# Usage-Based Approaches to Germanic Languages

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## Summary

The theoretical outlook of usage-based linguistics is a position that views language as a dynamic, evolving system and that recognizes the importance of usage frequency and frequency effects in language, as well as the foundational role of domain-general sociocognitive processes. Methodologically, usage-based studies draw on corpus-linguistic methods, experimentation, and computational modeling, often in ways that combine different methods and triangulate the results. Given the availability of corpus resources and the availability of experimental participants, there is a rich literature of usage-based studies focusing on Germanic languages, which at the same time has greatly benefited from usage-based research into other language families. This research has uncovered frequency effects based on measurements of token frequency, type frequency, collocational strength, and dispersion. These frequency effects result from the repeated experience of linguistic units such as words, collocations, morphological patterns, and syntactic constructions, which impact language production, language processing, and language change. Usage-based linguistics further investigates how the properties of linguistic structures can be explained in terms of cognitive and social processes that are not in themselves linguistic. Domain-general sociocognitive processes such as categorization, joint attention, pattern recognition, and intention reading manifest themselves in language processing and production, as well as in the structure of linguistic units. In addition to research that addresses the form and meaning of such linguistic units at different levels of linguistic organization, domains of inquiry that are in the current focus of usage-based studies include linguistic variation, first and second-language acquisition, bilingualism, and language change.

**Keywords:** usage-based linguistics, frequency, cognitive processes, social cognition, Germanic languages

**Subjects:** Cognitive Science, Computational Linguistics, Historical Linguistics, Language Families/Areas/Contact, Linguistic Theories, Morphology

## 1. Introduction

What is usage-based linguistics and what is its role in the study of Germanic languages? Summarized in a single statement, usage-based approaches view language as an inherently dynamic system that continuously evolves and changes, driven by language use. Repeated usage events shape the forms and meanings of linguistic units, their cognitive representations in the minds of language users, and the conventions that exist at the level of the linguistic community. This general idea, which is associated with the work of researchers such as Langacker (1987), Croft (1991), Bybee (2010), Tomasello (2003), or Ellis (2008), has been expressed as follows already by Hermann Paul in his *Principles of the History of Language* (Paul, 1891, p. 15):



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> The changes in language fulfill themselves in the individual, partly through his spontaneous activity, by means of speaking and thinking in the forms of language, and partly through the influence which each individual receives from others. A change in linguistic usage can hardly be brought about without the co-operation of both.

In the last 3 decades, usage-based approaches have given rise to a growing body of research that fleshes out this general idea and illustrates how it manifests itself. That research addresses a wide range of phenomena, including language processing and production (Bybee et al., 2016; Perek, 2015), morphological and syntactic productivity (Dąbrowska, 2008; Goldberg, 2019), first and second language acquisition (Lieven, 2014; Wulff & Ellis, 2018), grammaticalization (Bybee, 2012; Coussé et al., 2018), processes of semantic and morpho-syntactic change (Coussé & von Mengden, 2014; Traugott & Trousdale, 2013), and language contact and bilingualism (Backus, 2020). What unites these different strands of work is the insight that the frequency with which a linguistic unit is experienced impacts the way it is learned, represented, processed, produced, conventionalized, and changed. The study of frequency effects (Behrens & Pfänder, 2016; Divjak, 2019; Ellis, 2002) therefore occupies a central place in usage-based linguistics.

In addition to the notion that frequency of use shapes language structure, knowledge of language, and language change, usage-based approaches also work on the assumption that the human capacity for language is grounded in domain-general sociocognitive processes (Bybee, 2010, p. 6). In contrast with linguistic theories that attribute human language to an innate cognitive capacity that is specifically geared to handling language, usage-based linguistics takes the view that language emerges from a set of interacting processes that include categorization, association, routinization, generalization, schematization, joint attention, statistical learning, analogy, metaphor, and others. These processes are domain-general (Tomasello, 2003, p. 4), which means that they are used not just for language, but in fact across a wide range of cognitive tasks, including nonlinguistic ones.

Usage-based linguistics could not have evolved in the way it has without the methodological developments that have taken place in corpus linguistics, experimental psycholinguistics, and computational modeling. For example, the observation of frequency developments in language change (Hilpert & Gries, 2009) or the study of phonetic reduction across different morpho-syntactic contexts (Scheibman, 2000) is greatly supported by the availability of spoken and written corpora that allow for the quantification of probabilistic tendencies. Experimental techniques are an integral part of making the predictions of usage-based theories explicit and putting them to the test under laboratory-controlled conditions (Casenhiser & Goldberg, 2005; Dąbrowska, 2008). Computational techniques such as agent-based modeling allow in silico simulations of processes that take place in complex adaptive systems (Pijpops et al., 2015), thereby providing insights that can be usefully triangulated with both corpus-based and experimental studies.

