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Engel, Alexandra; Grafmiller, Jason; Rosseel, Laura; Szmrecsanyi, Benedikt

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Alexandra Engel*, Jason Grafmiller, Laura Rosseel and
Benedikt Szmrecsanyi

Assessing the complexity of lectal competence: the register-specificity of the dative alternation after *give*

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Abstract: Recent evidence suggests that probabilistic grammars may be modulated by communication mode and genre. Accordingly, the question arises how complex language users' lectal competence is, where complexity is proportional to the extent to which choice-making processes depend on the situation of language use. Do probabilistic constraints vary when we talk to a friend compared to when we give a speech? Are differences between spoken and written language larger than those within each mode? In the present study, we aim to approach these questions systematically. Guided by theorizing in cognitive (socio)linguistics and using logistic regression based on corpus materials, we analyzed the dative alternation with *give* (*The government gives farmers money* vs. *The government gives money to farmers*) in four broad registers of English: spoken informal, spoken formal, written informal, and written formal. Corpus analysis was supplemented with a scalar rating experiment. Results suggest that language users' probabilistic grammars vary as a function of register.

Keywords: dative alternation; rating task; register variation; variationist analysis

1 Introduction

This paper takes a fresh look at the well-known dative alternation in English, as in (1):

***Corresponding author: Alexandra Engel**, KU Leuven, Leuven, Belgium,

E-mail: alexandra.engel@kuleuven.be. <https://orcid.org/0000-0002-5890-3478>

Jason Grafmiller, University of Birmingham, Birmingham, UK. <https://orcid.org/0000-0002-1012-407X>

Laura Rosseel, Vrije Universiteit Brussel, Brussels, Belgium. <https://orcid.org/0000-0002-1005-7452>

Benedikt Szmrecsanyi, KU Leuven, Leuven, Belgium. <https://orcid.org/0000-0001-8844-6602>

- (1) a. ditransitive dative: *Will you give [me]_{recipient} [your land-line number]_{theme}?* (BNC2014, SLNB, S0057)
- b. prepositional dative: *The Prime Minister has given [contradictory statements]_{theme} to [this House]_{recipient}.* (House of Commons, 2011-06-15, Tom Clarke)

The new twist we are adding to dative alternation research consists of probing the register-specificity of probabilistic knowledge about dative variability, guided by theorizing in cognitive (socio)linguistics.

In contemporary linguistics, register variation has been widely studied by many researchers applying text-linguistic (Biber 2019; Biber and Conrad 2019) or genre-based¹ analysis approaches (Bakhtin 1986; Devitt 2004). These lines of research have brought forward important insights such as the fundamental distinction between oral and written discourse as a cross-linguistically stable pattern of register variation (Biber 1988, 2012) as well as the identification of specific discourse units and associated usage patterns within a genre (Tardy and Swales 2014). However, the role of register is less clear from a variationist perspective. The research questions that guide our analysis are thus the following:

1. When language users have the choice between semantically/functionally equivalent grammatical constructions, do they adjust their choice-making depending on the situational context?
2. If so, does mode of communication (spoken vs. written) or formality of the situation (formal vs. informal) play a greater role in moderating the cognitive factors involved?
3. To what extent does corpus evidence about register differences converge with experimental evidence?

These questions come under the remit of cognitive sociolinguistics, a research orientation in cognitive linguistics that, broadly speaking, investigates language users' knowledge of linguistic variation and the interplay between lectal dimensions and variational patterns and their conditioning (Geeraerts and Kristiansen 2015; Geeraerts et al. 2010). Lectal dimensions are cultural and sociolinguistic in nature (consider e.g., regional varieties, diachronic varieties, or – of course – registers); the conditioning of variation by language-internal constraints is where usage/experience-based linguistics, cognition, and representation come in. Specifically,

¹ Previous variationist literature often uses the term 'register' and 'genre' synonymously. Following the definitions in Biber and Conrad (2019), we prefer the term 'register' (defined as "a variety associated with a particular situation of use" by Biber and Conrad [2019: 6]) to characterize our own work, but do use the term 'genre' (defined as "recognizable categories of discourse used to carry out certain actions" by Tardy [2021: 51]) when referring to previous work using that particular term.

in this paper we take an interest in the sophistication of “lectal competence” (Geeraerts et al. 2010: 10). We know that regional varieties can differ with regard to the probabilistic grammars that regulate grammatical variation (see, e.g., Bresnan and Hay 2008 on the dative alternation). In the Probabilistic Grammar framework (cf. Bresnan and Hay 2008; Grafmiller and Szmrecsanyi 2018), grammatical knowledge is assumed to include a probabilistic component and to be emergent from previous experiences with usage events. Crucially, language users are assumed to have predictive capacities. Probabilistic grammars, then, describe usage events of alternating syntactic patterns by means of weighted, probabilistic constraints. In contrast to research on regional varieties, systematic, empirical investigations into whether registers differ in terms of grammatical choice-making are lacking. In fact, a widespread though implicit (and thus empirically largely untested) assumption in the literature is that they don’t and that registers merely differ in terms of the base frequencies of particular variants: “For the most part, stylistic variation is quantitatively simple, involving raising or lowering the selection frequency of socially sensitive variables without altering other grammatical constraints on variant selection” (Guy 2005: 562). As grammatical choice-making involves probabilistic conditioning, we argue that to the extent to which language users do adjust grammatical choice-making as a function of the situational context, lectal register competence is complex. Conversely, if probabilistic grammars are stable across registers, register competence is comparatively simple.

Despite this scarceness of previous work, there is some evidence that the situational context may modulate probabilistic choice-making. For example, Theijssen et al. (2013) investigated the dative alternation in English and showed that written and spoken modes differ in terms of the effect of theme definiteness. Grafmiller (2014) studied the genitive alternation (*of*-genitive vs. *s*-genitive) across conversational speech and six written genres in American English and found considerable variability in both effect size and direction across genres, pointing to different demands placed on the speakers and authors of the texts. However, these studies either operate with a very coarse distinction between spoken and written language (Theijssen et al. 2013), with distinctions within only one mode (Grafmiller 2014), or even within only one text type (e.g., research articles, Choura 2019). A more systematic understanding of how language users take into account the formality and mode of a situation in probabilistic choice-making is still lacking.

This paper fills this gap in the literature by exploring the way in which register interacts with language-internal constraints in the dative alternation with the verb *give*. We work with an operationalization of register at the intersection of formality and mode (cf. Koch and Oesterreicher 2012). In accordance with text-linguistic accounts (Biber and Conrad 2019), register is viewed as variation patterns that are associated with characteristics of the situational context of spoken or written

language production. Following common practice in corpus-based variationist research, we rely on customary text categories for register distinctions. Our methodology combines a corpus study with a supplementary rating task experiment. Corpora are an observational, real-life data source that covers both language production and, to some extent, also language comprehension – for in naturalistic settings, whatever is spoken/written is designed to be also comprehended (this is especially true in highly dialogic settings; cf. Schmid 2020: Ch. 3). Rating task experiments, on the other hand, tap into subjects' intuitions about the naturalness of grammatical variants given a real-life context (cf. Bresnan 2007). Our methodology thus covers production, comprehension, and the predictive capacities of language users.

The article begins by providing background information about the dative alternation (Section 2) and about our methodology (Section 3). Section 4 presents the corpus study, and Section 5 the rating task experiment. The discussion (Section 6) offers an interpretation of the findings in relation to the research questions before we conclude by discussing the limitations of this study and suggesting directions for future research (Section 7).

2 The dative alternation in English

The syntactic alternation under study, the dative alternation, is one of the most researched alternations in linguistics. In this alternation, the recipient and the theme vary in constituent order and whether or not the recipient is preceded by the preposition *to* (see example [1]). It is beyond the scope of this paper to provide an extensive literature review. Suffice it to say that previous multivariate studies have shown that the choice between the variants is co-determined by a multitude of formal syntactic and semantic factors, such as the length, pronominality, and definiteness of the recipient and the theme, as well as animacy and verb sense (e.g., Bresnan et al. 2007; Szmrecsanyi et al. 2017; Theijssen et al. 2013; Wasow and Arnold 2003). For example, the principle of end weight (according to which short elements tend to be placed before longer elements; see Behaghel 1909), has been shown to be one of the most important predictors in the dative alternation: recipients tend to be shorter than themes in the ditransitive dative variant, while themes tend to be shorter than recipients in the prepositional dative variant. Accordingly, the ditransitive dative is also the preferred variant when the recipient is pronominal, but the prepositional dative is preferred when the theme is pronominal. Importantly, it is the interplay of these syntactic and semantic factors leading a speaker or writer to use one or the other variant rather than one factor alone, and this choice is probabilistic in nature. What is more, probabilistic

grammars have been shown to vary not only across varieties (Röthlisberger et al. 2017; Tamaredo et al. 2020) but also across registers, showing differences in effect size and direction of the influence of certain factors within and across varieties (Röthlisberger 2021; Theijssen et al. 2013). Investigations into such register-specific effects, however, have not been systematic. Theijssen et al. (2013) contrasted spoken and written language, and Röthlisberger (2021) distinguishes four coarse registers by pooling over different text categories. In the present study, we would like to shed more light on probabilistic register effects in the dative alternation, focusing on the most frequent dative verb *give*. Specifically, we apply a two-fold research design to address the question of whether speakers and writers adjust their choice-making depending on the situational context of language use. Our hypothesis is that factors that have been shown to be subject to language change or that vary across varieties, such as recipient animacy (cf. Wolk et al. 2013), recipient pronominality, and end weight effects (cf. Röthlisberger et al. 2017), are also likely to vary across registers. It may be the case that end weight is of lesser importance in written registers because online processing constraints play a weaker role in writing (where editing is possible) than in speech.

3 Methodological combination of corpus study and experiment

The past decade has seen an increased interest in the combination of corpus-based and experimental methodologies both in cognitive linguistics (e.g., Divjak and Arppe 2013; Divjak et al. 2016; Klavan 2017) and in psycholinguistics (cf. Gilquin and Gries 2009), applying behavioral methods that tap into various aspects of processing, such as a self-paced reading paradigm (Horch 2019), and neurophysiological measures (e.g., Bentum et al. 2019; Blumenthal-Dramé et al. 2017). This move towards methodological diversity results from a general motivation to put conclusions on firmer grounds with the ultimate goal of getting a better grip on how corpus-derived usage models relate to the cognitive representation of language (see Klavan and Divjak 2016 for a discussion). As Dąbrowska (2016: 488) put it: “Corpus analysis is absolutely vital to usage-based approaches such as Cognitive Linguistics. In the end, however, corpora can only provide information about frequency of items and frequency of co-occurrence of items. If we want to make claims about speakers’ mental representations, corpus data needs to be complemented with experimental research.”

In cognitive sociolinguistic studies, particularly those concerned with alternation phenomena, the relatively inexpensive rating task has gained popularity as

an experimental paradigm. Participants rate how likely or how natural variants are as a continuation of a sentence. This task taps into predictive capacities of language users, which makes it particularly well-suited to investigate probabilistic, gradient grammatical knowledge. Bresnan and Ford (2010) highlighted the application potential of complementing multivariate logistic regression corpus models with rating task experiments (see also Bresnan 2007) and inspired a range of studies leading to both converging and diverging evidence when pitting corpus models against experimental data (e.g., Divjak and Arppe 2013; Divjak et al. 2016; Klavan 2017; Schäfer and Pankratz 2018; Thuilier 2014). In their study, Bresnan and Ford (2010) asked Australian English and American English native speakers to distribute 100 points across the two alternative variants of the dative alternation, thus making gradient judgments instead of a forced choice for either one of the variants. Participants' ratings corresponded to the predicted probabilities based on the corpus model. Importantly, the authors found that a difference in the effect of end weight between the two varieties in the rating patterns, in that Australian English speakers favored the ditransitive variant with longer recipient noun phrases (in number of words) even more than American English speakers. This result showcases the regionally specific sensitivity of language users to probabilistic effects in grammatical choice-making. The present study makes use of a similar rating task to evaluate whether language users are sensitive to register-specific effects. In what follows, we first present methods and results of the corpus study before we turn to the rating task experiment.

