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Individuality in complex systems: A constructionist approach

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Abstract: For a long time, linguists more or less denied the existence of individual differences in grammatical knowledge. While recent years have seen an explosion of research on individual differences, most usage-based research has failed to address this issue and has remained reluctant to study the synergy between individual and community grammars. This paper focuses on individual differences in linguistic knowledge and processing, and examines how these differences can be integrated into a more comprehensive constructionist theory of grammar. The examination is guided by the various challenges and opportunities that may be extracted from scattered research that exists across disciplines touching on these matters, while also presenting some new data that illustrate how differentiation between individuals can improve models of long-term language change. The paper also serves as the introduction to this special issue of *Cognitive Linguistics*, which collects seven contributions from various linguistic disciplines focusing on key aspects of individuals' grammars.

Keywords: construction grammar, individual differences, constrained variation, language as a complex adaptive system

1 The challenge

Language is (at least in part) a non-private phenomenon (cf. Wittgenstein 1953: § 243), which requires conventions to be effective as a means of communication. This communicative function implies that the amount of variation somehow has to be constrained, but does not preclude the possibility of significant differences between individuals. Both differences and similarities between individuals may be found in the domains of cognition, social embeddedness and overall

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experiences. Variation, and constraints on it, may therefore be expected to be both cognitive-psychological in nature (cognitive styles), as well as social¹, and the difference between them will not always be clearly delineated. While the nature and interplay of these factors is probably too complex to be fully modeled, it would seem that a plausible model of language at least needs to address these issues, and should try to define and identify the relevant factors as well as possible. Specifically, any theory that embraces the notion that variation is a fundamental dimension of language will need to address the functionality of this variation itself and how it partakes in shaping the macro-level.

Recent approaches that aim to factor in the intrinsically variable yet systematic nature of language commonly refer to language as a “complex adaptive system” (Steels 2000; Beckner et al. 2009; Bybee 2010; Ellis 2011; Van de Velde 2014; Schmid 2020; see Holland 1992 for other types of CAS in human behavior). Such a system is characterized by the following key features:

- (a) The system consists of multiple agents (the speakers in the speech community) interacting with one another.
- (b) The system is adaptive; that is, the speakers’ behavior is based on their past interactions, and current and past interactions together feed forward into future behavior.
- (c) A speaker’s behavior is the consequence of competing factors ranging from perceptual mechanisms to social motivations.
- (d) The structures of language emerge from interrelated patterns of experience, social interaction, and cognitive processes.

(Beckner et al. 2009: 2)

A view of language as a complex adaptive system requires a framework that offers both the methodological tools and theoretical concepts to analyze the various components of the system. While every theory of language covers grammar’s systemic aspects, few theories explicitly address the vast linguistic diversity that follows from the interaction of non-static entities. That is, dynamism does not only lie in the interaction of agents (a), but also in the agents themselves, as their grammars are continuously reshaped by experience and therefore inherently dynamic and non-identical between experiential phases (b)-(c). Assumptions on the dynamism of the agents themselves cannot readily be accommodated within theories of grammar that rely on idealized speaker-hearer communities such as those of generative grammar. In such models,

¹ See, for instance, the sociolinguistic concept of “orderly heterogeneity”, i. e., structured variation (Weinreich et al. 1968: 100).

linguistic knowledge, or at least an ‘initial state’ of it, is hard-wired in the brain (Chomsky 1965: 3) as a kind of ‘language organ’ (Paikeday 1985), relegating variable input to the realm of superficial noise (Berwick and Chomsky 2016).² By contrast, cognitive construction grammar (Goldberg 1995, Goldberg 2006a; for overviews, see Boas 2013; Ziem and Lasch 2013; cf. also the closely related framework in Croft 2001) has been claimed to agree well with the premises of language as a complex adaptive system (e.g., Beckner et al. 2009; Ellis 2011; Croft 2014). Its adherents have explicitly aspired to psychological plausibility (Tomasello 2003; Allen et al. 2012; Boas 2013; Hoffmann and Trousdale 2013; Pulvermüller et al. 2013). Yet in practice constructionist approaches have not fully embraced the individual dimension of this premise either. Few studies outside acquisition research have explicitly tried to make systematic observations about features of individual speakers’ grammars, or how their interaction leads to a community grammar as an emergent macro-phenomenon.

To adequately integrate the individual dimension into a constructionist model of language, information will be required from various linguistic disciplines, including psycholinguistics, sociolinguistics, and historical linguistics. This special issue brings together a number of studies from these various angles, focusing on how they all share the same fundamental questions:

- What is shared in linguistic knowledge?
- What is unique in linguistic knowledge?
- How are unique and shared knowledge dynamically related?

In Sections 2–4, we elaborate on these questions, reviewing research from various linguistic disciplines. Section 4, on the interaction between unique and shared features, also presents some new material from the research project *Mind-Bending Grammars* funded by the ERC (PI Peter Petr, for details see acknowledgments), showcasing how individual variation and diachronic change are related. In Section 5, we lay out the potential of a constructionist theory of language to account for individuality and its constitutive role in the complex adaptive system that language is. The section also introduces the various contributions to this special issue. Each of these studies explores the interaction between individual and shared knowledge from various constructionist perspectives, while drawing on recent advances in methods and resources that allow for targeted and robust quantitative and experimental research on this underrepresented topic. A concluding Section 6 takes stock of the special issue as a whole transcending its parts.