As a research program, usage-based linguistics aims to uncover universal properties of the human capacity for language. Accordingly, it is not inherently tied to the study of any particular type of language. That said, it is fair to point out that the Germanic languages, and especially



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English, have received a large amount of attention, mainly because of the availability of many language-specific resources and the international visibility of research that has addressed languages such as English. At the same time, usage-based research into Germanic languages has not only focused on languages with large populations of speakers and comprehensive corpus resources, such as English, Dutch, or German, but important results have also been obtained by research on languages such as Icelandic (Barðdal, 2008) or Afrikaans (Brink, 2020).

The section "2. Frequency Effects in Language" discusses different types of frequency effects in language. Frequency of use can be shown to be related to reduced pronunciation, ease of processing, productivity, and resistance to analogical change, among other things. "3. Domain-General Sociocognitive Processes" offers an overview of some of the domain-general sociocognitive processes that underlie the human capacity for language. The processes that have been selected for this overview are categorization, joint attention, pattern recognition, and intention reading. "4. Domains of Usage-Based Linguistic Research Into Germanic Languages" highlights recent usage-based findings from different domains of linguistic research into Germanic languages. The discussion covers studies that address language production, language processing, first- and second-language acquisition, language change, language contact, and bilingualism. "5. Concluding Remarks" offers a conclusion.

## 2. Frequency Effects in Language

Frequency effects in language result from the repeated experience of linguistic units such as words, collocations, morphological patterns, or syntactic constructions. It is important to distinguish different ways in which aspects of frequency can be measured. The discussion below will make reference to token frequency, type frequency, collocational strength, and dispersion (cf. Hilpert, 2017, p. 50). A linguistic unit that repeatedly appears in a given text, as for example the English definite determiner *the*, is high in token frequency. A morphological affix that appears with many different lexical bases, such as the English past tense affix *-ed*, is high in type frequency. Two words that have a strong tendency to occur together, such as *cashmere sweater*, exhibit high collocational strength. Hearing the word *cashmere* thus increases the predictability of the word *sweater* as an upcoming item. Dispersion refers to the regularity with which a linguistic unit appears and reappears in a given text. Two elements may be similar in token frequency, but different in dispersion, as for example the English words *without* and *London* in the British National Corpus. Tokens of *London* have a tendency to cluster together, whereas tokens of *without* appear at more regular intervals (Hilpert, 2017, p. 61). The following paragraphs offer illustrations of how these aspects of frequency impact language production, language processing, and language change.

If a complex action is carried out repeatedly, it becomes increasingly routinized. For example, the action of tying a shoelace is typically accomplished in one swift and economical motion. With regard to language, units that are high in token frequency and unit combinations that are high in collocational strength have the potential to become routinized and to undergo a process that leads to reduced pronunciation, which can manifest itself in shorter word duration, vowel reduction, consonant lenition, or even the loss of entire segments. An example of frequency-



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related reduction in pronunciation is offered by Bell et al. (2009), who investigate the effects of token frequency, recency, and collocational strength on word duration in spoken American English. They draw on the Switchboard corpus, which is a database of telephone conversations between strangers that was compiled in the 1990s. Bell et al. (2009, p. 98) use multiple linear regression in order to determine whether the token frequency of a linguistic unit, its appearance in the recent context, and its predictability given the preceding or following element affect the length of its pronunciation. The analysis controls for factors such as the number of syllables, speech rate, speaker age, and gender, as well as the position of an element within an intonational phrase. The regression analysis links shorter word duration to independent main effects of higher token frequency, recency, and collocational strength (Bell et al., 2009, p. 98). The results further indicate a difference between content words and function words, in that for function words, recency does not diminish word duration (Bell et al., 2009, p. 102). Bell et al. (2009, p. 109) conclude that less frequent content words have a lower resting level of lexical activation, which slows down their production in spontaneous language use.

