Testing the hypothesis
Objectivity and verification in usage-based Cognitive Semantics

Dylan Glynn

Abstract
This study has two aims: to show the methodological possibility of doing purely subjective semantic research quantitatively and to demonstrate theoretically that discreet senses and discreet linguistic forms do not exist. On the methodological front, it argues that, with due caution and statistical modelling, subjective semantic characteristics, such as affect and cause, can be successfully employed in corpus-driven research. The theoretical implications show that we cannot treat lexical senses as discreet categories and that the semasiological - onomasiological and polysemy - synonymy distinctions are not tenable and must be replaced with a more multidimensional and variable conception of semantic structure. The case study examines a sample of 650 occurrences of the lexeme *bother* in British and American English. The occurrences are manually analysed for a range of formal and semantic features. The exploratory multivariate technique Correspondence Analysis is used to indentify three basic senses relative to formal variation and subjective usage-features. Two of these sense clusters are then verified using Logistic Regression Analysis. The analysis demonstrates a statistically significant difference between the two senses and indentifies which of the semantic features are most important in distinguishing the uses. The statistical model is powerful and its predictive strength serves as further verification of the accuracy of the semantic analysis.

Keywords: polysemy, semantics, objectivity, corpus linguistics, behavioural profile, Logistic Regression Analysis, Correspondence Analysis

1. Introduction. Quantitative Cognitive Semantics

Is purely semantic research at all possible using quantitative techniques?[1] Within Cognitive Semantics, a range of studies have shown how a combination of observable formal characteristics and semantic, yet objectively determinable, characteristics yields coherent and verifiable descriptions of semantic structure (Geeraerts *et al.* 1994, Gries 2006, Divjak 2006 *inter alia*). However, not all linguistic forms

Glynn, D. 2010. Testing the Hypothesis. Objectivity and Verification in Usage-Based Cognitive Semantics. *Corpus-Driven Cognitive Semantics. Quantitaive approaches*. D. Glynn & K. Fischer (eds.), 239-270. Berlin: Mouton de Gruyter.

possess objectifiable semantic usage-features. Can we overcome this limitation by examining purely semantic usage-features?

As corpus-driven research comes to the study of semantics, it inevitably meets the question of subjectivity versus objectivity. There is an unfortunate tendency to believe that corpus-driven research and the quantitative treatment of the results obtained from such methods are inherently more objective than traditional methods, such as elicitation and introspection. This is not necessarily the case. The choices involved in the annotation of data remain largely subjective. This is especially true for the study of semantics. Whether approached with hermeneutics or the latest statistical modelling, meaning is a symbolic relation created in our minds and is therefore always beyond the reach of pure objectivity. Indeed, the 'object' of study does not exist, save as a subjective experience. Even the results from a formal operationalisation of semantics ('indirect' methods, such as collocation analysis) must be interpreted in subjective terms if they are to be used to capture meaning.

Indeed, in a usage-based framework, even 'direct' semantic analysis of found examples is an indirect line of inquiry: we make generalisations about usage and then make an assumption that these usage patterns represent speaker knowledge of the symbolic relations that constitute 'meaning'. It is for this reason that Talmy (2007, 2008) argues that some research questions are better answered by introspective methods. On the other hand, Geeraerts (2007; 2010; this vol.) argues that the results obtained through subjective experience represent merely the first step in the analytical cycle. They are crucial to research but represent hypotheses and, as hypotheses, need to be tested. From this perspective, the challenge is to find ways to operationalise this infamously slippery object of study, semantics.

Within Cognitive Linguistics, this challenge is being met on a variety of fronts. Two schools, a variationist, multifactorial approach (Heylen 2005; Tummers *et al.* 2005; Divjak 2006; Grondelaers *et al.* 2007; Glynn 2009; Speelman & Geeraerts 2010) and a collocation-based approach (Stefanowitsch & Gries 2003; Gries & Stefanowitsch 2004; Wulff *et al.* 2007; Hilpert 2006, 2009) lead the search for a response to this challenge. A third cognitively compatible approach is emerging that employs computational techniques. Building on the principle of collocation, it uses the word space modelling to investigate synonymy and polysemy (Peirsman & al. 2010).

All these approaches adopt a usage-based model of language and assume that patterns of usage found in corpora are indices of the grammar in the minds of speakers in a language community. This study belongs to the

first of these approaches, which is specifically concerned with the multidimensionality of language. In order to capture the interaction, or integration, of lexis, syntax, morphology, prosody, and then interpret all of these factors relative to the full gamut of sociolinguistic complexity, any analysis must employ multivariate statistics.