² This still seems to be the main tenet in Minimalism, even while this theory only retains highly abstract language universals such as move, merge, and recursion.

2 What is shared in linguistic knowledge?

The question what is shared in linguistic knowledge has particularly received attention within the subdisciplines of sociolinguistics and psycholinguistics. Sociolinguists have capitalized on the idea that language consists of conventions that are adopted by members of a speech community. The basic level of community that is the average speaker's target is wider than the connection with the primary caretakers (Labov 2012: 267), and has as its most significant independent predictors gender, age (Wagner 2012; Sankoff and Wagner 2006), social class, neighborhood, and race (Labov 2012: 282). Alignment to local networks along these lines has been shown to be very strong, with members sharing both probabilities of variant production as well as grammatical constraints (for an overview, see MacKenzie 2019: 2–6). The sociolinguistic variationist tradition has provided a rich toolbox to measure degrees of convergence, typically by contrasting two competing variants in terms of probabilities and constraints. This methodology has also unearthed emergent convergence beyond local communities and face-to-face communication, up to a level of 0.80 in larger regional studies (Labov 2012: 282). In written output, group delineations may be reflected in the form of differences in text types, textual force, or genres, to the extent that such phenomena are sociocognitive constructs to facilitate communication among peers or between speaker/writer and listener/reader (e. g., Tsiplakou and Floros 2013). Generally, sociolinguistic studies have repeatedly argued that the amount of social alignment is very high, up to the point that individual variation has been considered to be “reduced below the level of linguistic significance” (Labov 2012: 265).

From a constructionist perspective, individual constructional networks presumably contain rich contextual information, keeping track of which use of which construction is appropriate in which context (called the “sociolinguistic monitor” by Labov [2012: 266]). People have been shown to switch smoothly between communities of practice, using different types of language. The role of communities of practice or text types would appear to be of great relevance to corpus-based studies of individual behavior within a constructionist framework. Yet sociolinguistic concepts have received relatively little attention in construction grammar, although there have been some attempts to integrate them (e. g., Kristiansen and Dirven 2008; Croft 2009; Harder 2010; Hollmann 2013; Hilpert 2017; Hoffmann and Bergs 2018 specifically on genre as a sociocognitive construct). To adequately assess what it means to share constructional properties, it is essential to take the richness of an individual's context into account whenever possible.

Another basic level at which individuals are able to accommodate with one another is their general cognition. Psycholinguistic research within the framework of construction grammar has shown that adult speakers can learn a novel construction with limited input (Boyd et al. 2009; Casenhiser and Goldberg 2005; Kidd et al. 2005; Wonnacott et al. 2008, *inter alia*). Studies on first language acquisition, while embracing the existence of different learning processes, also typically conclude that the learning outcomes are highly similar. Mostly this conclusion remains somewhat implicit (e. g., Casenhiser and Bencini 2015: 584–589), but occasionally it comes to the fore, as in the observation that children’s “grammars seem to converge over time” in terms of clausal constructions (Bannard et al. 2009: 17,288). The findings suggest not only that constructions have some psychological reality, but also that the cognitive representation of frequent constructions (e. g., argument structure constructions such as the ditransitive) share a prototypical core among language users. Such shared prototypes are not unexpected given that people also have shared or similar experiences. While the weight of variation and convergence in these processes remains open to debate, there appears to be enough overlap to secure communication, even if possibly assisted by coping strategies like redundancy, rephrasing, non-verbal communication, etc.

3 What is unique in linguistic knowledge?

To fully appreciate the nature of what is shared, it is essential to understand in what ways representations can differ among language users (cf. also Newman 2017). Differences may be attributed to various factors, both cognitive and social. Early research in sociolinguistics has considered language to be primarily a community-level phenomenon. More recently, idiolectal contours have become more central. Third-wave sociolinguistics no longer views language users as passive adopters of their community standards, but rather as social agents, who (re)combine variants in a “continual process of bricolage” (Eckert 2012: 94), depending on their participation in specific communities of practice (Eckert 2006), and this new approach has considerably advanced our understanding of more individual stylistic preferences by speakers and writers, and their relation to indexicality (Hernández-Campoy 2020: 186; Wagner and Buchstaller 2017, among others).

Psycholinguistic research has regularly observed differences between speakers, but has generally not treated these as an object of study in their own right. Closer examination of differences between test subjects may shed light on the

scope of variation, as well as on its limits, in order for communication still to be effective. Dąbrowska's pioneering work (2008, 2013, this volume; Dąbrowska and Street 2006) on various morphosyntactic features has led to ground-breaking insights that only start to reveal the magnitude of individual differences. She demonstrates, on the basis of experimental evidence, that adult language users may have different representations of morphosyntactic constructions. Only a minority of speakers is sensitive to the underlying semantic generalization that accounts for the statistical regularities found in for example genitive marking and restrictions on long-distance dependencies. Other speakers, however, approximate the behavior of sensitive speakers as the latter sustain the pattern in language, thereby creating a pull effect. In other words, even identical (or highly similar) linguistic output may reveal differences in mental representations because the same knowledge can be stored at different levels of abstraction. Generalizations, in other words, are "as general as speakers allow them to be, and that can be very ungeneral or quite broadly general" (Joseph 1997: 158).

