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1 A Framework for Understanding Linguistic Entrenchment and Its Psychological Foundations

1.1 Introduction

This chapter introduces the main facets of the notion of entrenchment and highlights its role as a potential mediator between linguistic and psychological approaches to the study of linguistic knowledge, language learning, and their psychological foundations. The larger part of the chapter surveys empirical evidence for entrenchment processes and their linguistic effects from a variety of sources. It also discusses consequences of these findings and proposes an integrative framework for the study of entrenchment.

1.2 Entrenchment—A Multifaceted Concept

The main elements of the concept of entrenchment have a long history dating as far back as the 19th century (see, e.g., Blumenthal-Dramé, 2012, p. 11; Bybee, 1985, p. 117; Paul, 1920, e.g., pp. 12–14, 49–50, 94–95; de Saussure, 1916, e.g., pp. 122–127, 177; Wray, 2002, p. 8). The credit for introducing the term *entrenchment* into linguistics, however, goes to Ron Langacker (1987), one of the founding fathers of cognitive linguistics. According to him, there is a

continuous scale of entrenchment in cognitive organization. Every use of a [linguistic] structure has a positive impact on its degree of entrenchment, whereas extended periods of disuse have a negative impact. With repeated use, a novel structure becomes progressively entrenched, to the point of becoming a unit; moreover, units are variably entrenched depending on the frequency of their occurrence. (p. 59)

Langacker's description rests on two key assumptions that are still associated with entrenchment today: First, repetition and rehearsal increase the *strength of representations*, whereas disuse may cause decay (see also Langacker, 1987, p. 100, 1991, p. 45); second, repeated usage of a given linguistic structure causes it to be processed as a *holistic unit*. Although Langacker's account portrays both facets in terms of degrees, their characters seem to differ: The understanding in terms of strength of representation evokes a purely quantitative, gradual, potentially asymptotic trajectory, whereas the understanding in terms of a holistic chunk promotes the picture that a qualitative

change from analytic and declarative to holistic and procedural processing takes place at some point (see Blumenthal-Dramé, 2012, pp. 67–69, 186–187). From a psychological point of view, the first facet can be explained in terms of memory consolidation, while the second one involves a chunking process that can find an end point in a gestaltlike chunk that is emancipated from its component parts and defies analytical processing.

In a more recent publication, Langacker (2008) relates both facets of entrenchment to the process of automatization, understood in terms of a reduction of conscious monitoring:

Automatization is the process observed in learning to tie a shoe or recite the alphabet: through repetition or rehearsal, a complex structure is thoroughly mastered to the point that using it is virtually automatic and requires little conscious monitoring. In CG [cognitive grammar] parlance, a structure undergoes progressive **entrenchment** and eventually becomes established as a **unit**. (p. 16; emphasis in original)

As a first rough approximation, then, entrenchment can be understood as referring to a set of cognitive processes—mainly memory consolidation, chunking, and automatization—taking place in the minds of individual speakers. In addition, the term *entrenchment* has been used to denote not only these cognitive processes but also the effects they have on the representations of linguistic structures, that is, their products or resultant states. It is in this sense that we can talk about *degrees* or *strengths* of *entrenchment* and about *entrenched linguistic structures*. The main determinant of entrenchment identified in early work (see Bybee, 1985, p. 117; Langacker, 1987, p. 59) and much researched subsequently is frequency of exposure to and use of linguistic structures (see also Divjak & Caldwell-Harris, 2015).

1.3 Empirical Evidence for Entrenchment

Empirical evidence for entrenchment processes and their determinants and effects comes from four main sources: psycholinguistic and neurolinguistic experiments, quantitative corpus-linguistic investigations, studies of language change, and patterns of language use in context. In what follows, the major insights and claims from these sources are summarized, divided into work on frequency effects on entrenchment in terms of strength of representation (Section 1.3.1); frequency effects on entrenchment in terms of chunking and holistic units (1.3.2); effects of repetition in linguistic, situational, and social contexts on entrenchment (1.3.3); and other determinants of entrenchment (1.3.4). The superscript letters in Sections 1.3.1 through 1.3.4 serve as cross-references to the framework for the study of entrenchment proposed in Section 1.5 (see specifically Table 1.1).

The cognitive and linguistic effects of discourse frequency undoubtedly constitute the most intensively researched field relating to entrenchment. Recent surveys of

Tab. 1.1: Survey of Cognitive Entrenchment Processes and Their Cognitive and Linguistic Effects

Repetition-related determinant	Type of association affected	Psychological affordances	Cognitive effects	Linguistic effects
– Token repetition of word-forms and fixed strings	– Symbolic association	– Memory consolidation – routinization	– Increase in representational strength of symbolic association of specific form – meaning pairing ^a	– Faster and more effortless processing of words^a and expressions^d with less interference from paradigmatic neighbors^b – Faster resolution of lexical^c and syntactic ambiguities^e – Early acquisition of words^f – “Entrenchment” in a narrow sense (Braine & Brooks, 1995) in acquisition^l – Stability of morphological form^m – Resistance to analogical pressure and change^{n,r} – Reduction of phonological form and bleaching of meaning^o – Increase in frequency of usage^{a,l} – Constructionalization^p – Productivity^q – Innovation^r – New meanings, polysemy, partly under the influence of pragmatic associations^s – Fusion, coalescence, formulaic language (idioms, routine formulae, irreversible binominals), collocation^y – Form: phonetic and morphological reduction^x – Meaning: reduction of semantic specificity (grammaticalization), ^{a,b} loss of compositionality (lexicalization)^{a,c} – Tightening of internal syntagmatic bonds^{a,a} – Loosening of paradigmatic associations of composite parts^z
– Type repetition of variable construction (lexical or grammatical)	– Symbolic association	– Memory consolidation	– Emergence of, and increase in, representational strength of variable schema ^b (in cooperation with paradigmatic and syntagmatic associations) ^j	
– Token repetition of identical sequence of elements	– Syntagmatic association	– Memory consolidation – Routinization – Chunking – Automatization	– Increasing holistic processing of specific sequence of elements^w – Automatic processing of chunk once started^{a,d} – Priming effects between parts of sequence^{a,e} or sequences of larger constructions^{a,g}	

(continues)

Tab. 1.1: Survey of Cognitive Entrenchment Processes and Their Cognitive and Linguistic Effects (Continued)

Repetition-related determinant	Type of association affected	Psychological affordances	Cognitive effects	Linguistic effects
– Type repetition of functionally identical sequences with variable slots	– Syntagmatic association	– Memory consolidation – Routinization – Chunking – Categorization – Schematization	– Emergence of complex schematic constructions with variable slots (in cooperation with symbolic and paradigmatic associations) ^j	– Constructionalization ^p – Productivity ^q – Innovation ^r
– Token repetition	– Paradigmatic association	– Comparison	– Preferential selection ^u	– Increase in strength compared to paradigmatic competitors ^t – Attractor for analogical change ^v – Basis for analogical change and pressure ^s – Grammatical categories (word classes) ^j – Word fields, paradigmatic relation ^k
– Type repetition	– Paradigmatic association	– Comparison – Analogy	– Emergence of complex schematic constructions with variable slots (in cooperation with symbolic and syntagmatic associations) ^j – Rich memory of exemplars ^{a,f} – From episodic to semantic memory ^{a,i}	
– Token or type repetition in specific context	– Pragmatic association	– Memory consolidation		– Semantic change caused by invited inference, context absorption ^{a,h} – Emergence of connotations ^{a,j} – Emergence of register-specificity ^{a,k} – Support for chunking ^{a,l}

Note. For more details about the effects of entrenchment that are listed in this table, see Sections 1.3.1–1.3.3 and corresponding superscript notations. For more details about the types of associations, see Section 1.5.

frequency effects from a range of different perspectives are provided by Blumenthal-Dramé (2012, pp. 27–65, et passim), Bybee (2003), Diessel (2007), Divjak and Caldwell-Harris (2015), Divjak and Gries (2012), Gries and Divjak (2012), Jurafsky (2003), Krug (2003), and Lieven (2010).

1.3.1 Frequency Effects on Entrenchment in Terms of “Strength of Representation”

Psycholinguistic experiments on lexical frequency effects in production and comprehension arguably have the longest tradition. In general, lexical decision tasks as well as reading-time and eye-tracking experiments have shown that frequent words are recognized, accessed, and retrieved faster, with less effort and with less interference from paradigmatic neighbors than rare ones and that the same goes for frequent meanings of lemmas as opposed to rare meanings^c (Dell, 1990; de Vaan, Schreuder, & Baayen, 2007; Forster, 2007; Giora, 2003; Gregory, Raymond, Fosler-Lussier, & Jurafsky, 2000; Hauk & Pulvermüller, 2004; Jescheniak & Levelt, 1994; Jurafsky, Bell, Gregory, & Raymond, 2001; Just & Carpenter, 1980; Knobel, Finkbeiner, & Caramazza, 2008; Rugg, 1990; Sandra, 1994). For morphologically complex words such as compounds (e.g., *lifecycle*) and derivations (e.g., *undress*, *happiness*), additional effects of the frequencies of the constituents on processing and storage have been demonstrated (e.g., Blumenthal-Dramé, 2012; Bybee & McClelland, 2005; Hay, 2001). Frequent compounds and word pairs (e.g., *car accident*) and multiword expressions (e.g., *call it a day*) are activated faster than rare expressions of these types^d (Jurafsky, 2003, p. 62). Although the effects of frequency on larger syntactic constructions are less well supported by experimental evidence (Jurafsky, 2003, p. 63), it has been shown that frequency affects sentence parsing and the resolution of ambiguous syntactic structures^e (e.g., Diessel, 2007; Hare, McRae, & Elman, 2004; Jurafsky, 1996; Roland & Jurafsky, 2002). For example, the verb *remember* is more frequently complemented by a noun phrase (*he remembered the problem*), whereas the verb *suspect* favors clausal complements (*he suspected the problem was serious*). Sentences that meet the expectations arising from this probabilistic tendency are processed with less effort than those that do not—for example, *he remembered the problem was serious* and *he suspected the problem* (Diessel, 2007, p. 113; Jurafsky, 1996).

Evidence for frequency effects has also been found in research on first-language and second-language learning from a usage-based perspective (e.g., Childers & Tomasello, 2001; Cordes, 2014; Ellis, 2009; Gries & Divjak, 2012; Kidd, Lieven, & Tomasello, 2010; Lieven, 2010; Lieven & Tomasello, 2008; MacWhinney, 1999, 2004; Redington, Chater, & Finch, 1998). Although it is uncontroversial that frequent words are acquired earlier than rare ones,^f it has been shown that both children and second-language learners seem to be able to use more nuanced probabilistic information about co-occurrence tendencies while building up their lexicon and constructing a grammar (Diessel, 2007;

Ellis, 2006; Saffran, 2001; Saffran, Aslin, & Newport, 1996; see also Jost & Christiansen, Chapter 10, this volume).