Cognitive Linguistics adheres to a model of language that is semantically driven. It is argued that all form, and variation in that form, is motivated by variation in meaning. Therefore, identifying patterns in form indirectly identifies patterns of meaning. However, though all formal structure is motivated by semantic structure, this does not entail that all semantic structure is mirrored formally. Language is the vehicle for expressing meaning and so we can assume that speakers will constantly search for formal ways of encoding what they wish to express. Nevertheless, no one would argue that every possible concept should be distinguished formally. Therefore, we must assume that there is a great deal of semantic content that cannot be formally identified. Though formal variation is a result of semantic variation, and therefore indicative of it, it can only ever be indicative of a small part of semantic structure.

The variationist and multifactorial research mentioned above restricts itself to relatively objective semantic features, such as the animacy or concreteness of the actors in an event (Gries 2006; Divjak 2006; Grondelaers & Speelman 2007). These studies have shown how combining the analysis of purely formal characteristics and objectifiable semantic characteristics can accurately map the synonymy and polysemy of both grammatical and lexical semantics. However, in all these cases, the forms in question possess rich argument structures, where relatively objective semantic characteristics are available. However, not all objects of study possess such easily identifiable features. Can we extend quantitative methods to the study of semantic structures that are not so easily identifiable?

2. Objectivity, verification, and prediction

Sandra & Rice (1995) unequivocally demonstrated that the lexical network analyses prevalent at the beginning of Cognitive Semantics produced *ad hoc* and unverifiable results. Despite their resounding refutation, there is nothing inherently wrong with lexical network studies of semantic structure, such as Lakoff's (1987) analysis of *over*. This research, however, only represents the first step in semantic analysis – the proposal of a coding

schema. This is a crucial operationalisation for quantitative semantic analysis of natural language. Operationalisation enables quantification; quantification enables verification and thus the testing of hypotheses (see Geeraerts this vol. and Stefanowitsch this vol.).

It is often argued, and with some reason, that subjective semantic characteristics cannot be operationalised in a sufficiently objective manner to include them in quantitative studies. There exists, however, one strong counterargument. It is not objectivity that quantitative analysis offers us, but a better and more varied way of verifying the results. Seen from this perspective, quantitative methods are all the more important for subjective semantic analysis. Since the goal of descriptive research is accuracy, when an object of study does not possess clear observable features, verification is essential.

There are three basic ways in which the quantitative treatment of found data allows us to verify the results of analysis: overt operationalisation, repeat analysis, and statistical modelling. Let us consider the importance of each of these steps for corpus-driven quantitative analysis in semantic research.

Overt operationalisation - subjective analysis

Operationalisation is crucial in quantitative research. It requires overt identification of criteria for the analysis. Without entering into a philosophical debate, meaning exists entirely in our minds and not in the observable 'real world'. Thus, with no objectively observable characteristics, one cannot operationalise *direct* semantic analysis. It is for this reason that much quantitative research has avoided semantics. Although objectively operationalising subjective features may be technically impossible, using the principle of operationalisation to help overtly identify the analytical criteria acts as a perfect goal for improving semantic analysis. Most importantly, it permits quantification and therefore verification. If the semantic criteria, even subjective ones, are overtly identified, a second researcher can re-apply the analysis. Discrepancy between the analyses aids the process of refining the operationalisation and, thus, enhances its accuracy.

Repeat analysis - multiple datasets

Even if based on subjective analysis, the two basic advantages of empirical research are the ability to repeat the analysis on the same data and the possibility to apply the analysis to a second dataset. The former verifies the accuracy of the analysis, the latter verifies the representativity of the data.

Duplicating subjective analysis and comparing the results of different coders, or 'raters', has an established tradition in psychology. There is no reason why this should not be applied to semantic research. Szmrecsanyi (2003), Diessel (2008), and Zeschel (this vol.) use this technique in their analyses and employ Cohen's Kappa Coefficient to determine the degree of inter-coder agreement.

The second advantage is one of the basic and unquestionable assets of empirical research - if the criteria of the analysis are adequately operationalised, then the analysis can be simply repeated upon a second sample. Although no one will argue that any sample is perfectly representative of the population (in our case the collective utterances of an entire language), this will give concrete information on just how representative the sample is.

Statistical modelling - quantitative evaluation

There are two basic kinds of statistical analysis: exploratory and confirmatory. Both types offer means for verification. Firstly, exploratory statistical analysis identifies patterns in the data. Coherent patterns, as opposed to random dispersion in the data, are the first verification of the analysis. If, at this exploratory level, intuitively sound results are obtained, especially if these results match previous introspection-derived results, we have a strong argument that the semantic analysis was accurate.