Decreased word duration can be seen as the starting point of a continuum that reaches much further, to what Bybee et al. (2016, p. 421) call special reduction. If a sequence of words such as *going to* is pronounced as [gə̃ɾ̃ə̃], the reduction process has erased word boundaries, changed the quality of vowels and consonants, and deleted several segments. Bybee et al. (2016) argue that special reduction is based on repeated use and the process of chunking, which leads speakers to represent complex strings of words as holistic units. They also suggest that special reduction unfolds over time and aligns with general patterns of historical linguistic change. The kinds of units that can undergo special reduction includes greetings, forms of address, discourse markers, and grammaticalizing constructions, among others. As noted by Bybee and Scheibman (1999, p. 581), special reduction is context-sensitive, so that for example the vowel in the negated English verb form *don't* is reduced to different degrees. Reduction is strongest when the immediately preceding element is the pronoun *I*, and it is less strong if the preceding element is the pronoun *you* or a full noun phrase. The same can be observed in cases of special reduction in other languages, as for instance in the Portuguese expression *deixa eu* ['deɪʃə 'eʊ] 'let me', which can be reduced to [de.'ʃo], [tʃo] or even just [ʃ], especially if the immediately following element is the verb *ver* 'see' (Bybee et al., 2016, p. 431). These examples illustrate how high token frequency of multiword units can lead to routinization and subsequently to an extreme form of reduction in pronunciation.

Importantly, high token frequency does not only lead to reduction. It also has a conserving effect by making highly frequent linguistic units more resistant to analogical pressure (Bybee & Thompson, 1997, p. 577). This can be observed for example in irregular past tense forms such as *kept* or irregular plurals such as *children*. The higher the frequency of an irregular form, the stronger its representation in speakers' minds, and the lower the likelihood that it will be regularized. The strengthening of mental representations of linguistic units is captured by the term entrenchment (Langacker, 1987, p. 59; Schmid, 2020, p. 2), which is driven by the repeated experience of language use, which triggers the processes of activation, association, routinization, and schematization (cf. Schmid, 2020, p. 205).



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Effects of high token frequency are also observed in language processing. If a linguistic unit occurs very often, it can be recognized more quickly and accurately than a unit that is low in token frequency (Ellis, 2002, p. 152). This greater ease of processing is also observed for sequences of words. Arnon and Snider (2010) designed an experiment in which the participants saw English n-grams such as *don't have to worry* and *don't have to wait*. Their task was to indicate whether these n-grams are possible parts of grammatically formed sentences. Grammatically well-formed fragments were constructed in such a way that the token frequency of the individual component parts was kept constant, while the frequency of the sequence as a whole differed. The results show a processing advantage for n-grams with higher frequency.

Schematic linguistic patterns differ with regard to their productivity, which relates to the ease with which speakers create new instantiations of a schema. Productive schemas are typically high in type frequency. For example, the English regular past tense suffix *-ed* attaches to thousands of different verb stems and can therefore be regarded as highly productive. The same is true of the derivational suffix *-ly*, which appears in adverbs such as *gently* or *noisily*. By comparison, the derivational suffix *-some*, which is found in adjectives such as *wholesome*, *handsome*, or *awesome*, is lower in type frequency. Importantly, high type frequency is not a sufficient criterion for productivity. The English language contains more than a thousand nouns ending in the suffix *-ment*, but speakers do not use the suffix to create new forms (Hilpert, 2013, p. 116). Suttle and Goldberg (2011, p. 1239) further point out that the productivity of a schema is not only linked to its type frequency, but also to the variability of its instantiations and the similarity between them. The effect of high type frequency on productivity has been documented for example by Brooks and Tomasello (1999) in a study of child speech. English-speaking children between 2 and 4 years of age were exposed to novel verbs such as *meeking* and *tamming*. The presentation of the verbs differed with regard to their morpho-syntactic context. One group of children heard the verbs exclusively in the active voice, another group was presented with the verbs in the passive voice. In the test phase of the experiment, the children were encouraged to use the verbs for the description of a situation. The prompts for the children were designed so as to elicit either the use of the active or the passive. Children who had experienced the verbs in the active voice were very reluctant to generalize their usage to the passive (Brooks & Tomasello, 1999, p. 34). Conversely, the children were more open toward generalizing verbs toward the active voice, even when they had only been observed in the passive. In other words, children more readily generalize a construction that is high in type frequency.

Effects of frequency can also be driven by dispersion. An evenly dispersed linguistic unit will appear regularly throughout a corpus, so that when the corpus is divided into multiple parts, occurrences will be found within each part. If the dispersion of a linguistic unit is more uneven, there will be long stretches of text during which the unit does not occur, and there will be passages in which multiple occurrences of the unit closely follow one another. Dispersion can be operationalized and measured in different ways (Gries, 2008, 2010), typically by either dividing a corpus into multiple parts or by measuring distances between occurrences of a unit of interest. Data from lexical decision tasks and other experimental paradigms indicate that linguistic units



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with an even dispersion have a processing advantage over more unevenly dispersed units (Adelman et al., 2006, p. 817; Baayen, 2011, p. 454), and that dispersion thus accounts for effects that have traditionally been attributed to high token frequency.