A fundamental insight, which is paralleled by evidence from the study of language change (discussed later in the chapter), is that the repetition of identical tokens in the input (known as *token frequency*) results in increased entrenchment in terms of the strength of the corresponding specific representation,^g whereas repetition of varied items sharing commonalities of form or meaning (*type frequency*) facilitates categorization, abstraction, generalization, and the emergence of variable schemas^h (Abbot-Smith & Tomasello, 2006; Goldberg, 2006, 2009; Lieven & Tomasello, 2008, p. 174; Matthews, Lieven, Theakston, & Tomasello, 2005; Tomasello, 2003, pp. 173–175). For instance, the repetition of a fixed sequence such as *what's that* strengthens the representation of this form–meaning–function complex, whereas the repetition of expressions such as *give me* (or *gimme*) *the doll*, *give me the book*, *give me the cup*, and so on, encourages the formation of a variable schema “give me X” (see also in this volume Cordes, Chapter 12; Theakston, Chapter 14). The process of schematization requires an intricate interplay of an emerging symbolic association between forms and meanings/functions, of syntagmatic associations between the component parts of a schema (e.g., *gimme* + X), and of the paradigmatic associations between the elements that can fill the variable slot in a schema (*the doll*, *the book*, *the cup*).ⁱ These paradigmatic associations, which are based on the psychological processes of comparison and analogy, also make up the starting point for the emergence of grammatical categories such as word classes and clause constituents^j (Lieven, 2014; Tomasello, 2003, pp. 169–173) and for the paradigmatic dimension of lexical networks, such as word fields and sense relations.^k With regard to the productive use of such schemas and their slot fillers by children, it has been demonstrated that their frequency distribution encourages entrenchment of certain combinations and thus constrains overgeneralizations^l (Ambridge, Pine, Rowland, & Young, 2008; Braine & Brooks, 1995; Brooks & Tomasello, 1999; Theakston, 2004). For example, children are less likely to overgeneralize complementation patterns for frequent verbs (e.g., *read me a book*) than for rare ones (e.g., *examine me a book*) in production and are also more willing to accept frequent ones than rare ones as grammatical. Ambridge, Pine, Rowland, and Chang (2012) showed that this effect persists in adult language.

Corpus-based studies of frequency effects have tested the assumption that the frequencies of occurrence of lexical elements and syntactic constructions in large corpora mirror degrees of entrenchment and strengths of representation^a (Arppe, Gilquin, Glynn, Hilpert, & Zeschel, 2010; Blumenthal-Dramé, 2012; Schmid, 2000; see also Stefanowitsch & Flach, Chapter 5, this volume). The rationale on which these studies are based is that frequencies of occurrence in large, balanced corpora not only can serve as an approximation of the kind of repetitiveness that the average speaker produces and is typically exposed to but can actually provide clues as to the potential effects of this exposure on the cognitive systems of individual speakers. In view of the methodological gap between corpus data and degrees of entrenchment (see Mukherjee,

2005, p. 225; Schmid, 2010, 2013), it is particularly important that some studies have attempted to produce converging evidence from different sources by relating corpus-based measures to behavioral data collected in experiments (Divjak, 2008; Gries, Hampe, & Schönefeld, 2005, 2010; Schmid, 2013; Wiechmann, 2008). Questions to be considered include the following: Is relative or absolute frequency relevant for entrenchment, or do the two have different effects on entrenchment (Croft, 2008; Haspelmath, 2008; Schmid, 2014)? Are different types of relative frequencies relevant for different facets of entrenchment—for example, relative frequency to paradigmatic competitors, relative frequency to functional or onomasiological competitors, or relative frequency to relative frequencies of syntagmatic partners (see Divjak & Caldwell-Harris, 2015; Geeraerts, Grondelaers, & Bakema, 1994; Glynn & Fischer, 2010; Schmid, 2010; Schmid & Küchenhoff, 2013; Stefanowitsch & Gries, 2003)? Is the use of transitional or conditional probabilities superior in explanatory power to relative string frequencies (Blumenthal-Dramé, 2012; Bybee & Scheibman, 1999; Divjak, 2008; Jurafsky, 1996; Krug, 2003, pp. 33–39)?

The study of language change is another field in which entrenchment has been tied to discourse frequency (see De Smet, Chapter 4, this volume). Again, this is despite the fact that there is a considerable methodological gap between collective language change (i.e., conventionalization), which provides the data and explananda, on the one hand, and individual entrenchment, on the other hand. Cognitive processes such as routinization and automatization (e.g., Bybee, 2003; Croft, 2000, pp. 72–76; Haiman, 1994; Krug, 2003; Paul, 1920, pp. 49–50) and cognitive principles such as economy (Bybee, 1985; Croft, 2008; Haspelmath, 2008) have been held responsible for frequency-based types of language change. The shortcut between conventionalization and entrenchment is explicitly discussed, for example, by Blumenthal-Dramé (2012, p. 24); Croft (2000, p. 162); Paul (1920, pp. 12–14, 94–95); Rohde, Stefanowitsch, and Kemmer (2000); Schmid (2013); and Zenner, Speelman, and Geeraerts (2012, p. 769).

Diachronic frequency effects have to be interpreted in a highly differentiated way with regard to whether they affect the phonological or the morphological forms or the meanings and usage conditions of constructions, whether the constructions are morphologically simple or complex, and whether they are formally fixed or include variable slots. In addition, as mentioned earlier, the distinction between token frequency and type frequency has to be taken into consideration. The main claims concerning the entrenchment aspect of *strength of representations* (see Section 1.3.2 for chunking effects) are as follows: High token frequency of specific items, especially irregular ones such as *went*, *told*, or *spoke*, has a conserving effect on their morphological form (Bybee, 2007, p. 10; Diessel, 2007), which makes them resistant to paradigmatic analogical pressure and change; and high token frequency of specific items also has a reducing effect on their phonetic form (e.g., present-day English *free* and *friend* both derive by fusion from the Old English diphthongal stem *freo-* or *frio-*) and a bleaching effect on their meanings (Bybee, 2003, 2006; Bybee & Thompson, 1997; Krug, 2000). Type frequency of variable schemas also shows seemingly contradictory effects: On

the one hand, high type frequency combined with some degree of dispersion among the fillers of variable slots has the effect of facilitating the emergence of constructions (*constructionalization*; Traugott & Trousdale, 2013); this allows for productivity (*Mary baked me cake*), increases the potential for innovation (*Mary smiled me a kiss*), and provides the basis for change caused by analogical pressure (Himmelmann, 2004; Traugott & Trousdale, 2013, p. 18). On the other hand, highly frequent fillers of the variable slot are strongly represented compared with paradigmatic competitors and thus selected preferentially, almost by default (e.g., *give* in the ditransitive construction *Mary gave me the book*); they function as analogical attractors for less frequent items and contribute to the resistance to change (Bybee, 2006, 2010a; Traugott, 2008).

1.3.2 Frequency Effects on Entrenchment in Terms of Chunking and Holistic Units

Language change has also provided a massive body of insights into entrenchment in terms of “chunking” and the development of composite structures into holistic units (again, see De Smet, Chapter 4, this volume). The main type of evidence—which, as before, relies on a shortcut from conventionalization to entrenchment—comes from processes affecting the phonetic and morphological forms of repeated strings of words. High string token frequency, that is, the repetition of identical sequences of elements, has been found to be conducive to the phonetic and morphological reduction of complex words and word strings. Fusion and coalescence have been interpreted as symptoms of an increasing holistic processing and storage of repeated multiword sequences and other types of formulaic language (Bybee, 2003, 2007, p. 324; Bybee & Scheibman, 1999; Haspelmath, 2008, 2011). Whether these changes are the product of high relative frequency (Haspelmath, 2008) or absolute frequency (Croft, 2008); whether other measures, such as transitional probabilities, are more predictive (Bybee & McClelland, 2005; Hoffmann, 2005; Krug, 2003); and whether it is really frequency that is ultimately and solely responsible for formal reductions (Haspelmath, 2014) has yet to be determined.

The overall picture is again quite complex: On the one hand, formal reduction, fusion, and coalescence, as in *bye* from Early Modern English (*God*) *be wy you, because* from Middle English *by cause*, *lord* from Old English *hlāfweard* ‘loafkeeper,’ or, more recently, *gonna* and *wanna* from *going to* and *want to* are interpreted as indicating the emancipation of emerging holistic units from their component parts and their paradigmatic relations^z (Blumenthal-Dramé, 2012, p. 20; Bybee, 2007, p. 301; Peters, 2009); these effects are regarded as contributing to an increasing autonomy of representation (Blumenthal-Dramé, 2012, p. 4, et passim; Bybee, 2003, pp. 617–618). On the other hand, while strengthening their internal syntagmatic bonds,^{a, a} chunks with grammatical function tend to reduce their external syntagmatic autonomy, thus becoming more dependent on their grammatical cotext (Lehmann, 2004, p. 155). As far as semantic

aspects are concerned, long-term diachronic fusion is typically accompanied by a reduction in the semantic specificity of sequences with grammatical function^{a, b} (e.g., *going to* from ‘locomotion’ to ‘future intention’; see, e.g., Bybee & Pagliuca, 1985) and by semantic changes leading to a loss of compositionality for sequences with lexical meanings such as compounds (e.g., *lord*, noted earlier; see, e.g., Brinton & Traugott, 2005).

Although fixed multiword chunks such as *what’s that*, *more milk*, or *gimme hug* also play a key role in the early phases of first-language acquisition (Tomasello, 2003, 2009), these holophrastic units are not the result of a gradual chunking process, at least not in the minds of the child learners, but are learned and processed as chunks to begin with. It is only later that they are decomposed and can form the basis for early pivot schemas (*more milk*, *more tea*, *more toast* > “more *X*”) and more complex and variable schemas, for example, “give *X Y*” (Tomasello, 2003).