4 Corpus study

4.1 Data

In line with Koch and Oesterreicher (2012), this study operationalizes register at the intersection of formality and mode, resulting in four broad register categories. Formality is defined by situational characteristics of the context, such as the setting (private vs. public), the degree of self-monitoring on the part of the speaker/writer, the relationship between the speaker/writer and the audience, and the communicative purposes involved. These characteristics naturally intersect with mode in complex ways that have led some to view formal situations, such as a lecture or a newspaper article, in terms of a 'written' conception of language, and informal situations, such as private conversation, in terms of a rather 'spoken' conception (Koch and Oesterreicher 2012). The conflation of formality and mode is to a certain extent endemic to any discussion of register, and it remains an open question as whether effects of formality can be examined entirely independently to

those of mode. Our selection of register categories is thus conceptually designed to capture meaningful contrasts across these dimensions, yet we treat register as a single factor for the purposes of our analysis. Importantly, formality is seen as a continuum, which does not necessarily imply that the register categories included here represent endpoints of this continuum. Rather, we aimed for widely recognizable register categories while we also had to rely on the availability of corpora that are large enough to study the alternation under scrutiny. Assuming such a continuum, we selected and categorized the following register categories (cf. Koch and Oesterreicher 2012: 444):

- Spoken informal: conversations between family members and friends as provided in the Spoken BNC 2014 (~11.4 million words) (Love et al. 2017)
- Spoken formal: parliamentary debates from the House of Commons (~59.4 million words) (Marx and Schuth 2010)²
- Written informal: British English blogs part of the GloWbE (~148 million words) (Davies and Fuchs 2015)
- Written formal: online newspaper articles which have been scraped from the websites of *The Independent* (~113.5 million words) (Bušta et al. 2017)

From each corpus, 650 variable tokens of the dative alternation with *give* were randomly sampled, resulting in a balanced dataset of $N_{\text{total}} = 2,600$ observations.³ Half of these 650 tokens per register category are observations of the ditransitive dative and the other half are observations of the prepositional dative. This random sample was then manually annotated for the language-internal constraints that have been shown to play a role in the choice of the variant (see Section 4.3).

Restricting attention to the dative verb *give* does limit to some extent the generalizability of our results, as we know that lexical effects play an important role in the dative alternation (see e.g., Röthlisberger et al. 2017). With that being said, focusing on the prototypical dative verb *give* aligns this study with much previous research on the dative alternation (e.g., Bresnan et al. 2007), and eliminates a source of variability that would be hard to handle especially in the experimental track of this study.

² Note that parliamentary proceedings do not offer word-by-word transcriptions in order to enhance readability. Therefore, dative tokens were manually verified with regard to the actual language use based on debate recordings available on <https://www.parliamentlive.tv/Commons>.

³ We would like to note that balancing the dataset in this way will limit the interpretation of the main effect of Register in regression analysis. However, we would like to emphasize that we are primarily interested in the interaction effects between the predictor Register and the language-internal constraints under study, rather than in the main effect of Register. Balancing the sample as described poses no threat to the power of the study to capture these interaction effects.

4.2 Defining the variable context

From the set of *give*-tokens retrieved from the corpus material, tokens that are considered invariable following previous literature (Bresnan et al. 2007; Röthlisberger et al. 2017; Theijssen et al. 2013; Wolk et al. 2013) were weeded out. That is, tokens with passivized (2) or relativized constituents (3), clausal or gerundial constituents, particle verbs (e.g., *give back*, *give away*), non-canonical word order, or formulaic and fixed expressions (4) were discarded. Invariable tokens also include instances in which the preposition *to* depends on the head of the theme (5). Likewise, constructions in which two verbs were coordinated verbs having the same recipient were excluded (6) as well as instances in which the prepositional recipient was extraposed (7). In addition, direct quotes were filtered out for reasons of authorship contribution issues in the written texts.

- (2) *He said Labour MPs were given a free vote on bombing Syria.*
(*The Independent*, 2016-01-04)
- (3) *The main tip I can give you is not to panic.* (GloWbE-GB, blogs)
- (4) *It's only a problem if everyone gives you stick about it* (Spoken BNC2014, S2C9, S0362)
- (5) *All in One 15 costs 15 and gives 30-day access to all-you-can-eat data along with 300 any-network minutes and 3,000 texts.* (GloWbE-GB, blogs)
- (6) *[A]s we are putting much greater emphasis on, and giving more recognition to, the role of grandparents, I hope we are subsequently called the “granny state”.*
(House of Commons proceedings, 2008-03-20, Harriet Harman)
- (7) *To retain and attract population growth we need employment, and a variety of employment, giving opportunity and hope, especially to our young people.*
(House of Commons proceedings, 2011-07-19, Iain McKenzie)

4.3 Constraints

Tokens were subsequently manually annotated for various language-internal constraints that, according to the literature, play a role for variant choice. In the following, we describe findings of previous studies and our annotation schemes for the included predictors.

4.3.1 Animacy

Previous research has shown that animate recipients and inanimate themes (as in example [8]) prefer the ditransitive dative variant (Bresnan and Hay 2008; Bresnan et al. 2007).

- (8) *It is important to give [people]_{animate} [the chance to vote]_{inanimate}.*
(House of Commons, 2012-06-27, Sheila Gilmore)

For the annotation of animacy, we followed Wolk et al. (2013) in deploying five categories (i.e., ‘human’, ‘animate’, ‘collective’, ‘locative’, ‘temporal’; cf. Zaenen et al. 2004). To reduce multicollinearity, we eventually combined the categories humans, animals, and human- or animal-like entities (e.g., characters of video games) into ‘animate’, and collective, locative, and temporal constituent head nouns into ‘inanimate’ for analysis (following Bresnan and Hay 2008).

4.3.2 Definiteness

Previous research indicates that definiteness of a noun phrase is linked to information status and accessibility (Ariel 2001; Gundel et al. 1993; see also Section 6 below). Bresnan et al. (2007) found that definite recipients and indefinite themes favor the ditransitive dative.

The coding scheme for definiteness followed the guidelines by Garretson et al. (2004): nouns preceded by a definite article, possessive pronoun or s-genitive, as well as proper names and personal pronouns as constituent’s heads are coded ‘definite’, while nouns preceded by an indefinite article, bare nouns, and impersonal pronouns are coded as ‘indefinite’, see (9).

- (9) *Joining the Pistols in 1977 gave [Vicious]_{definite} [an outlet for his anger]_{indefinite}.*
(*The Independent*, 2019-02-02)

4.3.3 Pronominality

The ditransitive construction is more likely when the recipient is pronominal and when the theme is non-pronominal (e.g., Bresnan et al. 2007). Pronominal themes, on the other hand, favor the prepositional dative. Constituents were coded as pronominal when their head was a pronoun (personal, impersonal, reflexive pronouns as well as demonstrative pronouns) and as non-pronominal when their head was a (proper) noun, see (10).

- (10) *It’s not a new theory but they’ve given [a name]_{non-pronominal} to [it]_{pronominal}*
(Spoken BNC2014, S6EX, S0024)

4.3.4 Length

The dative alternation is governed by the end weight principle (Behaghel 1909), according to which short elements tend to occur before longer elements (see also Hawkins 1994). Previous research has shown that the ditransitive dative construction is the preferred variant when the recipient constituent is shorter than the theme and that the prepositional dative becomes more likely when the theme is shorter than the recipient (e.g., Bresnan et al. 2007). In addition, the strength of the effect has been shown to vary across varieties (Röthlisberger et al. 2017).

- (11) *The thought of improvement gives [me]_{recipient} [hope]_{theme}.* (GloWbE-GB, blogs)

Constituent length was operationalized as the number of characters (including whitespace). The preposition *to* in prepositional dative tokens was not included in the recipient length count. To reduce the number of predictors, recipient and theme lengths were then combined into a weight ratio, by dividing the length of the recipient by the length of the theme. The weight ratio in (11) is calculated as follows: $2/4 = 0.5$. This weight ratio was then log-transformed for analysis.

4.3.5 Complexity

This predictor captures the syntactic structure of the constituents above and beyond mere constituent length (Wasow and Arnold 2003). Röthlisberger et al. (2017) found that simple recipients and complex themes are likely to occur in the ditransitive dative, which is in line with a previous study on noun phrase complexity (Berlage 2014).

As in Röthlisberger et al. (2017), complexity was based on whether the constituent's head is followed by a restrictive postmodification (i.e., relative clauses, appositions, *to-/that*-complement clauses, prepositional phrases, coordinated constituents, adverbs or abbreviations) or not, see (12).

- (12) *I am also giving [councils]_{simple} [greater control over their budgets]_{complex}.* (House of Commons, 2010-12-13, Eric Pickles)

4.3.6 Frequency

Frequency effects are pervasive in language, and psycholinguistic research indicates that high-frequency words are more accessible than low-frequency words (Scarborough et al. 1977). Assuming that high-frequency words are placed earlier in a sentence (MacDonald 2013), we expect that the ditransitive dative is more

likely when the recipient is highly frequent and that the prepositional dative is more likely when the theme is highly frequent. In our analysis, we include corpus-specific normalized frequencies for the constituent's head lemma (see also Röthlisberger 2018; Szmrecsanyi et al. 2016 for such an approach in terms of regional variety). This means that our dataset may include differing frequencies for the same word depending on the register category that the token occurred in. For example, the word *government* occurs more often in the House of Commons corpus than in the other corpora. Frequency predictors were log-transformed for analysis.

4.3.7 Verb sense

Depending on the meaning of the theme lemma, we distinguish three verb senses of *give* (cf. Bresnan et al. 2007: 78, 85; Bresnan and Hay 2008: 250): 'transfer' for physical transfer of a concrete object (13a), 'abstract' for transfer of a non-concrete object (13b), or 'communication' for transfer of information (13c). In many cases, the categories 'abstract' and 'communication' can be clearly distinguished in that the communication sense denotes exclusively communication events. Ambiguous cases in which we had to decide between communication and abstract sense were annotated as 'abstract' (e.g., *give a lesson*).

- (13) a. transfer: *You're not supposed to give **your card** to anybody else.*
(Spoken BNC2014, S7RA, S0278)
- b. abstract: *A video at home can give you **the same results**, in private.* (GloWbE-GB, blogs)
- c. communicative: *But even before Conway had given **this reasonable-sounding comment** to Fox News, the knives were already out.* (*The Independent*, 2018-09-18)

Results by Bresnan and Hay (2008) suggest that the prepositional dative becomes more likely when *give* is used in a communicative or transfer sense compared to abstract sense in American and New Zealand English.

4.3.8 Register

Register category ('spoken informal' vs. 'spoken formal' vs. 'written informal' vs. 'written formal') was annotated according to the data source as outlined in Section 4.1.

4.3.9 Lemma

Each token was annotated for lemma of the head noun of both constituents. Lemmas are not equally distributed across registers, which can be exemplified by the frequency counts of theme lemmas (see Figure 1). While pronominal themes such as *it* or *them* are highly frequent in the spoken informal register, they rank considerably lower in both formal registers. This pattern suggests that speakers use pronouns to refer to entities in informal conversations, while more explicit, lexical items are used in the other registers. Another observation is that the written informal register features more or less the same themes in dative expressions as spoken informal and both formal registers, with a high rank for *it* but also for *opportunity* and *support*. Thus, in terms of absolute frequency of theme lemmas, the written informal register seems to be located between spoken informal and both formal registers in the present dataset.