Dąbrowska is generally cautious about cognitive factors, but sees a correlation with the more social factor of educational background. Formal schooling in grammar, for instance in the context of second language learning, enables a specific schema of an abstract construction to become entrenched in the mind, as has been demonstrated for the passive (Dąbrowska 2012). People without such schooling may not have (fully) acquired the schema, and often use more lexical heuristics to arrive at an interpretation. If they are confronted with unusual passives (e. g., *the dog was bitten by the man*), they may not parse these correctly because they lack an easily accessible schematic representation of the passive construction. Street and Dąbrowska (2010) have shown that these differences can easily be smoothed out by targeted instruction, and do not necessarily relate to innate differential cognitive abilities.

Differences in educational background may also play a role in the presence or absence of lifespan change. Standing and Petré (this volume) have found evidence that only writers without a university degree show significant lifespan change in the use of use cleft constructions in Early Modern English. This suggests that those with a university degree had already crystallized their grammatical behavior with respect to cleft usage, not unlikely in the context of the thorough linguistic training typical of early modern university studies. Moreover, lifespan change also only occurs when a generational change in usage is simultaneously unfolding, suggesting an interaction effect between community change and individual change (and see Section 4 below; Anthonissen this volume).

More generally, different linguistic behaviors seem to relate to different experiences. Such experiences may include exposure to specific types of

education or instruction, but can be of many kinds. Sociolinguistic research has repeatedly shown that progressive and conservative behavior are related to position in the social network. A language user with many weak ties (for instance in an urban environment) is more likely to innovate than someone with few strong ties (who might nevertheless be key in propagating change; e. g., Milroy and Milroy 1985). Recent psycholinguistic research (Lev-Ari 2018) has also found a positive correlation between social network size and discriminating between the respective functions of syntactic constructions that show some degree of functional overlap, which implies a direct link between the social dimension of language learning and grammatical representations. Network positions may also change across the lifespan, with corresponding consequences. An illustration is the case of Margaret Cavendish, who reverts to a more conservative grammar while abroad in exile with her much older husband and his accordingly more conservative grammar, and picks up on contemporary grammatical usage again after returning to London (Petré et al. 2019: 110). At the level of communities of practice, it has been shown that professional experience or exposure to register has an impact on the processing speed of collocations typical of that register (Verhagen et al. 2018), while differences in familiarity have an impact on the order of names in coordination constructions (Tachihara and Goldberg this volume). This last example demonstrates that experiences may hold emotional value, which is commonly transferred to linguistic expressions associated with them. As such, these experiences become a source of individual differences at the level of language evaluation, which directly impacts use. While the interaction between language attitudes and use of constructions is a well-known issue in sociolinguistics (e. g., avoidance of taboo words), it is rarely investigated on the basis of individual usage differences. Importantly, in all of these cases, there is a logical connection between certain types of experience and certain linguistic behaviors.

4 How do the unique and the shared traits interact?

4.1 State of the art

Individual differences are complex and determined by a great many factors, but they are not random. Indeed, they can generally be linked to more universal, shared properties among human language users. Differences can be grouped together at

the social level in a typology of communities of practice. Similarly, cognitive differences between individuals are also not merely idiosyncrasies but come in types. A useful notion from the psychology of learning is that of cognitive styles, which as an empirically testable concept was proposed and developed in the early 1990s (e. g., Riding and Rayner 1998), but has roots going back to Jungian theory of psychological types (Jung 1921). While the exact typology of cognitive styles remains a matter of dispute, the concept as such is not generally contested. Dąbrowska's findings suggest that differences in generalizations are primarily due to education, but it is not inconceivable that some of the differences also relate to differences in cognitive learning styles. Such an idea is however not very often entertained in constructionist (or other) approaches to grammar. Cognitive-constructionist approaches to language acquisition (Tomasello 2003) mostly focus on similarity, although there has been more attention to individual differences in second language acquisition (Schmidt 2012; Dörnyei 2014; Hulstijn 2015) and studies on bilingualism (Michael and Gollan 2005; Nichols 2017; de Bruin 2019), with experimental work on online adaptation situated somewhere in the middle (Kamide 2012; Fine et al. 2013; Ryskin et al. 2017).

For most purposes differently acquired generalizations will still be similar. Processing differences do not generally hamper communication in daily conversation, and as such do not weigh up against what is shared. They may, however, still have an impact in specific communicative contexts, as well as in how the system changes in the long term. Something similar holds for differences in social factors, which cannot always be easily separated from the cognitive factors. Progressive and conservative behavior in how adult language users adopt innovations has been primarily addressed by sociolinguistic work (e. g., Bergs 2005; Nevalainen et al. 2011). The question of differences in cognition has not received much attention, although the debate on uniformitarianism (Bergs 2012) is also in part a discussion about the stability of human cognition. A well-known case illustrating the intricacies of differentiating between the social and the cognitive is the gender paradox. Labov (2001: 293) observes that “women conform more closely than men to sociolinguistic norms that are overtly prescribed, but conform less than men when they are not”. One of the implications is that women are ahead in adopting innovations provided that they are not discouraged because of prestige considerations such as a prescriptive tradition. Because of the difficulties involved in identifying prestige variants (Bergs 2012), it is difficult to establish how universal this tendency is. However, if it is, this raises the question to what extent socialization is also a reinforcement of gender-related differences in cognitive styles (Bussey and Bandura 1999; Hyde 2014).