Yet, it is with confirmatory statistics that the real power of verification comes to the fore. Within the recent linguistic literature, there has been a growing tendency to use quantitative data and to employ tests for statistical significance. However, statistical modelling offers another equally, or perhaps, more important tool - that of explanatory power. Whereas, statistical significance merely tells us that the finding is more than chance, accuracy scores of explanatory power are obtained through confirmatory modelling, such as Logistic Regression Analysis. Obviously, with subjective non-observable criteria, confirmatory modelling is a vital part of result verification.

3. *Bother*. A quantitative semantic study

One of the problems for quantified semantic analysis is that beyond the finite verb and its argument structure, it becomes difficult to operationalise semantic features. Verbs are associated with actors and express relations between actors. These alone offer a wide range of readily quantifiable se-

mantic characteristics, such as the animacy of the actor or the boundedness of the ground and so forth. Such semantic information, one may quite easily operationalise and manually annotate in a sample of natural language. Prepositions, adverbs, and adjectives are relational and, therefore, also offer some room for this kind of indirect operationalisation of semantic analysis. However, what of very abstract verbs such as *love* or *hate*, or abstract nouns, or even discourse markers? How can one approach such lexemes? The lexical semantic study of emotion concepts, such as Kövecses (1986) and Lakoff (1987), is representative of the birth of Cognitive Linguistics. Yet, quarter of a century after Kövecses and Lakoff, as we apply powerful multivariate statistics to our corpus-driven analyses, we have no method for even beginning to approach abstract concepts like PRIDE, LOVE, or ANGER. Does this mean that corpus linguistics is ill-suited to the study of such lexical structure? The task of any scientist is to develop a method that will match the object of inquiry. We can say that abstract lexical concepts are beyond scientific reach no more than an astronomer can say the stars are too far to be studied. This study seeks to take the first steps towards the quantified study of abstract semantics with no identifiable referent to act as a *tertium comparationis*.

The study treats the lexical concept 'bother', which is profiled by a noun and a verb. It experiments with semantic analysis and the statistical treatment of the results thereof to ascertain the possibility of performing purely subjective quantified analysis. The lexeme *bother* is chosen because it is sufficiently abstract to test the method, while still possessing some points of reference, such as the Agentive cause of the emotion and the Affect of the event upon the patient. The study tests the efficacy of different degrees of subjectivity. Secondary annotation is also used to test the accuracy of the analysis.

3.1. Data and analysis

The data are taken from a corpus of on-line personal diaries, or 'blogs', in both British and American English[2]. Over 300 examples were randomly extracted from each of the two dialects, in total, some 650 occurrences. The sample included no instances of *bothersome*, *botheration, or botherly,* and only relatively small numbers of nominal and gerundive profilings. The majority of the occurrences belonged to a range of verbal constructions that are discussed below.

In order to limit the number of variables, the study is restricted to the extralinguistic variables dialect and thematic topic of discourse. One of the greatest limitations of any manual analysis is the small number of occurrences that can be treated. The labour-intensive process of manual annotation restricts the sample size considerably, which, in turn, significantly restricts the number of different factors that can be examined. The two regions are broadly defined as British and American. The thematic topic of discourse is highly subjective and is thus described below with the semantic factors. Other possible extralinguistic factors are controlled for by the homogenous nature of the corpus. Although impossible to determine scientifically, on-line personal diaries tend to be authored by women and we can suppose that, as a genre, they are restricted to the younger generations.

3.1.1. Objectifiable variables

The formal analysis covers the obvious grammatical features of form and part of speech, which, for nouns, include count singular, count plural, and mass and, for verbs, tense, aspect, mood, voice, polarity, person, and number. The frame semantics, argument structure, and syntax of the lexeme are quite rich. There are two basic frames: the first, where the Subject coincides with the Agent and affects the Patient, either directly or instrumentally, and the second, where the Subject is at once the Agent and the Patient of the BOTHER event. The first of these argument structures we will term the Agentive Frame and the second, the Predicative Frame. To understand the difference between these two argument structures, it can be useful to differentiate Cause and Agent. Expressions such as *I bother to eat* are semantically a kind of reflexive. The Cause of BOTHER is 'eating', but both the Agent and the Patient are the Subject of the sentence. The Subject chooses to eat and this choice leads to the experience of BOTHER. Therefore, 'eating' is the Cause, but it is not the Agent. Differences of this kind in profiling the relationship between the emotion, its experiencer, and the Cause of the experience vary greatly. Indeed, as we will see below, one of the constructions associated with this second frame completely backgrounds the Cause with no slot for its specification. Wierzbicka (1995) offers some discussion on these kind of phenomena.

At a relatively coarse-grained level of analysis, there exist five verb-based constructions. There were only three occurrences of resultatives,

which due to their marked argument structure and rarity will not be included in the analysis. All examples are taken from the corpus.

Direct Transitive

Subj.	V	Direct Object
I	BOTHER	you
Agent/Cause	verb	Patient

(1) but oh well it doesnt *bother* me too much because every1 is entitled to their own opinion.

