, all experimental RCs had a verbal gap site, meaning that the filler was integrated into the RC as part of the RC verb phrase. Verbal gap sites are known to increase stranding, compared to nonverbal gap sites (e.g., Hoffmann, 2011, pp. 155, 167; Trotta, 2000, pp. 184–185). In line with this, stranding was in general acceptable in this context. Stranding RCs were on average at a significantly higher level of acceptability than ungrammatical filler sentences across participant groups. Since none of these variables were varied systematically in the experiment but were held constant, the results of the rating study do not allow strong conclusions as to whether the participants had acquired any more specific constructions and, if so, what these constructions looked like.

4.2.3.5 Notes on Complexity and Prescription

Concerning complexity, the results suggest that stranding was not more complex to process than fronting. This is contrary to expectations based on the distance between filler and gap, according to which stranding is more complex and therefore

more difficult to process than fronting (Gibson, 1998; J. A. Hawkins, 1999, 2004; Jespersen, 1927). On this view, one would expect the asymmetry in complexity to be reflected in the acceptability ratings such that stranding would on average elicit lower acceptability ratings than fronting. Contrary to this expectation, however, acceptability ratings were on average not lower for stranding compared to fronting RCs. On the opposite, averaging across all participant groups, stranding was more acceptable than fronting. Nonnative participants in particular rated stranding on average as more acceptable than fronting, suggesting that stranding was not associated with increased processing load for them. This suggests that preposition stranding is not inherently more complex to learn and to process than fronting. This is in line with the findings of the corpus study, which indicated no correlation between preposition placement and different complexity measures. All in all, the findings cast serious doubt on the relationship between preposition placement and complexity postulated elsewhere (Hoffmann, 2011, pp. 93–98, 168; Gries, 2002; J. A. Hawkins, 1999).

Last, linguistic prescription seems to have had little influence on the acceptability ratings. This is all the more surprising because the participants were explicitly instructed to indicate by their ratings what sounded acceptable to them. Based on the long-standing stigmatization of stranding as bad English (Yáñez-Bouza, 2015, pp. 56–105), which has survived to some degree into modern linguistic descriptions (Huddleston & Pullum, 2002, p. 628; König & Gast, 2009, p. 193), one would probably expect that stranding is unacceptable, especially, for language users like the nonnative participants of this study, who had acquired English for the most part in classroom contexts where the focus is typically more on producing target forms than on communicative success. However, contrary to this expectation, there was little evidence in the ratings to suggest that the participants in this study considered stranding as problematic. Nonnative participants in particular indicated a preference for stranding, suggesting that they were insensitive to or ignorant of prescriptive norms against stranding. This is consistent with findings from native learner studies, which indicate increased acceptability of fronting around the age when schooling begins but consistently high acceptability of stranding across different age groups (McDaniel et al., 1998). Alternatively, the participants might have been influenced by the explicit instructions not to rely on their school grammar and as a consequence decided to base their ratings on the perceived degree of idiomaticity only. However, this would seem to imply an implausibly high degree of awareness of the experimental design and the involved linguistic knowledge.

Chapter 5

Discussion

The results of the corpus and the rating study have been discussed at length in Chapters 4.1.3 and 4.2.3, respectively. In this chapter, the focus is on the key results of both studies and the overarching research questions:

1. What is the relationship between the usage distribution of fronting and stranding and the acquisition of preposition placement in English as a second language?
2. What is the role of first-language experiences in the acquisition of preposition placement in English as a second language?
3. What is the effect of specific lexical items and strings on preposition placement in native and nonnative English?

5.1 Summary of Findings

In the corpus study, the distribution of fronting and stranding in native and nonnative English corpora was described with respect to a wide range of variables known to predict preposition placement in RCs and similar constructions. The initial exploration of the data indicated that the place of the preposition (fronted, stranded) in the sample was dependent on learner group (native, nonnative), the corpus writers' proficiency (novice, advanced), their first language type (European, East Asian), the gap site in the RC (verbal, adjectival, nominal, partitive), the animacy of the head nominal (animate, inanimate), the form of the RC subject (pronominal, nonpronominal), the meaning of the RC filler (participant, supplement, environment), the usage frequency and length of prepositions, item-preposition strings (e.g., *talk to*), and preposition-item strings (e.g., *in which*), specific relativizers in finite and nonfinite RCs, and specific prepositions and noun-preposition strings (e.g., *way in*). Style and modality were held constant across corpora. For the statistical analy-

sis, RCs with nominal and partitive gap sites and nonfinite *wh*-RCs were excluded because they forced prepositions to front. A series of binary logistic regression analyses indicated significant correlations between preposition placement and all predictor variables except learner group, animacy of the head nominal, and form of the RC subject, with robust coefficients and *p*-values across models. The models consistently predicted more stranding with novice than with advanced writers. Moreover, nonnative writers with a fronting-only European first language (German, French, Italian, Spanish) were more likely to front preposition than native English speakers. In contrast, East Asian writers (Chinese, Japanese, Korean) were more likely to strand than native English speakers, however, the difference was not significant across all models. Moreover, stranding was associated with participant fillers but inhibited by environment fillers. The expected contrasts to supplement fillers were not significant. Not surprisingly, stranding was associated with the relativizer *that*. With respect to specific lexical items and strings, the odds of stranding increased with high-frequency prepositions and item-preposition strings but decreased with high-frequency preposition-item strings. Collostructional analyses and model estimations of item-specific effects indicated that stranding was associated with specific prepositions, such as *through*, *about*, *with*, and *for*.

