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A gradient notion of constructionhood

Tobias Ungerer
Concordia University

Abstract

The last decades of constructionist research have seen a considerable transformation of the central concept of "constructions." Earlier categorical views, which assumed that linguistic units either qualify as a construction or do not, have increasingly given way to a gradient conception, according to which linguistic patterns vary in their degree of "constructionhood." This paper summarizes key arguments for the gradient perspective, before addressing some of its implications for current and future constructionist research. These include the question of how constructionhood can be quantified, how appropriate thresholds can be chosen, and to what extent constructional networks can capture gradience.

1 Introduction

Since the emergence of Construction Grammar in the late 1980s, its proponents have debated how the key notion of "construction" should be defined. Certain elements of the concept are universally acknowledged, for example the view that constructions are pairings of form and meaning – even though there is some disagreement about what specific dimensions each pole should subsume (Herbst & Uhrig 2020; Langacker 2005). Other aspects have been more controversially discussed, in particular the question of what criteria – for example, non-predictability (see Section 2 for details) – can be used to identify constructions. Based on such criteria, it should be possible to draw a categorical distinction between what "counts" as a construction and what does not. At the same time, there has been a growing awareness that hard-and-fast criteria distinguishing constructions from "non-constructions" are difficult to establish, and that the differences may in fact be gradual (e.g., Langacker 2006; Schmid 2017; Zeschel 2009). This suggests that what is often treated as a categorical distinction may in reality be a gradient (or continuous) scale along which patterns vary in their "constructionhood," i.e., the degree to which they exhibit constructional characteristics.

Over the last decades, this gradient perspective has gained increasing influence on constructionist theorizing, and to date most researchers may be at least implicitly sympathetic to it. Nevertheless, as I will suggest in the present think piece, elements of the categorical view remain prevalent in the literature, and the opportunities and challenges presented by the gradient view are not always fully recognized. The further discussion is structured as follows: In Section 2, I contrast the categorical with

Corresponding author(s): Tobias Ungerer, Concordia University, tobias.ungerer@concordia.ca

the gradient view, providing arguments for why the latter is better suited to capture the empirical and psychological reality of constructions. In Section 3, I then outline four implications that the gradient view has for current and future research in constructionist frameworks. These aspects concern the ways in which constructionhood can be quantified, the role of thresholds in delineating constructions, the potential limitations of constructional networks, and the question of whether constructions can fully capture speakers' linguistic knowledge. I discuss how recent work has addressed some of these aspects, while also highlighting remaining questions that merit further research. Finally, Section 4 provides a brief summary and some concluding remarks.

2 Two views of constructions

This section provides a brief sketch of the two competing approaches to defining constructions. In Section 2.1, I will trace the origins of the categorical view and illustrate its continuing influence on constructionist theorizing. Following this, I will use Section 2.2 to outline some of the problems of the categorical view and motivate an alternative gradient perspective.[1]

2.1 The categorical view

Early Construction Grammar research typically rested on a categorical view of the concept of "construction." One of the first and most well-known definitions of constructions, which is still widely used now, stems from Goldberg's (1995) monograph:

> C is a construction iff$_{def}$ C is a form-meaning pair <F_i, S_i> such that some aspect of F_i or some aspect of S_i is not strictly predictable from C's component parts or from other previously established constructions. (Goldberg 1995: 4)

This definition can be seen as the archetype of the categorical view: It distinguishes what is a construction from what is not by using a specific criterion, namely the fact that constructions are not predictable from their subcomponents or other related constructions. For example, the resultative construction, illustrated in (1a), expresses that an entity undergoes a change of state as the result of the action denoted by the verb (Boas 2003). This 'change of state' meaning is not predictable from the individual component parts of the construction, which could be involved in various other events (e.g., 'Susan hammered the metal while/because/although it was flat'). Moreover, the meaning cannot be predicted from potentially similar constructions: While the resultative is regarded as a relative of the caused-motion construction (Goldberg & Jackendoff 2004), illustrated in (1b), the patterns nevertheless seem distinct enough so that the form and meaning of one cannot be fully inferred from the other.

(1) a. *Susan hammered the metal flat.*
b. *James pushed the chair away / out of the room.*

[1] In this paper, I focus on gradient constructionhood at a psychological level (i.e., within an individual speaker's mind). I will, however, make some suggestions in Section 4 as to how this may relate to gradience at a social level (i.e., within a speech community).

The categorical view of constructions has had wide-ranging consequences for constructionist theorizing. Some of these effects are arguably still visible in present-day research. First, the categorical conception continues to shape the way in which scholars typically describe speakers' constructional knowledge: A construction is said to either "exist" or "not exist," and speakers are thought to either "have" (or "represent," "encode," "acquire," etc.) a construction or not. The nature of these expressions presupposes that a binary distinction can be drawn between what constitutes a construction and what does not. Second, constructions are often treated as discretely countable objects. This inspires comments about "how many" constructions make up the linguistic knowledge of a speaker, as illustrated by the following quote from Goldberg (2019: 145): "There are hundreds of grammatical constructions, thousands of idioms and conventional phrases, and tens of thousands of words." Again, counting constructions presupposes that each of them forms a categorically delimited unit.