Experimental studies on adult language have pursued the idea that frequent chunks (*good morning*) and more or less fixed formulaic sequences (*many happy returns*, *all the same*, *if you know what I mean*) are processed in a holistic manner, that is, by means of an access-and-retrieval rather than an online, computational procedure^w (Pawley & Syder, 1983; Wray, 2002, 2008; for a recent survey of experimental work, see Conklin & Schmitt, 2012). Such single-step memory retrieval can be interpreted as a symptom of the routinization and automaticity of processing (Logan, 1988). A second feature of chunk processing that is commonly associated with automaticity (Bargh, 1992; Moors & De Houwer, 2006) is autonomy in the sense that once started, the processing is completed without further monitoring^{a, d} (see Hartsuiker & Moors, Chapter 9, this volume). The frequent co-occurrence of linguistic elements sequentially ordered in running text is assumed to have both a lexical and a syntactic priming effect^{a, e} (Hoey, 2005; Pickering & Branigan, 1999; Pulvermüller, 2010), which presumably uses neuronal sequence detectors. As a consequence, the later portions of fixed and semi-fixed expressions are to some extent predictable. Lexical items have been shown to act as primes for both lexical items (Jones & Estes, 2012) and for syntactic structures (Newman, Ratliff, Muratore, & Burns, 2009; Segal, Kempen, Petersson, & Hagoort, 2013). The outcomes of these experiments crucially depend on the types of sequences tested, however. Variables to be taken into consideration include frequency (of parts and chunks), length, fixedness, idiomaticity, discourse function, and other pragmatic constraints. The elements tested range from more or less fixed and noncompositional idioms (e.g., *shoot the breeze*, *pull someone’s leg*; see Conklin & Schmitt, 2012; Gibbs, 1980; Siyanova-Chanturia, Conklin, & Schmitt, 2011; Swinney & Cutler, 1979; Underwood, Schmitt, & Galpin, 2004), phrasal verbs (*heat up*, *slow down*; see Cappelle, Shtyrov, & Pulvermüller, 2010), semiprefabricated phrases (e.g., *don’t have to worry*, *why don’t you*; Arnon & Snider, 2010; Tremblay & Baayen, 2010; Tremblay, Derwing, & Libben, 2009; Tremblay, Derwing, Libben, & Westbury, 2011), and irreversible binomials (e.g., *bread and butter*, *law and order*; Siyanova-Chanturia, Conklin, & van Heuven, 2011) to less strongly connected but still to some extent predictable collocations (e.g., *run a shop*, *crack a joke*; Jurafsky, 1996; McDonald & Shillcock, 2003; Sosa & MacFarlane,

2002). The evidence collected so far seems to be quite conclusive as regards the holistic storage and processing of prototypical, that is, noncompositional idioms. In contrast, the extent to which other, less fixed and more transparent combinations are indeed processed as chunks and the role played by discourse frequency for chunking has turned out to be much less easy to determine^y (see Blumenthal-Dramé, Chapter 6, this volume). One of the many remaining riddles is that the best candidates for holistic processing, idioms, belong in general to the least frequently occurring formulaic sequences.

Collocations and collostructions, that is, associations between grammatical constructions and lexical elements filling variable slots (e.g., *give* in the ditransitive noun phrase [NP]–verb [V]–NP–NP construction), have been in the focus of corpus-based research on entrenchment for some time (see Evert, 2004, for a survey, as well as Ellis & O'Donnell, 2014; Schmid & Küchenhoff, 2013; Stefanowitsch & Gries, 2003; Wiechmann, 2008; Zeschel, 2012). Although collocations can be explained from a psychological perspective as a loose form of chunking (see Gobet, Chapter 11, this volume) based on syntagmatic co-occurrence tendencies, collostructions involve schematization and are conducive to the emergence of paradigmatic relations between the lexical items that are more or less likely to occur in the variable slot. Typically, grammatical constructions show the tendency to attract one or two lexical items particularly frequently. This skewed distribution facilitates the acquisition of schematic constructions in first-language (e.g., Casenhiser & Goldberg, 2005; Childers & Tomasello, 2001; Goldberg & Casenhiser, 2006) and second-language acquisition (Ellis, 2009) and contributes to the role of these anchor words as prototype-like analogical attractors^q (discussed earlier). Recently, the problems in measuring frequency and exploring the relation between various types of frequency counts and hypothetical degrees and types of entrenchment have been highlighted (e.g., Arppe et al., 2010; Blumenthal-Dramé, 2012; Lieven, 2010; Schmid, 2010; Schmid & Küchenhoff, 2013).

1.3.3 Effects of Repetition in Linguistic, Situational, and Social Contexts on Entrenchment

The evidence reviewed so far indicates that frequency of occurrence, no matter how it is measured and operationalized, at least partly conditions both types of entrenchment processes. However, frequency as such is no more than an idealized and mechanical approximation of repeated use and exposure by individual speakers taking place in concrete situations. What pure frequency counts can certainly not inform us about are the manifold ways in which repeated exposure can affect the cognitive and linguistic system depending on the linguistic, situational, and social contexts of specific usage events (see in this volume Herdina, Chapter 17; Cowley, Chapter 18). Frequency counts also overlook the fact that entrenchment as a repetition-conditioned cognitive process can only become effective if the traces of processing events “survive,” as Pickering

and Garrod (2004, p. 218) put it, a particular communicative event and are carried over to the next. In addition, it is only in communicative situations that replication and subsequent propagation, that is, spread of communicative knowledge among speakers, can take place (Croft, 2000, p. 38). In fact, experimental work on diverse types of linguistic structures suggests that frequency as such may be a less good a predictor of behavioral measures than context-related variables such as contextual diversity (Adelman, Brown, & Quesada, 2006; McDonald & Shillcock, 2001) and dispersion across text types (Baayen, 2010). This is in line with basic tenets of usage-based models (Kemmer & Barlow, 2000, p. xxi) and exemplar-based models (e.g., Bybee, 2006, pp. 716–718; Bybee & McClelland, 2005; Pierrehumbert, 2001), which also assume rich storage of contextual information relating to previous linguistic experience.^{a,f}

Effects of the wider linguistic context on syntactic choices have also been investigated under the label of syntactic or structural priming^{a,g} mentioned earlier. The focus in the present context, however, lies not on the immediate linguistic environment but instead on the tendency to repeat syntactic structures used or heard in preceding sentences and to comprehend them faster and with less effort (Bock, 1986; Chang, Dell, & Bock, 2006; Reitter, Keller, & Moore, 2011; Segaert et al., 2013; Snider, 2007). Whether the observed persistence effects (Szmrecsanyi, 2005) are to be explained in terms of transient residual activation in short-term memory or as an early form of implicit procedural learning (Bock & Griffin, 2000) remains controversial.

Lexical and structural priming across sentence boundaries and particularly across speaker turns is conducive to repetition and imitation and is therefore likely to influence the automatization and memory consolidation underlying entrenchment. The tendency of speakers in conversation toward processes known as *replication* (Croft, 2000), *accommodation* (see Auer & Hinskens, 2005; Giles, Coupland, & Coupland, 1991; Giles & Ogay, 2006; Trudgill, 1986, p. 1–38), *alignment* (e.g., Jaeger & Snider, 2013; Pickering & Garrod, 2004), and *co-adaptation* (Ellis & Larsen-Freeman, 2009, p. 91) can also be related to these effects. This takes us to a higher, interactional level of situational aspects of entrenchment, where imitation, emulation, and joint activity come into play as determinants of repetition and memory consolidation (Auer & Hinskens, 2005; Garrod & Pickering, 2009). Interestingly, according to Garrod and Pickering (2007), the sociocognitive process of alignment is largely automatic (see also Hartsuiker & Moors, Chapter 9, this volume). The claim that joint activity and joint attention in concrete situations contribute to repetition and entrenchment in first-language acquisition is well supported by research in the usage-based framework (Tomasello, 2003, 2009).

Context effects become visible in terms of increasing strengths of representation and chunking, each on both the individual cognitive microlevel and the collective macrolevel. New and increasingly more strongly entrenched meanings associated with existing forms can arise by means of absorbing existing or new pragmatic associations from context^{a,h} (Boye & Harder, 2012, p. 17; Bybee, 2003, p. 618; Croft, 2000, pp. 130–140; Heine, Claudi, & Hünemeyer, 1991, Chapter 3; Kuteva, 2001, p. 150; Nicolle, 2011; Traugott & Dasher, 2004, pp. 34–41). Well-known examples include the addition of causal meanings

to originally temporal conjunctions such as *after*, *since*, or *as* on the basis of the common inference *post hoc ergo propter hoc* (König & Traugott, 1988). If it is assumed that context-dependent, pragmatic information is retained in episodic memory, while knowledge of concepts and words is stored in semantic memory, these changes can be interpreted as involving a shift or transfer from episodic to semantic memory^{a,i} (see Takashima & Bakker, Chapter 8, this volume). The same process can be held responsible for gradual connotative enrichment of meanings^{a,j} and knowledge about the register specificity of words and expressions,^{a,k} which are also derived from rich experience of exemplars in specific situations (Schmid, 2014). Finally, the study of language acquisition (Behrens, 2009; Tomasello & Rakoczy, 2003), conversational patterns (Auer & Pfänder, 2011; Günthner, 2011; Hopper, 1987; Nattinger & DeCarrico, 1992), and language change (e.g., Bybee, 2010a, 2010b; Traugott, 2008) strongly indicate that formulaic sequences are supported by pragmatic associations and patterns in discourse (see also Schmid, 2014).

1.3.4 Other Determinants of Entrenchment

Frequency and repetition in context are not the only factors affecting entrenchment processes and their outcomes. Instead, a wide range of other variables play a role, in part by acting directly on entrenchment processes and in part by indirectly influencing repetition and thus frequency. Theoretical models of entrenchment should be informed about these factors, and empirical work investigating entrenchment must keep an eye on them as potential confounding variables (see Herdina, Chapter 17, this volume). The following brief overview is divided into linguistic factors, processing-related factors other than frequency and repetition, speaker-centered factors, and other context-related factors.

The main linguistic factor influencing the outcome of entrenchment processes is the grammatical structure of the language in question. Although entrenchment processes as such are arguably universal (Bybee, 2003, p. 622), the specific ways in which they affect first the representations of individual speakers and eventually the conventional system of the language will differ depending on the basic typological (isolating, agglutinative, fusional) and other structural characteristics. The nature of the linguistic units subjected to entrenchment processes differs considerably across language types, and so, presumably, will the outcomes of entrenchment. For example, because string chunking is largely a process involving elements in linear sequence (Bybee, 2002), it is likely that the outcome of chunking differs depending on whether the language has fixed or flexible word order. The length of potential chunks, which is partly influenced by typological factors as well, is also likely to affect degrees of entrenchment (Blumenthal-Dramé, 2012, p. 40).