To look more closely at the influence of proficiency, native languages, and specific lexical items, the corpus study was complemented by an experimental rating study. Two groups of nonnative participants with different first languages (German, Chinese) and a group of native English speakers rated the acceptability of fronting and stranding RCs with different prepositional verbs. The verbs were either English-German translation equivalents or not. Other relevant variables were held constant or distributed equally across experimental conditions. All experimental RCs had a verbal gap site, animate or inanimate head nominals, pronominal or proper noun subjects, participant fillers, and *wh*-relativizers. Moreover, the usage frequency of different prepositions, item-preposition, and preposition-item strings, and the idiosyncractic behavior of specific prepositions was statistically controlled for. In addition, a continuous measure of proficiency was computed based on the participants' ability to rate grammatical and ungrammatical filler sentences accurately. The acceptability ratings were subjected to linear mixed-effects regression analyses with acceptability as a continuous dependent variable and a wide range of predictor and control variables. The results indicated that acceptability was dependent on the place of the preposition and on learner group such that stranding was more acceptable to the nonnative participants than to the native participants. Moreover, the results revealed that acceptability was contingent on interactions be-

tween the place of the preposition, first language, and proficiency such that the acceptability of fronting and stranding developed in first-language-specific patterns with improving proficiency. For the German participants, fronting was at a consistently high level of acceptability across proficiency levels, whereas stranding was associated with low acceptability at low levels of proficiency and then increased in acceptability with increasing proficiency. For Chinese learners, stranding evinced high acceptability ratings at low levels of proficiency and then dropped in acceptability with increasing proficiency. In contrast, fronting was at a low level of acceptability for low-proficiency Chinese participants and became more acceptable at higher levels of proficiency. For the native English participants, the ability to rate filler sentences likely indicated the degree of commitment to the experimental task rather than proficiency. For them, the acceptability of fronting was high at low levels of commitment and dropped more rapidly with increasing commitment. By comparison, stranding evinced relatively low levels of acceptability, independent of commitment. At the highest level of proficiency/commitment, mean acceptability estimates of all participant groups tended to converge. Moreover, the acceptability of oblique RCs in general increased with daily use of English. Contrary to predictions, translation equivalence was not significantly related to the acceptability of fronting for German participants.

5.2 Learning from Different Distributions

Findings of prior research indicated that nonnative language learners acquire preposition stranding before fronting and subsequently develop a preference for stranding in *wh*-RCs and similar constructions such as *wh*-questions (Bardovi-Harlig, 1987; Hoffmann, 2007, 2013; Kao, 2001; Quintero, 1992). In contrast, native speakers develop a tendency to front prepositions in the context of *wh*-RCs (Hoffmann, 2011, p. 148; C. Johansson & Geisler, 1998). Consistent with this, the results of the corpus and the rating study indicated that preposition stranding is more common than fronting in nonnative language use and is more acceptable than fronting for nonnative learners, respectively, suggesting a higher degree of entrenchment of stranding. Moreover, in line with the research, the results indicated a tendency to front prepositions in some of the native corpus material and higher acceptability of fronting for native English speakers. Following Bardovi-Harlig (1987), this suggests that nonnative learning is driven by the relative salience of preposition fronting and stranding in language use. Stranding is more common than fronting in English, as is evident from the frequency distribution given in Table 3.1. As the figures

indicate, stranding is in total more frequent than fronting, that is, counted across different clause types. On the assumption that learner input is sampled from native language use, learners therefore receive more stranding than fronting input, which advantages the acquisition of stranding, while fronting falls behind the presumably innate acquisition schedule.

On closer examination, however, the results partially conflict with this interpretation. For one thing, the corpus study indicated that preposition placement was more dependent on level of proficiency (novice, advanced) than on learner group (native, nonnative). While the advanced writers were more likely to front prepositions, the novice writers tended to strand prepositions across learner groups. Consistent with this, the rating study indicated that the acceptability of fronting and stranding changed as a function of proficiency. Acceptability ratings developed in first-language-specific patterns, which were most distinct from each other at low levels of proficiency but gradually approximated mean native ratings as proficiency improved and converged at the highest level of proficiency. This suggests that preposition placement is primarily dependent not on different learner groups but on different levels of proficiency, with converging developments as proficiency improves. This is readily explained in terms of usage-based language learning.

In the usage-based framework adopted for this study (Bybee, 2010; Diessel, 2016; Langacker, 2010), proficiency is closely related to experience. Linguistic input is not merely a fleeting stimulus triggering the growth of innate linguistic representations, as is commonly assumed in generative linguistics (Chomsky, 1995; Radford, 2009; White, 2003), but an essential driving force of learning which accumulates in memory over time, forming emergent and adaptable linguistic representations. Usage-based researchers thus hold that linguistic constructions emerge as generalizations over lexical strings in a learner's input and therefore retain traces of language use. More specifically, constructions are expected to reflect the distributional characteristics of the input from which they emerged and to vary in entrenchment and schematicity as a function of their lexical type-token distribution. With time and experience, learners gradually adjust their constructions to the recurrent contexts in which they have encountered them and approximate the distribution in their input as their proficiency improves.

On the assumption that language learning is usage-based, the different groups of language users in the two studies had likely become attuned to different distributions of fronting and stranding depending on their proficiency. On the one hand, as mentioned above, stranding is in total more common than fronting in English so that learners receive more stranding than fronting input. The results indicated that

novice learners used stranding more than fronting and rated stranding as more acceptable than fronting. This suggests that this group of learners had acquired preposition placement on the basis of the total relative frequency distribution of fronting and stranding in English. Since the distribution is skewed in favor of stranding, the novice learners had developed a preference for stranding. This was reflected in the higher use and acceptability of stranding compared to frontings RCs, which indicate a relatively high level of entrenchment due to frequent encounter of stranding for this learner group. On the other hand, however, fronting is more common than stranding in *wh*-RCs. This is evident from the distributions in Tables 3.1 and 3.2. While stranding is more common than fronting in total, there is considerably more fronting than stranding in the context of *wh*-RCs across multiple native English corpora. The results indicated increasing use and acceptability of fronting with increasing proficiency. In keeping with the assumption of usage-based language learning, this suggests that with improving proficiency learners had become attuned to the conditional relative frequency distribution of preposition placement. More specificially, based on more fine-grained, context-sensitive counts of fronting and stranding, they had learned to associated fronting with *wh*-RCs. More generally speaking, this suggests that learning is sensitive to usage and that sensitivity changes with proficiency. With improving proficiency sensitivity changes from context-independent to more context-dependent distributions as learners gradually adjust their constructions to more fine-grained contexts of use in which they experience them.