Constructional networks within individuals may be idiosyncratic to a certain extent, but they will also obey a number of rules that apply generally across

individuals. De Smet (2016) has argued, for instance, that the appearance of some constructional innovations depends on the pre-existence of other constructions in an individual's repertoire. He illustrates this with the development of the noun *key* into a predicative adjective. As a noun, *key* may appear in compounds such as *a key moment in my childhood*. In such compounds it can be interpreted as having a more adjectival function (in the example, as modifying *moment*). Such interpretations led to the introduction of truly adjectival uses, where *key* has been detached from its co-compound, as in *access to most of the key official documents*. This use in turn invites an interpretation as a regular adjective, leading to the introduction of the predicative use, as in *this step is key*. Importantly, De Smet finds evidence that individuals who have predicative *key* attested in the Hansard Corpus also generally have attributive *key*, but not vice versa. This holds even after predicative *key* has become quite common in the community. De Smet concludes from this that the individual cognitive language system has to be 'ready' before it can adopt an innovation, regardless whether that innovation has already conventionalized. Put differently, a node *b* has to exist in the network to link node *a* to a hypothetical farther removed node *c*. De Smet refers to this as the *cascade model*. Cognitive-constructionist analyses of this type can complement sociolinguistic analyses. It is currently unclear to what extent progressive behavior across constructions can be accounted for by associations between these constructions in individuals' constructional networks. To the extent that such associations exist, progressive and conservative behavior is not purely socially motivated, but receives (additional) support from system-internal properties of language knowledge.

4.2 Measuring the weight of individual and shared traits

A standing challenge is to go beyond establishing the existence of shared and unique traits into measuring their respective weights. To measure what is shared, correlation measures can be used (as reported in Labov 2012), or a model trained on one corpus can be fitted to another and the goodness of fit calculated, as has been done for the dative alternation in two registers of US English in Bresnan et al. (2007). By measuring degrees of correlation or fit one automatically also gains some knowledge on how much difference there is. In psycholinguistics, it has been standard practice to control for items and subjects (i. e., individual speakers) in a by-item and by-subject design (see Baayen 2008 for some examples). Mixed-effects regression modeling in particular, which has been advocated for its precision and predictive power, has also found its way into a variety of linguistic disciplines. What these techniques share, however, is that they are not (typically) employed to study

individual variation, but to filter it out as a source of noise. Also, the corpus linguistic analyses that use the most advanced statistical methods tend to focus on alternations (binary response variables). However, it has been noted that “most linguistic decisions that speakers make are more complex than binary choices” (Arppe et al. 2010: 12). Bresnan and Ford (2010) for instance look into the dative alternation in Australian and American speakers. Syntactic variation of this type is conditioned by various functional and formal factors (independent of the social embedding of the user), such as the pronominality of the recipient (*I gave him a book* vs. *I gave a book to my nephew*). The overall ranking of constraints on usage is typically kept intact between test subjects. Such models do not in fact fully explain the interindividual variation (beyond variation tied to social indices), but rather tacitly assume that it does not contribute in any significant way to the aggregate picture.

One way of going beyond the individual-as-noise conundrum is to exploit the information on the random effect (i. e., the individuals), not to control for variation, but to gain insight into it (for an illustration see Section 4.3 below). Even so, mixed models are not very well suited to capture interindividual variation when individuals have fundamentally different cognitive representations of syntactic patterns (as in Dąbrowska’s work, see also Han et al. 2016), or when the constraints conditioning the use of an alternating variant are variably ranked between individuals. For the latter case, other methods such as Conditional Inference Trees may be used. This method has been applied by Fonteyn and Nini (this volume) to the variation between two types of gerund, enabling a more precise measurement of which constraints are shared, which ones are more idiosyncratic, as well as what their relative weights in the decision process are.

4.3 Mind-Bending Grammars: Illustrating the connection

New results from the *Mind-Bending Grammars* project provide a more elaborate illustration of how individual differences interact with general traits of language knowledge and change at the aggregate level. Research on the diffusion of innovations has established that the spread of a novelty typically follows an s-curve at the population level (Rogers 2003 [1962]; Feltgen et al. 2017). Critical reviews outside linguistics have pointed out that cognitive differences between individuals in the timing of their adoption have been largely ignored (Greenhalgh et al. 2004: 599). Linguistic research into diffusion (or propagation) suffers from similar shortcomings. Neither Blythe and Croft (2012) nor Nevalainen (2006) mention cognition in their authoritative discussions of s-curves. One factor that is typically not given enough consideration is the fit between the innovation and the state of the grammar of a potential adopter (cf.

De Smet 2016 referred to previously). The results from the *Mind-Bending Grammars* project show that taking into account the current state of an individual's grammar can lead to a more accurate delineation of the diffusion process.