A third area in which the categorical view continues to exert its influence is in studies of language change. Many diachronic constructionist accounts rely on Traugott & Trousdale's (2013) distinction between constructionalization and constructional changes, where the former is defined as the creation of a new form-meaning pairing, and the latter are understood as internal changes to an already existing construction. For example, Traugott & Trousdale (2013: 217–224) regard the emergence of the *BE going to* future in the 17th and 18th century as an instance of constructionalization because its meaning was not predictable from the motion semantics of the lexical verb *go*, and because it changed its syntactic status from main verb to auxiliary. On the other hand, later developments of *BE going to*, such as its increase in token frequency, its growing compatibility with stative verbs (e.g., *be*, *like*) that do not imply intentionality, and its morphophonological reduction to *BE gonna*, are seen as constructional changes because they do not give rise to a new form-meaning pairing (see also Traugott 2014: 9). As these examples show, the distinction between constructionalization and constructional changes rests on a categorical view: It requires researchers to set apart what counts as a "new" construction from what does not (see Section 3.1 for further discussion).

Following this summary of the categorical view, the next section will outline some of the arguments that have been raised against it and motivate an alternative gradient view.

2.2 The gradient view

In the years following Goldberg's (1995) definition, Construction Grammarians became increasingly aware of the limitations inherent in a categorical view of constructions that rests on the single criterion of non-predictability. In particular, the findings of Bybee and colleagues (e.g., Bybee 2007; Bybee & Hopper 2001) suggested that frequency plays an important role in shaping speakers' representations of linguistic units and thus their status as constructions. For example, expressions like *this year* or *I love* you may be so frequent that they can be regarded as constructions in their own right, even if they instantiate regular patterns such as the noun phrase and the transitive construction, respectively (Langacker 2005: 140–141; Smirnova & Sommerer 2020: 23). In response to this, Goldberg (2006: 5) amended her earlier definition

and included frequency as an additional criterion, arguing that even fully predictable patterns can constitute constructions as long as they "occur with sufficient frequency". It is interesting to note that the addition of "sufficient" in this definition turns what is underlyingly a continuous concept – frequencies vary along a gradient cline, rather than falling into two discrete categories – into a categorical notion. In this sense, Goldberg's (2006) account can be regarded as a hybrid that integrates an implicitly gradient element into the definition of constructions, while still suggesting that a categorical distinction can be drawn between constructions and "non-constructions."[2]

Other researchers, meanwhile, have questioned the categorical conception of constructions on a more principled basis, providing a number of arguments in favor of an alternative gradient view (e.g., Langacker 2006; Schmid 2017; Zeschel 2009). Most crucially, these authors have pointed out that it is not only frequency that forms a continuous cline, but that (non-)predictability, too, is a gradient rather than a categorical property of expressions. Idioms, for example, vary in their degree of compositionality, ranging from highly transparent patterns (e.g., *land a blow*) to patterns with intermediate transparency (e.g., *spill the beans*) to opaque expressions (e.g., *kick the bucket*; Libben & Titone 2008). These examples illustrate gradual differences in the extent to which linguistic units can be predicted from their component parts (compare Goldberg's [1995] definition, discussed in Section 2.1).

Moreover, constructions vary in the degree to which they are predictable from similar expressions. At one end of the spectrum, alternating constructions, such as the two English verb-particle constructions (e.g., *pick up the book* vs. *pick the book up*; Cappelle 2006), are very similar and thus highly predictable from each other. They are therefore sometimes regarded as "allostructions," i.e., variant structural realizations of a single higher-level "constructeme" (Perek 2015). At the other end of the spectrum, patterns like the middle construction (e.g., *This book reads easily*; Hundt 2007) are known for having rather "unique" formal and functional characteristics, thus differing more markedly from their potential relatives, such as canonical actives and passives. As these examples suggest, (non-)predictability forms a continuum rather than a categorical property. In fact, it is only the addition of "strictly" in Goldberg's (1995) definition ("not strictly predictable") that imposes a categorical interpretation on an otherwise gradient concept, similar to the discretizing use of "sufficient" in Goldberg's (2006) reference to "sufficient frequency" (see above).

The problems that arise from a categorical notion of constructions also become evident in a diachronic context, where researchers have found it difficult to determine what a "not strictly predictable" or a "sufficiently frequent" pattern would be. This has been related to the classic Sorites paradox (Börjars et al. 2015; Flach 2020; Hilpert 2015): How many grains of sand make a heap? Applied to language change, the

[2] An anonymous reviewer asks how "non-constructions" are defined. The answer depends on the respective view of constructions that is adopted: For example, if the non-predictability criterion is emphasized, any unit that is fully predictable from a construction (e.g., a specific instance of that construction) may be regarded as a non-construction (but see Section 3.4 for some criticism of this view). Alternatively, on a storage-oriented account, any unit that is not independently stored within a speaker's mental system could be treated as a construction. Finally, from a computational perspective, Dunn (2017: 274) defines non-constructions as "possible alternate generalizations drawn from linguistic expressions", i.e., any regularity that does not contribute to a computationally optimal description of the grammar.

question is: How many changes must a pattern undergo to count as a "new" construction? Most processes of language change are gradual and incremental: They lead to a gradually widening gap between an initial state of speakers' linguistic knowledge and several subsequent stages, which are increasingly less predictable from the initial state. Seen from this perspective, the mechanisms of language change are intuitively more compatible with a gradient view of constructions than with a categorical one.