This interpretation is in line with usage-based research on the sensitivity of processing to usage, which indicates that language users become sensitive to more fine-grained and context-dependent distributions with increasing experience (for a review, see Schmitt, 2012). For instance, results from a study by N. C. Ellis et al. (2008) suggest that native and nonnative language users are attuned to different usage distributions. In processing tasks with formulas of different frequency and collocational strength (e.g., *circumstances in which*, *is one of the*), behavior was best predicted by total frequency for nonnative participants but by collocation strength for native participants. The researchers concluded that the difference in sensitivity was due to the participants' amount of experience and exposure. All else being equal, nonnative learners have received only a fraction of the input which native speakers of the language have been exposed to. As predicted by the power law of practice (Newell, 1990), the correlation between frequency of exposure and improvement of processing (learning) was strong at low levels of exposure but gradually leveled out and plateaued at higher levels of exposure. The more experienced native participants had instead tailored their constructions to more context-sensitive measures of

collocation strength, which presupposes an amount of input large enough to extract not only highly frequent collocations but also low-frequency strings of strongly associated lexical items. Consistent with this, findings of a corpus study by Durrant and Schmitt (2009) suggest that the lack of idiomaticity which is characteristic of nonnative language use is in part due to the overuse of high-frequency collocations and the underuse of low-frequency strings of strongly associated items. Comparing different measures of collocation strength, the researchers found that nonnative speakers heavily relied on collocations with high *t*-scores but had not yet learned collocations with high mutual information scores. While *t*-scores highlight high-frequency collocations (e.g., *good example*, *hard work*), mutual information scores give more prominence to strings of infrequent items with high probabilities of co-occurrence (e.g., *immortal souls*, *tectonic plates*). In line with this, frequency estimations and response times obtained from a judgement task in a study by Siyanova and Schmitt (2008) indicated that nonnative learners were poor at estimating fine-scale differences in frequency and were insensitive to them in processing tasks. However, estimations by nonnative participants who had spent at least a year in a native English environment were more nativelike, suggesting that with increasing exposure learners had weighted their constructions in accordance with more fine-grained distributions based on their more extensive input.

Altogether, this suggests that language learners rely on input and that their sensitivity to distributions changes with improving proficiency as a result of accumulating experience. At low levels of experience, learning is strongly affected by coarse-grained, context-independent input distributions. The effect of total frequency on learning levels out with growing experience. Based on their increasing experience base, learners are instead able to extract more fine-grained, context-dependent usage patterns, for instance, low-frequency collocations. With respect to preposition placement, this means that novice learners at a low level of experience rely on the total relative frequency distribution of preposition placement in English which advantages stranding. As a consequence, they acquire a stranding-fronting asymmetry which was evident from a preference to strand rather than front prepositions for novice writers in the corpus study and higher acceptability scores of stranding at lower levels of proficiency in the rating study. With improving proficiency and increasing experience, however, learners become sensitive to more fine-grained, context-dependent distributions of preposition placement and gradually readjust their constructions accordingly. As a consequence, fronting is gradually entrenched in the context of *wh*-RCs, which lead to more fronting and increased acceptability of fronting in the corpus and in the rating study, respectively. This interpretation

is in line with mounting evidence from usage-based research for the essential role of frequency of exposure and contextual predictability in language learning (Bybee, 2013; Diessel, 2018; N. C. Ellis et al., 2016; Goldberg, 2006).

5.3 Interlingual Fronting Constructions

The gradual adjustment of constructions from total to conditional relative frequency distributions was most evident from the nonnative learners with an East Asian native language such as Chinese, Japanese, and Korean. Novice learners of this group used more stranding and rated stranding as more acceptable than fronting, which arguably reflected the skewed total relative frequency distribution of preposition placement in their English input. With improving proficiency they adjusted their use and ratings to the contexts in which they had experienced fronting and stranding and thus associated fronting with *wh*-RCs, in line with the conditional relative frequency distribution in English. Like the East Asian learners, nonnative learners with a European fronting-only native language such as German, French, Spanish, and Italian gradually became more nativelike as their proficiency improved, suggesting that they readjusted their constructions to more context-dependent distributions in their input over time. Unlike their East Asian counterparts, however, for this group of learners, stranding elicited low acceptability ratings at low levels of proficiency and received increasingly high ratings with improving proficiency, while fronting consistently evoked high acceptability ratings, independent of proficiency.

The advantage of fronting for the nonnative European learners was likely due to cross-linguistic influence. A contrastive analysis of RCs in English and the involved first languages suggests that cross-linguistic word order similarity favors the acquisition and use of fronting for this group of learners. As described in detail above, German, French, Italian, and Spanish like English use postnominal RCs with a similar word order. Unlike English, however, these languages only front prepositions in RCs, while stranding is not grammatical. This is illustrated above for German, French, and Spanish. As a reminder, consider the German RCs in Example 94.

Example 94

a. *die Frau, bei der wir wohnen*
the woman at whom we live

"the woman with whom we live" (Zifonun, 2001, p. 84)

b. **die Frau, der wir bei wohnen*
the woman whom we at live

c. *der Fluss, in dem noch viele Fische leben*
the river in which.DAT still many fish live

"the river in which many fish still live" (Eisenberg et al., 2009, p. 1030)

d. **der Fluss dem noch viele Fische in leben*
the river which.DAT still many fish in live

Consider Example 94 first. The RC *bei der wir wohnen* ("with whom we live") follows the modified noun *Frau* ("woman") and the preposition *bei* ("at, with") is fronted to a clause-initial position preceding the relative pronoun *der* ("whom"). The word order of the German RC is ADV SUBJ V, which overlaps with the word order of the English fronting RC counterpart *the woman with whom we live*. Unlike in English, however, stranding the preposition is not grammatical in German (94b). To give another example, consider Example 94c next. Again, the relative clause *in dem noch viele Fische leben* ("in which many fish still live") follows the modified noun *Fluss* ("river") and fronts the preposition *in* ("in") to a clause-initial position. The word order OBJ SUBJ V is similar to the English counterpart *the river in which many fish still live*. Stranding would again be not grammatical though (94d). Note that in fronting-only languages like German, preposition fronting occurs with both adverbial fillers (94a) and participant fillers (94c). While participant fillers attract stranding in English, as seen in the English translation of Example 94d.