4.3.10 Speaker/writer identity

We annotated speaker/writer identity to account for individual preferences by including a random effect (see Section 4.4 below). Note that there is no author information available in the written corpora, and so we treated each text as coming from a different author, which is standard practice in corpus-based variationist studies (cf. Speelman et al. 2018: 2). In addition, some speakers/writers do not have many observations in the present dataset due to the random sampling method.

4.4 Analysis

A logistic mixed effects regression model was fitted in R (version 4.0.3, R Core Team 2020) with the package *lme4* (Bates et al. 2015). The model predicts the odds for the prepositional dative. Treatment coding was used such that one level of the categorical predictors serves as a reference level to which all other levels are compared. For the language-internal predictors, the reference levels were set to the default levels for the ditransitive dative construction. In the interactions, we compare the effects of the respective register category to the effects found in the spoken informal category. Continuous predictors, i.e., length and frequency, were centered and standardized. To account for lexical and speaker-related

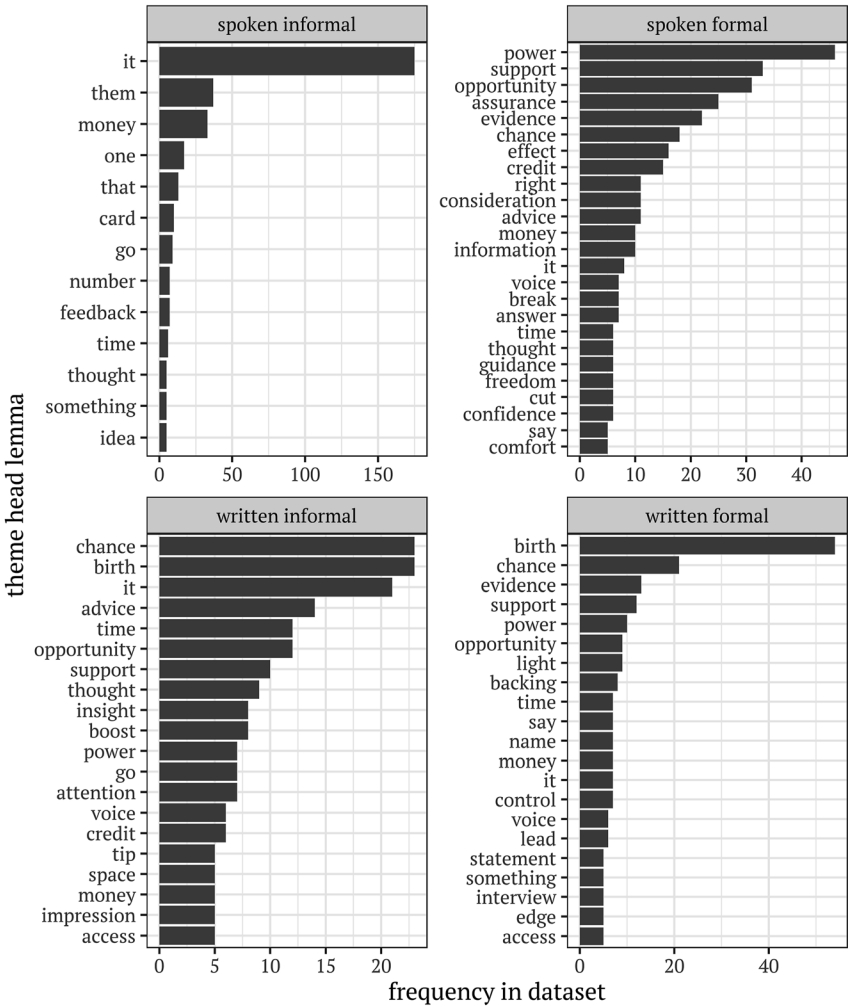


Figure 1: Most frequent theme lemmas (occurring at least five times) across registers as present in the dataset. The x-axis shows the raw frequency in the dataset.

idiosyncrasies, random intercepts for recipient and theme head lemma as well as for speaker identity were included.⁴

⁴ These variables were pruned so that speakers with only one observation, recipient lemmas with less than four observations, and theme lemmas with less than seven observations were pooled together into one category ‘other’ (cf. Wolk et al. 2013: 399), which means that 90% of the least frequent levels were combined.

We were mainly interested in potential interaction effects between Register and the language-internal variables. Due to high multicollinearity between Register and the internal constraints, the number of interaction terms was limited to three interactions that appeared stable in terms of significance and that are particularly interesting on theoretical grounds, namely the two-way interactions with Recipient Definiteness, Theme Definiteness, and Weight Ratio. Model selection followed a backward elimination process by comparing the Akaike Information Criterion (AIC) and keeping the model with a significantly lower AIC value (as outlined by Gries 2015). First, the random effect structure of the full model was simplified by excluding those random effects that did not significantly improve the model fit (based on the likelihood ratio test as implemented in the *anova()*-function in R). Then, the non-significant interaction effects and main effects followed. The final model has a C-index of 0.97, indicating an outstanding discriminatory performance (cf. Hosmer and Lemeshow 2000: 162), and an accuracy of 91.4% (baseline 50%). The condition index $\kappa = 14.1$ indicates medium collinearity, substantially below the threshold of 30 indicating “potentially harmful” collinearity (Baayen 2008: 182).

4.5 Results

The minimal adequate model, therefore, only includes a random effect for theme lemma ($\sigma^2 = 3.27$; $SD = 1.81$; $N_{\text{ThemeLemma}} = 75$). This is in line with previous research showing lexical idiosyncrasies related to the theme. More specifically, the themes *evidence*, *birth*, *it*, *them*, and *light* had the largest intercept adjustments for the prepositional dative, while intercept adjustments in favor of the ditransitive dative were made for the themes *go*, *say*, *lead*, *chance*, *assurance*, and *choice*. Recipient lemma and speaker identity did not significantly improve the model fit.

Table 1 presents the regression coefficients. Overall, the main effects are in line with previous research (e.g., Bresnan et al. 2007; Bresnan and Ford 2010; cf. Theijssen et al. 2013), such that animate, simple and pronominal recipients favor the ditransitive dative, simple and pronominal themes favor the prepositional dative (Table 1). The prepositional dative is also the preferred variant when the recipient is longer than the theme or when the verb sense is transfer or communication.

In addition, two interactions turned out to be significant: the interaction between Register and Recipient Definiteness, and the interaction between Register and Theme Definiteness. As shown in Table 1, these interactions occur within the spoken mode. Neither written register shows a significant difference in the effects of both definiteness predictors compared to the effects found in spoken informal

Table 1: Coefficients in regression analysis. Predictions are for the prepositional dative. Reference levels are indicated to the left of the arrow. Effects of Recipient Definiteness and Theme Definiteness represent the effects found in the spoken informal register (due to the presence of interaction terms). All other effects represent the general trend in the dataset as a whole. 91.4% correctly predicted vis-a-vis baseline of 50%.

Predictors	<i>b</i> (log-odds)	SE	Wald <i>z</i>	<i>p</i>
(Intercept)	−5.18	0.49	−10.49	<0.001
Recipient Animacy				
animate ⇒ inanimate	0.95	0.18	5.20	<0.001
Recipient Complexity				
simple ⇒ complex	0.68	0.29	2.33	0.020
Theme Complexity				
complex ⇒ simple	2.19	0.24	9.25	<0.001
Recipient Definiteness				
definite ⇒ indefinite	2.28	0.59	3.85	<0.001
Theme Definiteness				
indefinite ⇒ definite	1.06	0.38	2.81	0.005
Weight Ratio	1.84	0.18	10.47	<0.001
Recipient Pronominality				
pronominal ⇒ non-pronominal	2.18	0.25	8.70	<0.001
Theme Pronominality				
non-pronominal ⇒ pronominal	1.40	0.50	2.80	0.005
Verb Sense				
abstract ⇒ communicative	1.37	0.32	4.29	<0.001
abstract ⇒ transfer	0.73	0.29	2.53	0.011
Register				
spoken informal ⇒ spoken formal	1.06	0.37	2.84	0.005
spoken informal ⇒ written informal	0.96	0.36	2.66	0.008
spoken informal ⇒ written formal	−0.39	0.37	−1.05	0.293
Register * Recipient Definiteness				
spoken formal + indefinite	−2.02	0.67	−3.02	0.003
written informal + indefinite	−1.07	0.73	1.47	0.142
written formal + indefinite	−0.46	0.68	−0.67	0.500
Register * Theme Definiteness				
spoken formal + definite	−1.70	0.51	−3.31	0.001
written informal + definite	−0.47	0.53	−0.89	0.372
written formal + definite	−0.55	0.50	−1.10	0.271

Significant *p*-values ($\alpha=0.05$) are printed in bold.

conversations. The interaction between Register and Weight Ratio was not significant and was therefore excluded from the model.

Figures 2 and 3 depict the predicted probability of the prepositional dative (on the *y*-axis) for both levels of the definiteness predictors across the four register categories (on the *x*-axis). Effects for definite constituents are represented by

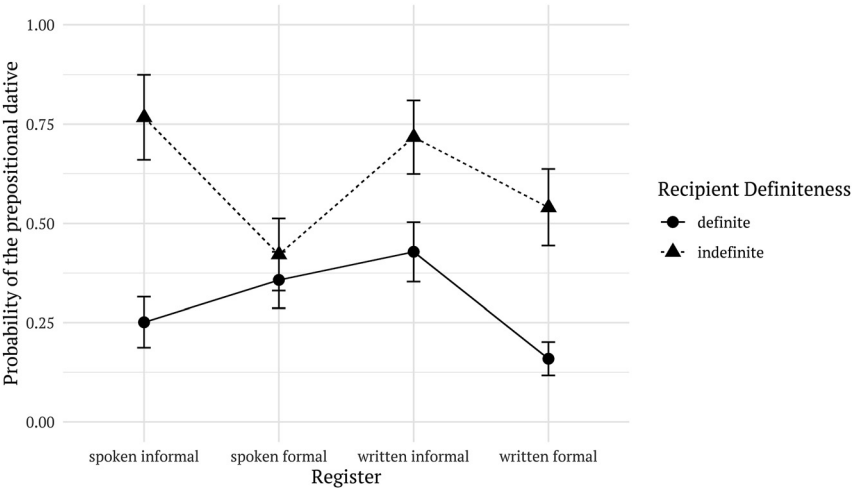


Figure 2: Effects plot: interaction between Register and Recipient Definiteness. The y-axis shows the predicted probability for the prepositional dative for both definite (dot-symbols) and indefinite recipients (triangles) across the four register categories (x-axis).