Oblique Transitive

Subj.	V	Direct Obj.	Indirect Object
I	BOTHER	you	*with/about -over -because of it*
Agent	Verb	Patient	Cause

(2) The day carried on as boring and reptative as ever so I wont *bother* you wiith the rest.

Oblique Reflexive Transitive

Subj.	V	Indirect Object
I	BOTHER	about/ over/ with it
Agent/Patient	Verb	Cause

(3) I will no longer *bother* with questions of the capabilities of people not caring for each other. (Instrumental)

Complement Clause Transitive

Subj.	Verb	Infinitive / Gerund / Dep. Clause
I	BOTHER	to eat / eating / that I'm not eating
Agent/Patient	Verb	Cause

(4) a. Actually I did and no one bothers to move. (Infinitive)
b. That's if i can be *bothered* goin into business! (Gerund)
c. and I was *bothered* that I never knew about it until just then. (Dep. Clause)

Predicative

S	COP	Participle
I	am	bothered
Agent/Patient	Verb	

(5) a. but its so crusty and I really cannot be *bothered* :(
b. I been listening to the K's choice and eisley CD a lot if anyones *bothered* they should download some of their music or something.

The final construction poses difficulties because, at first glance, it appears to be a middle voice and therefore an elided transitive construction. However, there is no possibility of rephrasing the sentence as an active form. This suggests we could term it an Intransitive Construction. Moreover, it behaves, at many levels, like a Predicative Adjective. It is felicitous with verbs other than *be,* for example, *she seems bothered*. In order to avoid terminology debates, we will use the term Predicative Construction.

The sample also includes count singular, count plural, and mass nouns as well as gerunds. However, they will be excluded from the analysis due to the low number of occurrences.

3.1.2. Non-objectifiable variables

The subjective semantic analysis is the central point of the study and so warrants a close explanation. Following previous multifactorial lexical semantic research (Gries 2006, Divjak 2006, Glynn 2009), the actors in the event are coded for semantic features such as animacy and specificity. We can call this the coarse-grained Actor Semantics. However, in this study, progressively more subjective levels of analysis are applied. In particular, the Actor Semantics was analysed for a fine-grained, and therefore subjective, level of analysis. The features are listed below.

Cause and Agent

The semantics of the Cause and the Agent can be determined through sorting and re-labelling the analysis of the Subject, Object, and Oblique. Therefore, in order to render the subjective analysis more overt, the formal categories are analysed, not the semantic categories. Cause and Agent are determined through post-analysis sorting. This gives us two sets of semantic analysis: one linked to the formal Actors - Subject, Object, and Oblique, and the other, to the semantic Roles - Agent and Cause. Since the Patient is almost exclusively a specified known human, this factor is uninformative. A fine-grained list of features for the Actors and Roles is presented below. They are broadly grouped into things and events, though one of the features, 'abstract state of affairs', represents a blurred line between the two. This feature was typically encoded by *it* or *this* or some conceptual shell noun (cf. Schmid 2000), but the point of reference is so abstract that it often is actually an event of some sort.

Human Specified	A specific individual, or individuals, known to the speaker
Human Non-specified	Human, but a generic human unknown to the speaker
Thing Concrete	Something at which you can point
Thing Abstract	A thing at which you cannot point
State of Affairs Abstr.	Abstract information about the world known by the interlocutors
State Concrete	Abstract event that is profiled as durative
Event	An event with a perfective profiling
Activity	An event with an imperfective profiling

Up until this point, the present semantic analysis differs from the analyses of Gries, Divjak, and Glynn only in a matter of degree of semantic granularity. The fine-grained categories used to annotate the Actors and Roles are difficult to operationalise only because of their detail. In principle, such semantic characteristics can be quite objectively determined. However, two other semantic analyses of the examples are performed – the Patient's Affect (or the emotion experienced) and the Thematic Subject (or the topic of discourse).

Affect

For the Affect, the analyst must read and attempt to ascertain what kind of emotion is being expressed by the use of the term. The only way of operationalising this variable was by composing questions and, after close reading of the text, asking which of the questions most accurately captured the emotional state of the patient. The Affect features were identified with the questions listed below (note that for negative sentences, phrasing the question with the hypothetical *would* made the analysis clearer):

Anger	Does the Patient feel angry because of the event?
Anxiety	Is the Patient concerned or worried by the event?
Boredom	Does the Patient feel bored because of the event?
Energy	Does the Patient feel tired because of the event?
Imposition	Does the Patient feel imposed upon by the event? Does the Patient have to do something she/he does not want to do?
Interruption	Does the Patient feel interrupted? Is the Patient prevented from doing something she/he wants to do?
Pain	Does the Patient feel seriously upset by the event?