The short survey offered in this section does not exhaust the full spectrum of frequency effects that have been documented in the literature (cf. Divjak, 2019 for an overview), but it does offer an illustration of the breadth of the phenomena that are impacted by frequency, which is one of the main motivations of usage-based approaches to language.

## 3. Domain-General Sociocognitive Processes

The aim of usage-based linguistics is "to explore the possibility that the structural phenomena we observe in the grammar of natural languages can be derived from domain-general cognitive processes" (Bybee, 2010, p. 1). In other words, it investigates how the properties of linguistic structures can be explained in terms of cognitive and social processes that are not in themselves linguistic. This section highlights four such processes, namely categorization, joint attention, pattern recognition, and intention reading. It will be illustrated how these processes manifest themselves in language processing and in the structure of linguistic units.

Categorization is a process that allows human beings to perceive elements in the world as instances of more general phenomena. A desk is thus not just an individual object that is used as a surface for office work, it represents a class of such objects that share common features. Despite the fact that no two desks are exactly the same, they are perceived as equivalent, which reflects an act of abstraction. How that abstraction is accomplished is the subject of a vast philosophical and psychological literature (Cohen & Lefebvre, 2005). Usage-based linguistics aligns with a gradient view of category membership, which has been developed under the label of prototype theory (Rosch & Mervis, 1975), and which informs exemplar-based theories of categorization (Pierrehumbert, 2001, 2002). The central hypothesis of the usage-based position is that linguistic categories emerge from the experience of concrete tokens that are memorized, mutually associated in a conceptual space, and that form clusters with peripheral and more marginal areas. The words and constructions that make up languages reflect distinctions such as the difference between a *desk* and a *table*, between present and past, or between singular and plural. Categorization influences language processing not only with regard to meaning, but also at other levels of linguistic structure. In a classic experiment on speech perception (Liberman et al., 1957), English-speaking participants listened to pairs of speech sounds such as /da/ and /ga/ and had to indicate whether those were the same or different. The stimuli represented a continuum of sounds, so that some pairs were technically different from one another, but still instantiated the same phoneme. The results show that it was more difficult for the participants to discriminate between sounds that represent the same phoneme. Conversely, the participants were highly sensitive to phoneme boundaries. This indicates that categorization guides and influences the perception of speech sounds. Linguistic sounds are assigned to a phonemic category, and while speakers are extremely sensitive to differences between categories, they are less sensitive to the variation that exists within a category.



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The categories that are expressed in a given language further have the potential to influence nonlinguistic cognition, as has been shown in an experiment by Winawer et al. (2007), who presented their participants with pairs of tiles that were colored in different shades of blue. The experimental task was to determine which member of the pair matches a third tile with regard to the exact hue of the color. The experiment was carried out with speakers of English and speakers of Russian. Whereas English has a single linguistic label for all different shades of blue, Russian has two labels, which distinguish between lighter and darker shades of blue. The results indicate that speakers of Russian had greater difficulties to find matches when all tiles represented the same color term. By contrast, when the difference in color corresponded to a difference in color terms, the responses were faster. The overall conclusion is that categorization and language are deeply interconnected, so that language structure, language processing, and even nonlinguistic perception are shaped by this connection.

Another process that is foundational for language is joint attention. The term describes an ability that human children typically develop around the age of 9 months. At that point, they learn to engage in the shared experience of focusing on an object of attention together with a partner, and to be mutually aware of this experience. Joint attention plays a central role in language acquisition because it makes it possible for the child to associate speech sounds with events and objects in the environment that lie at the center of a shared experience. For example, an expression such as *bye-bye* is learned in the context of situations in which the participants jointly focus on the activity of leave-taking. Empirical work on the development of child language has shown that joint attention facilitates word learning in young children (Carpenter et al., 1998) and that children actively leverage joint attention to infer the meanings of unknown words from the interactions between third parties (Floor & Akhtar, 2006). Children are thus able to learn new word meanings by listening in on others' conversations while also monitoring their shared center of attention. Joint attention is not only central to language acquisition, but also to other aspects of language structure and language use. Diessel (2006) points out that demonstratives can be viewed as grammatical forms that are specifically dedicated to the management of joint attention. In adult language use, demonstratives are not only used to point out objects and events in the external world, but they are recruited into the service of referring to elements in the ongoing discourse. Demonstratives such as English *this* and *that* can thus anaphorically refer to parts of previous utterances. The diachronic development from demonstrative to anaphoric meaning is found across typologically different languages, and it is commonly further extended to other grammatical categories. Cross-linguistically, definite determiners, agreement markers, relative pronouns, and complementizers often originate from demonstrative markers (Diessel, 2006, pp. 477–480; Kuteva et al., 2019, pp. 137–144). The breadth of these grammatical categories reflects the importance of directing others' attention to a shared center of attention. Like categorization, joint attention is profoundly implicated both in language processing and in language structure.