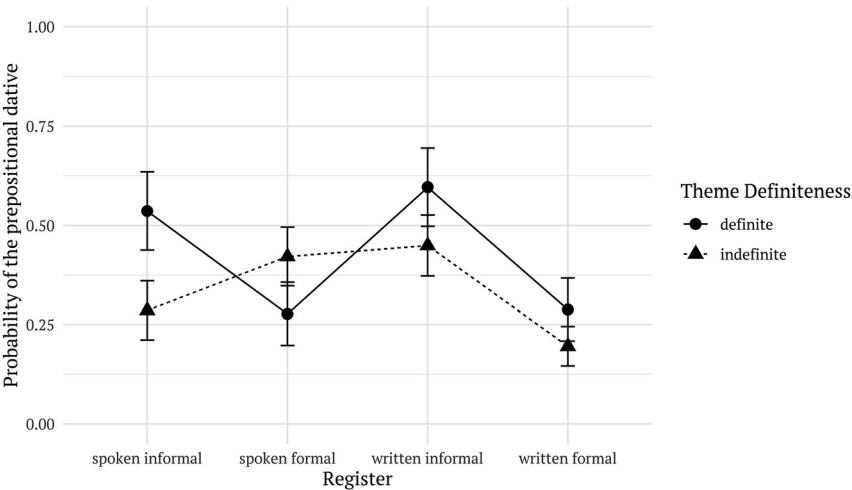


Figure 3: Effects plot: interaction between Register and Theme Definiteness. The y-axis shows the predicted probability for the prepositional dative for both definite (dot-symbols) and indefinite recipients (triangles) across the four register categories (x-axis).

dot-symbols connected with a solid line, effects for indefinite constituents by the triangles connected with a dashed line. The further the effects for definite and indefinite constituents lay apart, the stronger the effect for this predictor in the respective register category. Figure 2 shows that, in all register categories, the prepositional dative is more likely when the recipient is indefinite. However, Register modulates the effect size of this predictor. Recipient Definiteness has the largest effect in the spoken informal category, while the effect is smallest in the spoken formal category.

Interestingly, Register not only modulates the effect size, but also the direction of the effect for Theme Definiteness, which is reversed in the spoken formal debates compared to all other categories (see Figure 3). Again, only the difference between the effects in spoken informal and in spoken formal register categories is significant.

In sum, we found two interactions between Register and language-internal effects, in addition to expected main effects and lexical idiosyncrasies pertaining to the theme. Specifically, Register modulated the effect size of Recipient Definiteness and the effect direction of Theme Definiteness. We further discuss these findings in Section 6.

5 Rating task experiment

The corpus analysis was complemented with a rating task experiment, in which native speakers were asked to give gradient ratings of how natural the respective dative variants are given their context. In doing so, we sought to examine whether language users are in fact sensitive to probabilistic effects in general and, in particular, to register-specific patterns. If we find that the corpus predictions and participants' ratings show the same pattern, we have reason to believe that the two tasks are tapping into similar aspects of linguistic knowledge and processing (Klavan and Divjak 2016: 378).

5.1 Methods

5.1.1 Participants

In total, 100 British English native speakers (50 women, 50 men; mean age: 55 years old, range: 19–78, SD = 14.36) completed the survey. They originated from all over the United Kingdom, including Scotland and Wales, and did not have a background in linguistics, with the exception of one participant who reported

having taken a course in linguistics at university level (a detailed account of the demographic information can be found in Table 4 and Table 5 in Appendix A).⁵

Participants were sampled through Qualtrics Research Services which uses several market research panels. This resulted in a fairly heterogeneous sample (compared to a student population), with participants used to taking online surveys, mostly for market research purposes. In order to ensure that participants read the context preceding the linguistic variants they were rating, the trials of the experiment were interspersed with eight comprehension checks, i.e., simple yes/no questions that tested whether participants had read all text offered in the preceding trial as instructed. Participants were screened out if they answered fewer than six out of eight comprehension questions correctly. The minimum completion time was set at 12 min. In this way, we aimed to limit the sample to participants who worked diligently on the task.

For analysis, we excluded data from four participants due to their low accuracy score on the comprehension questions. Additionally, seven participants were excluded who took longer than 40 min (i.e., their completion time was more than 1.5 IQR above the third quartile; cf. Speed et al. 2017: 197) as they were potentially distracted by other tasks. The data of the remaining 89 participants were entered in the analysis.

5.1.2 Materials

Given the interaction in the corpus model, the spoken informal and spoken formal categories were chosen to provide the items for the experiment. Overall, 32 authentic corpus excerpts served as items for the rating task experiment. Per register category, 16 items were selected: six target items containing a dative construction and 10 filler items with a choice either between lexical items that are known to be register-sensitive (e.g., *retain* vs. *keep*) or the relativizers *that* and *which*.

As for the target items, a separate model was fitted on the subset of the spoken categories following the same procedure as for the full dataset.⁶ Based on this subset model, we calculated the probabilities for the prepositional dative. Target items were taken from six probability bins over the entire probability range with probabilities matching as closely as possible for both register categories. The set of

⁵ Upon closer inspection, we could not identify any obvious diverging patterns in this participant's responses and, therefore, the participant remained in the sample.

⁶ This model slightly deviates from the model for the full dataset in that the main effect for Recipient Complexity and Verb Sense were not significant, but the effect for Recipient Frequency turned out to be significant. The overall pattern of the results (esp. with regard to the interactions), however, remained the same. The model output can be found in Table 8 in Appendix C.

Table 2: Overview of target items (per register category).

Dative variant	Probability bin	Theme definiteness	Seen/unseen	Predicted probability of the prepositional dative	
Ditransitive dative	1	Indefinite	Unseen	Spoken formal:	0.06
				Spoken informal:	0.09
Ditransitive dative	2	Definite	Unseen	Spoken formal:	0.27
				Spoken informal:	0.20
Prepositional dative	3	Indefinite	Seen	Spoken formal:	0.47
				Spoken informal:	0.39
Ditransitive dative	4	Definite	Seen	Spoken formal:	0.50
				Spoken informal:	0.56
Prepositional dative	5	Indefinite	Unseen	Spoken formal:	0.80
				Spoken informal:	0.85
Prepositional dative	6	Definite	Seen	Spoken formal:	0.94
				Spoken informal:	0.99

possible target items was restricted to tokens with non-pronominal and simple constituents and definite recipients in order to control for possible confounding variables. As a result, it was not possible to find appropriate items for all probability bins in our dataset. For three out of six probability bins, we therefore selected items from the same corpora that were ‘unseen’ by the corpus model. We calculated the predicted probability for these items based on our corpus model. Half of the items per category contained an indefinite theme and the other half a definite theme. Theme definiteness was distributed across the probability bins so that not all indefinite themes occur in items with the ditransitive dative or in lower probability bins and vice versa. Table 2 provides an overview of the parameters that were counterbalanced across probability bins in both register categories.

In addition, two types of register-sensitive filler items complemented the set of items: per register category, four items contained a lexical choice and six items contained the choice between the relativizers *which* and *that*. According to Biber et al. (2021b: 610), *which* as restrictive relativizer occurs more frequently in formal registers than in informal registers. With this grammatical manipulation, we aimed to distract from the dative constructions. In addition, the lexical choice items serve as a manipulation check with regard to register. These items were selected so that if the participants take the context of the register into account, we should see clear preferences for the variants in their ratings. To avoid priming, filler items did not include any dative variants. A naïve native speaker was asked to judge the interchangeability of the filler variants, and only items for which both variants were judged possible were included.

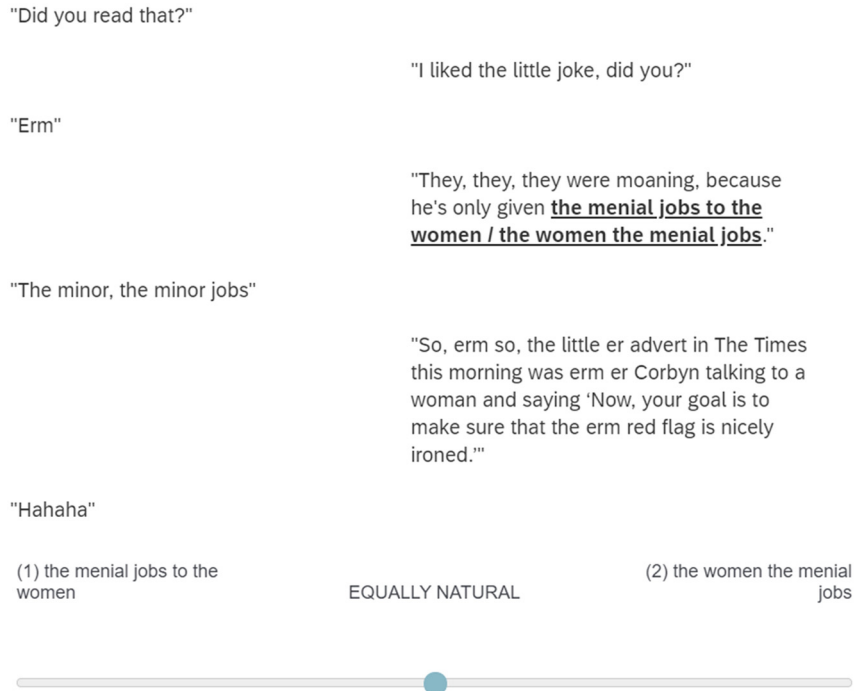


Figure 4: Example trial screen of a target item. Both variants are presented in context and on top of the slider bar. List manipulation ensured that ordering of variants did not confound results.

Register was presented in a blocked manner, that is, all items of one register category were presented after one another followed by all items of the other register category. In order to avoid possible confounding with respect to the presentation order of the variants, two lists were created by manipulating the presentation side of the original variant on top of the slider bar. For example, if the original variant in an item was the prepositional dative and was presented on the right-hand side in List 1, the prepositional dative was presented on the left-hand side in List 2 (see Figure 4). Each list had two versions with reversed register order: Version A began with the spoken formal items, Version B with the spoken informal items. Participants were each assigned to a list and a version. No more than two items of the same type were presented consecutively, for example, no more than two dative items followed each other. Eight simple yes/no comprehension questions were included to ensure that participants read the excerpts carefully.

5.1.3 Design and procedure

The survey was conducted online and implemented in the Qualtrics survey software. Participants were given detailed instructions about the task, including an example item with a gradient rating, before giving written consent to participate. For screening purposes, a sociodemographic background questionnaire followed before the participants were presented with the rating task.⁷ This questionnaire consisted of general questions about regional provenance and language background, as well as education level.

The experiment had a within-subjects design, meaning that all participants saw all items of both register categories. Participants were instructed that they were going to be presented with various extracts from conversations between family members and friends and from House of Commons debates and that they should take this situational context into account when performing the rating task. At the beginning of each register block, visual primes were displayed to reinforce the situational context of the utterances. We showed two visual illustrations per category to provide sufficient exemplification of the situational context of the utterances. For the spoken informal category, participants saw two pictures of situations in which multiple people were chatting and laughing at the kitchen table: one picture showed a family with three generations having breakfast; the other picture showed a group of young adults having a casual conversation. For the spoken formal category, two pictures of the House of Commons were displayed: on one of the pictures, a Member of Parliament (Andy Sawford) is talking while others listen; the second picture shows a full House of Commons Chamber taken on the first sitting of the new parliament in 2013.

Each item included the prompt “Drag the slider to indicate which option is the most natural continuation”. Participants were asked to indicate their rating by means of a slider bar below the corpus excerpt, with each variant being presented on one side of the bar (according to the order in the excerpt). The further they dragged the slider towards one of the variants, the stronger their preference for this continuation is. If they had no preference, they were able to put the slider in the middle, which was also the default position (cf. Figure 4). The survey ended with a question on the participant’s guess about the purpose of the study and an option to leave additional comments (see Table 6 and Table 7 in Appendix B). Mean duration was 26 min and participants received an expense allowance for completing the survey.

⁷ Multilingually raised participants were screened out automatically.