Theme

The last subjective variable under consideration is more of an extralinguistic factor than a semantic one. In this, it can be an important operationalisation of register and, therefore, representativity of a sample. It can also, indirectly, give semantic information, since we can suppose that more serious topics of discourse will be associated with certain meanings of a word and so forth. In general, it can be a useful factor, but it suffers from the constraint that with small samples, keyword indices are not possible, leaving only the possibility of highly subjective manual coding. In this study, the basic distinction is between the personal sphere and society, in the broad sense. This is then re-analysed for more fine-grained distinctions. The personal features are by far the more common and important, due to the genre of diary. The features include:

Society-	
Entertainment Soc.	Discussion about cinema, music, and sport at the level of society
Miscellaneous Soc.	Discussion at a social level not fitting into other categories
Religion & Politics	Discussion about religion, history, politics and economics at the level of society
Personal-	
Cyber Friends	Discussion about friends in the cyber community of the on-line diaries. Due to the genre, an important category
Entertainment Pers.	Discussion about going out, parties concerts and so forth
Family	Discussion about family and personal relationships
Health	Discussion about personal health
Miscellaneous Pers.	Discussion at a personal level not fitting into the other categories
Study & work	Discussion about school, university, and work at a personal level
Computing	This refers to problems with a personal computer, a common topic in the on-line diaries

3.1.3. Inter-coder agreement

Following Szmrecsanyi (2003) and Zeschel (this vol.), secondary annotation was employed. Each of these four highly subjective variables, the semantics of the Agent, the Cause, the Affect, and the Theme of Discourse, were coded independently by two linguists. After discussion and trial samples, inter-coder agreement was excellent. Cohen's Kappa is used to calculate the degree of inter-coder agreement. The rules of thumb over agreement rating follow: Strength of agreement < 0.2 Poor; $> 0.2 \leq 0.4$ Fair; $> 0.4 \leq 0.6$ Moderate; $> 0.6 \leq 0.8$ Good; $> 0.8 \leq 1$ Very good. Despite the fact that this calculation is considered a conservative measure, the inter-coder agreement was approaching 1, which is perfect.

Affect - $\kappa = 0.949181$	Theme - $\kappa = 0.9367972$
Agent - $\kappa = 0.9875858$	Cause - $\kappa = 0.9510682$

For the factors of Agent and Cause, only the distinction between 'state' and 'abstract state of affairs', and, to a small degree, 'event', caused any disagreement. For the factor of Affect, it was found that 'emotional pain' and 'anxiety' were on a continuum. These two features differ only in their degree of emotional engagement. When a continuous feature is treated categorically, it presents a fuzzy boundary leading to coder disagreement. The other coder disagreement concerned the distinction between 'imposition' and 'interruption'. Again, there is a fine line between the two affects. Although it may be difficult to claim that they form a continuum, there is obviously similarity between having to do something that one does not want to do and not being able to do something that one wants to do.

In this section, we have overtly described the subjective features that are annotated. It was argued in the previous section that this stage in itself permits a kind of verification which is sometimes less evident in purely introspective research. Although good introspective studies clearly identify the criteria used in analysis, by systematically applying those criteria many hundreds of times to randomly chosen examples, they are refined. It is the process of annotation that leads to a clearer analysis. Other than the use of multiple analysts, there is no inherent reason that this stage of the analysis would be any more accurate than any traditional introspection-based study. However, we now have one very important advantage – a fine-grained annotated dataset. In this study, the sample consists of 650 examples that can be examined for tendencies in usage, especially the interaction of different

factors such as the effects of formal variation and sociolinguistic variation in semantic structure.

4. Results

4.1. Exploratory statistics – Correspondence Analysis

Multiple Correspondence Analysis is a dimension reduction technique similar to Multi-dimensional scaling.[3] It is a simple method that offers insights into the interaction of multiple factors, but does not offer any means for testing the statistical significance of the associations it reveals. Despite this limitation, it represents a useful tool for identifying the patterns in the data, patterns that would be difficult or impossible to identify heuristically. The analysis works on a simple principle; it calculates a table of co-occurrences of the different features in question and then converts these figures to relative distances. The plot is interpreted accordingly – proximity represents high association, distance represents disassociation. This is, of course, relative and data points may push other points away so that one feature may be highly associated with another, even though they are not placed close together because one of the points is being "pushed" away from a third and unrelated feature. For this reason, the plots can be difficult to read, but their analogue representation of the tendencies in correlations between usage-features avoids giving a misleading picture that we are dealing with discreet senses.