The case study that was examined is the adoption of grammaticalized uses of *be going to* INF across the lifespan. For details on its development, readers are referred to Anthonissen and Petré (2019) and Petré and Van de Velde (2018). The new results are based on data from a more extensive set of 49 authors (totalling 98 million words of text) than previously used.³ The median number of instances of *be going to* INF found across an author's career is 100. The diffusion process we are interested in here is that of the very first innovation that marks a point of no return in the grammaticalization process of *be going to*. This innovation involves the loss of motion, which is an essential feature of its lexical use (as in *I am going to the market to buy meat*). Once motion is no longer present, as in *I am going to explain what I mean in a minute*, the semantics of imminent future that was previously associated with the *to*-infinitive, has been reassigned to the entire construction, which has therefore acquired a more grammatical function. Metalinguistic evidence (presented in Petré and Van de Velde 2018) points to conventionalization of the non-motion use around 1630. The 49 authors in our current data set were born between 1580 and 1663, encompassing a range that starts well before and ends well after this date. Figure 1 plots how many of the informants have already adopted the innovation in a given year if we take their first attestation as an indication of adoption date.⁴ The annual ratio is each time calculated as the number of adopters out of all active authors for that year. Table 1 provides the respective coefficients.

3 The data are mostly derived from the EMMA corpus (Petré et al. 2019). EMMA is an in-depth collection of the published work of 50 individuals across 5 generations who, to a greater or lesser extent, were part of the London-based elite born in the seventeenth century. Generations 1 and 2 were analyzed in full, generation 3 except authors with ids 302, 303, 307, 314, and from generation 4 authors 401 to 406 were analyzed. Authors studied in Petré and Van de Velde (2018) that are not in EMMA (Clarke, Watson, Davies, Simon, Bulteel, Horneck and Ravenscroft) were also included. Finally, six more authors were added on the basis of their work in EEBO (see references), who represent a 'generation zero'. These are John Taylor (b. 1580), Richard Brathwaite (b. 1588), George Wither (b. 1588), Alexander Ross (b. 1591), James Shirley (b. 1596), and Edward Reynolds (b. 1599).

4 This measurement is not entirely unproblematic. A first attestation may be a fluke rather than genuine adoption, although this is less likely in writing. First uses may also have occurred in speech rather than writing, but this holds for all writers, and is therefore not expected to distort the general picture. Finally, we only have data from adulthood onwards. This affects the results in that later-born writers probably adopted in childhood. It is hard to assess how much this distorts the overall picture, but we assume this is less of a problem for the current purpose, which is comparing the fit of two graphs that suffer from the same drawbacks.

Figure 1: Diffusion of motionless *be going to* INF in a corpus of 49 informants.

Table 1: Regression coefficients and diagnostics related to Figure 1.

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	−1.250e+02	4.909e+00	−25.47	< 2e-16 ***
Year	7.490e-02	2.937e-03	25.50	< 2e-16 ***
Residual deviance:		0.53427 on 44 degrees of freedom		

The data show a highly significant fit with a logistic curve. This is encouraging, but not entirely unexpected given the natural accumulative effect of tracking first attestations. Figure 1 only tracks instances of the progressive form *be going to* INF. This is the form that eventually became the only truly grammaticalized form (and led to the contracted form *gonna* in the nineteenth century). However, at the time this development started, the non-progressive variant *go to* INF was also still much around, even in grammaticalized non-motion uses, as in (1), where Richard Baxter announces the position he will defend in the book from whose preface this sentence derives.

- (1) England in her Articles and Ordination, professeth to cleave to Scripture-sufficiency, as being the Protestant Religion. **I go to joyn** [rather than ‘am going’] in this profest Religion. (Baxter, 1684)

When the non-progressive instances are included⁵, adoption dates are as in the graph in Figure 2 (with their coefficients in Table 2).

Figure 2: Diffusion of motionless *be going to INF/go to INF* in a corpus of 49 informants.

Table 2: Regression coefficients and diagnostics related to Figure 2.

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	−1.332e + 02	3.284e + 00	−40.56	< 2e-16 ***
Year	8.009e-02	1.973e-03	40.60	< 2e-16 ***
Residual deviance:		0.43608 on 53 degrees of freedom		

The fit of the data to the logistic curve is, once again, highly significant. In addition though, the residual deviance has decreased significantly.⁶ This means

5 Unlike (1), many of the non-progressive instances lacking motion appear in conditions, generic statements or as historical presents. These are contexts where the progressive would remain rare, and perhaps a more comfortable context for early-born authors to try out the innovation. We leave this issue as a topic for further research.

6 This increase is even more telling given the increase in degrees of freedom owing to the inclusion of adopters that only have the non-progressive variant (non-adopters in either scenario are considered in the 100% limit of the active community, but are not data points themselves).

that including the non-progressive variant improves the model significantly. Further scrutiny reveals that it is the earlier-born individuals that primarily use the non-progressive variant. Out of the 20 informants born before 1620 (roughly those who had already acquired their language before non-motion *be going to* INF was conventionalized), nine use the non-progressive variant in their first attestation. Only four have the progressive variant, whereas seven never adopt non-motion *be going to* INF. In contrast, all 29 informants born after 1620 (acquiring the language after non-motion *be going to* INF had already conventionalized) have non-motion uses, and only two have the non-progressive variant as their first attestations. We would like to suggest that the first innovators probably were later-born authors, and that the context of the innovation was the progressive variant. However, the earlier-born writers adapted the innovation in accordance with their existing grammars, in which the progressive was still not entrenched. Indeed, while rapidly becoming more common, the progressive was still highly optional at the beginning of the seventeenth century (Kranich 2010). Corroborative evidence comes from the observation that in general these writers do not adopt the innovation earlier than the later-born ones in terms of absolute chronology. This suggests that they bided their time until they had been sufficiently exposed to the innovations. If this is what happened, it would also be evidence that language users decompose input into actual constructions (combination of *go* and progressive). Overall, the extensive individual corpus data suggest that adoption of a syntactic innovation may occur at different ages, but that pre-existing language habits increasingly impact the way adoption occurs, either in adapted form, or not at all. Taking into account these habits and how they apply variously to different individuals, in turn, may lead to a more accurate understanding of the aggregate process of diffusion.