If knowledge of language is usage-based, that implies that speakers have the capacity to extract complex regularities from the input that they receive. For instance, children need to be able to identify words from a continuous stream of speech sounds, they need to infer part-of-speech categories that correspond to these words, and they have to detect abstract syntactic patterns that encode meaning relations between the different parts of an utterance. There is empirical



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evidence suggesting that young language learners engage in sophisticated pattern recognition that allows them to accomplish these tasks. A classic study presented 8-month-old infants with 2-minute recordings of trisyllabic sound sequences such as *bidaku*, *padoti*, *golabu*, and *tupiro* (Saffran et al., 1996). After exposure to the training data, the infants reacted with relatively greater interest to stimuli in which the syllables were arranged differently. If a stimulus such as *pabiku* is perceived as surprising, this suggests that the infants expected the syllable *pa* to be followed by *do*. A related experiment (Marcus et al., 1999) tested whether 7-month-old infants use the statistical regularities in their input to draw generalizations that go beyond specific sounds. During the training phase of the study, the infants heard sound sequences such as *gatiti*, *linana*, *nigigi*, and *talala*. The test phase exposed them to sounds such as *wofewo* and *dekoko*. Both stimuli contain two syllables that are identical, but only the second one conforms to the established pattern, in which the identical syllables appear at the end and in direct sequence. The results reported by Marcus et al. (1999) indicate that the infants react differently to the novelty of nonconforming stimuli. The generalizations that are extracted from the input are structural and represent abstractions. Children's pattern-matching skills further support the learning of syntactic constructions. Casenhiser and Goldberg (2005) devised an experiment in which children between 5 and 7 years of age listened to sentences such as *The rabbit the hat moopoed* or *The monster the cloth keeboed*. The stimuli use English words, but they feature nonce verb forms that are positioned sentence-finally. The sentences were accompanied by short video clips in which toys suddenly appeared, for example out of a hat or from underneath a cloth. Exposure to the stimuli and the videos enabled the children to determine the meaning of a previously unheard sentence such as *The sailor the pond neeboed*. Cues such as sounds, the relative position of linguistic units, and the situated context are combined when children extract regularities from experience.

In ordinary language use, speakers commonly mean more than they say, and hearers interpret the words that are said against their best judgment of the speaker's intentions. An indirect speech act such as *Isn't it hot in here?* can be understood as a prompt to open the window. The skill of intention reading, which is understood here as the capacity to attribute thoughts and states of knowledge to others (Tomasello, 2003, p. 3), helps children to learn word meanings. To illustrate, in an experiment that exposed 2-year-old children to new verbs, Tomasello and Barton (1994) show that children rely on intention reading to determine what those verbs mean. The children observed an experimenter who used the verb to describe an activity. In one scenario, the experimenter carried out the activity and showed a display of satisfaction at the success. In another scenario, the experimenter acted clumsily and expressed disappointment. When the experimenter used the new verb as a prompt for the children to enact the activity, the children's responses indicated that they associated the verb with the activity that led to the intended result, rather than the accidental outcome.

Intention reading drives processes of meaning extension and semantic change. Over time, linguistic expressions tend to become charged with the meanings that speakers regularly intend to convey with them. This can be illustrated with the English conjunction *since*. In the utterance *She has lived in England since she was ten years old*, the conjunction denotes a point in time. The utterance *Since Bob joined our team, we have become a lot more competitive* also conveys temporal



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meaning, but in addition, the hearer has good reasons to assume that the speaker wants to express a causal relation. Utterances such as *Since we'll meet tomorrow, we can talk about it then* suggest that *since* has become conventionally associated with the meaning of causality. A similar case of meaning change can be seen in history of the English expression *a bunch of*, as in *a bunch of carrots*. Shao et al. (2019) found that the types of nouns that occur with the expression change significantly over time. Nouns that refer to plants account for most examples during the 19th century, later usage shows a drift toward other categories, including people (*a bunch of teenagers*) or abstract ideas (*a bunch of lies*). Frequently, the expression conveys a negative evaluation, so that for example *a bunch of university professors* carries a dismissive undertone. The meaning change of *a bunch of* is the result of intention reading and the gradual process of conventionalization. The more hearers witness an expression used with a certain intended meaning, the more they associate the expression with that meaning, until the two can no longer be dissociated.