Other processing-related factors, in addition to repetition and rehearsal, include the perceptual salience of linguistic forms and of extralinguistic referents as well as the cognitive salience of concepts (Geeraerts, Grondelaers, & Bakema, 1994).

The relation between attention, salience, and entrenchment is far from trivial (Schmid, 2007; see also Günther, Müller, & Geyer, Chapter 13, this volume). On the one hand, because salient forms and referents are more likely to attract attention and therefore invite repeated processing, they are also more likely to become entrenched. Once entrenched, these routines are activated more quickly and with less effort and are therefore more likely to be repeated. Obviously, this gives rise to a feedback loop in which frequency comes to serve as both a cause and an effect of entrenchment^{a,1} (Barlow & Kemmer, 2000, p. x; Schmid & Günther, 2016; see also Geeraerts, Chapter 7, this volume). Although this seems to involve the danger of a circular argumentation (Blumenthal-Dramé, 2012, p. 43), feedback loops of this type are common not only in cognitive processing, but also in diffusion processes in social systems. On the other hand, while entrenched form–meaning pairings are unlikely to attract attention, less entrenched constructions, such as rare words, are highly salient. This is shown in the inverse frequency effects reported from experiments on structural priming in which low-frequency combinations of verbs and constructions emerge as more likely to be repeated than high-frequency ones (e.g., Snider, 2007, p. 96).

Processing mode may have an effect as well. Because chunking processes are usually traced back to articulatory economy (e.g., Bybee, 1985), it is often assumed that individual entrenchment and long-term collective conventionalization of this type are fostered more by frequency in speech than by frequency in written text (Krug, 2003, p. 32). Whether the processing of spoken language is also more conducive to entrenchment in terms of strength of representation and schematization than the processing of written language has yet to be shown. The fact that many speakers are highly aware of the appropriateness of words and constructions in specific situational contexts supports the assumption that contextual information is stored alongside formal and semantic aspects. Blumenthal-Dramé (2012, p. 40) reviewed studies suggesting that the potential for mental imagery and emotional arousal may have an effect on entrenchment.

If entrenchment relates to the minds of individual speakers, it is, more or less by definition, subject to individual, speaker-related differences (Barlow, 2013; Dąbrowska, 2012, 2015; Schmid & Mantlik, 2015; Street & Dąbrowska, 2010). Most of these are hard to grasp and control methodologically because their sources are hidden in the exposure and usage histories of individual speakers, which, in turn, are influenced not only by familiar social variables such as region, gender, education, training, and social roles (Geeraerts, 2005) but also by personal routines and experiences. In addition, individual preferences for analytical and holistic perceptual processing may well have an effect (de-Wit & Wagemans, 2015). Age undoubtedly plays a key role because neuroplasticity, and with it the potential for cognitive reorganization, decreases over time (Blumenthal-Dramé, 2012, pp. 44–47; Seidenberg & Zevin, 2006). Even if entrenchment is conceived of as a lifelong learning process, there can be no doubt that linguistic reorganization is particularly dynamic during the so-called *critical* or *sensitive period* (Lenneberg, 1967), that is, before the age of approximately 14 years. Furthermore,

entrenchment processes and their outcomes crucially depend on whether speakers are acquiring and developing their first, second, or a later language, because entrenched first-language routines have a strong transfer and interference effect on the learning of later languages (MacWhinney, 2008; see also MacWhinney, Chapter 15, this volume). Feedback effects of languages learned later on the first language and especially on other nonnative languages learned earlier are also well attested (see Cenoz, Hufeisen, & Jessner, 2001).

Finally, because entrenchment is subject to the use of language in social situations, key social parameters of the other interlocutors are likely to play a role, both directly and mediated by other variables, such as salience. The extent to which accommodation, imitation, and alignment take place and can have an effect on short- and long-term entrenchment depends on the social roles and the (overt and covert) prestige of the interlocutors vis-à-vis the speaker. Research in communication accommodation theory (Giles, Coupland, & Coupland, 1991) has shown that speakers are more willing to converge in their use of language if they feel solidarity. Finally, the prestige of sources and media that provide input (e.g., newspapers, magazines, TV, Internet) and the speakers and writers, respectively, also influence entrenchment.

1.4 Consequences for Understanding the Psychological Foundations of Entrenchment

The discussion so far has demonstrated that entrenchment processes can be made responsible for a wide range of cognitive and linguistic effects. Before a proposal integrating these effects is made (see Section 1.5), it is important to summarize the psychological foundations of entrenchment and point to missing links between insights on linguistic entrenchment and the underlying psychological processes.

First, entrenchment in terms of variable strengths of representations suggests memory-based interpretations (see Takashima & Bakker, Chapter 8, this volume): Rehearsal affected by repeated exposure and use results in memory consolidation; disuse causes decay and attrition (Langacker, 1987, p. 57). Although a single exposure may leave memory traces strong enough to persist (de Vaan, Schreuder, & Baayen, 2007), it has to be assumed that memory consolidation requires repetition, ideally in different communicative situations, and the retaining of memory traces from one communicative event to the next. Sleep has been shown to be conducive to memorizing new words (Dumay & Gaskell, 2007). Automaticity could come into play here as an effect of increasingly routinized reactions to communicative demands in social situations by means of implicit statistical learning. For example, for most people, it is a highly automatic routine requiring little monitoring and conscious effort to greet family members or colleagues when they see them for the first time in the morning. Because a large proportion of everyday conversation is formulaic (see the references provided in Conklin

& Schmitt, 2012, p. 46), automaticity may well complement memory consolidation as an important cognitive process (see Hartsuiker & Moors, Chapter 9, this volume). The boundary between stored knowledge of linguistic routines and the automatic skill of applying them in the right context does not seem to be clear-cut.

This leads to the second main facet of entrenchment: holistic processing and storage of complex chunks (see Gobet, Chapter 11, this volume). As pointed out earlier, the autonomous processing of fixed chunks, in the sense of unmonitored completion once begun (Bargh, 1992), points toward an account in terms of high degrees of automaticity, as does the tendency to align linguistically with interlocutors (Garrod & Pickering, 2009). However, language production as such (see Garrod & Pickering, 2009) is of course clearly not an entirely automatic cognitive process, and so memory and other higher cognitive abilities definitely have a role to play. If we want to understand how knowledge of language and linguistic competence can emerge by means of entrenchment, the details of how memory, learning, and automatization work together have to be spelled out in greater detail.

This, thirdly, is not enough, however. As the discussions in Sections 1.3.1 and 1.3.2 have shown, entrenchment in terms of strength of representation and entrenchment in terms of chunking are inextricably intertwined with schematization. As soon as entrenched routines involve variable forms or contain variable slots, schematization comes into play. If one accepts the reasonable working definition of Blumenthal-Dramé (2012, p. 4), which states that entrenchment denotes “the strength of autonomy or representation of a form–meaning pairing *at a given level of abstraction in the cognitive system*” (emphasis added), it becomes clear that schematization is an inevitable part of entrenchment, not least because constructional schemas undoubtedly lie at the heart of language learning, linguistic knowledge, and the generative capacity of speakers to form sentences. From a psychological point of view, the decision to include schematization as a key entrenchment process widens the agenda even further to include categorization, generalization, and abstraction as relevant cognitive processes underlying schematization (see Cordes, Chapter 12, this volume).

Fourth, a model of entrenchment has to factor in the psychosocial processes mentioned in Section 1.3.3: imitation, emulation, accommodation, alignment, and co-adaptation, as well as the range of social variables affecting their effects (see Section 1.3.4). A solid understanding of these processes is essential because they act as mediators between the cognitive processes taking place in the minds of language users and the communicative factors that lie behind frequency-based repetition and the way it affects speakers’ cognitive systems and the collective linguistic system (Schmid, 2015). Models of language as a complex adaptive system (Ellis & Larsen-Freeman, 2009; Frank & Gontier, 2010; Five Graces Group, 2009; see also Herdina, Chapter 17, this volume) or as distributed cognition (Cowley, 2011; Cowley & Vallée-Tourangeau, 2013; see also Cowley, Chapter 18, this volume), as well as sociocognitive models of linguistic knowledge (Geeraerts, 2005; Geeraerts, Kristiansen, & Peirsman, 2010; Kristiansen, 2008; Zenner, Spielman, & Geeraerts, 2012) target these aspects.

1.5 Toward an Integrated Framework for the Study of Entrenchment and Its Psychological Foundations

In light of the preceding discussion, the following working definition of entrenchment is suggested: *Entrenchment* refers to the ongoing reorganization and adaptation of individual communicative knowledge, which is subject to exposure to language and language use and to the exigencies of domain-general cognitive processes and the social environment. Specifically, entrenchment subsumes processes related to

1. different strengths of the representations of simple and complex linguistic elements and structures,
2. degrees of chunking resulting in the availability of more or less holistically processed units, and
3. the emergence and reorganization of variable schemas providing the means required for generative linguistic competence.

The linguistic effects that can result from these basic entrenchment processes are numerous, diverse, and, in part, seemingly contradictory. Conceptual and terminological confusion is increased because the term *entrenchment* has been used to refer to a variety of things: cognitive processes and their cognitive and linguistic effects, as well as collective processes and their long-term linguistic effects on the language system. Terms denoting more specific entrenchment processes such as *chunking*, *fusion*, and *analogy* have also been used to refer to both individual cognitive and long-term collective conventionalization processes.

To demonstrate that entrenchment is nevertheless a valuable and coherent concept with considerable explanatory power, the remainder of this introduction sketches out an integrative framework for the study of entrenchment and its psychological foundation. In this proposal,

- cognitive processes taking place in the minds of individuals (entrenchment) are distinguished from social processes effecting long-term language change (conventionalization);
- cognitive processes are distinguished from cognitive effects;
- cognitive effects are distinguished from linguistic effects;
- determinants and predictors of entrenchment are distinguished from entrenchment processes, and these in turn from cognitive and linguistic effects;
- effects of repetition of specific tokens and exemplars (token frequency) are distinguished from effects of repetition of abstract types and schemas (type frequency); and
- effects of entrenchment in linguistic forms are distinguished from effects on linguistic meanings.