A different aspect of the shifting individual dimension is the *degree* to which individuals adopt innovations related to a grammaticalizing construction. Petré and Van de Velde (2018) carried out a detailed quantitative analysis of the interaction of aggregate and individual levels of eight different grammaticalization features of *be going to* INF. Some tentative evidence was found that the first generations that acquired the grammaticalized form in first language acquisition tended to increasingly realize the grammatical potential of the construction with age. Their hypothesis is that language users from these generations might initially have been inhibited by alignment to their elder peers, but start using the form in more openly grammaticalized ways as these elder peers gradually disappear from society.

Other results from the *Mind-Bending Grammars* project, based on new data from 30 authors spread over 5 generations (6 authors each), reveal how individuals may differ in the extent to which they associate lower-level constructions vertically by means of a higher-level construction, and how these different association

strengths correlate in turn with communal (or perhaps generational) change across time. Specifically, we looked at the normalized frequencies per million words of two constructions that both belong to the family of ‘passive constructions’. The first is the so-called NCI-construction (for *Nominativus cum Infinitivo*), as in *he is said to be a thief*, where the notional subject of the embedded verb *be* appears as the syntactic subject of the passive matrix verb *is said* (what is called subject-to-subject raising in the transformational tradition). The second is the prepositional passive, as in *he was highly thought of*. Both constructions are quite common in Early Modern English. Figure 3 shows that their frequencies strongly correlate in individual use: those individuals who use the NCI-construction often, also use the prepositional passive often, and vice versa.

Figure 3: Correlation between NCI and Prepositional Passive usage.

While the correlation is significant, thirteen out of the 30 authors, a substantial minority, do not fall within the 95% confidence interval of the regression line. Crucially, the distribution of the deviant individuals reveals a pattern. Five of them belong to the last generation (born between 1672 and 1686), making up all but one of the informants from that generation. In contrast, the other generations never have more than two out six deviant informants. The five authors that deviate from the last generation are Addison, Hoadly (a clear outlier), Jacob (another outlier), Oldmixon, and Steele. Two other highly deviant individuals are Cotton Mather and (John) Dennis. Both happen to belong to generation 4 (respective birth dates 1657 and 1663), and are therefore also among the latest-born authors in the corpus. In general therefore, the evidence suggests that the two constructions were closely associated by means of a higher-level passive construction in the minds of early-born authors, but became more and more dissociated over time. Analysis of the NCI suggests that it increasingly specialized in an evidential function, being used when the writer wanted to shrink responsibility for an evaluative statement (Anthonissen 2019; see also Noël and Colleman 2009). In that function, it is less regulated by motivations for the use of passives generally (such as topicalization of a non-agent), and dissociation could be a natural consequence of this development.

The question is further examined by tracing the lifespan developments of the two passive constructions in the sample of authors (see Anthonissen ms. for details). The longitudinal data deepen the findings for the averaged frequencies presented in Figure 3 and show that there are basically two scenarios in individual usage. While the majority of authors show a persistent association of the two constructions across the lifespan, a minority (4/30) exhibit a pattern of dissociation, whereby the frequencies of the two construction types are fairly comparable in the earliest stage of the authors' careers, but increasingly diverge over time. Mixed effects modeling was used, beyond its intentional design, to establish whether variation is greater between individuals than within individuals. This can be done by extracting the intraclass correlation coefficient (ICC). In this way, Anthonissen (ms.) is able to verify statistically that for the majority of authors in her sample, between-author variation is much higher than within-author variation.

These are only some of the aspects that enable us to shed light on the interaction between individual and aggregate levels of linguistic phenomena. These and other facets are scrutinized in the other contributions in this special issue. A summary of these individual contributions is provided in Section 5.2.

5 Cognitive construction grammar as a framework for the integration of the individual level

5.1 Opportunities and limitations

We have argued that a comprehensive and psychologically plausible theory of language needs to pay more attention to individual differences between language users than is typically done. In this section we would like to argue that cognitive construction grammar is a suitable framework to do so, but has so far insufficiently embraced this opportunity.

Construction grammar theory is typically data-oriented, introspection being curtailed in that it no longer serves as the main source of evidence but rather takes on a supportive or hypothesis-generating role.⁷ The use of native speaker intuitions has been largely supplanted by experiments or corpus research. Corpus data are used to examine language in its natural habitat, providing (a) valuable descriptive insights into the system *as is* (or *was*), or (b), a testing ground for constructionist hypotheses. Experimental design allows us to control for a variety of factors and is helpful in answering specific research questions or in eliciting speakers' behavior in hypothetical situations. By advocating the use of interdisciplinary and corroborating evidence, construction grammar aims to strengthen the cognitive plausibility of the models it proposes.⁸ What has been missing, however, is a systematic integration of the individual dimension in this empirical endeavor. As a theoretical model of language, construction grammar is, however, well equipped to describe the dynamics of a complex adaptive system. We will concentrate on two key features of construction grammar that hold great promise to help integrate the oft-neglected individual dimension: (1) usage-based storage; (2) linguistic knowledge as a network.