5.1.4 Analysis

Ratings were analyzed for target items and filler items separately. Ratings were first rescaled to a scale from 0 to 100 for the prepositional dative, and the formal variant of the fillers respectively, and then *z*-transformed (cf. Schütze and Sprouse 2013: 43). Linear mixed-effects regression models were fitted in R (version 4.0.3; R Core Team 2020) using the *lme4* package (Bates et al. 2015). Ratings were entered as the dependent variable; in the model for the target items, *Register*, *Predicted Corpus Probability*, *Theme Definiteness* and *Weight Ratio* were entered as predictors, as well as a two-way interaction between *Register* and *Theme Definiteness*. All continuous predictors were *z*-transformed. Random effects structure included by-participant intercepts as well as by-participant slopes for the effect of *Predicted Corpus Probability*.⁸ The model for the filler items included an interaction between *Register* and *Filler Type* as well as by-participant intercepts along with by-participant slopes for each of the effects of *Register*, *Filler Type*, and their interaction. By-participant intercepts were included to account for participants' personal preferences of using the rating scale; by-participant slopes were included in both models to account for participants' differing experience with language use. Model comparisons were carried out using the likelihood ratio test as implemented in the *anova()*-function.

5.2 Results

As shown in Table 3, there was a main effect for *Predicted Corpus Probability* (see Figure 5), indicating that participants were sensitive to probabilities of the variants. Moreover, the interaction between *Register* and *Theme Definiteness* is significant, indicating that the ratings for the prepositional dative were higher in the spoken formal category when the theme was indefinite, as opposed to higher ratings for the prepositional dative in informal items when the theme was definite (see Figure 6). This effect is in line with the interaction effect in the corpus model. There is also a main effect for *Theme Definiteness*, indicating that, in general, participants favored the prepositional dative with definite themes. The main effect for *Weight Ratio* was included to cancel out the possibility that the rating patterns are simply due to end weight effects. Note that it was not possible to control for the length of the constituents when using authentic corpus excerpts as items.

⁸ When we add a random slope, the model assumes that each participant has a different effect for the predictor in the slope, i.e., in our case, the participants might differ as to their experience with the probability of the variants. Due to convergence issues, *Register* was not included in the slope.

Table 3: Model output for the ratings of the target items. σ^2 is the mean random effect variance of the model, τ_{00pt} and $\tau_{00pt.1}$ refer to the between-participants variance adjusted for by random intercepts and random slopes. ICC refers to the intraclass-correlation coefficient.

Predictors	Estimates	SE	t	p
(Intercept)	0.04	0.06	0.66	0.508
Register				
spoken informal \Rightarrow spoken formal	0.03	0.08	−0.11	0.681
Theme Definiteness				
definite \Rightarrow indefinite	−0.30	0.08	−4.02	<0.001
Predicted Corpus Probability	0.29	0.04	8.02	<0.001
Weight Ratio	−0.17	0.04	−5.03	<0.001
Register * Theme Definiteness				
spoken formal + indefinite	0.38	0.12	3.22	0.002

Random effects	
σ^2	0.89
τ_{00pt}	0.02
$\tau_{00pt.1}$	0.01
ICC	0.02
Number of participants	89
Observations	1,068
Marginal R^2	0.092
Conditional R^2	0.107

Significant p -values ($\alpha=0.05$) are printed in bold.

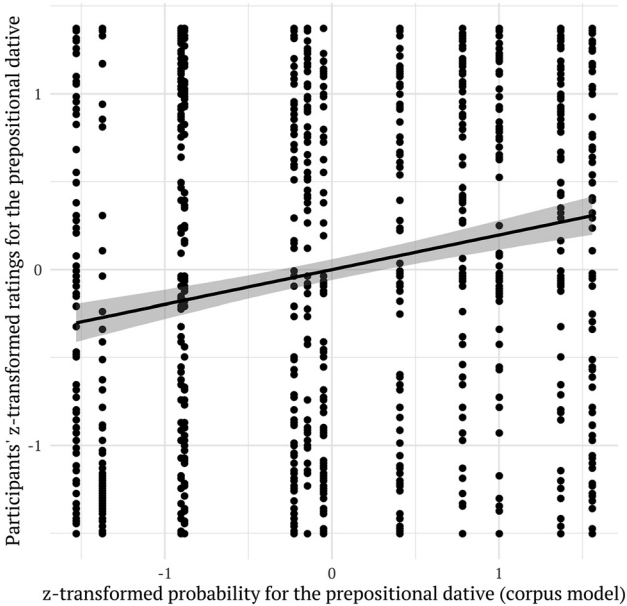


Figure 5: Corpus probabilities plotted against participants' ratings (z-transformed).

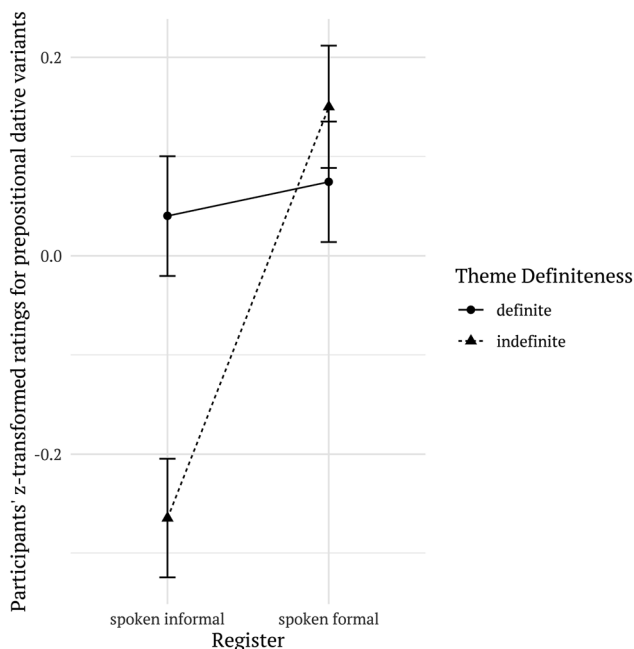


Figure 6: Effect plot: interaction between Register and Theme Definiteness in participants' ratings. Effects plot shows that the prepositional dative received higher ratings with indefinite themes compared to definite themes in the spoken formal category as opposed to higher ratings with definite themes compared to indefinite themes in the spoken informal category.

Results of the model on the filler data show that the interaction between *Register* and *Filler Type* is significant, indicating that the formal variant in lexical items received higher ratings in the spoken formal category than the relativizer *which* (see Figure 7). In addition, there is a main effect for *Register* with higher ratings for the formal variant in the formal category (see Table 9 in Appendix D). These results show that participants took the register context into account for their ratings, confirming that the manipulation of register worked out as intended.

In sum, there was an interaction between Register and Theme Definiteness in participants' responses, which corresponds to the pattern found in the corpus model. Participants gave higher ratings for the prepositional dative in spoken informal items when the theme was definite in contrast to higher ratings for the prepositional dative in spoken formal items with indefinite themes.

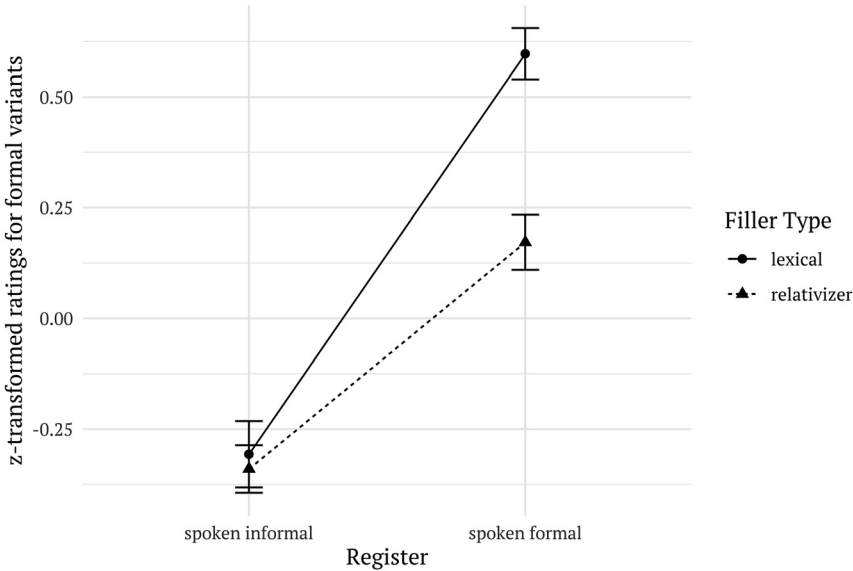


Figure 7: Effect plot: interaction between Register and Filler Type. Both filler types received higher ratings in the spoken formal category compared to the spoken informal category. In addition, the formal variants of the lexical choice items received higher ratings than relativizer choice items in the spoken formal category.

6 General discussion

The present study investigated the register-specificity of probabilistic knowledge about the dative alternation by means of a two-fold methodology consisting of a corpus study and a complementing rating task experiment, in which participants were asked about their intuition with regard to the naturalness of variants in authentic corpus extracts. Our corpus-cum-experiment analysis has shown that – all other things being equal – there are differences in the magnitude of the effect of recipient definiteness and the direction of the effect of theme definiteness, both contrasting formal and informal categories in the spoken mode. Participants’ ratings corresponded to the patterns found in the corpus model, suggesting that the predictive capacities of language users are sensitive to register-specific effects in the dative alternation. In what follows, let us come back to the research questions that we enumerated at the outset of the paper.

6.1 When language users have the choice between semantically/functionally equivalent grammatical constructions, do they adjust their choice-making depending on the situational context?

Indeed, our results suggest that probabilistic grammars include knowledge about register differences. Specifically, definiteness of both constituents varies in effect size and direction in formal debates compared to informal conversations. Distributional statistics show that in the spoken formal category, speakers use more indefinite referents in general, and indefinite themes in particular, as opposed to the spoken informal category, in which definite referents are prevalent, especially with regard to the recipient (cf. supplementary materials). In the literature, definiteness has been linked to information status and accessibility, indicating that definite referents are associated with old information and indefinite referents with new information (Ariel 2001; Gundel et al. 1993, 2012; Prince 1992).⁹ Accordingly, definite referents are easier to access during language processing.

Another interaction that we checked but that did not turn out to be significant is the interaction between register and end weight. This suggests that the end weight pressure seems to be similarly high in all register categories included here. However, it is also possible that we were not able to detect this interaction due to the statistical method that we used. That is, language-internal constraints showed a high level of collinearity with register, which made it impossible to study the full complexity of register-specific effects with logistic regression, so that we had to restrict the number of interaction effects in our model (see also Section 7).

Our findings are particularly interesting given customary sociolinguistic theorizing about grammatical variation. A common assumption has been that “internal constraints are ... normally independent of social and stylistic factors” (Labov 2010: 265). Thus, style-related shifts are seen as quantitatively simple, concerning the frequencies of occurrence of a particular variant, but not as probabilistically variable (Guy 2005: 562; Rickford 2014: 601). The fact that we found two interactions with register calls this assumption into question. This suggests that the situational context of language use triggers associations with different strengths and directions of effects of grammatical constraints, thus, probabilistically altering grammatical representations. In line with Guy (2015), we may even argue that the existence of register-specific probabilistic grammars is equivalent to multilingual competence:

⁹ Of course, this relation between definiteness marking and information status is only an approximation and cannot be understood as a one-to-one mapping.