In contrast, the East Asian native languages Chinese, Korean, and Japanese all tend to omit prepositions in equivalent constructions and in general have a different word order. This is illustrated for Chinese and Korean above. Example 95 provides a Japanese example.

Example 95 (Ozeki & Shirai, 2007, p. 178)

a. *Ken-ga hoteru-ni tomatta.*
Ken-NOM hotel-LOC stayed

"Ken stayed at the hotel."

b. *Ken-ga tomatta hoteru*
Ken-NOM stayed hotel

"The hotel that Ken stayed at"

For a better understanding, consider the Japanese declarative clause in Example 95a first. The declarative clause has the word order SUBJ OBJ V and an oblique relation like in *hoteru-ni* ("at the hotel") is marked by a locative particle, here, *ni* ("at").

By comparison, in a Japanese RC like in Example 95b, the oblique relationship is not explicitly encoded. Moreover, unlike in English or one of the other European languages considered above, Japanese RC precede the modified noun and do not include a relative pronoun or other relative marker, resulting in the word order SUBJ V OBJ. Here, the RC *Ken-ga tomatta* ("Ken stayed") precedes the modified noun *hoteru* ("hotel"). Again note that *hoteru* ("hotel") is not suffixed by *ni* ("at") to indicate the locative relationship between the head nominal and the RC verb.

The results of both the corpus and the rating study suggest that the European learners of English benefitted from the cross-linguistic similarity of English RCs and their respective first-language constructions. More specifically, the relatively high odds and acceptability of fronting for European learners of English in the corpus and in the rating study, respectively, suggest that the cross-linguistic similarity boosted the acquisition and use of fronting. In contrast, the East Asian learners were not significantly different from the native English speakers, suggesting that they acquired preposition placement based on the distribution of fronting and stranding in their English input, as detailed above, without interference from their first languages. This is consistent with findings of another cross-linguistic study, which indicated that nonnative learners with a typologically related first language benefited from cross-linguistic similarity when acquiring English fronting, compared to learners with a typologically distant first language (Mazurkewich, 1985). This is also reminiscent of research on language contrasts and learner errors which highlighted cross-linguistic similarity as a strong predictor for cross-linguistic influence (Andersen, 1983; Kellerman, 1979; Ringbom & Jarvis, 2009).

The usage-based approach to language learning adopted in this study (Langacker, 2010; Tomasello, 2003) provides a more in-depth explanation of the role of cross-linguistic similarity. According to this view, construction learning is based on similarity. Constructions represent the form and meaning overlap of similar exemplars which language users have encoutered in their input. In this view, nonnative learners likely exploit first-language constructions to process similar exemplars in their second-language input, leading to cross-linguistic influence or transfer in language use and processing (N. C. Ellis, 2006b, 2012b). In keeping with the assumption that constructions emerge from experiences of language use and processing, this results in the emergence of more schematic, cross-linguistically shared constructions or diaconstructions which represent the form and meaning overlap of exemplars from two or more languages (Höder, 2012, 2014a, 2014b). Accordingly, the learners with a European fronting-only native language likely recognized English exemplars of fronting RCs as instantiations of their respective first-language constructions. Put

differently, they probably exploited their respective first-language constructions to categorize and process fronting RCs that they encoutered in their second-language input. From this, a more schematic diaconstruction emerged which represents the similar word order of fronting RCs across their languages. The emerging diaconstructions inherited the frequency of the language-specific fronting constructions, resulting in a high degree of entrenchment (Runnqvist et al., 2013), which lead to the fronting advantage for European learners. Moreover, since the effect of input on learning plateaus at high levels of exposure and entrenchment, fronting elicited consistently high acceptability ratings across proficiency levels.

Contrary to expectations, the European writers in the corpus study were more likely to front prepositions than the native English writers. This was likely due to cross-linguistic influence, too. First, cross-linguistic frequency inheritance boosted fronting. Second and more importantly, the fronting diaconstruction which the German learners had acquired was probably more schematic than the native English counterpart. Recall that while in English fronting is associated with adverbial fillers but competes with stranding in the context of participant fillers, in fronting-only European languages like German, French, Spanish, and Italian fronting covers both adverbial and participant fillers. Building on their first-language constructions, the European learners likely established fronting diaconstructions which covered English stranding contexts, that is, contexts in which native English speakers would strand rather than front prepositions. Therefore, the emerging fronting diaconstruction was more schematic than the corresponding native English construction. As a consequence, the European learners overgeneralized fronting.

This explanation is in line with usage-based research emphasizing the importance of word order similarities within and across languages for the learning and processing of RCs (e.g., S. Brandt, 2011; S. Brandt, Diessel, & Tomasello, 2008; J. Chen & Shirai, 2014; Diessel, 2004, 2007; Diessel & Tomasello, 2005; Kidd, Chan, & Chiu, 2015). In general, the usage-based approach considers drawing analogies based on perceived similarity as an essential cognitive ability which enables language acquisition (Tomasello, 2003, 163–169; see also Diessel, 2013; Tomasello, 2009). For instance, Kidd et al. (2015) compared the comprehension of Cantonese object RCs by monolingual Cantonese and bilingual Cantonese-English children. Cantonese object RCs have the word order SUBJ V OBJ and are temporarily ambiguous between a RC and a transitive clause reading. The results of a comprehension task indicated that the bilinguals were more likely than the monolinguals to opt for the transitive clause reading, arguably because of cross-linguistic word order similarity with the English transitive clause. Against this background, consider prepositional

RCs. In English, fronting is associated with an adverbial reading, while stranding indicates a participant reading. In European languages such as German, French, Italian, and Spanish, however, fronting does not compete with stranding and is thus compatible with both readings. European learners of English may adopt their first-language constructions to process fronting exemplars in their English input. Unlike the Cantonese-English bilinguals, doing so will not garden-path them. In contrast, one would expect that English learners of a fronting-only lanuage such as German likely misinterpret participant fillers as adverbial fillers in German fronting RCs due to cross-linguistic influence. This hypothesis should be tested by future research to obtain corroborating evidence for cross-linguistic influence and the emergence of diaconstructions.