Finally, the gradient view of constructions draws additional support from the ubiquity of gradience effects in grammar. In particular, researchers across different theoretical paradigms have argued that grammaticality is a gradient rather than a categorical property of linguistic units, with some patterns being more (un)grammatical than others (Francis 2022; McClelland & Bybee 2007; Wasow 2007). Moreover, Aarts (2007) discusses numerous cases of "constructional gradience," addressing both the fact that instances of the same construction vary in the extent to which they display its typical characteristics ("subsective gradience") and the fact that linguistic occurrences often display mixed characteristics of more than one construction ("intersective gradience"). Even if these phenomena may not be fully identical with a gradient view of construction status, they are nevertheless closely related to it. For example, differences in grammaticality may result from the fact that some patterns qualify more clearly as constructions than others, thus providing stronger licensing to their instances. Similarly, Aarts' observations about the fuzziness and partial overlap of constructions highlights the fact that they are not categorically delimited units. The gradient perspective thus also aligns with a view of constructions as prototypically structured categories that consist of more central and more peripheral members, as has been argued for many other mental categories (Lakoff 1987; Taylor 2003).

If Goldberg's (1995) early definition is taken to illustrate the categorical view, then Langacker's (1987; 2006; 2017; *inter alia*) approach can be seen as the archetype of the gradient view.[3] On his account, constructions (or "linguistic units," in his terminology) are characterized by their degree of *entrenchment*, i.e., the extent to which the patterns are cognitively routinized and can be accessed automatically (see also Blumenthal-Dramé 2012; Schmid 2017). Crucially, from the very beginning, Langacker has used the notion of entrenchment to argue against a categorical view of constructions, assuming instead "a gradation, with greater entrenchment implying greater centrality and linguistic significance" (Langacker 1987: 59). As the author acknowledges, a gradient notion of constructions entails that it cannot be precisely delimited what is a construction and what is not; but in Langacker's view, this conclusion is "both acceptable and realistic" (p. 60).[4]

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[3] Langacker is discussed here due to his immense impact on constructionist theorizing, even though he is perhaps not a Construction Grammarian in the narrow sense. Nevertheless, many of his ideas have been integrated into Construction Grammar, and his own framework of Cognitive Grammar is sometimes regarded as a subtype of the former (e.g., Langacker 2005).

[4] An anonymous reviewer suggests that entrenchment is not the only dimension relevant for constructionhood, but that other factors, such as the degree of productivity, non-compositionality, and holistic processing of a unit, also play a role. All of these factors could, however, be regarded as related to, and potentially even part of, a broad understanding of entrenchment, especially if the latter concept is operationalized via multiple parameters such as frequency, similarity, and syntagmatic attraction (Dunn 2022; Schmid 2020; see Section 3.1 for details). For example, since more productive patterns generalize over larger classes of similar subtypes, they are likely

Instead of drawing a sharp dividing line between constructions and non-constructions, the gradient view focuses on determining the degree to which a given pattern exhibits constructional characteristics – what could be called the *constructionhood* of the pattern. Another way of saying this is that proponents of the gradient view focus on how *likely* a pattern is to be a construction. Schmid (2020: 234), for instance, discusses the "likelihood" that speakers form a certain schematic representation, i.e., the equivalent of an abstract construction. Similarly, in the domain of language change, Hilpert (2015, 2021) argues that constructional schemas become "strengthened" over time by their instances. According to this "upward strengthening hypothesis," the more varied and frequent the instances of a pattern become, the more plausible it is to treat the resulting generalization as a construction. Both upward strengthening and the likelihood of schematic representations are inherently gradient concepts, which situate linguistic units along a cline of constructionhood.

A final piece of evidence that the gradient view has increasingly supplanted earlier categorical conceptions comes from Goldberg's (2019) most recent definition of constructions. Compared with her earlier 1995 and 2006 accounts (see above and Section 2.1), the author's latest definition is framed in strikingly more continuous terms: Constructions are viewed as "emergent clusters of [...] memory traces," which are aligned within speakers' conceptual space "on the basis of shared form, function, and contextual dimensions" (Goldberg 2019: 7). This definition makes no reference to earlier categorical criteria such as non-predictability or sufficient frequency. Rather, the concept of "emergent clusters" suggests that constructions arise through a continuous process that presumably leads to increasingly higher levels of constructionhood rather than to a sharp division between constructions and "non-constructions." Similarly, the reference to "shared" aspects of form, function, and context invites the interpretation that it is the *amount* of shared content, i.e., a continuous rather than a categorical notion, that determines the construction status of a pattern.

In sum, the arguments reviewed in this section suggest that the gradient view provides an empirically more robust and psychologically more plausible account of speakers' linguistic knowledge than its categorical counterpart. As a result of these differences, the gradient view raises a number of questions about core aspects of constructionist theorizing, while also opening up new avenues for research. Several of these implications will be addressed in the next section.