4.1.1. Affect

Affect is obviously one of the most important factors since, as an emotion term, it is essentially the 'meaning' of the lexeme; it is also one of the most subjective factors under investigation. Let us examine how this factor interacts with the formal variation associated with the lexeme. Restricting the data to just the verbal examples, we can submit the factor of Affect to a Correspondence Analysis with the Grammatical Construction. Recall that the five basic verbal constructions include the Direct Transitive Cx, Oblique Transitive Cx, Oblique Reflexive Transitive Cx, Complementary Clause Cx, and the Predicative Cx. Figure 1, below, visualises the results of the analysis.

(i) Oblique Transitive Cx – 'interruption' and 'imposition'

Figure 1 gives us clear results where three distinct clusters emerge. In the first cluster (i), bottom left, the Oblique Transitive Construction is placed as distinct from the other constructions. This placement is of interest for three reasons. First, the fact that it is distinctly placed far from the other clusters means that relative to the factor of Affect, this construction is used in a specific way. In other words, it is a form–meaning pair. The two Affect features are located between it and the Direct Transitive Construction, which means that they are not unique to the Oblique Transitive Construction, but on occasions also occur with the direct form. However, the relative proximity shows their high association with the Oblique form.

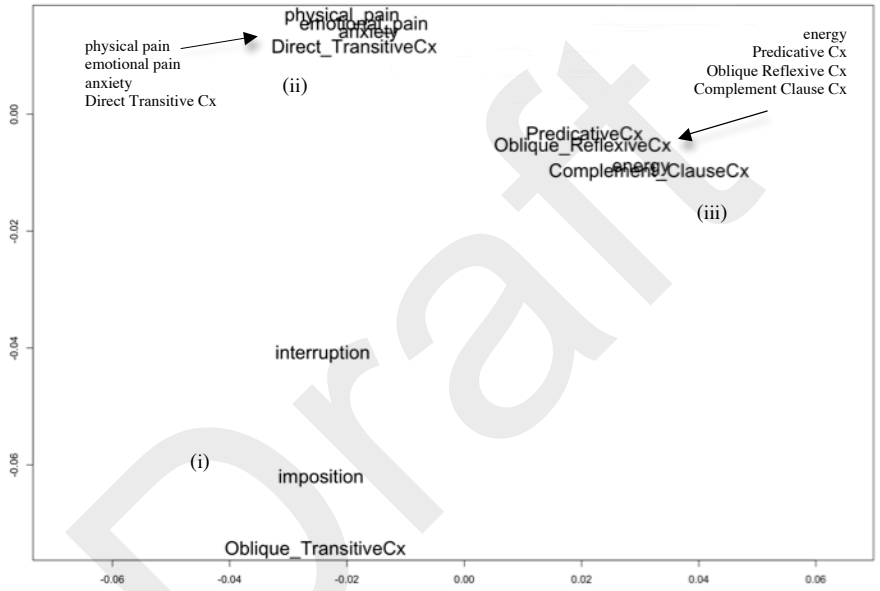

Figure 1. Correspondence Analysis – Construction and Affect

Second, the Oblique Transitive and the Direct Transitive are the two constructions that profile the Agentive Frame of BOTHER. Although the Affects of 'imposition' and 'interruption' are clearly more associated with the use of the Oblique form, it is with the other Agentive construction that they share some association. In other words, although the Oblique and Direct Transitive Constructions are distinct, they are also semantically similar, relative to the factor of Affect. The Affect factor divides the plot into left

and right halves – the constructions profiling an Agentive argument structure appear on the left, and the constructions profiling a Predicative structure on the right. Third, these two semantic features, 'imposition' and 'interruption', are similar. Indeed, this was one of the two points of inter-coder disagreement for this factor. Therefore, that these highly similar and difficult to distinguish semantic features should behave in a similar manner relative to the formal variables of construction type verifies the accuracy of the semantic feature analysis. Example (6) is typical of the kind of occurrence this association captures.

(6) a. It's great because now my sister can't *bother* me with her little annoying-as-fuck friends upstairs anymore. (Oblique Trans Cx and 'interruption')

b. It's not subconiously anymore either and she told me she couldn't stop. and people wouldn't stop asking her and *bothering* her about it and I kept telling them to leave her alone that they were making her feel worse. (Oblique Trans Cx and 'imposition')

These examples also show why there was difficulty in distinguishing the Affect features of 'imposition' and 'interruption'.

(ii) Direct Transitive Cx – 'physical pain', 'emotional pain', and 'anxiety'
The second cluster in the top left of the plot is the Direct Transitive associated with the Affect features of 'physical pain', 'emotional pain', and 'anxiety'. This cluster is interesting for the same three reasons as the previous. First, the semantic features render this a form-meaning pair, distinct from the other constructions. Second, the construction still shares the left side of the plot with its daughter construction, the Oblique Transitive Construction, linked by the features of 'imposition' and 'interruption'. Third, the semantic features that are associated with this form are similar and form a coherent meaning cluster. Indeed, just as for 'interruption' and 'imposition', the other difficulty for inter-coder agreement was the distinction between 'anxiety' and 'emotional pain'. Both constructions cluster with semantic features in an intuitively sound way. It takes a lot of context to annotate such subjective features. Only short excerpts are included, hopefully long enough to represent the emotions at stake.