This also resonates with findings from cross-linguistic priming studies which suggest that multilingual speakers establish shared representations across their languages (Hartsuiker et al., 2004; Hartsuiker & Pickering, 2008; Hartsuiker & Bernolet, 2017; Schoonbaert et al., 2007). Contrary to results of more recent studies indicating a gradual integration of similar constructions (Bernolet et al., 2013), fronting was on a consistently high level of acceptability across proficiency levels for the German participants in the rating study. This is consistent with findings of earlier studies (Hartsuiker et al., 2004; Hartsuiker & Pickering, 2008) and suggests that nonnative learners virtually immediately collapse their first-language fronting construction with a similar second-language representation. This might be due to the typological proximity and overall similarity of their first and second language. Moreover, the concept of diaconstructions is reminiscent of work on the development of interlingual speech sounds by Flege (Flege, 1987, 1995; Flege, Schirru, & MacKay, 2003; Flege, 2007). In a series of production and comprehension tasks, Flege and colleagues found that multilingual speakers merge similar sounds from their languages to form an intermediate phonetic category which is different from the equivalent categories of monolingual speakers of the respective languages. For example, Flege (1987) compared the voice onset time of utterance-initial /t/ by French learners of English, English learners of French, and French and English monolingual speakers. The results indicated that the nonnative speakers approximated but failed to reach the monolingual voice onset time for /t/ in their second language, producing sounds intermediate to the monolingual voice onset time in the involved languages. Moreover and importantly, multilinguals also deviated from the monolingual voice onset time when speaking their native languages. Consistent with the usage-based concept of diaconstructions, the authors suggested that intermediate sound categories emerge as a result of processing input from different languages.

All this is in line with recent usage-based research arguing that multilingual language users acquire an open and ever-changing repertoire of situation-specific constructions rather than two or more distinct languages (Franceschini, 2011; Hall et al., 2006; Hall, 2016). Since diaconstructions establish cross-linguistic links, they blur the boundaries between first and second language in a multilingual mind. With increasing experience, more high-level dialinks emerge forming an "inter-connected whole within a single mind, an eco-system of mutual interdependence" (Cook, 2016, p. 7) or "one merged system of situation-specific utterances" (De Bot, 2016, p. 138). This continues a long line of research which has challenged the structuralist view of languages as distinct entities. This research has called into question the fractional image of multilinguals as multiple monolinguals in one mind and instead emphasized the specifics of learning and knowing more than one language (Cook, 1995, 2003; Grosjean, 1982, 1989).

5.4 A Network of Constructions

In line with prior research (e.g., Biber et al., 1999, p. 106; Gries, 2002; Hoffmann, 2011, pp. 164–165), fronting and stranding were associated with specific lexical items and strings in the examined corpora. The type-token distributions of lexical items across the constructions is illustrated by the word clouds in Figure 4.6. Varying font and cloud size indicate that the distributions are skewed, suggesting that the constructions attract and repel different items to varying degrees. Moreover, effects of specific prepositions and relativizers on placement were evident from the results of the regression analysis. In the rating study, however, acceptability of independent of specific items. More specifically, contrary to expectations, the acceptability of fronting failed to increase for the German participants when the RC prepositional verb was English-German translation equivalent. This suggests that German learners do not acquire verb-specific fronting constructions. This is inconsistent with findings from cross-linguistic priming studies indicating a lexical boost for translation equivalent verbs (Schoonbaert et al., 2007) and requires a closer examination.

Additionally, the findings suggested that prepositions were used as parts of chunked strings. The distribution of the string frequencies across fronting and stranding RCs, illustrated in the density curves in Figure 4.2, indicated that stranding RCs were populated by high-frequency item-preposition strings, such as *go to*, *talk about*, and *aware of*. By comparison, fronting RCs were characterized by high-frequency preposition-item strings, most notably *in which*. Consistent with this, a regression analysis suggested that stranding is more likely with high-frequency item-preposition

strings but less likely with high-frequency preposition-item strings. This is in line with findings from corpus studies emphasizing the role of prefabs and collocations in language use in general (Biber et al., 1999; Sinclair, 1991; Wray & Perkins, 2000) and in preposition placement in particular (Biber et al., 1999, p. 106; Gries, 2002). In accordance with this, usage-based researchers assume that linguistic knowledge involves sequential knowledge (Bybee, 2002, 2010; Dąbrowska, 2014; N. C. Ellis, 1996, 2003). While there is some debate about what is the best measure to predict the coherence of a sequence (Bybee, 2010, pp. 97–101; Gries, 2012), highly frequent strings are likely to be chunked in memory and subsequently retrieved as units, as evidenced by studies on constituency structure and coalescence (Bybee & Scheibman, 1999; Bybee, 2002; Krug, 1998), word learning (Saffran et al., 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 et al., 2016; McCauley & Christiansen, 2011, 2014; see also Reali & Christiansen, 2009).

Accordingly, learners probably memorize high-frequency strings as units or chunks, which they use as prepackaged coherent wholes when processing or producing a RC. For instance, the verb-preposition string *belong to* is highly frequent in language use and therefore likely chunked and stored as a complex verb, which leads to stranding. Similarly, the high-frequency string *in which* arguably forms a complex relativizer which is entrenched as a unit, which leads to fronting. From chunking, constituent structure emerges. According to usage-based research (Bybee, 2002), constituents develop from the chunking of recurrent sequences of lexical items, with the degree of coherence depending on their frequency of co-occurrence. Accordingly, the recurrent use of highly frequent item-preposition chunks like *talk about* in stranding RCs (e.g., *the topic which I was talking about*) likely gives rise to the following constituent structure, indicated by square brackets: [N [Rel [Subj [V (Obj) Prep]]]]. Highly frequent item-preposition chunks like *in which* and noun-preposition strings like *way in* (e.g., *the way in which we view the world*), on the other hand, reinforce the sequential relationships between the head nominal, the preposition, and the relativizer of fronting RC constructions, which gives rise to the following constituent structure: [[N [Prep Rel]] [Subj [V (Obj)]]]. The emergent constituent structures cut across phrase-structure boundaries. This is reminiscent of the analysis proposed by Hornstein and Weinberg (1981) in a generative linguistic framework. Instead of assuming reanalysis of the phrase structure tree, however, a usage-based approach sees constituent structure as an epiphenomenal by-product of sequential learning (Bybee, 2002).