As a first step, the nature of the entities that serve as input to entrenchment processes is redefined. Usage-based models usually assume that entrenchment operates over constructions and constructional schemas that are characterized as form–meaning pairings. Furthermore, they claim that these constructions and schemas are related to each other in a massive associative memory network organized mainly in terms of hierarchical relations (see Hilpert & Diessel, Chapter 3, this volume). The present proposal diverges from this idea in two important ways: First, it rejects the distinction between constructions serving as nodes in the network and relations between nodes and instead assumes that linguistic knowledge is available in one format only, namely, associations. These associations come in four types: symbolic, syntagmatic, paradigmatic, and pragmatic. Second, entrenchment processes are seen as operating over these four types of associations in the network rather than over constructions, which, in turn, are regarded as more or less strongly entrenched symbolic associations between forms and meanings (for more details, see Schmid, 2014, 2015). This decision is partly motivated by concerns (Schmid, 2013; see also Blumenthal-Dramé, 2012) that as soon as one claims that a “construction” is “represented” in a speaker’s mind, both the gradual and the dynamic aspects inherent in the concept of entrenchment are left behind. The four types of associations are defined as follows:

- *Symbolic* associations link linguistic forms and meanings in language processing and thus afford the semiotic potential of linguistic signs and constructions.
- *Syntagmatic* associations link forms and meanings processed sequentially in language production and comprehension.
- *Paradigmatic* associations link associations during ongoing language processing to competing associations, that is, to associations that could potentially enter the focus of attention in the given linguistic and situational environment.
- *Pragmatic* associations link symbolic, paradigmatic, and syntagmatic associations with perceptual input garnered from external situations.

While all four types of associations are portrayed as being activated in the course of ongoing language processing, entrenchment is brought about by the routinization effected by the repeated processing of identical or similar stimuli. This is exactly what is predicted by emergentist and usage-based models of language.

The precise ways in which these four types of associations are affected by entrenchment processes is summarized in Table 1.1 (see Section 1.3). The table focuses on frequency and repetition as the main determinant of entrenchment and distinguishes between types of repetition, cognitive effects, and linguistic effects. Details about these effects can be found in Sections 1.3.1 through 1.3.3. In addition, suggestions concerning possible psychological affordances underlying entrenchment are listed.

The table should be read from left to right. The first line, for example, states that the token repetition of identical word forms and fixed strings increases the representational strength of the symbolic association between these forms and

the corresponding meanings by means of memory consolidation and routinization, which has the numerous linguistic effects listed in the right-hand cell. The additional determinants of entrenchment discussed in Section 1.3 are not included in the table but form part of the general framework of entrenchment. The goal of this proposal, in addition to highlighting the dynamic quality of entrenchment processes, is to show that the large diversity of entrenchment processes can be reconciled in a unified framework if types of inputs to entrenchment processes, determinants, and effects of entrenchment are systematically distinguished. It would be exaggerated to claim that everything falls into place once this is done, but a small step forward may be accomplished.

1.6 Conclusion

The proposed framework in this chapter is bound to raise a lot of questions, but it may still serve as a starting point for the investigation of entrenchment processes and the interpretation of empirical data and findings. The contributions to this volume will equip readers with everything they need to form their own ideas of entrenchment and its psychological foundations in memory and automatization.

References

- Abbot-Smith, K., & Tomasello, M. (2006). Exemplar-learning and schematization in a usage-based account of syntactic acquisition. *The Linguistic Review*, 23, 275–290. <http://dx.doi.org/10.1515/TLR.2006.011>
- Adelman, J. S., Brown, G. D. A., & Quesada, J. F. (2006). Contextual diversity, not word frequency, determines word-naming and lexical decision times. *Psychological Science*, 17, 814–823. <http://dx.doi.org/10.1111/j.1467-9280.2006.01787.x>
- Ambridge, B., Pine, J. M., Rowland, C. F., & Chang, F. (2012). The roles of verb semantics, entrenchment, and morphophonology in the retreat from dative argument-structure overgeneralization errors. *Language*, 88, 45–81. <http://dx.doi.org/10.1353/lan.2012.0000>
- Ambridge, B., Pine, J. M., Rowland, C. F., & Young, C. R. (2008). The effect of verb semantic class and verb frequency (entrenchment) on children's and adults' graded judgements of argument-structure overgeneralization errors. *Cognition*, 106, 87–129. <http://dx.doi.org/10.1016/j.cognition.2006.12.015>
- Arnon, I., & Snider, N. (2010). More than words: Frequency effects for multi-word phrases. *Journal of Memory and Language*, 62, 67–82. <http://dx.doi.org/10.1016/j.jml.2009.09.005>
- Arppe, A., Gilquin, G., Glynn, D., Hilpert, M., & Zeschel, A. (2010). Cognitive corpus linguistics: Five points of debate on current theory and methodology. *Corpora*, 5, 1–27. <http://dx.doi.org/10.3366/cor.2010.0001>
- Auer, P., & Hinskens, F. (2005). The role of interpersonal accommodation in a theory of language change. In P. Auer, F. Hinskens, & P. Kerswill (Eds.), *Dialect change* (pp. 335–357). Cambridge, England: Cambridge University Press. <http://dx.doi.org/10.1017/CBO9780511486623.015>

- Auer, P., & Pfänder, S. (Eds.). (2011). *Constructions: Emerging and emergent*. <http://dx.doi.org/10.1515/9783110229080>
- Baayen, R. H. (2010). Demythologizing the word frequency effect: A discriminative learning perspective. *The Mental Lexicon*, 5, 436–461. <http://dx.doi.org/10.1075/ml.5.3.10baa>
- Bargh, J. A. (1992). The ecology of automaticity: Toward establishing the conditions needed to produce automatic processing effects. *The American Journal of Psychology*, 105, 181–199. <http://dx.doi.org/10.2307/1423027>
- Barlow, M. (2013). Individual differences and usage-based grammar. *International Journal of Corpus Linguistics*, 18, 443–478. <http://dx.doi.org/10.1075/ijcl.18.4.01bar>
- Barlow, M., & Kemmer, S. (Eds.). (2000). *Usage-based models of language*. Stanford, CA: CSLI.
- Behrens, H. (2009). Usage-based and emergentist approaches to language acquisition. *Linguistics*, 47, 381–411. <http://dx.doi.org/10.1515/LING.2009.014>
- Blumenthal-Dramé, A. (2012). *Entrenchment in usage-based theories: What corpus data do and do not reveal about the mind*. <http://dx.doi.org/10.1515/9783110294002>
- Bock, K. (1986). Syntactic persistence in language production. *Cognitive Psychology*, 18, 355–387. [http://dx.doi.org/10.1016/0010-0285\(86\)90004-6](http://dx.doi.org/10.1016/0010-0285(86)90004-6)
- Bock, K., & Griffin, Z. M. (2000). The persistence of structural priming: Transient activation or implicit learning? *Journal of Experimental Psychology: General*, 129, 177–192. <http://dx.doi.org/10.1037/0096-3445.129.2.177>
- Boye, K., & Harder, P. (2012). A usage-based theory of grammatical status and grammaticalization. *Language*, 88, 1–44. <http://dx.doi.org/10.1353/lan.2012.0020>
- Braine, M., & Brooks, P. (1995). Verb argument structure and the problem of avoiding an overgeneral grammar. In M. Tomasello & W. Merriman (Eds.), *Beyond names for things: Young children's acquisition of verbs* (pp. 353–376). Hillsdale, NJ: Erlbaum.
- Brinton, L. J., & Traugott, E. C. (2005). *Lexicalization and language change*. Cambridge, England: Cambridge University Press. <http://dx.doi.org/10.1017/CBO9780511615962>
- Brooks, P., & Tomasello, M. (1999). How children constrain their argument structure constructions. *Language*, 75, 720–738. <http://dx.doi.org/10.2307/417731>
- Bybee, J. L. (1985). *Morphology: A study of the relation between meaning and form*. <http://dx.doi.org/10.1075/tsl.9>
- Bybee, J. L. (2002). Sequentiality as the basis of constituent structure. In T. Givón & B. F. Malle (Eds.), *The evolution of language out of pre-language* (pp. 109–134). <http://dx.doi.org/10.1075/tsl.53.07byb>
- Bybee, J. L. (2003). Mechanisms of change in grammaticization: The role of frequency. In B. Joseph & R. Janda (Eds.), *Handbook of historical linguistics* (pp. 602–623). <http://dx.doi.org/10.1002/9780470756393.ch19>
- Bybee, J. L. (2006). From usage to grammar: The mind's response to repetition. *Language*, 82, 711–733. <http://dx.doi.org/10.1353/lan.2006.0186>
- Bybee, J. L. (2007). *Frequency of use and the organization of language*. <http://dx.doi.org/10.1093/acprof:oso/9780195301571.001.0001>
- Bybee, J. L. (2010a). *Language, usage and cognition*. <http://dx.doi.org/10.1017/CBO9780511750526>
- Bybee, J. L. (2010b). Usage-based theory. In B. Heine & H. Narrog (Eds.), *The Oxford handbook of linguistic analysis* (pp. 69–78). Oxford, England: Oxford University Press.
- Bybee, J. L., & McClelland, J. L. (2005). Alternatives to the combinatorial paradigm of linguistic theory based on domain general principles of human cognition. *The Linguistic Review*, 22, 381–410. <http://dx.doi.org/10.1515/tlir.2005.22.2-4.381>