3 Implications of the gradient view

As the notion of gradient constructionhood has gained increasing popularity among Construction Grammarians, it has had important consequences for how scholars operationalize and represent speakers' linguistic knowledge. In recent years, this has led to significant advances, especially with respect to quantitative analyses of constructional inventories (see Section 3.1 for details). At the same time, the gradient perspective continues to compete with earlier categorical conceptions, thus raising a number of

to be routinely activated and thus more strongly entrenched. Non-compositional patterns are presumably well-entrenched because they are sufficiently dissimilar to (and thus less predictable from) compositional patterns; while holistically processed units derive their entrenchment from a high degree of syntagmatic attraction between their elements.

challenges that yet need to be addressed by constructionist work. This section will address four areas in which the gradient view sheds new light on established concepts, calls current research practices into question, and illustrates the need for future work.

3.1 Constructionhood can be quantified, but how?

A first important implication of the gradient view is that the construction status of linguistic patterns can, at least in principle, be *quantified*. This point has both theoretical and methodological significance, as becomes clear by comparing it to a more categorical approach to identifying constructions. For example, within the domain of language change, Section 2.1 introduced Traugott & Trousdale's (2013) analysis of the emergence of the *BE going to* future. In the authors' model, constructionalization, i.e., the creation of a "new" construction, is instantaneous, engendering a qualitative difference between the new form-meaning pairing and existing ones (pp. 29–30). Applied to the *BE going to* future, the authors argue that the pattern constituted a new construction because it expressed a distinct meaning ('future') and acquired a different syntactic role (auxiliary). While Traugott & Trousdale highlight that constructionalization is "accompanied by changes in degree of schematicity, productivity, and compositionality" (p. 22), and that it may be preceded and followed by gradual constructional changes (p. 26), the moment of constructional creation itself is couched in categorical terms. Methodologically, the emphasis on an instantaneous qualitative change leads the authors to rely on a qualitative assessment of the textual record to diagnose the occurrence of constructionalization. In contrast, as mentioned in Section 2.2, this approach is difficult to reconcile with quantitative approaches to language change, where researchers have struggled to pinpoint a single moment at which change occurs.

The gradient view, on the other hand, affords scholars the opportunity to operationalize constructionhood via a combination of continuous, and thus quantifiable, factors. Ideally, these factors are not defined in construction-specific ways, as in the above example of *BE going to*, but in more general terms so that they can be applied across different construction types. The literature contains a few proposals for what the relevant parameters may be: Schmid (2020: 234), for example, suggests that the "likelihood" with which speakers form a schematic representation (see Section 2.2) depends on the frequency, similarity, and paradigmatic variability of a pattern's instances, as well as its syntagmatic size. Each of these factors can be quantified using appropriate corpus-based and experimental methods, as I will illustrate with some examples below. Nevertheless, I will also show that the existing approaches have a number of limitations, and that further work is required to determine the construction status of linguistic units in a bottom-up, data-driven way.

Starting with frequency as a first plausible determinant of constructionhood, Construction Grammarians have drawn on a wide variety of corpus-based tools to quantify the frequency of linguistic expressions, including simple token and type counts but also more advanced measures of, for instance, dispersion. These methods cannot be discussed in detail here, but the reader is referred to existing reviews (e.g., Divjak 2019; Gries 2008). Some frequency-based measures can also be used to investigate the degree of association between the linearly co-occurring elements of a construction,

thus providing insight about the syntagmatic dimension of constructions (the second of Schmid's criteria mentioned above). In particular, collostructional analysis methods (Stefanowitsch 2013), along with other association measures such as delta *P* (Ellis 2007), can shed light on, for instance, which verbs typically combine with the ditransitive and the *to*-dative construction (e.g., *She gave the man the book / the book to the man*; Gries & Stefanowitsch 2004), or to identify potential subpatterns of more general constructions (e.g., [ADJ *as hell*] as a subtype of [ADJ *as* NP]; Desagulier 2016).

Similarity, meanwhile, is potentially more difficult to quantify. From a corpus-based perspective, it is often assessed with the help of distributional semantic methods such as vector-space analysis (Hilpert & Perek 2015; Lenci 2018), which use contextual co-occurrences to determine how similar two constructions (or the lexical items that occur in their open slots) are to each other. On the experimental side, a suitable paradigm for testing constructional similarities is provided by priming, given that previous exposure to a linguistic pattern tends to affect speakers' subsequent processing of the same or similar patterns (Bock 1986; Branigan & Pickering 2017; Ungerer 2021). Of course, all of these methods have their respective limitations: While corpus-based approaches cannot directly tap into the psychological reality of speakers' linguistic representations, experimental methods such as priming can only be applied to a few constructions at a time, often yielding relatively coarse-grained effects (see Ungerer in press-a for discussion).

In recent work, researchers have started to combine several of the aforementioned factors and methods to determine degrees of constructionhood in a data-driven way. One approach is illustrated by Hilpert (2015, 2021), who investigates the diachronic development of English noun-participle patterns, such as [N-*oriented*] (e.g., *career-oriented*) and [N-*based*] (e.g., *computer-based*). The author tries to determine how plausible it is that speakers have, over the last 200 years, formed a more abstract [N-participle] schema that generalizes over these subpatterns. Specifically, Hilpert calculates how much "upward strengthening" the abstract schema has received from its subtypes (see Section 2.2) – a notion that is closely akin to assessing the constructionhood of the schematic construction. To measure the degree of upward strengthening, the author combines three factors: frequency (how many new noun-participle instances are attested per time period), category salience (how clearly these instances instantiate the general schema), and semantic similarity (how similar the instances are to each other). Based on his calculations, Hilpert concludes that the overarching schema was not significantly strengthened during the period of investigation, and that the family of noun-participle constructions is better accounted for in terms of lower-level generalizations.