This section has discussed the processes of categorization, joint attention, pattern matching, and intention reading in order to illustrate how domain-general sociocognitive processes, which are not in themselves linguistic, shape language in its processing, its development, and its structure. Importantly, these four processes are complemented by several others that underlie language use, including analogy, metaphor, routinization, cross-modal association, and others (Bybee, 2010; Ibbotson, 2013).

## 4. Domains of Usage-Based Linguistic Research Into Germanic Languages

To summarize, usage-based approaches to language emphasize the role of frequency in its different manifestations, and they investigate the ways in which domain-general sociocognitive processes underlie language use and language structure. How are these ideas put into practice in usage-based linguistic research? This section surveys recent studies from different domains of inquiry, which illustrate the breadth of phenomena that current usage-based research focuses on.

A first domain is research on morpho-syntactic variation. Usage-based knowledge of language necessarily includes knowledge of variation (Hilpert, 2019, p. 185). Languages provide their speakers with the option of verbalizing the same message in different ways. These different options tend to be characterized by their adaptation to specific contexts, so that each variant is preferable in a different setting. Research into variation has the objective of identifying the factors that lead speakers to choose one variant over another. An example of this is offered by Richter and van Hout (2020), who conducted a study of Dutch intensifiers and their ordering in utterances such as *zo mega fucking goed* 'so mega fucking good'. Why is it that an alternative ordering such as *mega zo fucking goed* is strongly dispreferred by speakers of Dutch? Richter and van Hout (2020, p. 347) propose that the informativeness of intensifiers has an impact on the preferred ordering. The study is based on a corpus of Twitter data that contains more than 100 different intensifier types. For each intensifier, two types of information value were computed. Contextual information content is based on conditional probability and measures the informativity of an element for its right-side context. Given an intensifier such as *super*, can the



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hearer already anticipate the next word with confidence, or are there many possible continuations? Intensifiers that have many transitional options receive a contextual information score that is high. Intensifiers that can only be followed by a low number of contextual items receive a low score. The second type of information value, paradigmatic information content, is operationalized as Shannon Information. This measure estimates the information value of an element in general, in relation to existing competitors. Intensifiers that are very common score low on this measure. Richter and van Hout (2020, p. 350) observe that the two measures are negatively correlated. Intensifiers that are low in paradigmatic information content, as for example *zo* 'so', tend to be high in contextual information content. The opposite is true for intensifiers that are high in paradigmatic information content, as for instance *reuze* 'giant', which are low in contextual information content. Regarding the ordering of intensifiers, the initial hypothesis is confirmed. Informativeness influences how speakers stack multiple intensifiers. Paradigmatic information content tends to increase, so that intensifiers with low paradigmatic information content tend to precede intensifiers with higher paradigmatic information content. Conversely, contextual information content is shown to decrease, so that intensifiers with high contextual information content tend to precede intensifiers with low contextual information content. Richter and van Hout (2020, p. 353) conclude that measures of informativeness tap into the factors that influence speakers' choices of intensifiers. As speakers strive to find the right balance between conventionality and expressiveness, an initial conventionalized intensifier such as *zo* 'so' provides an optimal start to the utterance, which can then be continued with more expressive intensifiers. More generally, the study illustrates how frequency-based measures of informativity can be leveraged to investigate the complex interplay of conditioning factors in cases of linguistic variation.