(7) a. I had such a great time and I missed hanging out with those peeps well some of them at least. I don't know but for some it just doesn't *bother* me anymore maybe it's their fucking attitude. (Direct Transitive Cx and 'anxiety')

b. I am trying not to be too sensitive because I know he doesn't mean to hurt me. Normally comments don't bother much I've certainly heard much worse... I guess it just hurts me when he does it because I love him so much. (Direct Transitive Cx and 'emotional pain')

(iii) Oblique Reflexive, Complement Clause, Predicative Cxs – 'energy'
The third cluster of the top right groups all the Predicative Frame Constructions with a single Affect feature, 'energy'. The use of energy was the most common Affect with 314 out of 628 verbal occurrences and it seems highly associated with the Predicative Frame Constructions. Finally, it should be stressed that the results of this first Correspondence Analysis add weight to the distinction between a Predicative and Agentive Frame of BOTHER. Example (5a) above is typical of the Predicative Frame Constructions, examples (8a) - (8c) correlate the Complement Clause and Oblique Reflexive Cxs with the Affect feature of 'energy'.

(8) a. i didn't bother with breakfast as i was being picked up at 11:30 Complement Clause and 'energy')
b. why do I bother to update my journal? (Complement Clause and 'energy')

c. hes sweet keeps askin me stuff about the essay though and i dont actually have a clue what its *about* so im not actually much use so dont know why he bothers lol! (Oblique Reflexive Cx & 'energy')

4.1.2. Agent

Let us consider another Correspondence Analysis, this time with a third factor added, that of Agent. The constructions behave in the same manner, grouping together relative to the semantic features along the lines of Agentive and Predicative Frames. Thus, in order to render the plot more legible, the constructional categories are conflated to Predicative and Agentive. The Correspondecne Anlsyis in Figure 2 reveals a high degree of correlation between the Agent and the Affect. Most of the correlations are immediately interpretable and intuitively sound.

(i) *Humans, 'interruption' and 'imposition'*
The first cluster (i) shows a strong and distinct correlation between 'interruption' and 'imposition' with 'Non-Specified Humans' and 'Specified Humans'. The association there should be self-explanatory. Example (6), above, serves well to represent this cluster of features.

(ii) Agentive Frame Cxs – 'things', 'states', 'pain', and 'anxiety'
Likewise, in cluster (ii), that 'emotional pain' and 'physical pain' should be the Affect resulting from Agents such as 'things', 'states' and 'abstract states of affairs' is intuitively sound. These two kinds of Agent and Affect represent two of the central meanings of *bother*. These constructions and semantic features were amongst the most common in the sample.

(9) a. my confidence aint exactly full.. but i stil have the courage 2 go on stage and dance cz i said 2 alison i would. But then tht lot.. had 2 go and shout stuff while i wis on stage.. i really wanted 2 walk off but cz of alison i didnt.. they can get 2 fuk.. im not gona let it *bother* me.. thrs 2 many otha things on my mind wifout tht lot anol!! (Agentive Frame Cx, 'abstract state of affairs', & 'anxiety')

b. Rob is all stressy coz he has this red rash bloody thing on his face n dnt want lauren 2 c him :P awwww..he dnt reilise tht she loves him sooo much it dnt *bother* her wot is on his face lol :) (Agentive Frame Cx, 'concrete thing', & 'anxiety')