Usage-based researchers assume that language users learn constructions by generalizing over similar lexical strings in their input (Diessel, 2016, 2018; Hilpert & Diessel, 2017). Recurrent invariant parts are reinforced and entrenched in memory, therefore, high-frequency lexical strings with low type variation build up partially schematic, partially filled prototypes which embody recurrent lexical items of high token frequency. At higher levels of schematicity, constructions emerge as generalizations over lower-level constructions and represent increasingly schematic commonalities. From this perspective, the effects of specific prepositions, relativizers, and lexical strings suggest that learners acquire item-specific fronting and stranding RC constructions at different levels of specificity, reflecting the type-token distribution of fronting and stranding in their input. Based on this, more schematic RC constructions emerge, resulting in a dense hierarchical network in which each node represents a construction and links between nodes capture overlap in form and meaning. A part of the network is illustrated in Figure 5.1, with rectangles symbolizing constructions and edges indicating formal overlap. Empty rectangles and open edges signal that, for reasons of space, only a part of the entire network is given. For example, zero RCs and constructions with a nonverbal gap site are missing from the figure. English-language constructions are black; constructions from different languages and cross-linguistic constructions are gray. The "stream" of examples from the corpus material is italicized.

At the bottom level, the network is populated by item-specific constructions which represent commonalities between exemplars at a high level of granularity. For instance, the results suggested that language users learn a construction of the form N *in which* Subj V (Obj) from frequent exemplars with low type variation like *way in which* Subj V (Obj), *world in which...*, *period in which...*, *case in which...*, and so on. The exemplars differ in specific head nominals but share the lexical preposition-item string *in which*, which is incorporated into the emerging construction. Item-specific stranding constructions emerge at a similar level of specificity, for example, a construction of the form N *that* Subj V (Obj) Prep, which is associated with the frequent and distinctive relativizer *that*. The higher levels of the network are populated by more schematic constructions which represent form and meaning overlap between more specific, lower-level constructions. For instance, the results suggest that advanced language users generalize over lower-level item-specific fronting constructions and acquire a more schematic construction of the form N Prep *which* Subj V (Obj) at an intermediate level of specificity. Moreover, nonnative learners with a European fronting-only native language likely extend their native construction to English input and acquire a high-level cross-linguistic fronting construction

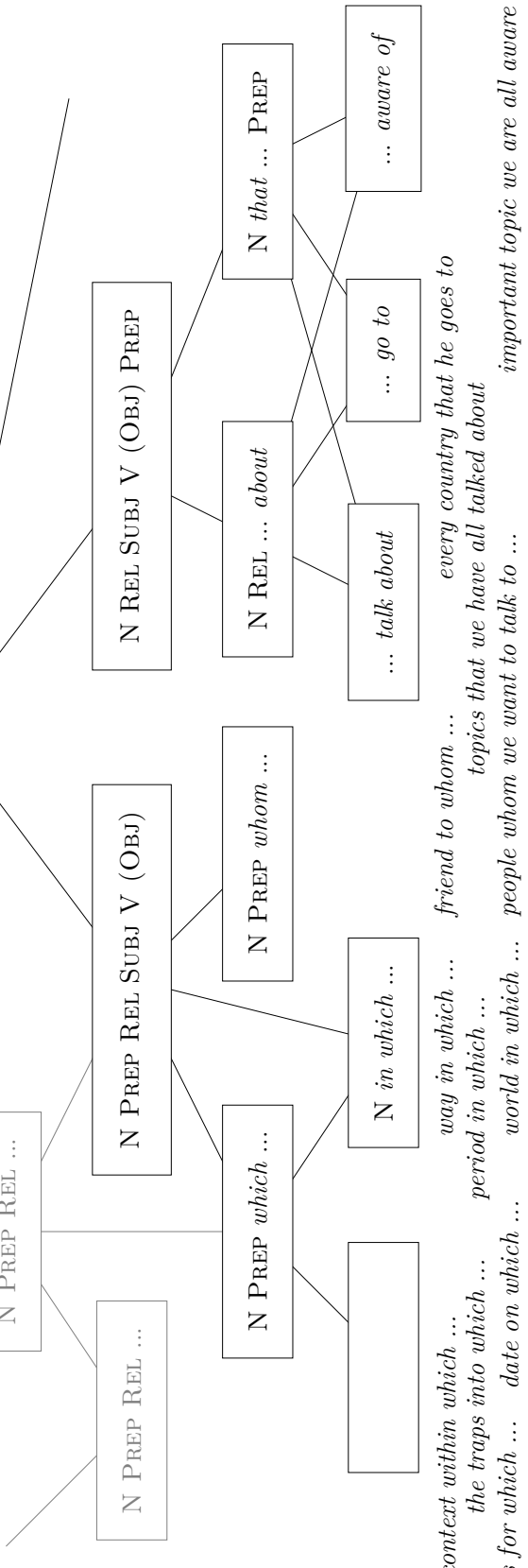


Figure 5.1: Network of fronting and stranding RC constructions

which links fronting constructions in their first and second language.