Usage-based research also yields new insights into questions that fall into the domain of pragmatics. For example, Pankratz and van Tiel (2021) offer an experimental and corpus-based study of scalar inferences, which lead language users to interpret a weak statement as the negation of a stronger statement. If a person is described as *happy*, this could trigger the scalar inference that the person is not *ecstatic*. By the same token, a description of an apartment as *comfortable* might lead a hearer to the conclusion that it is not *luxurious*. How do such interpretations arise? Pankratz and van Tiel (2021, p. 562) suggest that experience of language use guides scalar inferences. In order to put this hypothesis to the test, they prompted speakers of English to indicate their agreement with a scalar inference (e.g., *Imagine that your friend Mary says "The village was pretty." Would you conclude from this that the village was not beautiful*?). Responses were obtained for 50 adjective pairs such as *warm* and *hot*, *sad* and *tragic*, or *funny* and *hilarious*. Pankratz and van Tiel (2021, p. 586) use regression modeling to test whether the rate of positive responses can be predicted by factors that reflect language use, and that have been identified in earlier research as being relevant to the interpretation of scalar inferences. A first variable that is taken into account concerns the polarity of adjectives. An element such as *comfortable* carries positive meaning, whereas an element such as *terrible* carries negative meaning. A second variable captures the semantic distance between two adjectives on a scale, such as *good* and *excellent*. Based on the distributional behavior of the adjectives, their difference in meaning can be quantified. As a third variable, the adjectives are classified with regard to the boundedness of the scale they evoke. An adjective such as *perfect* evokes an endpoint on a bounded scale. With an



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adjective such as *great*, there is still room for improvement. The fourth factor that is considered is the extremeness of the stronger adjective. Elements such as *excellent* or *gorgeous* are situated at a very high position of their respective scales. Extremeness is operationalized in terms of co-occurrence with modifiers such as *downright* or *flat-out*, which are not found with adjectives that carry more moderate meanings. For the fifth variable in their study, Pankratz and van Tiel (2021, p. 575) determine the frequency with which adjectives are used in scalar constructions such as *A but not B* or *A or even B*. For a set of 20 scalar constructions, frequency data from the ENCOW16A corpus is used to determine how commonly the 50 adjective pairs are juxtaposed in this way. A regression analysis finds significant main effects for all five predictors, including usage frequency. The more often an adjective appears in scalar constructions, the stronger its tendency to trigger a scalar inference. Pankratz and van Tiel (2021, p. 590) conclude that usage frequencies yield pragmatic effects by influencing what speakers consider to be common ground. Experience of language use, and specifically co-occurrence patterns of words and constructions, guides the inferences that language users are likely to draw.

The research domain of first language acquisition (Ambridge & Lieven, 2011; Tomasello, 2003) has a central place in usage-based linguistics. The existing literature has offered strong empirical support for the idea that linguistic input and domain-general sociocognitive processes interact and shape the development of linguistic knowledge. Children can be observed to build up their language skills from single words and holistic phrases to patterns with open slots that allow them to express new ideas. An area of research that draws on these insights and expands them further is focusing on bilingual first language acquisition. Do bilingual children exhibit the same patterns of acquiring pivot schemas that are gradually extended? How can phenomena such as code-switching in child language be explained when child-directed speech follows a pattern of one language per parent? Gaskins et al. (2019) address these questions using diary data and video recordings in a case study of a bilingual child acquiring English and Polish as first languages. The data documents the child's development from 10 months to the age of 2 years. The study uses the traceback method (Dąbrowska & Lieven, 2005), which identifies patterns of two or more words in the language use of the child. The patterns are then analyzed with regard to their productivity, and it is systematically checked when and how a pattern has been used in earlier input in identical or similar forms. Gaskins et al. (2019, p. 11) identify a set of patterns in which the open slot accommodates fillers from both languages. Some of these patterns have English as their matrix language, for example in *More X*, *X gone*, or *No X*. Patterns such as *Daj mi X* 'give me X' have Polish as their matrix language. In the child's language use, the patterns are combined with words from either English or Polish, yielding expressions such as *more tissue*, *more kaczki* 'more ducks', or *Daj mi keys* 'give me keys'. The data indicate that bilingual patterns tend to be more productive on average than patterns that are restricted to a single language. Gaskins et al. (2019, p. 14) suggest that code-switching in child language is driven by the availability of productive patterns, which can be used not just with elements from the matrix language, but with any element that is contextually appropriate. In this way, bilingual children make the greatest possible use of their linguistic resources.