- Bybee, J. L., & Pagliuca, W. (1985). Cross-linguistic comparison and the development of grammatical meaning. In J. Fisiak (Ed.), *Historical semantics—Historical word-formation* (pp. 59–83). <http://dx.doi.org/10.1515/9783110850178.59>
- Bybee, J. L., & Scheibman, J. (1999). The effect of usage on degrees of constituency: The reduction of *don't* in English. *Linguistics*, 37, 575–596. <http://dx.doi.org/10.1515/ling.37.4.575>
- Bybee, J. L., & Thompson, S. A. (1997). Three frequency effects in syntax. In L. J. Matthew & J. Moxley (Eds.), *Proceedings of the 23rd annual meeting of the Berkeley Linguistics Society* (pp. 378–388). Berkeley, CA: Berkeley Linguistics Society.
- Cappelle, B., Shtyrov, Y., & Pulvermüller, F. (2010). *Heating up or cooling up* the brain? MEG evidence that phrasal verbs are lexical units. *Brain and Language*, 115, 189–201. <http://dx.doi.org/10.1016/j.bandl.2010.09.004>
- Casenhiser, D., & Goldberg, A. E. (2005). Fast mapping between a phrasal form and meaning. *Developmental Science*, 8, 500–508. <http://dx.doi.org/10.1111/j.1467-7687.2005.00441.x>
- Cenoz, J., Hufeisen, B., & Jessner, U. (Eds.). (2001). *Cross-linguistic influence in third language acquisition: Psycholinguistic perspectives*. Bristol, England: Multilingual Matters.
- Chang, F., Dell, G. S., & Bock, K. (2006). Becoming syntactic. *Psychological Review*, 113, 234–272. <http://dx.doi.org/10.1037/0033-295X.113.2.234>
- Childers, J. B., & Tomasello, M. (2001). The role of pronouns in young children's acquisition of the English transitive construction. *Developmental Psychology*, 37, 739–748. <http://dx.doi.org/10.1037/0012-1649.37.6.739>
- Conklin, K., & Schmitt, N. (2012). The processing of formulaic language. *Annual Review of Applied Linguistics*, 32, 45–61. <http://dx.doi.org/10.1017/S0267190512000074>
- Cordes, A. K. (2014). *The role of frequency in children's learning of morphological constructions*. Tübingen, Germany: Narr.
- Cowley, S. J. (Ed.). (2011). *Distributed language*. <http://dx.doi.org/10.1075/bct.34>
- Cowley, S. J., & Vallée-Tourangeau, F. (Eds.). (2013). *Cognition beyond the brain: Computation, interactivity and human artifice*. <http://dx.doi.org/10.1007/978-1-4471-5125-8>
- Croft, W. (2000). *Explaining language change: An evolutionary approach*. Harlow, England: Longman.
- Croft, W. (2008). On iconicity of distance. *Cognitive Linguistics*, 19, 49–57. <http://dx.doi.org/10.1515/COG.2008.003>
- Dąbrowska, E. (2012). Different speakers, different grammars: Individual differences in native language attainment. *Linguistic Approaches to Bilingualism*, 2, 219–253. <http://dx.doi.org/10.1075/lab.2.3.01dab>
- Dąbrowska, E. (2015). Individual differences in grammatical knowledge. In E. Dąbrowska & D. Divjak (Eds.), *Handbook of cognitive linguistics* (pp. 650–668). <http://dx.doi.org/10.1515/9783110292022-033>
- Dell, G. S. (1990). Effects of frequency and vocabulary type on phonological speech errors. *Language and Cognitive Processes*, 5, 313–349. <http://dx.doi.org/10.1080/01690969008407066>
- de Saussure, F. (1916). *Cours de linguistique générale* [Course in general linguistics]. Paris, France: Payot.
- de Vaan, L., Schreuder, R., & Baayen, R. H. (2007). Regular morphologically complex neologisms leave detectable traces in the mental lexicon. *The Mental Lexicon*, 2, 1–23. <http://dx.doi.org/10.1075/ml.2.1.02vaa>
- de Wit, L., & Wagemans, J. (2015). Individual differences in local and global perceptual organization. In J. Wagemans (Ed.), *Oxford handbook of perceptual organization* (pp. 713–735). Oxford, England: Oxford University Press.

- Diessel, H. (2007). Frequency effects in language acquisition, language use, and diachronic change. *New Ideas in Psychology*, 25, 108–127. <http://dx.doi.org/10.1016/j.newideapsych.2007.02.002>
- Divjak, D. (2008). On (in)frequency and (un)acceptability. In B. Lewandowska-Tomaszczyk (Ed.), *Corpus linguistics, computer tools and applications—State of the art* (pp. 1–21). Frankfurt, Germany: Peter Lang.
- Divjak, D., & Caldwell-Harris, C. L. (2015). Frequency and entrenchment. In E. Dąbrowska & D. Divjak (Eds.), *Handbook of cognitive linguistics* (pp. 53–75). <http://dx.doi.org/10.1515/9783110292022-004>
- Divjak, D., & Gries, S. T. (Eds.). (2012). *Frequency effects in language representation*. <http://dx.doi.org/10.1515/9783110274073>
- Dumay, N., & Gaskell, M. G. (2007). Sleep-associated changes in the mental representation of spoken words. *Psychological Science*, 18, 35–39.
- Ellis, N. C. (2006). Language acquisition as rational contingency learning. *Applied Linguistics*, 27, 1–24. <http://dx.doi.org/10.1093/applin/ami038>
- Ellis, N. C. (2009). Constructing a second language. In N. C. Ellis, C. Nick, & D. Larsen-Freeman (Eds.), *Language as a complex adaptive system* (pp. 90–123). Chichester, England: Wiley-Blackwell.
- Ellis, N. C., & Larsen-Freeman, D. (Eds.). (2009). *Language as a complex adaptive system*. Chichester, England: Wiley-Blackwell.
- Ellis, N. C., & O'Donnell, M. (2014). Construction learning as category learning: A cognitive analysis. In T. Herbst, H.-J. Schmid, & S. Faulhaber (Eds.), *Constructions collocations patterns* (pp. 71–97). <http://dx.doi.org/10.1515/9783110356854-71>
- Evert, S. (2004). *The statistics of word cooccurrences: Word pairs and collocations* (Unpublished doctoral dissertation). Institut für Maschinelle Sprachverarbeitung, University of Stuttgart, Germany.
- Five Graces Group [Becker, C., Blythe, R., Bybee, J., Christiansen, M. H., Croft, W., Ellis, N. C., Holland, J., Ke, J., Larsen-Freeman, D., & Schoenemann, T.]. (2009). Language is a complex adaptive system: Position paper. In N. C. Ellis & D. Larsen-Freeman (Eds.), *Language as a complex adaptive system* (pp. 1–26). Chichester, England: Wiley-Blackwell.
- Forster, K. I. (2007). Visual word recognition: Problems and issues. In G. Jarema & G. Libben (Eds.), *The mental lexicon. Core perspectives* (pp. 31–53). Amsterdam, the Netherlands: Elsevier.
- Frank, R. M., & Gontier, N. (2010). On constructing a research model for historical cognitive linguistics (HCL): Some theoretical considerations. In M. E. Winters, H. Tissari, & K. Allan (Eds.), *Historical cognitive linguistics* (pp. 31–69). Berlin, Germany: De Gruyter Mouton.
- Garrod, S., & Pickering, M. (2007). Automaticity in language production in monologue and dialogue. In A. Meyer, L. Wheeldon, & A. Krott (Eds.), *Automaticity and control in language processing* (pp. 1–20). New York, NY: Psychology Press.
- Garrod, S., & Pickering, M. J. (2009). Joint action, interactive alignment, and dialog. *Topics in Cognitive Science*, 1, 292–304. <http://dx.doi.org/10.1111/j.1756-8765.2009.01020.x>
- Geeraerts, D. (2005). Lectal variation and empirical data in Cognitive Linguistics. In F. J. Ruiz De Mendoza Ibanez & M. S. Pena Cervel (Eds.), *Cognitive linguistics: Internal dynamics and interdisciplinary interaction* (pp. 163–189). Berlin, Germany: Mouton de Gruyter.
- Geeraerts, D., Grondelaers, S., & Bakema, P. (1994). *The structure of lexical variation. A descriptive framework for cognitive lexicology*. <http://dx.doi.org/10.1515/9783110873061>
- Geeraerts, D., Kristiansen, G., & Peirsman, Y. (Eds.). (2010). *Advances in cognitive sociolinguistics*. <http://dx.doi.org/10.1515/9783110226461>
- Gibbs, R. W., Jr. (1980). Spilling the beans on understanding and memory for idioms in conversation. *Memory & Cognition*, 8, 149–156. <http://dx.doi.org/10.3758/BF03213418>

- Giles, H., Coupland, N., & Coupland, J. (1991). Accommodation theory: Communication, context and consequence. In H. Giles, N. Coupland, & J. Coupland (Eds.), *Contexts of accommodation: Developments in applied sociolinguistics* (pp. 1–68). <http://dx.doi.org/10.1017/CBO9780511663673.001>
- Giles, H., & Ogay, T. (2006). Communication accommodation theory. In B. B. Whaley & W. Samter (Eds.), *Explaining communication: Contemporary theories and exemplars* (pp. 293–310). Mahwah, NJ: Erlbaum.
- Giora, R. (2003). *On our mind: Salience, context, and figurative language*. <http://dx.doi.org/10.1093/acprof:oso/9780195136166.001.0001>
- Glynn, D., & Fischer, K. (Eds.). (2010). *Quantitative methods in cognitive semantics: Corpus-driven approaches*. <http://dx.doi.org/10.1515/9783110226423>
- Goldberg, A. (2006). *Constructions at work: The nature of generalization in language*. Oxford, England: Oxford University Press.
- Goldberg, A. (2009). The nature of generalization in language. *Cognitive Linguistics*, 20, 93–127.
- Goldberg, A., & Casenhiser, D. (2006). Learning argument structure constructions. In E. V. Clark & B. F. Kelly (Eds.), *Constructions in acquisition* (pp. 185–204). Stanford, CA: CSLI.
- Gregory, M., Raymond, W., Fosler-Lussier, E., & Jurafsky, D. (2000). The effects of collocational strength and contextual predictability in lexical production. *Chicago Linguistic Society*, 35, 151–166.
- Gries, S. T., & Divjak, D. (Eds.). (2012). Frequency effects in language learning and processing. <http://dx.doi.org/10.1515/9783110274059>
- Gries, S. T., Hampe, B., & Schönefeld, D. (2005). Converging evidence: Bringing together experimental and corpus data on the associations of verbs and constructions. *Cognitive Linguistics*, 16, 635–676. <http://dx.doi.org/10.1515/cogl.2005.16.4.635>
- Gries, S. T., Hampe, B., & Schönefeld, D. (2010). Converging evidence II: More on the association of verbs and constructions. In J. Newman & S. Rice (Eds.), *Experimental and empirical methods in the study of conceptual structure, discourse, and language* (pp. 59–72). Stanford, CA: CSLI.
- Günthner, S. (2011). Between emergence and sedimentation: Projecting constructions in German interactions. In P. Auer & S. Pfänder (Eds.), *Constructions: Emerging and emergent* (pp. 165–185). <http://dx.doi.org/10.1515/9783110229080.156>
- Haiman, J. (1994). Ritualization and the development of language. In W. Pagliuca (Ed.), *Perspectives on grammaticalization* (pp. 3–28). <http://dx.doi.org/10.1075/cilt.109.07hai>
- Hare, M., McRae, K., & Elman, J. L. (2004). Admitting that admitting verb sense into corpus analyses makes sense. *Language and Cognitive Processes*, 19, 181–224. <http://dx.doi.org/10.1080/01690960344000152>
- Haspelmath, M. (2008). Frequency vs. iconicity in explaining grammatical asymmetries. *Cognitive Linguistics*, 19, 1–33. <http://dx.doi.org/10.1515/COG.2008.001>
- Haspelmath, M. (2011). The gradual coalescence into “words” in grammaticalization. In H. Narrog & B. Heine (Eds.), *The Oxford handbook of grammaticalization* (pp. 342–355). Oxford, England: Oxford University Press.
- Haspelmath, M. (2014). On system pressure competing with economic motivation. In B. MacWhinney, A. Malchukov, & E. Moravcsik (Eds.), *Competing motivations in grammar and usage* (pp. 197–208). <http://dx.doi.org/10.1093/acprof:oso/9780198709848.003.0012>
- Hauk, O., & Pulvermüller, F. (2004). Effects of word length and frequency on the human event-related potential. *Clinical Neurophysiology*, 115, 1090–1103. <http://dx.doi.org/10.1016/j.clinph.2003.12.020>