[M]ost sociolinguistic, and social-semiotic variation is purely quantitative, involving rates of use. When the CONTEXTS of use differ, different grammars are involved. In the speech communities we most often study, speakers share one grammar with common constraint effects, and speakers do not alter those constraint effects for social semiotic ends. But in more complicated situations with multiple grammars competing in a community, individuals may differ substantively in the contexts of variation; however, using different constraint effects stylistically will be equivalent to diglossic or bilingual behavior, rather than simple stylizing within one language. (Guy 2015; emphasis in original)

From a cognitive (socio)linguistic perspective specifically, these register-specific effects can be explained in a usage-based grammar framework. Recently, Schmid (2015, 2016, 2020) proposed the Entrenchment-Conventionalization Model (EC-Model) – inspired by cognitive linguistics, construction grammar, neuro- and psycholinguistics, as well as variational sociolinguistics – that, crucially, integrates the social and socio-pragmatic aspects of usage events. Essentially, the model is dynamic and flexible, adopting the view of language as a complex adaptive system (e.g., Beckner et al. 2009). In this model, situation-dependent knowledge is a product emergent from conventionalization of structures across repeated individual utterance types. Conventionalization takes place at the community level, while entrenchment is conceptualized as a process on the level of the individual. Both processes are interrelated and co-influence each other. Crucially, an utterance type becomes conventionalized by means of co-adaptation and diffusion in a context-sensitive manner. Register differences, therefore, emerge from repeated usage in specific situations and with specific communicative purposes. This situational knowledge is then activated during language processing via so-called ‘pragmatic associations’. Consequently, the model can explain the probabilistically varying definiteness effects as conventionalized utterance types that are associated with an informal or formal speech situation.

6.2 Does mode of communication or formality of the situation play a greater role in moderating the cognitive factors involved?

As regards RQ2, register differences in the present study were found within the spoken mode. Language-internal constraints did not vary across modes. To better understand why this is the case, it is worthwhile to delineate the situational context and linguistic features of the two spoken register categories: While the spoken informal corpus contains only spontaneous conversations produced in a private setting, typically with only few interlocutors, spoken formal parliamentary debates take place in an institutionalized context, are aimed at a wider audience

and are publicly accessible. Conversations are characterized by a high degree of direct interaction, commonly expressed by features such as first and second person pronouns and *wh*-questions (Biber 1988). In contrast, turn-taking and speaking time are regularized in the House of Commons, in that the Speaker of the House of Commons has an intermediary position to select and monitor speakers (Ilie 2002) and address forms are highly conventionalized with a very limited use of second person address (Ilie 2010). Debates consist of pre-planned, monologous speeches, but spontaneous interruptions and interventions are possible.¹⁰ Applying multi-dimensional analysis on Hansard records from 1901 to 2015, Kruger et al. (2019) identified a shift towards an even denser style, characterized by an increased use of noun-phrase features such as pre- and post-modifications, attributive adjectives and phrasal coordination. Along with this densification trend, Hansard records became less dialogic and interactive over the past century.

Parliamentary discourse is confrontational, with the ultimate goal of establishing power relations and questioning the government's work (Ilie 2002: 72–73). Communicative purposes in debates involve “position-claiming, persuading, negotiating, agenda-setting, and opinion building, usually along ideological or party lines” (Ilie 2015: 3). In contrast, conversations have been described as involved discourse as opposed to informational discourse (Biber 1988). However, recent research identifying various discourse types in conversations shows that discourse units with informational content are as common as discourse types involving personal stance (Biber et al. 2021a). Taken together, parliamentary discourse, as opposed to informal conversations, is governed by institutional rules and discursive practices constraining language use. This suggests that present-day register distinctions are reinforced in our spoken data: the spoken informal conversations that we examined are highly interactive and marked for personal stance, while the spoken formal register category we investigated has become “a more monologic, and less interactive and interpersonally marked presentation of information without strongly marking stance or opening up the space for the audience to interact with the information” (Kruger et al. 2019: 202). While we have confidence in the validity of our findings, we do acknowledge that the selection of data sources under study represents a limited set of registers. In particular, due to the specificities of parliamentary debates, this register may not compare to other (sub)registers in the spoken formal category. That said, one of the reasons why we chose parliamentary debates was the (non-)availability of corpora that are suitable to investigate the alternation at hand. We consider the present study a point of departure for future research on sub-register variability.

10 Note, however, that Members of Parliament are not allowed to read their speeches word by word, but rather they may use notes (Bayley 2004: 14; Ilie 2015: 8).

Against this backdrop, it is possible that, due to the prevalence of (personal) pronouns in informal conversations, definiteness effects are correlated with pronominality. Supplementary analyses (cf. supplementary materials¹¹) show that definite constituents indeed contain far more pronouns in spoken informal than in all other register categories, especially with regard to the theme. While indefinite pronouns are rarer in general, there are almost no indefinite pronominal constituents in the spoken formal category. Thus, it is evident that speakers in informal conversations use pronouns to refer to familiar entities whereas speakers in parliament use more explicit means to express themselves. Possibly, the reversed effect of theme definiteness is also linked to the formulaic nature of political discourse, in which speakers use a range of recurring themes such as *power*, *support*, *evidence* or *credit* (cf. Figure 1). More specifically, these lemmas often occur as bare nouns – thus coded as indefinite – in the prepositional dative construction.

Contrary to what one would expect if differences in production circumstances place different processing demands on the speakers and writers, we did not find significant interactions contrasting modes of production (cf. corpus results in Section 4.5). Although written and spoken registers differ in many parameters from each other (e.g., with regard to the option for editing, audience, or interaction involved), why do the effects in, for example, newspaper articles not differ from the effects in conversations? One possible explanation is that while the newspaper register contains rather formal news reports, it also includes sports reporting and articles from the sections ‘lifestyle’ or ‘voices’, which employ a more colloquial style. Possibly, register-internal variability of the written categories in our study is too high to detect probabilistic differences between modes. This also applies to the blogs of the GloWbE corpus, which are automatically scraped from blog domains and cover a broad range of communicative purposes (Biber and Egbert 2018; Biber et al. 2015, 2020). It might be this difference in the range of communicative purposes that distinguishes the spoken formal category from the written texts included here.

6.3 To what extent does corpus evidence about register differences converge with experimental evidence?

Importantly, our experimental results converge with the patterns found in the corpus study, indicating that grammatical knowledge entails a probabilistic component (Bresnan and Ford 2010; Lau et al. 2017) and that the register specificities emerging from corpus study are not merely epiphenomenal. This adds to the body of

11 Supplementary materials are available at <https://osf.io/2ahgf/>.

literature that combines classification models with behavioral evidence (e.g., Bresnan and Ford 2010; Divjak et al. 2016). With the two-fold methodology, we not only tap into language production and comprehension (corpus), but also into the predictive capacities of language users by assessing their metalinguistic knowledge (rating task). By carefully controlling for most predictors of our corpus model, we were able to single out the interaction we were interested in. The converging evidence puts our conclusion on firmer grounds. In accordance with Klavan and Divjak (2016: 378), we argue that corpus-based models and metalinguistic judgments can be meaningfully combined to study similar aspects of language processing and that the probabilistic register differences we uncovered must, therefore, be cognitively represented.

It is important to note here that this study shows group-level convergence since we not only average across speakers and participants but also compare production and prediction of distinct samples of speakers in corpus study and experiment. The convergence in our data suggests that speakers share implicit knowledge about register differences. Previous research, however, has shown that there are individual differences in predictive processing depending on the experience with different registers (Verhagen et al. 2018). By averaging across speaker groups, such individual information is lost. It is thus possible that not all of our participants converge to the same extent (cf. Verhagen et al. 2020). Another noteworthy point is that the participant sample in the rating task was rather heterogeneous compared to a typical student population. Therefore, it is even more striking that we do find a corresponding pattern in both sources of data.

7 Conclusion

Using a methodology that combines corpus evidence with an experimental task, we have shown that probabilistic knowledge about grammatical variation includes knowledge about register differences. As we have argued, this register specificity challenges the widely held belief in sociolinguistic theorizing that language-internal constraints are stable within a language variety (Guy 2005: 562; Labov 2010: 265). Our findings suggest that language-internal constraints such as definiteness vary *within* one variety. Language users juggle different grammatical configurations depending on the situational context (Guy 2015). As to *cognitive* sociolinguistics, our results suggest that register distinctions play a more important role in the mental representation of *grammar*. Although the register specificities we uncovered are not overwhelming – affecting a couple of language-internal constraints, with contrasts only emerging in the spoken mode – they are empirically robust and demonstrate that probabilistic grammars

are not stable across registers. Instead, language users adjust grammatical choice-making as a function of the situational context. This is another way of saying that “lectal competence” (Geeraerts et al. 2010: 10) in regard to register distinctions is comparatively complex, involving not only adjustments of the base frequency of particular variants but also knowledge about how variation is differentially constrained across registers. Recent approaches such as the EC-model by Schmid (2015, 2020) can account for the emergence of this register-specific probabilistic knowledge.

We see a number of possible directions for future research in this domain. First, the statistical method of the present study is regression analysis, which involves several statistical and interpretive problems (see also Milin et al. 2016: 507–508). With the present analysis, for example, we cannot ultimately answer the question as to why we found an interaction with definiteness predictors rather than with constituent length ratio. A relatively new technique to remedy the issue of multicollinearity is structural equation modelling (Larsson et al. 2021). This statistical method enables researchers to examine causal relationships among predictors (based on theoretical grounds), which makes it a powerful application for linguistic research. In accordance with Larsson et al. (2021), we argue that studies as the present one can serve as departure point to uncover the casual relationships between predictors using techniques such as structural equation models.

Second, the model of the ratings fails to explain a large part of the variance. This is possibly due to individual differences, which have been consistently found in previous research (Schütze and Sprouse 2013; Verhagen et al. 2020). From a usage-based view, individual differences can arise from differential experience with the variants (Street and Dąbrowska 2010), presumably in combination with differences in cognitive mechanisms (such as executive functions and working memory) in language processing (Dąbrowska 2018; Just and Carpenter 1992; Kidd et al. 2018; Wells et al. 2009). Such individual differences do not seem to be consistent in the present sample since the random effect for participant did not explain this variability. Rather, it is possible that participants constructed and adapted their rating scale throughout the experiment differently (cf. Bresnan and Ford 2010; see also Verhagen et al. 2020), taking into account the different types of grammatical and lexical features. That is, the rating behavior seems to be more consistent in the filler items than in the items with the dative choice. We therefore assume that participants adjusted their use of the rating scale due to stronger register-specific preferences in the lexical choice items. In other words, encountering items with a choice such as between *nevertheless* and *anyway*, which are strongly associated with either a formal or an informal context, might have lead participants to use the full range of the slider for such items, while participants did not make use of the full range when encountering items of the dative alternation.

Future research could aim at keeping parameters (such as register-sensitivity) as comparable as possible across target items and filler items and reduce inter-individual variation, for example, by using only high-frequency words or phrases.

Third, more work with different grammatical alternations or different (experimental) designs is necessary to further corroborate our findings and to determine the locus of variation (between modes or within a mode) (Szmrecsanyi 2017). For example, it remains to be seen whether such register effects are consistently found within one mode of communication (Graffmiller 2014) or rather related to a specific alternation. Moreover, an important question is how we should operationalize register in variationist studies, i.e., which level of granularity is theoretically interesting and cognitively plausible. And lastly, the nature of the rating task inherently involves a metalinguistic component. Participants have to make a conscious choice between the variants, while in language production this choice is often subconscious. Future research combining observational and behavioral evidence could apply a more ecologically valid method such as eye-tracking, which taps into online processing mechanisms (cf. Bridgwater et al. 2019).

In conclusion, this study has clearly shown that grammatical knowledge includes knowledge about the situational context. To the best of our knowledge, this is the first variationist study that systematically examined the influence of register with a two-fold methodology. Future studies in this vein may elucidate the precise nature of this register-specificity and provide further support for integrating register in cognitive sociolinguistic theory.

Data availability statement

The data that support the findings of this study and supplementary materials are available on OSF at <https://osf.io/2ahgf/> (DOI: <https://doi.org/10.17605/OSF.IO/2AHGF>).

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Appendix

Appendix A: Demographic information of participants

Table 4: Education level of the participants.

Education level	Number of participants
Secondary education	53
Higher education (undergraduate studies)	33
Higher education (postgraduate studies)	14

Table 5: Geographic provenance of the participants.