Usage-based storage: Cognitive construction grammar is committed to a usage-based model of language (cf. Langacker 1988; Barlow and Kemmer 2000; Tomasello 2003; Bybee 2010, Bybee 2013; Schmid 2020), which understands “grammar [...] as the cognitive organization of one's experience with

⁷ Note that foundational work in cognitive linguistics (e. g., Lakoff 1987; Langacker 1987, Langacker 1991; Talmy 1988) relies quite heavily on introspection. However, it is safe to say that with increasing access to experimental methods and the availability of better and larger corpora, the programme has embraced the need for rigorous empirical methods.

⁸ An overview of the various methods employed in constructionist research can be found in Ziem and Lasch (2013: 67–76) and Gries (2013: 94), who characterizes construction grammar as “one of the methodologically most pluralistic fields”.

language” (Bybee 2013: 49). Storage of linguistic (and other types of) knowledge proceeds by means of recurrent feature learning from exemplars, leading to fluid categories and variable constraints. While early constructionist approaches concentrated on idiosyncrasies of form-meaning pairings (Fillmore et al. 1988; Goldberg 1995), even fully compositional sequences are now considered constructions if they are sufficiently frequent (Goldberg 2006a: 5). This shift ties in with CxG’s increased usage-based orientation, where constructions can be understood as “processing units or chunks – sequences of words (or morphemes) that have been used often enough to be accessed together” (Bybee 2013: 51). With gradience, variation and dynamicity as core design principles of language, construction grammar, and usage-based linguistics more generally, radically depart from the concept of the idealized language user (cf. Chomsky 1965: 3). Since no-one’s input is identical (Dąbrowska 2012), and in addition people display a set of different cognitive styles of processing information (Jonassen and Grabowski 2011 [1993]), no two people share the exact same grammar. Yet neither are their grammars unrelated: variation is constrained. This aspect may be covered by the network architecture of cognitive construction grammar.

CxG’s network architecture: Linguistic information is assumed to be stored in the mind as a hierarchical and dynamic associative network, consisting of nodes (constructions) and links between them (Goldberg 1995). While constructions (pairings of form and meaning) are considered the basic building blocks of language, their ontological status is not unique. Accordingly, and in line with CxG’s usage-based bearings, nodes are constructed by means of general cognitive abilities, such as categorisation (Croft 2001: 27; Goldberg 2006b; Langacker 2006). When a speaker is exposed to a series of linguistic utterances with formal and semantic commonalities, she may, at one point, categorize these utterances as instances of the same construction, thereby creating a node in her associative network. This node is not only dynamically created, it remains a dynamic entity that may be strengthened or weakened by experience as usage feeds into the existing representations. The concept of a constructional network also emphasizes that interindividual variation is constrained, as it is governed by regular processes (associations based on similarity), and deviation from the common ground is expected to occur systematically, along lines of recurrent network associations (as in the cascade system proposed by De Smet 2016).

By relying on usage-based storage and the idea of a constructional network, cognitive construction grammar is more robustly equipped to deal with variation than a modular system with linking rules. Variation is not noise, it is anticipated; one might even argue variation it is a fundamental design

principle. Individual differences in competence depend on a wide range of features that impact the state of the individual constructional network, including age, personality, experience, education, socio-economic status, attitudes, cognitive abilities, etc. (cf. e.g., Mills and Hemsley 1976; Ginsborg 2006; Street and Dąbrowska 2010, Street and Dąbrowska 2014; Pakulak and Neville 2010; Dąbrowska 2015). Yet the newly recognized diversity in competence has rarely been addressed by usage-based frameworks outside acquisition research (Schmidt 2012; Dörnyei 2014; Hartshorne et al. 2018; Kidd et al. 2018; Dąbrowska and Andringa 2019) and research on multilingualism (Michael and Gollan 2005; Nichols 2017; de Bruin 2019).

Methodologically, corpus studies typically treat language at the aggregate level. This is in part because linguists have always sought to make generalizations about language as a social phenomenon, but also because the necessary resources to do quantitative research at the micro-level of the individual were lacking. In this respect the contributions in this special issue are timely, as they respond to recent advances in available resources, which have made it possible for the first time to do quantitative research on naturalistic corpus data at the individual level (e.g., Schmid and Mantlik 2015; De Smet 2016; Petré and Van de Velde 2018; Anthonissen and Petré 2019; Petré et al. 2019).

5.2 Contribution of the special issue

In sum, most cognitive research on language has not fully embraced individual variation. The present issue aims to address this gap, by bringing together various subdisciplines that focus on different aspects of individual differences. Integrating individual behavior is an ambitious undertaking, as most aspects of individual variation are hard to quantify and disentangle. An overarching goal of this issue, therefore, is to make headway in delineating a typology of individual behaviors by asking which behaviors are recurrent, which cognitive styles can be identified, under which conditions, with which motivations, and by investigating how the constrained range of behaviors collectively (re)shapes and is (re)shaped by the macro-level of the community. This issue's contributions fall into two main groups: Dąbrowska, Tachihara and Goldberg, and De Smet shed light on psychological aspects of constructions; Fonteyn and Nini, Anthonissen, and Neels cover issues from the field of historical linguistics.