Chapter 6

Conclusion

Prior research has examined the grammar, use, and learning of preposition placement in English across different constructions and populations. A wide range of variables has been proposed to predict fronting and stranding in language use and to determine the order of acquisition, including salience and usage frequency (Bardovi-Harlig, 1987), first language (Mazurkewich, 1985), specific prepositions and lexical strings (Biber et al., 1999, p. 106; Quirk et al., 1985, p. 664), the meaning of the RC filler (Hoffmann, 2011, pp. 65–72; Hornstein & Weinberg, 1981; C. Johansson & Geisler, 1998), the gap site (Hoffmann, 2011, pp. 84–93; Trotta, 2000, pp. 184–185), complexity (J. A. Hawkins, 1999; Hoffmann, 2011, pp. 93–98), and different relativizers (Guy & Bayley, 1995), among others. Recently, researchers in the field of cognitive usage-based linguistics have conducted more sophisticated multivariate analyses of larger corpus samples and acceptability ratings to estimate the effects of multiple variables at a time and to find interactions among them (Hoffmann, 2011; Gries, 2002). Following this line of research, the current thesis has investigated preposition placement in RCs in English as a second language on the basis of a sample from native and nonnative English corpora and acceptability ratings by native and nonnative English speakers.

In line with prior findings, the results suggest that preposition placement in English as a second language is influenced by the distribution of fronting and stranding in language use. In addition to this, the study has provided deeper insight into the relationship between usage and learning and suggests that learners' sensitivity to usage distributions changes as their proficiency improves. Moreover, the results tie in with previous findings indicating cross-linguistic influence of similar first-language constructions. The cognitive usage-based framework adopted here provided a better understanding of cross-linguistic influence than previous approaches. In addition, the study has described the distribution of lexical items and strings across fronting

and stranding RCs in detail. Consistent with previous corpus studies, the results suggest that preposition placement is associated with specific items, in particular, prepositions. Moreover, this study is, to the best of my knowledge, the first to provide quantitative evidence for the role of collocation strength (string frequency) in preposition placement. In addition to this, the study confirmed that preposition placement is correlated with filler meaning and gap site and provided an innovative cognitive frame-semantic explanation.

Both the role of collocation strength and of meaning frames in learning grammar will be explored in future work, together with information flow, which is known to influence preposition placement (Takami, 1988, 1992) but which has not received much attention in this study. Moreover, recent research suggests that constructions emerge at an item-specific level from contexts of low uncertainty, that is, from highly predictable lexical strings (Divjak & Caldwell-Harris, 2015; N. C. Ellis et al., 2016; Goldberg et al., 2004; Gries & Ellis, 2015). In this sense, Gries 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). For example, the results of this study indicate that the type-token distribution of head nominals, prepositions, and relativizers in fronting RCs follows a Zipf-like distribution in which the frequency of types decreases as a power function of their rank, with *way in which* taking the lead followed by strings of decreasing frequency like *world in which*, *society in which*, *situation in which*, and so on. On the assumption that constructions emerge at points of low uncertainty, an item-specific *way in which* prototype likely emerges from the distribution, on the basis of which lower-frequency exemplars are then categorized. All this relates to the role of contextual predictability in learning and encourages research at the intersection of corpus linguistics, language processing, and language learning.

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Appendix

Instructions for the rating task

The purpose of the experiment is to get you to judge the acceptability of some English sentences. You will see a series of sentences on the screen. These sentences are all different. Some will seem perfectly okay to you, others will not. What I'm after is not what you think of the meaning or grammar of the sentences, but how good or bad they sound to you in proportion to a reference sentence.

(1) the cat the mat on sat the. value: 100 (Reference sentence)
(2) the dog the bone ate. value: ____

For example, sentence (1) is the reference sentence. The reference sentence is preassigned an arbitrary value, 100. Does the following sentence (2) sound better, worse or just as good as the first sentence to you? Go with your gut. If sentence (2) sounds, for example, one and a half times as acceptable as (1) to you, then your rating of (2) should be 150. If sentence (2) sounds, for example, twice as acceptable as (1) to you, then your rating should be 200. If (2) sounds only half as acceptable as (1) to you, then your rating should be 50. If (2) sounds only a tenth as acceptable as (1) to you, your rating should be 10. You may use any positive number which is a fraction or multiple of 100 to express your intuition. There will be some practice trials at the beginning of the experiment.

Experimental sentences in the rating task

96. a. I know the man on whom Jane relied.
    b. I know the man who Jane relied on.
    c. I know the man in whom Jane believes.
    d. I know the man who Jane believes in.

97. a. Jennifer never calls the guys with whom she sleeps.
    b. Jennifer never calls the guys who she sleeps with.
    c. Jennifer never calls the guys for whom she falls.
    d. Jennifer never calls the guys who she falls for.

98. a. Sally fancies the boy about whom Steve talked.
    b. Sally fancies the boy who Steve talked about.
    c. Sally fancies the boy to whom Steve talked.
    d. Sally fancies the boy who Steve talked to.

99. a. You wouldn't believe the things about which Bill laughs.
    b. You wouldn't believe the things which Bill laughs about.
    c. You wouldn't believe the things at which Bill laughs.
    d. You wouldn't believe the things which Bill laughs at.

100. a. Brad did something for which he never apologised.
     b. Brad did something which he never apologised for.
     c. Brad did something to which he never confessed.
     d. Brad did something which he never confessed to.

101. a. Sarah never achieved the fame of which she dreamt.
     b. Sarah never achieved the fame which she dreamt of.
     c. Sarah never achieved the fame about which she dreamt.
     d. Sarah never achieved the fame which she dreamt about.

102. a. Do you know the lady with whom he is speaking?
     b. Do you know the lady who he is speaking with?
     c. Do you know the lady to whom he is speaking?
     d. Do you know the lady who he is speaking to?

103. a. I didn't like the painting with which John compared me.
     b. I didn't like the painting which John compared me with.
     c. I didn't like the painting to which John compared me.
     d. I didn't like the painting which John compared me to.