While Hilpert's approach provides proof of concept for how the constructionhood of a schema could be quantified, it still displays some limitations. First, it is not quite clear how some factors (e.g., category salience) are measured, and whether they require manual annotation that would introduce a subjective component into the analysis. Second, the model applies a "penalty" to high-frequency noun-participle types that are semantically similar to already established types, based on the rationale that those types should contribute less to the productivity of the schema. While such an additional mechanism is theoretically grounded, its specific implementation (e.g., the size of the penalty) is left to the analyst's discretion. Third, and perhaps most crucially,

the logic of Hilpert's approach is somewhat top-down: The analyst first identifies a putative construction and then examines its constructionhood, rather than deriving possible constructions from the data itself.

To address the latter point, several researchers have developed computational models that aim to identify constructions in a purely bottom-up way (Dunn 2017, 2018, 2022; Forsberg et al. 2014; Wible & Tsao 2010, 2020). All of these approaches search for frequently recurring patterns in a corpus and rank them in terms of how well they capture generalizations over the data. In one of the most recent implementations, Dunn (2022) combines automatic part-of-speech tagging, distributional semantics, and association measures like delta *P* (see above) to identify both syntactic and semantic generalizations over sequences of syntagmatically associated units. For a sample of 35 languages, he thus creates inventories of grammatical patterns which, in psychological terms, could correspond to the most well-entrenched constructions in speakers' minds. While Dunn's approach may to date be the most advanced attempt to quantify degrees of constructionhood, it still leaves room for discussion and further refinement. For one, the patterns identified by the algorithm, such as [*due* – ADPOSITION – DET – N] (e.g., *due to this difference*; Dunn 2022: 669), are not necessarily situated at the level of abstraction that is typical of (and potentially most useful for) traditional linguistic analyses. This is especially true of patterns that refer to distributional semantic clusters, such as [N – *of* – DET – semantic cluster no. <587>] (e.g., *part of the frontier*; Dunn 2022: 669), which are not directly interpretable. Further work will therefore need to examine to what extent the computationally derived patterns correspond to speakers' actual mental representations, and how they can be utilized in other theoretical and empirical work.

Together, these observations illustrate that the gradient view brings with it the opportunity, but also the challenge, of quantifying the constructionhood of linguistic patterns. Recent work has made significant advances in determining degrees of constructionhood based on a combination of measurable factors, with some bottom-up approaches inferring suitable generalizations from the data itself. Nevertheless, a number of questions remain about how frequency, similarity, syntagmatic attraction, and other relevant factors can be operationalized, how their interaction should be modeled, and how the findings can be interpreted both in terms of their theoretical relevance and their psychological plausibility.

3.2 Turning gradience into categories: What is the right threshold?

The second implication that I will discuss here concerns the relationship between the gradient notion of constructionhood and the categorical use of the label "construction." As noted above, the gradient view entails that there is no natural cutoff point that separates constructions from non-constructions. As Langacker (1987: 59) puts it: "Is there some particular level of entrenchment, with special behavioral significance, that can serve as a nonarbitrary cutoff point in defining units? There are no obvious grounds for believing so." Nevertheless, the fact remains that categorical distinctions are very useful for scientific analysis (and more generally, for human cognition): In many situations, linguists simply want to decide whether they refer to a pattern as a "construction" or not. There is, of course, a simple way to turn a gradient scale of

constructionhood into a categorical distinction: by defining a threshold that separates what is considered a construction from what is not. For example, assuming that constructionhood could be successfully quantified as suggested in Section 3.1, researchers could select a numerical threshold value and then treat everything that exceeds that value as a construction.

To the critical reader, combining the gradient view with a threshold may sound like the equivalent of the categorical view, but the two have in fact crucially different implications. On the categorical view, the boundary between constructions and non-constructions is regarded as a natural division, determined by a binary criterion (e.g., predictable vs. non-predictable). On the gradient view, however, the distinction is viewed as an artificial threshold that is imposed on what is in reality a gradient scale. As a result, the gradient view confronts researchers with a number of questions that do not arise under a categorical perspective. The most important of these is how an appropriate threshold can be determined, and what factors should influence the decision. More specifically, do suitable thresholds have to be determined in a top-down fashion based on the analyst's intuition, or can they be inferred in a bottom-up way from the properties of the linguistic units themselves? And what factors determine the adequacy of a threshold – should researchers strive to maximize theoretical parsimony, descriptive accuracy, psychological plausibility, computational efficiency, or some other dimension? Finally, is it possible to determine a "universal" threshold for constructionhood that applies across different phenomena, or are thresholds necessarily defined in relation to a given analysis (and its specific objectives)?