Dąbrowska's paper examines the intriguing phenomenon of non-psychological generalizations, that is, linguistic regularities that can be observed in

language, but are not captured in the mental grammars of most speakers. Two cases of such generalizations are discussed: genitive marking on masculine nouns in Polish and restrictions on questions with long-distance dependencies (LDDs) in English. While attestations of these masculine nouns and LDDs are found to conform to specific rules and constraints, experimental evidence shows that only a minority of speakers is sensitive to the underlying generalizations. However, by their consistency in usage, the ‘sensitive’ group modulates the frequency distribution in the speech community, creating a pull effect for speakers that are not sensitive to the underlying semantic abstraction, but nevertheless accommodate conventionalized patterns. The findings demonstrate that linguistic knowledge is distributed and may be processed and stored at different levels of abstraction by individual speakers. As a side-effect, the language of a speech community may be shaped more by some members than by others.

Tachihara and Goldberg also study the interaction between apparent generalizations and individual behavior, with an emphasis on how our unique experiences with language shape our usage. They concentrate on the order in binomial pairs, e. g., *Mike and Laura* versus *Laura and Mike*, drawing on experimental data from English and Japanese speakers. In both cases, the order is predicted by accessibility, that is, by how close one feels to the individuals in question.

The third synchronic study examines frequency effects in predicting the productivity of morphological patterns in individuals. More specifically, De Smet conducts a corpus study on *-ly* and *-ness* derivations in order to verify whether the general claim that type and token frequency are positively and negatively correlated with morphological productivity also holds at the individual level. His results both confirm and refine previous theoretical findings. Interestingly, and in line with Dabrowska’s concept of ‘sensitive’ speakers, there are strong correlations in individual productivity across the two morphological patterns, that is, speakers who use *-ly* productively also tend to use *-ness* formations productively, and vice versa.

Fonteyn and Nini make use of random forests and conditional inference trees to identify whether any differences emerge between (sets of) individuals in how they condition the use of two types of gerund. They find that the individuals in their data sample share some basic constraints on the attested variation, but their individual usage profiles start to differ as more factors are included and interacting. They also observe and warn against the way in which the distribution at the aggregate level may in fact be obliterating and in contradiction with what happens at the individual levels.

Similarly, in a study on the rise of the prepositional passive, Anthonissen demonstrates that regularities and trends that arise at the aggregate level of

language (e. g., a steady increase in normalized frequency) conceal the complexity and unpredictability found at the individual level. Intermediate levels of abstraction, whereby for instance age cohorts or group membership are taken into account, may also reveal systematicity that is not apparent in individual behavior. Anthonissen furthermore shows that the minority group that exhibits a lifespan increase in line with the communal trend is also the group of authors leading the change.

Another example of lifespan change is discussed in Neels. His study is an in-depth analysis of usage patterns of the *let alone* construction in William Faulkner's writing, as compared to general communal trends (Faulkner vs. other contemporary fiction writers) and across different career stages (early vs. late Faulkner). As regards frequency, Faulkner is found to deviate quite substantially from the aggregate community data; his late work furthermore exhibits a much higher frequency of the construction than his early work. Neels connects these inter- and intraspeaker differences in frequency to different degrees of grammaticalization in terms of context expansion.

6 Conclusion

The different contributions in this special issue reveal different aspects of the role that individual processing and behavior play in shaping the community language. Dąbrowska provides evidence that macro-level generalizations are only made by some sensitive individuals synchronically. This picture is refined by Fonteyn and Nini, who show that in multilayered alternations, some constraints are shared by most individuals, while many are shared only by some. A diachronic reflex of Dąbrowska's findings is found by Anthonissen: some language users pick up on new generalizations and expand their usage of a construction accordingly across their lifespans, while most appear to be less sensitive and stick to their established usage. De Smet concludes that some language users may have more talent in spotting a construction's potential. The paper by Neels illustrates this talent in one individual (William Faulkner), unveiling how a feedback loop reinforces his grammaticalizing use of *let alone* across his lifespan. All these contributions show that macro-level properties of language can be decomposed into input from language users that are sensitive to constructional abstractions, and those preferring to stick to routinized collocations or coinings. At the same time, they reveal different things about this apparent variation among individuals. It is not always the case that only some individuals are sensitive to a generalization. Sometimes all individuals share some constraints, but diverge when looking for

less salient, potentially more local constraints. Local constraints may also depend on private experiences (Tachihara and Goldberg this volume), or language users adjust the properties of a construction to their pre-existing grammar, as in the case study on *be going to* in this introductory paper. All these different mechanisms that are active at the individual level contribute to variation in the community. Much of this variation has often been taken for noise if it did not neatly fall into well-known sociolinguistic variables. However, the papers in this issue show that the variation does make sense, and seems to be largely brought about by three major factors (i) natural sensitivity to language abstraction; (ii) life experiences; (iii) cognitive aging effects (other than, though interwoven with the social dimension of age).

Neither the reality of the interaction between individual grammars and community, nor that of the role of variation are currently integrated to a satisfactory degree in most constructionist practice. This is a missed opportunity because cognitive construction grammar has the proper theoretical tools to accomplish this. The current contributions address this gap, and taken together, their analyses go some way towards unraveling the mystery of how different levels of language interact, providing substance to the more generic idea of language as a complex adaptive system.

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