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In the domain of second-language acquisition, usage-based research has investigated how different aspects of frequency are implicated in the language learning process. Murakami and Ellis (2022) study how token frequency, contingency, and idiomaticity impact the accuracy with which grammatical morphemes are used in the writing of second-language learners of English. The analysis focuses on past tense *-ed*, progressive *-ing*, third person *-s*, and plural *-s*. Token frequency represents the number of times with which an affix such as *-ing* appears in language use. Contingency relates to the frequency of an affix in a given context. For example, the verb stem *talk* combines more often with the *-ing* than with third person *-s*. The verb stem *know* has the inverse preference. Idiomaticity was operationalized with the collocation measure delta-p, as applied to n-grams between three and five elements that included the word with the affix in question. A 4-gram such as *all kinds of people* has a higher degree of idiomaticity than the 4-gram *kinds of people and*. For the measures of token frequency, contingency, and idiomaticity, the Corpus of Contemporary American English was used as a reference. The learner data was taken from a corpus of student essays holding approximately 147 million words, produced by learners from various linguistic backgrounds. Errors and accurate uses of the target morphemes were identified automatically. Murakami and Ellis (2022, p. 918) use Bayesian mixed-effects binary logistic regression in order to test if token frequency, contingency, and idiomaticity predict accurate morpheme usage. Variables such as the learners' level of English and their first language are controlled for. The results indicate a positive effect of contingency. The effect of token frequency is uneven across the four affixes and does not reach significance. Idiomaticity does not appear to have an effect on the accurate usage of grammatical affixes. Murakami and Ellis (2022, p. 925) comment on the special role of contingency, arguing that inflected forms such as the progressive form *talking* or the plural noun *kinds* instantiate constructions that speakers mentally represent in their own right. The results indicate that second-language learners are sensitive to the distribution of inflectional forms for a given lemma.

Yet another domain that has become an especially dynamic area of usage-based research is the study of language change. In this area, corpus-based research, experimentation, and computational modeling come together. Pijpops et al. (2015) take the latter approach in a paper that uses agent-based modeling to address the rise of weak verbal inflection in Germanic. In present-day Germanic languages, the weak inflection is used productively with new verbs, historically strong verbs show a tendency to become regularized, and the remaining strong verbs form a relatively idiosyncratic system. The central question of the paper is how the weak inflection came to replace a well-established and stable system of ablaut classes. Whereas earlier treatments of the issue have sought to explain the change through intergenerational transmission, Pijpops et al. (2015) investigate whether and how the weak inflection hay have arisen through language use. Specifically, they ask whether the general applicability of the weak inflection may have given it a decisive advantage. Pijpops et al. (2015, p. 83) devise an agent-based model in which there is competition between a dominant strong system, comprised of different ablaut classes that are internally regular, and an upcoming weak system that is initially inferior in token and type frequency. The model features agents that interact with one another. In those interactions, they use verbs for which they choose either a strong or a weak inflection. The probabilities of the two variants are determined by the agent's prior experience. The verbs show a Zipfian distribution, so that a small set of types is high in token frequency whereas the majority



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of types is infrequent. The agents learn from their experience and update their memory after each interaction. In order to simulate generational turnover, they are gradually replaced by new generations of agents. Existing work on the development of the weak inflection has shown that its rise was gradual, that verbs with low token frequency changed earlier than verbs with high token frequency, and that ablaut classes with high type frequency were more resistant to the change. If and only if the agent-based model manages to exhibit these properties can it be regarded as a viable hypothesis about the actual historical development. Pijpops et al. (2015, p. 89) obtain results that show a steady but gradually flattening rise of the weak inflection. The early expansion of the weak inflection strongly affects ablaut classes with low type frequencies and verbs with low token frequencies. Once these verbs have been drawn into the weak inflection, its further development is slowed down. Pijpops et al. (2015, p. 92) conclude that an infrequent incoming regularity has a chance to establish itself if it is widely applicable. In the model, the weak inflection has the advantage of being usable with any and all verbs, whereas the ablaut classes are restricted. Since the agent-based model is constructed in such a way that each ablaut class behaves regularly, Pijpops et al. (2015, p. 93) argue against the hypothesis that the weak inflection would have arisen as a consequence of irregularization in the strong inflection. Usage may thus drive change, even when an existing grammatical system is fully regular.

The areas of linguistic variation, pragmatics, first and second-language acquisition, bilingualism, and language change are not the only current frontiers of usage-based inquiries into Germanic languages, but the examples discussed in this section reflect the diversity of topics that usage-based linguistics has come to address since its inception.

## 5. Concluding Remarks

The theoretical outlook of usage-based linguistics is a position that views language as a dynamic, evolving system and that recognizes the importance of usage frequency and frequency effects in language, as well as the foundational role of domain-general sociocognitive processes. Methodologically, usage-based studies draw on corpus-linguistic methods, experimentation, and computational modeling, often in ways that combine different methods and triangulate the results. Given the availability of corpus resources and the availability of experimental participants, there is a rich literature of usage-based studies focusing on Germanic languages, which at the same time has greatly benefited from usage-based research into other language families.

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