Broad region	Number of participants
Scotland	11
North	22
Midlands	20
Wales	7
South East	12
London	15
South West	11
NA (England)	2

Appendix B: Participants’ responses to the questions at the end of the study

Table 6: Participants’ answers to the question about the purpose of the study.

Guess	Number of participants
No idea/not sure	18
Testing understanding of grammar/language (in general)	27
Assessing correct grammar/test linguistic capacities	21
Assessing linguistic preferences	6
To study political speech/make political speech easier to understand	6
Studying language use in (situational) context	11
Studying other social factors (region/age/gender)	6
other	5

Table 7: Aggregated answers in the additional comments section at the end of the survey (multiple assignment possible).

Type of comment	Number of participants
None/thank you	43
Interesting/fun/different/great	16
Boring/too long	4
Confusing/strange	6
N/A	30

Appendix C: Model output for subset of spoken informal and spoken formal categories

Table 8: Model output of model on subset of spoken categories for item selection. Predictions are for the prepositional dative. Reference levels are indicated to the left of the arrow. Effects of Recipient Definiteness and Theme Definiteness represent the effects found in the spoken informal register (due to the presence of interaction terms).

Predictors	<i>b</i> (log-odds)	SE	Wald <i>z</i>	<i>p</i>
(Intercept)	−3.85	0.62	−6.25	<0.001
Recipient Animacy				
animate ⇒ inanimate	1.50	0.31	4.83	<0.001
Theme Complexity				
complex ⇒ simple	2.05	0.38	5.43	<0.001
Recipient Definiteness				
definite ⇒ indefinite	1.88	0.66	2.86	0.004
Theme Definiteness				
indefinite ⇒ definite	1.47	0.42	3.47	0.001
Weight Ratio	2.10	0.27	7.82	<0.001
Recipient Frequency	−0.54	0.22	−2.45	0.014
Recipient Pronominality				
pronominal ⇒ non-pronominal	1.77	0.46	3.83	<0.001
Theme Pronominality				
non-pronominal ⇒ pronominal	2.18	0.72	3.03	0.002
Register				
spoken informal ⇒ spoken formal	0.45	0.43	1.02	0.306
Register * Recipient Definiteness				
spoken formal + indefinite	−1.81	0.72	−2.52	0.012
Register * Theme Definiteness				
spoken formal + definite	−2.20	0.56	−3.91	<0.001
Random effects				
σ^2				3.29
τ_{00} ThemeHeadFilter				2.72
ICC				0.45
$N_{\text{ThemeHeadFilter}}$				101
Observations				1,300
Marginal R^2 /Conditional R^2				0.745/0.860

Significant *p*-values ($\alpha=0.05$) are printed in bold.

Appendix D: Model output filler items

Table 9: Model output filler items. σ^2 is the mean random effect variance of the model, τ_{00pt} and τ_{11pt} refer to the between-participants variance adjusted for by random intercepts and random slopes. ρ_{01} shows the random slope-intercept correlation. ICC refers to the intraclass-correlation coefficient.

Predictors	Estimates	SE	t	p
(Intercept)	−0.31	0.08	−4.09	<0.001
Filler Type				
lexical ⇒ relativizer	−0.03	0.09	−0.36	0.719
Register				
spoken informal ⇒ spoken formal	0.90	0.10	8.66	<0.001
Register*Filler Type				
spoken formal + relativizer	−0.39	0.13	−3.08	0.002
Random effects				
σ^2				0.78
τ_{00pt}				0.12
$\tau_{11pt.registerspokenformal}$				0.23
$\tau_{11pt.typerelativizer}$				0.32
$\tau_{11pt.registerspokenformal:typerelativizer}$				0.47
ρ_{01}				−0.93
				−0.93
				0.96
ICC				0.21
N_{pt}				89
Observations				1780
Marginal R^2				0.119
Conditional R^2				0.306

Significant *p*-values ($\alpha=0.05$) are printed in bold.

References

Ariel, Mira. 2001. Accessibility theory: An overview. In Joost Schilperoord, Ted Sanders & Wilbert Spooren (eds.), *Text representation. Linguistic and psycholinguistic aspects* (Human Cognitive Processing v. 8), 29–88. Amsterdam, Philadelphia: J. Benjamins.

Baayen, R. Harald. 2008. *Analyzing linguistic data: A practical introduction to statistics using R*. Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo: Cambridge University Press.

Bakhtin, Mikhaïl M. 1986. The problem of speech genres. In Caryl Emerson & Michael Holquist (eds.), *Speech genres and other late essays*. Translated by McGee, Vern W., 60–102. Austin: University of Texas.

- Bates, Douglas, Martin Mächler, Bolker Ben & Steve Walker. 2015. Fitting linear mixed-effects models using lme4. *Journal of Statistical Software* 67(1). 1–48.
- Bayley, Paul. 2004. Introduction: The whys and wherefores of analysing parliamentary discourse. In Paul Bayley (ed.), *Cross-cultural perspectives on parliamentary discourse* (Discourse approaches to politics, society and culture 10), 1–44. Amsterdam/Philadelphia: John Benjamins Publishing Company.
- Beckner, Clay, Richard Blythe, Joan Bybee, Morten H. Christiansen, William Croft, Nick C. Ellis, John Holland, Jinyun Ke, Diane Larsen-Freeman & Tom Schoenemann. 2009. Language is a complex adaptive system: Position paper. *Language Learning* 59(1). 1–26.
- Behaghel, Otto. 1909. Beziehungen zwischen Umfang und Reihenfolge von Satzgliedern. *Indogermanische Forschungen* 25. 110–142.
- Bentum, Martijn, Louis ten Bosch, Antal van den Bosch & Mirjam Ernestus. 2019. Listening with great expectations: An investigation of word form anticipations in naturalistic speech. *Proceedings of Interspeech 2019*. 2265–2269.
- Berlage, Eva. 2014. *Noun phrase complexity in English* (Studies in English language). Cambridge: Cambridge University Press.
- Biber, Douglas. 1988. *Variation across speech and writing*. Cambridge: Cambridge University Press.
- Biber, Douglas. 2012. Register as a predictor of linguistic variation. *Corpus Linguistics and Linguistic Theory* 8(1). 9–37.
- Biber, Douglas. 2019. Text-linguistic approaches to register variation. *Register Studies* 1(1). 42–75.
- Biber, Douglas & Susan Conrad. 2019. *Register, genre, and style*, 2nd edn. New York: Cambridge University Press.
- Biber, Douglas & Jesse Egbert. 2018. *Register variation online*. Cambridge: Cambridge University Press.
- Biber, Douglas, Jesse Egbert & Mark Davies. 2015. Exploring the composition of the searchable web: A corpus-based taxonomy of web registers. *Corpora* 10(1). 11–45.
- Biber, Douglas, Jesse Egbert & Daniel Keller. 2020. Reconceptualizing register in a continuous situational space. *Corpus Linguistics and Linguistic Theory* 16(3). 581–616.
- Biber, Douglas, Jesse Egbert, Daniel Keller & Stacey Wizner. 2021a. Towards a taxonomy of conversational discourse types: An empirical corpus-based analysis. *Journal of Pragmatics* 171(1). 20–35.
- Biber, Douglas, Stig Johansson, Geoffrey N. Leech, Susan Conrad & Edward Finegan. 2021b. *Grammar of spoken and written English*. Amsterdam, Philadelphia: John Benjamins Publishing Company.
- Blumenthal-Dramé, Alice, Volkmar Glauche, Tobias Bormann, Cornelius Weiller, Mariacristina Musso & Bernd Kortmann. 2017. Frequency and chunking in derived words: A parametric fMRI study. *Journal of Cognitive Neuroscience* 29(7). 1162–1177.
- Bresnan, Joan. 2007. Is syntactic knowledge probabilistic? Experiments with the English dative alternation. In Sam Featherston & Wolfgang Sternefeld (eds.), *Roots: Linguistics in search of its evidential base* (Studies in generative grammar), 77–96. Berlin: Mouton de Gruyter.
- Bresnan, Joan, Anna Cueni, Tatiana Nikitina & R. Harald Baayen. 2007. Predicting the dative alternation. In Gerlof Boume, Irene Kraemer & Joost Zwarts (eds.), *Cognitive foundations of interpretation*, 69–94. Amsterdam: Royal Netherlands Academy of Arts and Sciences.
- Bresnan, Joan & Marilyn Ford. 2010. Predicting syntax: Processing dative constructions in American and Australian varieties of English. *Language* 86(1). 168–213.

- Bresnan, Joan & Jennifer Hay. 2008. Gradient grammar: An effect of animacy on the syntax of give in New Zealand and American English. *Lingua* 118(2). 245–259.
- Bridgwater, Emma, Aki-Juhani Kyröläinen & Victor Kuperman. 2019. The influence of syntactic expectations on reading comprehension is malleable and strategic: An eye-tracking study of English dative alternation. *Canadian Journal of Experimental Psychology = Revue canadienne de psychologie expérimentale* 73(3). 179–192.
- Bušta, Jan, Ondřej Herman, Miloš Jakubíček, Simon Krek & Blaž Novak. 2017. JSI Newsfeed Corpus. Paper presented at the 9th International Corpus Linguistics Conference, University of Birmingham, 24–28 July.
- Choura, Sabiha. 2019. Grammatical choices of ditransitive patterns in academic articles. *Text & Talk* 39(3). 315–340.
- Dąbrowska, Ewa. 2016. Cognitive Linguistics' seven deadly sins. *Cognitive Linguistics* 27(4). 479–491.
- Dąbrowska, Ewa. 2018. Experience, aptitude and individual differences in native language ultimate attainment. *Cognition* 178. 222–235.
- Davies, Mark & Robert Fuchs. 2015. Expanding horizons in the study of World Englishes with the 1.9 billion word Global Web-based English Corpus (GloWbE). *English World-Wide* 36(1). 1–28.
- Devitt, Amy J. 2004. *Writing genres* (Rhetorical philosophy & theory). Carbondale: Southern Illinois University Press. Available at: <http://gbv.eblib.com/patron/FullRecord.aspx?p=4414630>.
- Divjak, Dagmar & Antti Arppe. 2013. Extracting prototypes from exemplars What can corpus data tell us about concept representation? *Cognitive Linguistics* 24(2). 221–274.
- Divjak, Dagmar, Ewa Dąbrowska & Antti Arppe. 2016. Machine meets man: Evaluating the psychological reality of corpus-based probabilistic models. *Cognitive Linguistics* 27(1). 1–33.
- Garretson, Gregory, Catherine O'Connor, Barbora Skarabela & Marjorie Hogan. 2004. *Coding practices used in the project optimal typology of determiner phrases*. Unpublished manuscript. Boston: Boston University.
- Geeraerts, Dirk & Gitte Kristiansen. 2015. Variationist linguistics. In Ewa Dąbrowska & Dagmar Divjak (eds.), *Handbook of cognitive linguistics*, 366–389. Berlin, München, Boston: De Gruyter Mouton.
- Geeraerts, Dirk, Gitte Kristiansen & Yves Peirsman. 2010. *Advances in cognitive sociolinguistics* (Cognitive linguistics research 45). New York, NY: Mouton de Gruyter.
- Gilquin, Gaëtanelle & Stefan T. Gries. 2009. Corpora and experimental methods: A state-of-the-art review. *Corpus Linguistics and Linguistic Theory* 5(1). 1–26.
- Grafmiller, Jason. 2014. Variation in English genitives across modality and genres. *English Language and Linguistics* 18(03). 471–496.
- Grafmiller, Jason & Benedikt Szmrecsanyi. 2018. General introduction: A comparative perspective on probabilistic variation in grammar. *Glossa: A Journal of General Linguistics* 3(1). 110.
- Gries, Stefan T. 2015. The most under-used statistical method in corpus linguistics: Multi-level (and mixed-effects) models. *Corpora* 10(1). 95–125.
- Gundel, Jeanette K., Nancy Hedberg & Ron Zacharski. 1993. Cognitive status and the form of referring expressions in discourse. *Language* 69(2). 274–307.
- Gundel, Jeanette K., Nancy Hedberg & Ron Zacharski. 2012. Underspecification of cognitive status in reference production: Some empirical predictions. *Topics in Cognitive Science* 4(2). 249–268.
- Guy, Gregory R. 2005. Letters to language. *Language* 81(3). 561–563.