From a bottom-up perspective, determining an appropriate threshold would essentially be an optimization problem. An optimal threshold should classify the smallest possible number of units as constructions, while at the same time explaining the maximum amount of variation in a given dataset. Evidently, the explanatory potential of a particular construction is related to its degree of constructionhood, i.e., its ability to generalize over groups of similar instances. This logic is taken up by some of the computational approaches mentioned in Section 3.1: Dunn (2017), for example, implements minimum thresholds for the frequency and syntagmatic attraction of units that his algorithm identifies as possible constructions. Dunn (2018, 2022), meanwhile, uses the more refined mechanism of Minimum Description Length (Grünwald 2007), which calculates the optimal tradeoff between the encoding size of (i.e., the amount of computational resources required to describe) the constructional inventory and the encoding size of the corpus given this constructional inventory. This model also identifies the generalizations with the highest degree of constructionhood, but it does so in an implicit, data-driven way rather than based on an explicitly predetermined threshold.

As a potential drawback, this bottom-up strategy assumes that there are objectifiable thresholds on constructionhood that should apply consistently across different analyses. In many cases, however, researchers may want to choose varying thresholds in relation to the specific goals of their studies. For example, if the purpose of a project is to conduct a coarse-grained survey of an entire grammatical domain, then scholars might set a high threshold for what is regarded as a construction, thus including only the most well-entrenched constructions in their analysis. On the other hand, when analyzing the internal structure of a single constructional family, a lower threshold

may allow researchers to examine a wider variety of patterns as constructions, even if they are not all equally strongly represented in speakers' minds.

Together, these remarks suggest that suitable thresholds on constructionhood could potentially be chosen by combining bottom-up data-driven methods with the top-down perspective of the analyst's intuition. Crucially, the gradient view requires researchers to be explicit about whatever strategies they use to mark off a category of "constructions." It should therefore make future analyses more transparent and comparable, thus helping to address recent concerns about the falsifiability of constructionist theories (see, e.g., Hoffmann 2020).

3.3 Can networks capture gradience?

As a third aspect, the gradient view has implications for, and raises new questions about, the widespread use of constructional networks to capture aspects of speakers' linguistic knowledge (e.g., Diessel 2019; Langacker 1987; Goldberg 1995; Sommerer & Smirnova 2020; Ungerer in press-a). In these networks, the nodes represent constructions, and they are interrelated by a variety of links expressing relationships such as taxonomic similarity and syntagmatic association. In some models, nodes can also be internally complex, giving rise to "nested" networks (Diessel 2019; Ungerer & Hartmann in press). For example, a complex construction like the ditransitive (e.g., *She gave the man the book*) can be represented as a network node, but this node itself may consist of a linking pattern between lower-level nodes that represent the component parts of the ditransitive (i.e., its constituents) or more specific subtypes of the ditransitive (e.g., semantic variants expressing 'actual transfer of possession' and 'intended transfer'; Goldberg 1995).

Intuitively, networks lend themselves to a categorical interpretation: The visual representation suggests that nodes are discrete units that are fundamentally distinct from the links between or within them. Applied once again to language change, for instance, networks have been used to highlight the categorical distinction between constructionalization and constructional changes (see Section 2.1): While the former is assumed to involve the creation of new nodes, the latter is represented via changes to the node-internal links (Smirnova & Sommerer 2020). This strict separation between network nodes and links is, however, questioned by the gradient view, which rejects the categorical division between constructions and non-constructions. Under this view, the stronger the network links between two linguistic units, the more plausible it is to posit a higher-level generalization that subsumes them, and which can be represented as a single network node. Crucially, since the strength of network links is gradient, there is no natural cutoff point at which a configuration of lower-level links should be "translated" into a discrete higher-level node. Rather, as discussed in Section 3.2, the creation of a new node requires analysts to select an (artificial) threshold along a continuous cline of constructionhood.

That the division between network nodes and links may be less categorical than often assumed is also illustrated by a comparison of so-called "node-centered" and "connection-centered" approaches to the network architecture (see Hilpert 2018 and Hilpert & Diessel 2017 for discussion). Proponents of node-centered approaches

place most of the information relevant for their analyses within the network nodes, while advocates of connection-centered approaches highlight the role of changing linking patterns in the network. As Hilpert (2018: 33) notes, however, the two approaches can typically be used to capture the same insights in different ways. In the author's example, the fact that the Dutch *krijgen*-passive came to combine with more varied verb types during the 20th century (see Colleman 2015) can be modeled either via changes to the meaning pole of the constructional node (from a node-centered perspective) or as newly emerging syntagmatic links between the verb *krijgen* and particle types that it had previously not combined with (from a connection-centered perspective). Crucially, if nodes and links were categorically different, representing fundamentally distinct cognitive units, one would not expect that one analysis can so easily be reformulated in terms of the other. As a result, Hilpert's observations seem to support the gradient view, on which the distinction between network nodes and links is one of degree rather than of kind. This view is also in line with Hoffmann's (2020: 150) verdict that current network models "have no principled way of distinguishing constructions from relationships between constructions," which again questions the clear-cut distinction between nodes and links. It is further supported by Ungerer's (in press-b) discussion, who argues that positing a schema node that generalizes over a group of subtypes is conceptually equivalent to positing similarity links between each pair of subtypes, and that the difference between the two is essentially notational.