- Hay, J. (2001). Lexical frequency in morphology: Is everything relative? *Linguistics*, 39, 1041–1070. <http://dx.doi.org/10.1515/ling.2001.041>
- Heine, B., Claudi, U., & Hünemeyer, F. (1991). *Grammaticalization: A conceptual framework*. Chicago, IL: University of Chicago Press.
- Himmelmann, N. P. (2004). Lexicalization and grammaticization: opposite or orthogonal? In W. Bisang, N. P. Himmelmann, & B. Wiemer (Eds.), *What makes grammaticalization: A look from its fringes and its components* (pp. 21–42). Berlin, Germany: Mouton de Gruyter.
- Hoey, M. (2005). *Lexical priming: A new theory of words and language*. <http://dx.doi.org/10.4324/9780203327630>
- Hoffmann, S. (2005). *Grammaticalization and English complex prepositions: A corpus-based study*. New York, NY: Routledge.
- Hopper, P. (1987). Emergent grammar. *Berkeley Linguistics Society*, 13, 139–157.
- Jaeger, T. F., & Snider, N. E. (2013). Alignment as a consequence of expectation adaptation: Syntactic priming is affected by the prime's prediction error given both prior and recent experience. *Cognition*, 127, 57–83. <http://dx.doi.org/10.1016/j.cognition.2012.10.013>
- Jescheniak, J. D., & Levelt, W. J. M. (1994). Word frequency effects in speech production: Retrieval of syntactic information and of phonological form. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 20, 824–843. <http://dx.doi.org/10.1037/0278-7393.20.4.824>
- Jones, L. L., & Estes, Z. (2012). Lexical priming: Associative, semantic, and thematic influences on word recognition. In J. S. Adelman (Ed.), *Visual word recognition: Vol. 2. Meaning and context, individuals and development* (pp. 44–72). Hove, England: Psychology Press.
- Jurafsky, D. (1996). A probabilistic model of lexical and syntactic access and disambiguation. *Cognitive Science*, 20, 137–194. http://dx.doi.org/10.1207/s15516709cog2002_1
- Jurafsky, D. (2003). Probabilistic modelling in psycholinguistics: Linguistic comprehension and production. In R. Bod, J. Hay, & S. Jannedy (Eds.), *Probabilistic linguistics* (pp. 39–76). Cambridge, MA: MIT Press.
- Jurafsky, D., Bell, A., Gregory, M., & Raymond, W. D. (2001). Probabilistic relations between words: Evidence from reduction in lexical production. In J. Bybee & P. Hopper (Eds.), *Frequency and the emergence of linguistic structure* (pp. 229–254). <http://dx.doi.org/10.1075/tsl.45.13jur>
- Just, M. A., & Carpenter, P. A. (1980). A theory of reading: From eye fixations to comprehension. *Psychological Review*, 87, 329–354. <http://dx.doi.org/10.1037/0033-295X.87.4.329>
- Kemmer, S., & Barlow, M. (2000). Introduction. In M. Barlow & S. Kemmer (Eds.), *Usage-based models of language* (pp. vii–xxvii). Stanford, CA: CSLI.
- Kidd, A., Lieven, E. V. M., & Tomasello, M. (2010). Lexical frequency and exemplar-based learning effects in language acquisition: Evidence from sentential complements. *Language Sciences*, 32, 132–142. <http://dx.doi.org/10.1016/j.langsci.2009.05.002>
- Knobel, M., Finkbeiner, M., & Caramazza, A. (2008). The many places of frequency: Evidence for a novel locus of the lexical frequency effect in word production. *Cognitive Neuropsychology*, 25, 256–286. <http://dx.doi.org/10.1080/02643290701502425>
- König, E., & Traugott, E. C. (1988). Pragmatic strengthening and semantic change: The conventionalizing of conversational implicature. In W. Hüllen & R. Schulze (Eds.), *Understanding the lexicon* (pp. 110–124). <http://dx.doi.org/10.1515/9783111355191.110>
- Kristiansen, G. (2008). Style-shifting and shifting styles: A socio-cognitive approach to lectal variation. In G. Kristiansen & R. Dirven (Eds.), *Cognitive sociolinguistics: Language variation, cultural models, social systems* (pp. 45–88). <http://dx.doi.org/10.1515/9783110199154.1.45>

- Krug, M. (2000). *Emerging English modals: A corpus-based study of grammaticalization*. <http://dx.doi.org/10.1515/9783110820980>
- Krug, M. (2003). Frequency as a determinant in grammatical variation and change. In G. Rohdenburg & B. Mondorf (Eds.), *Determinants of grammatical variation in English* (pp. 7–67). <http://dx.doi.org/10.1515/9783110900019.7>
- Kuteva, T. (2001). *Auxiliation: An enquiry into the nature of grammaticalization*. Oxford, England: Oxford University Press.
- Langacker, R. W. (1987). *Foundations of cognitive grammar: Vol. 1. Theoretical prerequisites*. Stanford, CA: Stanford University Press.
- Langacker, R. W. (1991). *Foundations of cognitive grammar: Vol. 2. Descriptive application*. Stanford, CA: Stanford University Press.
- Langacker, R. W. (2008). *Cognitive grammar: A basic introduction*. <http://dx.doi.org/10.1093/acprof:oso/9780195331967.001.0001>
- Lehmann, C. (2004). Theory and method in grammaticalization. *Zeitschrift für Germanistische Linguistik*, 32(2), 152–187. <http://dx.doi.org/10.1515/zfgl.2004.32.2.152>
- Lenneberg, E. H. (1967). *Biological foundations of language*. Chichester, England: Wiley-Blackwell.
- Lieven, E. V. (2010). Input and first language acquisition: Evaluating the role of frequency. *Lingua*, 120, 2546–2556. <http://dx.doi.org/10.1016/j.lingua.2010.06.005>
- Lieven, E. V. (2014). Language-learning from a usage-based approach. In T. Herbst, H.-J. Schmid, & S. Faulhaber (Eds.), *Constructions collocations patterns* (pp. 9–32). Berlin, Germany: De Gruyter Mouton.
- Lieven, E. V., & Tomasello, M. (2008). Children's first language acquisition from a usage-based perspective. In P. Robinson & N. C. Ellis (Eds.), *Handbook of cognitive linguistics and second language acquisition* (pp. 168–196). New York, NY: Routledge.
- Logan, G. D. (1988). Towards an instance theory of automatization. *Psychological Review*, 95, 492–527. <http://dx.doi.org/10.1037/0033-295X.95.4.492>
- MacWhinney, B. (Ed.). (1999). *The emergence of language*. Mahwah, NJ: Erlbaum.
- MacWhinney, B. (2004). A multiple process solution to the logical problem of language acquisition. *Journal of Child Language*, 31, 883–914. <http://dx.doi.org/10.1017/S0305000904006336>
- MacWhinney, B. (2008). A unified model. In P. Robinson & N. Ellis (Eds.), *Handbook of cognitive linguistics and second language acquisition* (pp. 341–371). New York, NY: Routledge.
- Matthews, D., Lieven, E., Theakston, A., & Tomasello, M. (2005). The role of frequency in the acquisition of English word order. *Cognitive Development*, 20, 121–136. <http://dx.doi.org/10.1016/j.cogdev.2004.08.001>
- McDonald, S. A., & Shillcock, R. C. (2001). Rethinking the word frequency effect: The neglected role of distributional information in lexical processing. *Language and Speech*, 44, 295–323. <http://dx.doi.org/10.1177/00238309010440030101>
- McDonald, S. A., & Shillcock, R. C. (2003). Low-level predictive inference in reading: The influence of transitional probabilities on eye movements. *Vision Research*, 43, 1735–1751. [http://dx.doi.org/10.1016/S0042-6989\(03\)00237-2](http://dx.doi.org/10.1016/S0042-6989(03)00237-2)
- Moors, A., & De Houwer, J. (2006). Automaticity: A theoretical and conceptual analysis. *Psychological Bulletin*, 132, 297–326. <http://dx.doi.org/10.1037/0033-2909.132.2.297>
- Mukherjee, J. (2005). *English ditransitive verbs: Aspects of theory, description and a usage-based model*. Amsterdam, the Netherlands: Rodopi.