Filler sentences in the rating task

104. I expect my mummy and daddy to be exceptional which they never are.

105. She writes some wonderful other books that I like.

106. There's a bug which has caused major problems.

107. You need something that you're going to enjoy.

108. He didn't have to describe the woman who was sitting there.

109. There's a bone in my nose that's slightly bent.

110. They all tell me all the things that the books tell me.

111. I presume it's something again which we haven't done.

112. They has a conventional cooker as well which they was using.

113. I does not know anyone else who could does it.

114. I had to meets these girl who I hasn't seen for ten years.

115. There was lots of activity goes on there.

116. We visited a wood in the morning was an oak wood.

117. That's a tape sent I them that done I've myself.

118. Having we're not the cottage that had we before.

119. Enjoyed I the time which was I given.

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Curriculum Vitae

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Current position

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Education

Since 2014 **Ph.D.**, *Friedrich Schiller University*, Jena, Germany.
Cognitive linguistics

2011–2014 **M.A.**, *Friedrich Schiller University*, Jena, Germany.
German linguistics

2013 **Study stay**, *Radboud University*, Nijmegen, Netherlands.
Multilingualism

2010–2011 **M.A.**, *University of Tennessee*, Knoxville, TN, USA.
German language studies

2007–2010 **B.A.**, *University of Mannheim*, Mannheim, Germany.
German language studies

1998–2007 **Abitur**, *Hanns-Seidel-Gymnasium*, Hösbach, Germany.
Secondary school studies

Publications and talks

Articles

2018 A usage-based approach to preposition placement in English as a second language. *Language Learning*, *68*, 271-304. https://doi.org/10.1111/lang.12277

Talks

2018 What preposition placement depends on in learner English: A usage-based corpus study. 8th International Conference of the German Cognitive Linguistics Association: Applied Cognitive Linguistics, Koblenz, Germany, September 2018.

2017 Preposition placement in learner English: Acceptability depends on input frequency and cross-linguistic similarity. 14th International Cognitive Linguistics Conference (ICLC), Tartu, Estonia, July 2017.

2016 On oblique relative clauses in learner English: A magnitude estimation acceptability judgement experiment. Cognitive Linguistics in Brno (CLiB), Brno, Czech Republic, October 2016.

Reviews

2011 Eisenberg, Peter. Das Fremdwort im Deutschen. *Lebende Sprachen*, *56*(2), 387-389. https://doi.org/10.1515/les.2011.027

Scholarships

2013/14 Scholarship of the Federal Ministry of Education and Research

2012/13 Scholarship of the Federal Ministry of Education and Research

2009/10 Tuition Fee Scholarship of the University of Mannheim

2008/09 Tuition Fee Scholarship of the University of Mannheim

Teaching experience

Training

2017 **Higher education teacher program**.
I completed an extended training program at the university service centre for higher education didactics in Jena, Germany.

2015–2017 **Teaching workshops**.
I attended multiple workshops at the service centre for higher education didactics on grading, teaching methods, and materials.

2010 **Tutor training**.
I attended a two-day teacher training seminar at the department for higher education didactics in Mannheim, Germany.

Courses

Second language acquisition.
The seminar is concerned with cognitive processes underlying language learning and the effects of expsoure and cross-linguistic similarity.

Cognitive English grammar.
Students are introduced to cognitive grammar (Langacker, 1987, 1991) and learn to analyze English grammatical constructions as construal devices.

Text and discourse linguistics.
Students learn to analyze structure and coherence of texts, genres and text types, and the interaction of text, cognition, and society.

Introduction to linguistics II.
The second part of an introduction to English linguistics which covers aspects of language meaning and use.

German language courses.
Teaching German as a foreign language at an advanced beginners level. As a language teacher, I follow a communiative approach with focus on form.

Introduction to linguistics tutorials.
Tutorials and exam preparations for first-year students.

Working experience

Since 2014 **Research assistant**, *Department for English and American Studies*, Jena, Germany.
Under the direction of Holger Diessel, I teach two hours a week, supervise student assistants, and conduct examinations.

2013 **Research intern**, *Donders Institute for Brain, Cognition and Behaviour*, Nijmegen, Netherlands.
I assisted Monique Flecken in her experimental work on cognitive aspects of multilingualism and linguistic relativity.

2012 **Research assistant**, *Department of German as a Foreign Language*, Jena, Germany.
I compiled and annotated part of a textbook corpus under the direction of Bernt Ahrenholz.

2009–2010 **Student assistant**, *Department for German philology*, Mannheim, Germany.
I assisted Beate Henn-Memmesheimer with preparing teaching material and grading exams.

2006–2008 **Intern and freelancer**, *Daily newspaper "Main-Echo"*, Aschaffenburg, Germany.
As a roving reporter in the editorial office of the daily newspaper "Main-Echo", I covered stories in and around my hometown in southern Germany.

Languages

German	Fluent/native	
English	Fluent	
Chinese	Basic	*Basic text comprehension, A2 level*
Dutch	Basic	*Basic words and phrases only*
Latin	Rudimentary	*High school Latinum*

Computer skills

Good R, LaTeX, Knitr, LibreOffice Writer and Calc, Ibex Farm, WebExp, DMDX

Basic HTML, PYTHON, corpus annotation tool EXMARaLDA

Service to the community

2013 Organization of a graduate student conference on linguistics, Jena, Germany.

2011-2014 Teaching German as a second language to refugees with Amnesty International, Jena, Germany.

2009 Teaching high school students how to write different newspaper text types in a seminar on political education, Heppenheim, Germany.

Declaration of Academic Honesty

Ich versichere hiermit, dass ich die vorliegende Dissertation selbst angefertigt habe. Alle von mir verwendeten Hilfsmittel und Quellen sowie unterstützende Personen sind in der Arbeit angegeben. Alle Textabschnitte fremder Autoren sind als solche kenntlich gemacht. Die Hilfe eines Promotionsberaters wurde nicht in Anspruch genommen; Dritte haben weder unmittelbar noch mittelbar geldwerte Leistungen von mir für Arbeiten, die im Zusammenhang mit dem Inhalt der vorgelegten Dissertation stehen, erhalten. Ich versichere weiterhin, dass die Dissertation noch nicht als Prüfungsarbeit für eine wissenschaftliche Prüfung eingereicht wurde. Weder wurde eine gleiche, eine in wesentlichen Teilen ähnliche oder eine andere Abhandlung bei einer anderen Hochschule als Dissertation eingereicht. Die geltende Promotionsordnung der Friedrich-Schiller-Universität Jena ist mir bekannt.

Jena, 11. Dezember 2018