Networks thus bear the inherent tension that they impose a categorical distinction between nodes and links on an underlyingly continuous reality. The question is, however, whether network representations can still integrate, at least to some extent, elements of gradience. Two possible strategies suggest themselves: On the one hand, some researchers have characterized network nodes in terms of varying degrees of entrenchment, for instance by placing thicker boxes around more strongly entrenched units (for examples of this practice, see Barðdal 2008; Goldberg 2013; Langacker 1987). On the other hand, others (e.g., Diessel 2019; Ungerer in press-a; Zehentner 2019) have applied the same idea to the network links, indicating their different strengths with lines of varying thickness, and thus yielding what formal approaches refer to as "weighted" networks (e.g., Barabási 2016). Such modifications of network diagrams allow for more nuanced interpretations: For example, a cluster of strongly linked units may be "closer" to acquiring construction status than a weakly connected configuration. Nevertheless, these additions cannot fully make up for the fundamental distinction between nodes and links as well as the fact that a constructional node can, in principle, be reformulated as a constellation of links.[5]

Overall, this does not mean that researchers should refrain from using networks to illustrate the structure of speakers' linguistic knowledge. Rather, the gradient view merely reminds scholars to maintain a clear view of the assumptions that underlie the network model and the fact that, like any other representational tool, networks have their strengths and limitations. Langacker (2006: 139–148), in particular, has

[5] An anonymous reviewer points out that network models and network diagrams are not the same, and that the former can be more complex than what is visually representable. While this is certainly true, the present discussion focuses on fundamental aspects of the network architecture, such as the distinction between nodes and links and the question of what the respective elements represent, which are independent from the specific visualization.

been outspoken about the "overly discrete" (p. 146) nature of network nodes as well as the potential dangers of taking the network "metaphor" too literally and mapping it directly onto a putative psychological reality. Nevertheless, if interpreted with care, networks provide a powerful tool to capture relationships between linguistic units in an explicit, flexible, and computationally feasible way. As such, the present discussion contributes an additional perspective to the ongoing discussion about the architecture and psychological plausibility of constructional networks, which are certain to remain active topics of constructionist research.

3.4 Is it really "constructions all the way down"?

As a final implication, the gradient view of constructions allows for a reassessment of the widespread claim that speakers' knowledge of language *in toto* consists of constructions. This perspective is most commonly captured with reference to Goldberg's (2006: 18) slogan that "it's constructions all the way down." Over the years, Construction Grammarians have posited a wealth of constructions at increasingly lower levels of abstraction, for example by restricting their slots to certain semantic classes or specific lexical elements (e.g., Boas 2003; Hartmann 2019; Hilpert 2015; Sommerer & Baumann 2021). This suggests that even fine-grained aspects of speakers' knowledge can be captured in terms of constructions, which might thus potentially account for the entirety of speakers' linguistic knowledge.

Nevertheless, the view that language consists entirely of constructions creates some potential problems (see also Ungerer & Hartmann in press for discussion). For example, many constructionist researchers assume that speakers store linguistic information down to the finest level of detail, including information about individual usage events, or "exemplars" (Ambridge 2020b; Bybee 2013; Goldberg 2006; Tomasello 2003).[6] These exemplars must therefore be regarded as part of speakers' linguistic knowledge, which according to Goldberg's slogan consists of constructions all the way down. This creates a dilemma: On the one hand, scholars could treat each individual exemplar as a construction. This is, for example, suggested by an anonymous reviewer of this paper, who argues that "exemplars are complex form-meaning pairings (similar to holophrases in child language) – why are the authors hesitant to call these 'constructions'?" The problem of this view is that it would drastically increase the number of units that are recognized as constructions. If every exemplar is potentially regarded as a construction, the latter concept would no longer fulfil its role of capturing meaningful regularities within speakers' linguistic knowledge.

On the other hand, researchers could regard exemplars as stored units that are distinct from constructions. But in this case, speakers' knowledge of language would no longer consist of constructions *only*. The latter point is contested by another anonymous reviewer, who suggests that "exemplars [...] are memorized as instances of constructions, that is, their representations are not autonomous, but they are associated with a generalization." It is, however, not quite clear what a "memorized"

[6] I do not address extreme versions of exemplar-based theories here, according to which speakers store *only* exemplars but do not generalize across them. To date, most researchers seem to agree that exemplars coexist with more schematic representations (see, e.g., Ambridge 2020a for a recent discussion).

but still "non-autonomous" representation would be: While exemplars are partially predictable from the more abstract generalizations they instantiate, they also contain highly specific information (e.g., about the situational context) that is not part of the schema – which is exactly the reason why they need to be stored in the first place. As stored and partially non-predictable units, they should, however, qualify as constructions. A further problem of this view is that it introduces a categorical divide between exemplars, which are assumed to be stored but non-autonomous, and generalizations over those exemplars, which are presumably autonomous and can therefore have construction status. Following the aforementioned logic, however, lower-level generalizations (e.g., verb-class-specific subtypes of the ditransitive; Croft 2003) can be regarded as partially dependent on their higher-level supertypes (e.g., the fully schematic ditransitive) and would thus not qualify as constructions. As this example illustrates, there seems to be no principled reason to treat exemplars as (categorically) distinct from the rest of speakers' linguistic knowledge.[7]