- Nattinger, J. R., & DeCarrico, J. S. (1992). *Lexical phrases and language teaching*. Oxford, England: Oxford University Press.
- Newman, S. D., Ratliff, K., Muratore, T., & Burns, T., Jr. (2009). The effect of lexical priming on sentence comprehension: An fMRI study. *Brain Research*, 1285, 99–108. <http://dx.doi.org/10.1016/j.brainres.2009.06.027>
- Nicolle, S. (2011). Pragmatic aspects of grammaticalization. In H. Narrog & B. Heine (Eds.), *The Oxford handbook of grammaticalization* (pp. 401–412). Oxford, England: Oxford University Press.
- Paul, H. (1920). *Prinzipien der Sprachgeschichte* [Principles of the history of language]. Halle, Germany: Niemeyer.
- Pawley, A., & Syder, F. H. (1983). Two puzzles for linguistics theory: Nativelike selection and nativelike fluency. In J. C. Richards & R. W. Schmidt (Eds.), *Language and communication* (pp. 191–226). New York, NY: Longman.
- Peters, A. (2009). Connecting the dots to unpack the language. In R. Corrigan, E. A. Moravcsik, H. Ouali, & K. M. Wheatley (Eds.), *Formulaic language: Vol. 2. Acquisition, loss, psychological reality, and functional explanations* (pp. 387–404). <http://dx.doi.org/10.1075/tsl.83.08pet>
- Pickering, M. J., & Branigan, H. P. (1999). Syntactic priming in language production. *Trends in Cognitive Sciences*, 3, 136–141. [http://dx.doi.org/10.1016/S1364-6613\(99\)01293-0](http://dx.doi.org/10.1016/S1364-6613(99)01293-0)
- Pickering, M. J., & Garrod, S. (2004). Toward a mechanistic psychology of dialogue. *Behavioral and Brain Sciences*, 27, 169–190. <http://dx.doi.org/10.1017/S0140525X04000056>
- Pierrehumbert, J. B. (2001). Exemplar dynamics: Word frequency, lenition and contrast. In J. Bybee & P. Hopper (Eds.), *Frequency and the emergence of linguistic structure* (pp. 516–530). <http://dx.doi.org/10.1075/tsl.45.08pie>
- Pulvermüller, F. (2010). Brain embodiment of syntax and grammar: Discrete combinatorial mechanisms spelt out in neuronal circuits. *Brain and Language*, 112, 167–179. <http://dx.doi.org/10.1016/j.bandl.2009.08.002>
- Redington, M., Chater, N., & Finch, S. (1998). Distributional information: A powerful cue for acquiring syntactic categories. *Cognitive Science*, 22, 425–469. http://dx.doi.org/10.1207/s15516709cog2204_2
- Reitter, D., Keller, F., & Moore, J. D. (2011). A computational cognitive model of syntactic priming. *Cognitive Science*, 35, 587–637. <http://dx.doi.org/10.1111/j.1551-6709.2010.01165.x>
- Rohde, A., Stefanowitsch, A., & Kemmer, S. (2000). Loanwords in a usage-based model. *Chicago Linguistic Society: Papers from the General Session*, 35, 265–275.
- Roland, D., & Jurafsky, D. (2002). Verb sense and verb subcategorization probabilities. In P. Merlo & S. Stevenson (Eds.), *Sentence processing and the lexicon: Formal, computational, and experimental perspectives* (pp. 325–346). <http://dx.doi.org/10.1075/nlp.4.17rol>
- Rugg, M. D. (1990). Event-related brain potentials dissociate repetition effects of high- and low-frequency words. *Memory & Cognition*, 18, 367–379. <http://dx.doi.org/10.3758/BF03197126>
- Saffran, J. R. (2001). Words in a sea of sounds: The output of infant statistical learning. *Cognition*, 81, 149–169. [http://dx.doi.org/10.1016/S0010-0277\(01\)00132-9](http://dx.doi.org/10.1016/S0010-0277(01)00132-9)
- Saffran, J. R., Aslin, R. N., & Newport, E. L. (1996). Statistical learning by 8-month-old infants. *Science*, 274, 1926–1928. <http://dx.doi.org/10.1126/science.274.5294.1926>
- Sandra, D. (1994). *Morphology in the reader's mental lexicon*. Frankfurt/Main, Germany: Peter Lang.
- Schmid, H.-J. (2000). *English abstract nouns as conceptual shells. From corpus to cognition*. <http://dx.doi.org/10.1515/9783110808704>

- Schmid, H.-J. (2007). Entrenchment, salience and basic levels. In D. Geeraerts & H. Cuyckens (Eds.), *The Oxford handbook of cognitive linguistics* (pp. 117–138). Oxford, England: Oxford University Press.
- Schmid, H.-J. (2010). Does frequency in text really instantiate entrenchment in the cognitive system? In D. Glynn & K. Fischer (Eds.), *Quantitative methods in cognitive semantics: Corpus-driven approaches* (pp. 101–133). <http://dx.doi.org/10.1515/9783110226423.101>
- Schmid, H.-J. (2013). Is usage more than usage after all? The case of English *not that*. *Linguistics*, 51, 75–116.
- Schmid, H.-J. (2014). Lexico-grammatical patterns, pragmatic associations and discourse frequency. In T. Herbst, H.-J. Schmid, & S. Faulhaber (Eds.), *Constructions collocations patterns* (pp. 239–293). <http://dx.doi.org/10.1515/9783110356854.239>
- Schmid, H.-J. (2015). A blueprint of the entrenchment-and-conventionalization model. *Yearbook of the German Cognitive Linguistics Association*, 3, 1–27. <http://dx.doi.org/10.1515/gcla-2015-0002>
- Schmid, H.-J., & Günther, F. (2016). Toward a unified socio-cognitive framework for salience in language. *Frontiers in Psychology*, 7. <http://dx.doi.org/10.3389/fpsyg.2016.01110>
- Schmid, H.-J., & Küchenhoff, H. (2013). Collostructional analysis and other ways of measuring lexico-grammatical attraction: Theoretical premises, practical problems and cognitive underpinnings. *Cognitive Linguistics*, 24, 531–577. <http://dx.doi.org/10.1515/cog-2013-0018>
- Schmid, H.-J., & Mantlik, A. (2015). Entrenchment in historical corpora? Reconstructing dead authors' minds from their usage profiles. *Anglia*, 133, 583–623. <http://dx.doi.org/10.1515/ang-2015-0056>
- Segaert, K., Kempen, G., Petersson, K. M., & Hagoort, P. (2013). Syntactic priming and the lexical boost effect during sentence production and sentence comprehension: An fMRI study. *Brain and Language*, 124, 174–183. <http://dx.doi.org/10.1016/j.bandl.2012.12.003>
- Seidenberg, M. S., & Zevin, J. D. (2006). Connectionist models in developmental cognitive neuroscience: Critical periods and the paradox of success. In Y. Munakata & M. Johnson (Eds.), *Processes of change in brain and cognitive development. Attention and performance XXI* (pp. 585–612). Oxford, England: Oxford University Press.
- Siyanova-Chanturia, A., Conklin, K., & Schmitt, N. (2011). Adding more fuel to the fire: An eye-tracking study of idiom processing by native and nonnative speakers. *Second Language Research*, 27, 251–272. <http://dx.doi.org/10.1177/0267658310382068>
- Siyanova-Chanturia, A., Conklin, K., & van Heuven, W. J. (2011). Seeing a phrase “time and again” matters: The role of phrasal frequency in the processing of multiword sequences. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 37, 776–784. <http://dx.doi.org/10.1037/a0022531>
- Snider, N. (2007). *An exemplar model of syntactic priming*. Stanford, CA: Proquest.
- Sosa, A. V., & MacFarlane, J. (2002). Evidence for frequency-based constituents in the mental lexicon: Collocations involving the word *of*. *Brain and Language*, 83, 227–236. [http://dx.doi.org/10.1016/S0093-934X\(02\)00032-9](http://dx.doi.org/10.1016/S0093-934X(02)00032-9)
- Stefanowitsch, A., & Gries, S. T. (2003). Collostructions: Investigating the interaction of words and constructions. *International Journal of Corpus Linguistics*, 8, 209–243. <http://dx.doi.org/10.1075/ijcl.8.2.03ste>
- Street, J., & Dąbrowska, E. (2010). More individual differences in language attainment: How much do adult native speakers of English know about passives and quantifiers? *Lingua*, 120, 2080–2094. <http://dx.doi.org/10.1016/j.lingua.2010.01.004>

- Swinney, D. A., & Cutler, R. A. (1979). The access and processing of idiomatic expressions. *Journal of Verbal Learning & Verbal Behavior*, 18, 523–534. [http://dx.doi.org/10.1016/S0022-5371\(79\)90284-6](http://dx.doi.org/10.1016/S0022-5371(79)90284-6)
- Szmrecsanyi, B. (2005). Language users as creatures of habit: A corpus-based analysis of persistence in spoken English. *Corpus Linguistics and Linguistic Theory*, 1, 113–150. <http://dx.doi.org/10.1515/cllt.2005.1.1.113>
- Theakston, A. (2004). The role of entrenchment in children's and adults' performance on grammaticality judgment tasks. *Cognitive Development*, 19, 15–34. <http://dx.doi.org/10.1016/j.cogdev.2003.08.001>
- Tomasello, M. (2003). *Constructing a language. A usage-based theory of language acquisition*. Cambridge, MA: Harvard University Press.
- Tomasello, M. (2009). The usage-based theory of language acquisition. In E. L. Bavin (Ed.), *Cambridge handbook of child language* (pp. 69–88). Cambridge, England: Cambridge University Press.
- Tomasello, M., & Rakoczy, H. (2003). What makes human cognition unique? From individual to shared to collective intentionality. *Mind & Language*, 18, 121–147. <http://dx.doi.org/10.1111/1468-0017.00217>
- Traugott, E. C. (2008). The grammaticalization of *NP of NP* constructions. In A. Bergs & G. Diewald (Eds.), *Constructions and language change* (pp. 21–43). Berlin, Germany: Mouton de Gruyter.
- Traugott, E. C., & Dasher, R. B. (2004). *Regularity in semantic change*. Cambridge, England: Cambridge University Press.
- Traugott, E. C., & Trousdale, G. (2013). *Constructionalization and constructional changes*. <http://dx.doi.org/10.1093/acprof:oso/9780199679898.001.0001>
- Tremblay, A., & Baayen, H. (2010). Holistic processing of regular four-word sequences: A behavioral and ERP study of the effects of structure, frequency, and probability on immediate free recall. In D. Wood (Ed.), *Perspectives on formulaic language: Acquisition and communication* (pp. 151–173). London, England: The Continuum International.
- Tremblay, A., Derwing, B., & Libben, G. (2009). Are lexical bundles stored and processed as single units? *Working Papers of the Linguistics Circle of the University of Victoria*, 19, 258–279.
- Tremblay, A., Derwing, B., Libben, G., & Westbury, C. (2011). Processing advantages of lexical bundles: Evidence from self-paced reading and sentence recall tasks. *Language Learning*, 61, 569–613. <http://dx.doi.org/10.1111/j.1467-9922.2010.00622.x>
- Trudgill, P. (1986). *Dialects in contact*. Oxford, England: Blackwell.
- Underwood, G., Schmitt, N., & Galpin, A. (2004). The eyes have it: An eye-movement study into the processing of formulaic sequences. In N. Schmitt (Ed.), *Formulaic sequences: Acquisition, processing, and use* (pp. 153–172). <http://dx.doi.org/10.1075/llt.9.09und>
- Wiechmann, D. (2008). On the computation of collocation strength: Testing measures of association as expressions of lexical bias. *Corpus Linguistics and Linguistic Theory*, 4, 253–290. <http://dx.doi.org/10.1515/CLLT.2008.011>
- Wray, A. (2002). *Formulaic language and the lexicon*. <http://dx.doi.org/10.1017/CBO9780511519772>
- Wray, A. (2008). *Formulaic language: Pushing the boundaries*. Oxford, England: Oxford University Press.
- Zenner, E., Speelman, D., & Geeraerts, D. (2012). Cognitive sociolinguistics meets loanword research: Measuring variation in the success of anglicisms in Dutch. *Cognitive Linguistics*, 23, 749–792. <http://dx.doi.org/10.1515/cog-2012-0023>
- Zeschel, A. (2012). *Incipient productivity. A construction-based approach to linguistic creativity*. Berlin, Germany: De Gruyter Mouton.