- Guy, Gregory R. 2015. Coherence, constraints and quantities. *Paper presented at New Ways of Analyzing Variation (NWAY) 44*, University of Toronto, 22–25 October.
- Hawkins, John A. 1994. *A performance theory of order and constituency*. Cambridge: Cambridge University Press.
- Horch, Stephanie. 2019. Complementing corpus analysis with web-based experimentation in research on World Englishes. *English World-Wide* 40(1). 24–52.
- Hosmer, David W. & Stanley Lemeshow. 2000. *Applied logistic regression* (Wiley series in probability and statistics), 2nd edn. New York: Wiley.
- Ilie, Cornelia. 2002. Discourse and metadiscourse in parliamentary debates. *Journal of Language and Politics* 2(1). 71–92.
- Ilie, Cornelia. 2010. Strategic uses of parliamentary forms of address: The case of the U.K. Parliament and the Swedish Riksdag. *Journal of Pragmatics* 42(4). 885–911.
- Ilie, Cornelia. 2015. Parliamentary discourse. In Karen Tracy, Cornelia Ilie & Todd Sandel (eds.), *The international encyclopedia of language and social interaction*. Chichester: Wiley Blackwell.
- Just, Marcel A. & Patricia A. Carpenter. 1992. A capacity theory of comprehension: Individual differences in working memory. *Psychological Review* 99(1). 122–149.
- Kidd, Evan, Seamus Donnelly & Morten H. Christiansen. 2018. Individual differences in language acquisition and processing. *Trends in Cognitive Sciences* 22(2). 154–169.
- Klavan, Jane. 2017. Pitting corpus-based classification models against each other: A case study for predicting constructional choice in written Estonian. *Corpus Linguistics and Linguistic Theory* 16(2). 363–391.
- Klavan, Jane & Dagmar Divjak. 2016. The cognitive plausibility of statistical classification models: Comparing textual and behavioral evidence. *Folia Linguistica* 50(2). 355–384.
- Koch, Peter & Wulf Oesterreicher. 2012. Language of immediacy – Language of distance: Orality and literacy from the perspective of language theory and linguistic history. In Claudia Lange, Beatrix Weber & Göran Wolf (eds.), *Communicative spaces. Variation, contact, and change. Papers in honour of Ursula Schaefer*, 441–473. Frankfurt am Main: Peter Lang.
- Kruger, Haidee, Bertus van Rooy & Adam Smith. 2019. Register change in the British and Australian Hansard (1901–2015). *Journal of English Linguistics* 47(3). 183–220.
- Labov, William. 2010. *Principles of linguistic change: Cognitive and cultural factors* (Language in society 39), vol. 3. Malden, MA: Wiley-Blackwell.
- Larsson, Tove, Luke Plonsky & Gregory R. Hancock. 2021. On the benefits of structural equation modeling for corpus linguists. *Corpus Linguistics and Linguistic Theory* 17(3). 683–714.
- Lau, Jey H., Alexander Clark & Shalom Lappin. 2017. Grammaticality, acceptability, and probability: A probabilistic view of linguistic knowledge. *Cognitive Science* 41(5). 1202–1241.
- Love, Robbie, Claire Dembry, Andrew Hardie, Vaclav Brezina & Tony McEnery. 2017. The Spoken BNC2014: Designing and building a spoken corpus of everyday conversations. *International Journal of Corpus Linguistics* 22(3). 319–344.
- MacDonald, Maryellen C. 2013. How language production shapes language form and comprehension. *Frontiers in Psychology* 4. 226.
- Marx, Maarten & Anne Schuth. 2010. DutchParl. The parliamentary documents in Dutch. In Nicoletta Calzolari (Conference Chair), Khalid Choukri, Bente Maegaard, Joseph Mariani, Jan Odijk, Stelios Piperidis, Mike Rosner & Daniel Tapias (eds.), *Proceedings of the seventh international conference on language resources and evaluation (LREC'10)*, 3670–3677. Valletta, Malta: European Language Resources Association (ELRA). Available at: <http://www.lrec-conf.org/proceedings/lrec2010/summaries/263.html>.

- Milin, Petar, Dagmar Divjak, Strahinja Dimitrijević & R. Harald Baayen. 2016. Towards cognitively plausible data science in language research. *Cognitive Linguistics* 27(4). 507–526.
- Prince, Ellen F. 1992. The ZPG Letter: Subjects, definiteness, and information-status. In William C. Mann & Sandra A. Thompson (eds.), *Discourse description. Diverse linguistic analyses of a fund-raising text* (Pragmatics & beyond New Series 16), 295–326. Amsterdam/Philadelphia: John Benjamins Publishing Company.
- R Core Team. 2020. *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Available at: <https://www.R-project.org/>.
- Rickford, John R. 2014. Situation: Stylistic variation in sociolinguistic corpora and theory. *Language and Linguistics Compass* 8(11). 590–603.
- Röthlisberger, Melanie. 2018. *Regional variation in probabilistic grammars: A multifactorial study of the English dative alternation*. Leuven: KU Leuven PhD Dissertation.
- Röthlisberger, Melanie. 2021. Between context and community: Regional variation in register effects the English dative alternation. In Elena Seoane & Douglas Biber (eds.), *Corpus-based approaches to register variation* (Studies in corpus linguistics). Amsterdam: Benjamins.
- Röthlisberger, Melanie, Jason Grafmiller & Benedikt Szmrecsanyi. 2017. Cognitive indigenization effects in the English dative alternation. *Cognitive Linguistics* 28(4). 673–710.
- Scarborough, Don L., Charles Cortese & Hollis S. Scarborough. 1977. Frequency and repetition effects in lexical memory. *Journal of Experimental Psychology: Human Perception and Performance* 3(1). 1–17.
- Schäfer, Roland & Elizabeth Pankratz. 2018. The plural interpretability of German linking elements. *Morphology* 28(4). 325–358.
- Schmid, Hans-Jörg. 2015. A blueprint of the entrenchment-and-Conventionalization model. *Yearbook of the German Cognitive Linguistics Association* 3(1). 3–25.
- Schmid, Hans-Jörg. 2016. Why Cognitive Linguistics must embrace the social and pragmatic dimensions of language and how it could do so more seriously. *Cognitive Linguistics* 27(4). 543–557.
- Schmid, Hans-Jörg. 2020. *The dynamics of the linguistic system: Usage, conventionalization, and entrenchment*, 1st edn. Oxford, New York, NY: Oxford University Press.
- Schütze, Carson T. & Jon Sprouse. 2013. Judgment data. In Robert J. Podesva & Devyani Sharma (eds.), *Research methods in linguistics*, 27–50. Cambridge: Cambridge University Press.
- Speed, Laura J., Ewelina Wnuk & Asifa Majid. 2017. Studying psycholinguistics out of the lab. In Annette M. B. de Groot & Peter Haagoort (eds.), *Research methods in psycholinguistics and the neurobiology of language: A practical guide* (GMLZ – Guides to research methods in language and linguistics), 190–207. Hoboken, NJ: Wiley-Blackwell.
- Speelman, Dirk, Kris Heylen & Dirk Geeraerts. 2018. *Mixed-effects regression models in linguistics*. Cham: Springer International Publishing.
- Street, James A. & Ewa Dąbrowska. 2010. More individual differences in language attainment: How much do adult native speakers of English know about passives and quantifiers? *Lingua* 120(8). 2080–2094.
- Szmrecsanyi, Benedikt. 2017. Variationist sociolinguistics and corpus-based variationist linguistics: Overlap and cross-pollination potential. *Canadian Journal of Linguistics/Revue canadienne de linguistique* 62(4). 685–701.
- Szmrecsanyi, Benedikt, Jason Grafmiller, Joan Bresnan, Anette Rosenbach, Sali Tagliamonte & Simon Todd. 2017. Spoken syntax in a comparative perspective: The dative and genitive alternation in varieties of English. *Glossa: A Journal of General Linguistics* 2(1). 1–27.

- Szmrecsanyi, Benedikt, Jason Grafmiller, Benedikt Heller & Melanie Röthlisberger. 2016. Around the world in three alternations. *English World-Wide* 37(2). 109–137.
- Tamaredo, Iván, Melanie Röthlisberger, Jason Grafmiller & Benedikt Heller. 2020. Probabilistic indigenization effects at the lexis–syntax interface. *English Language and Linguistics* 24(2). 413–440.
- Tardy, Christine M. 2021. Genre analysis. In Ken Hyland, Brian Paltridge & Lillian L. C. Wong (eds.), *The Bloomsbury handbook of discourse analysis* (Bloomsbury handbooks), 2nd edn., 51–63. London, New York, Oxford, New Delhi, Sydney: Bloomsbury Academic.
- Tardy, Christine M. & John M. Swales. 2014. Genre analysis. In Klaus P. Schneider & Anne Barron (eds.), *Pragmatics of discourse* (Handbooks of pragmatics), vol. 3, 165–187. Berlin: De Gruyter Mouton.
- Theijssen, Daphne, Louis ten Bosch, Lou Boves, Bert Cranen & Hans van Halteren. 2013. Choosing alternatives: Using Bayesian Networks and memory-based learning to study the dative alternation. *Corpus Linguistics and Linguistic Theory* 9(2). 227–262.
- Thuillier, Juliette. 2014. An experimental approach to French attributive adjective syntax. In Christopher Piñón (ed.), *Empirical issues in syntax and semantics*, vol. 10, 287–304.
- Verhagen, Véronique, Ad Backus, Maria Mos & Joost Schilperoord. 2018. Predictive language processing revealing usage-based variation. *Language and Cognition* 10(2). 329–373.
- Verhagen, Véronique, Maria Mos, Joost Schilperoord & Ad Backus. 2020. Variation is information: Analyses of variation across items, participants, time, and methods in metalinguistic judgment data. *Linguistics* 58(1). 37–81.
- Wasow, Thomas & Jennifer E. Arnold. 2003. Post-verbal constituent ordering in English. In Günter Rohdenburg & Britta Mondorf (eds.), *Determinants of grammatical variation in English*, 119–154. Berlin, New York: De Gruyter Mouton.
- Wells, Justine B., Morten H. Christiansen, David S. Race, Daniel J. Acheson & Maryellen C. MacDonald. 2009. Experience and sentence processing: Statistical learning and relative clause comprehension. *Cognitive Psychology* 58(2). 250–271.
- Wolk, Christoph, Joan Bresnan, Anette Rosenbach & Benedikt Szmrecsanyi. 2013. Dative and genitive variability in Late Modern English: Exploring cross-constructual variation and change. *Diachronica* 30(3). 382–419.
- Zaenen, Annie, Jean Carletta, Gregory Garretson, Joan Bresnan, Andrew Koontz-Garboden, Tatiana Nikitina, Catherine O'Connor & Thomas Wasow. 2004. Animacy encoding in English: Why and how. In Bonnie Webber & Donna Byron (eds.), *Proceedings of the 2004 ACL workshop on Discourse annotation, Barcelona, July 2004*, 118–125. East Stroudsburg, PA: Association for Computational Linguistics.