While the categorical perspective forces researchers to choose between these two views, each of which is problematic, the gradient conception offers a potential way out of the conundrum. On this view, it is not assumed that all of speakers' linguistic knowledge consists of constructions. Rather, the assumption is that all linguistic units *can be characterized in terms of their constructionhood*. In other words, the units may not all be of the same type, but they are measured along the same gradient scale. Applied to exemplars, the question does not arise of whether these low-level units "are" or "are not" constructions since the binary distinction itself does not exist. Rather, like any other linguistic unit, exemplars can be regarded as having a certain degree of entrenchment, and thus a certain level of constructionhood, even though this level is presumably quite low because exemplars are, by definition, minimally frequent and thus less likely to be routinely activated. Similarly, at the other end of the schematicity continuum, researchers have debated whether speakers store highly abstract generalizations such as a putative "subject-predicate construction," which captures the most basic clause structure (e.g., Tomasello 2003: 319–320). This schema, too, can be assessed in terms of its constructionhood, even if the latter may turn out to be low because speakers perceive its instances as too dissimilar to generalize over them.

In this way, the gradient view suggests that speakers' linguistic knowledge is not made up entirely of constructions, but that it can be evaluated along a continuous cline of constructionhood. As a result, Goldberg's (2006) original slogan may need to be adapted. Rather than consisting of "constructions all the way down," speakers' knowledge of language may better be conceptualized as "constructionhood all the way down."[8]

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7 Also relevant in this context (as pointed out by a reviewer) is the concept of a "construct," which is often used to denote a single instance of a construction (e.g., Traugott & Trousdale 2013). However, the same arguments made here for exemplars apply to constructs, too: Each construct encompasses features that cannot be predicted from its schema; constructs can vary in their degree of entrenchment (see, e.g., Hoffmann 2013: 314–315); and consequently, the difference between constructs and constructions could be reconceptualized as a gradient rather than as a categorical distinction.

8 See also Hoffmann's (2020: 151) alternative modification of Goldberg's slogan, according to which language is "a *network of constructions* all the way down" (original highlighting). While this is not identical to the present account, the two share the fact that they use a more flexible notion

4 Conclusion

In the spirit of this journal issue, the present paper has illustrated that the concept of "construction" has undergone a considerable transformation over the last 35 years of constructionist research. In particular, I have suggested that early categorical views of constructions have increasingly given way to a gradient conception, according to which linguistic units are characterized along a continuous cline of constructionhood. In Section 2, I outlined a number of reasons for why the gradient view provides a theoretically and empirically more plausible account of speakers' linguistic knowledge. In particular, I highlighted that the factors that determine the construction status of linguistic patterns – such as their (non-)predictability and frequency – are continuous rather than categorical properties, and that the gradient view is in line with the incremental nature of language change as well as the ubiquity of gradience effects in grammar. In Section 3, I then elaborated on four implications that the gradient view has for current and future constructionist research. These aspects concern the possibility of quantifying constructions in a bottom-up, data-driven way; the choice of adequate (but ultimately artificial) thresholds on constructionhood; the limitations of network representations in accounting for gradience; and a reassessment of the well-known claim that language consists of constructions all the way down.

Naturally, the notion of gradient constructionhood raises further questions, and there are a number of aspects that I could not address in detail in this think piece. In particular, the discussion has focused on how constructions can be defined within an average speaker's linguistic knowledge, thus centering on the psychological level of the individual, as captured by the central notion of entrenchment (see Section 2.2). However, as Schmid (2020) and others have emphasized, language is also characterized by processes of social *conventionalization* that unfold at the level of the speech community. Given that individuals vary considerably in their linguistic representations (Barlow 2013; Dąbrowska 2015; Petré & Anthonissen 2020), the question is whether and how this interspeaker variation can be integrated into a gradient notion of constructionhood. Only a few tentative suggestions can be made here: On the one hand, a complex concept of constructionhood could take into account measures of social diffusion, thus assigning higher degrees of constructionhood to patterns that are more widely (or evenly) distributed across speakers. On the other hand, entrenchment and conventionalization depend on very different factors, and there may be good reasons to distinguish between gradience along the two dimensions. For example, a pattern could be represented only in the minds of a few speakers, but strongly so, thus displaying a high degree of entrenchment and a low degree of conventionalization. In an alternative scenario, all speakers of a community could potentially represent the same abstract schema, but only weakly so, which would therefore have a high degree of conventionalization and a low degree of entrenchment. These two distinct scenarios would be confounded if degrees of constructionhood were calculated simply by summing over the psychological and the social dimension.

As these observations suggest, the gradient view of constructions continues to pose both opportunities and challenges for constructionist research. In this way, the present

to capture speakers' linguistic knowledge (constructional networks in Hoffmann's case; a gradient cline of constructionhood in the present case).

discussion contributes to current self-reflective practices in Construction Grammar (see, e.g., Hilpert 2018; Hoffmann 2020; Ungerer & Hartmann in press; and the other contributions to this journal issue), where fundamental assumptions are questioned and new theoretical and methodological avenues are explored. In particular, I aimed to show how the concept of gradient constructionhood opens up a number of exciting research directions for how constructions can be operationalized, represented, and interpreted.

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