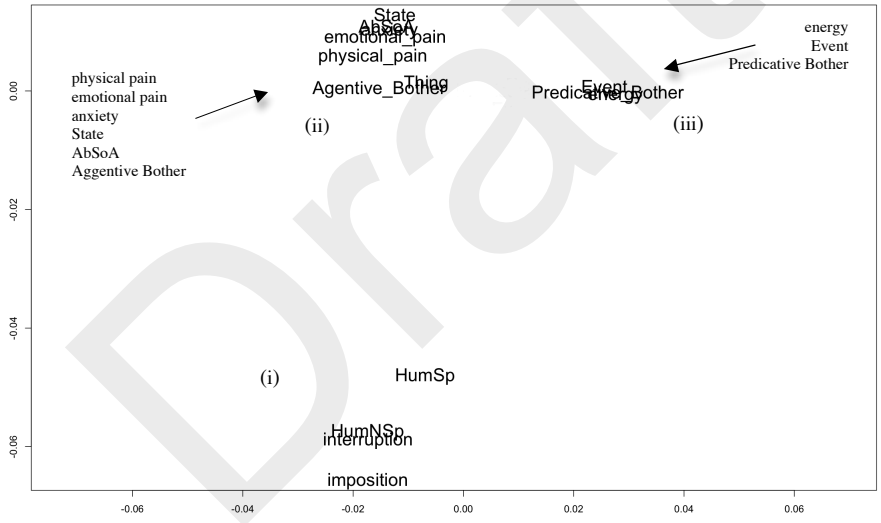

Figure 2. Correspondence Analysis – Construction, Affect and Agent

(iii) Predicative Frame Cxs – 'events' and 'energy'
Lastly, we learn that people use the word *bother* combined with a Predicative Frame Construction when talking about the use of energy that results from having to do some 'event'. For example:

(10) i might be going to blackpool for the weekend i dont know i dont really do anything on my birthday because its just nothing if you think about it because what you get a few gifts and then your just a day older than you were the day before that so why do they *bother* with birthdays?

The two Correspondence Analyses presented here are only a sample of a wider range of analyses that were performed. They have focused on two of the semantic factors under investigation. There is a much wider range of features, semantic and otherwise, that are informative here. However, for practical reasons, we restrict the study to just these dimensions. These two factors alone, combined with a coarse-grained level of constructional analysis have produced three clusters of form-meaning features that could be argued to represent lexical senses. Importantly, these senses are associated with certain syntactic patterns. Results such as these underline the fact that lexical senses are not discreet, but continuous and multidimensional. Furthermore, they are often drawn towards certain formal variants of a word's use and should not be seen as pockets of meaning inside words waiting to be activated by situation–context. In Cognitive Linguistics, we have dismantled the syntax–lexicon distinction for good reason - the meaning of words is wrapped up with the semantics of grammatical variation.

4.1.3. Hypothesis

These exploratory analyses have given us a clear and testable hypothesis. The Correspondence Analyses revealed a semantically motivated distinction between two sets of syntactic patterns, licensed by the verb *bother*. We have termed these patterns Agentive and Predicative Constructions. Confirmatory statistics can help here in three ways. Firstly, it can corroborate the findings of the Correspondence Analyses. Secondly, it can give us a probability score that our findings are not chance. In other words, if we were to repeat this analysis another 100 or 1,000 times, it can tell us what are the chances that we would obtain similar results. Thirdly, it will offer us information on how explanatorily powerful our analysis is. That is, quantitatively, how often can we predict the usage, or speaker's choice, of the construction–verb pairing, given our factors of analysis and their application to the data?

4.2. Confirmatory statistics – Logistic Regression Analysis

Unlike Correspondence Analysis, regression modelling is a confirmatory technique. Since confirmatory modelling gives probability scores and also calculates the explanatory power of the model, it is more complicated than exploratory techniques such as Correspondence Analysis or Hierarchical Cluster Analysis. This is because one must test the model for a range of possible problems, all of which or a combination of which may lead to false predictions of probability or a misleadingly good (or bad) interpretation of the accuracy of the linguistic analysis.

The principle of a Logistic Regression Analysis is quite simple. Given a binary response variable, such as the speaker's choice of a Predicative Frame Construction over an Agentive Frame Construction, the model calculates how accurately one may 'predict' that choice, with the given linguistic analysis of the data. Accordingly, the model is made up of predictor factors, each of which offers information to help the model accurately predict the outcome. In simpler terms, imagine having a list of examples and your analysis, then hiding whether the example is Agentive or Predicative. With this hidden, try to guess, based on the feature analysis of the examples, whether it is Agentive or Predicative. How often you get the answer correct is the explanatory power of the model. Obviously, if one can accurately predict the speaker's choice in such a situation, one has analysed the data accurately and sufficiently.

We saw in the Correspondence Analyses that both the semantic factors of Affect and Agent were important in understanding the difference between the Predicative and Agentive Constructions. We cannot use the Cause factors to distinguish between Predicative and Agentive because all examples of Predicatives were either 'specified human' or 'non-specified human'. The one-to-one correlation here is obviously unhelpful in multifactorial modelling. This factor is insightful solely for the Agentive Constructions. For reasons of brevity, we will not consider the results of those analyses. Another Correspondence Analysis, not presented, revealed that the other highly subjective factor, Theme (Topic of Discourse), also interacts in informative ways with both the semantics and the constructions. We will include this factor in the regression modelling.

Several models are run with variation combinations of these semantic factors as well as other factors, such as the presence of humour, the regional variation and certain formal factors, such as tense, aspect, and mood. After comparing a range of models, the most significant and explanatory

ones are selected.[5] Although a combination of Affect and Agent was the most powerful, multicollinearity was identified between the two factors. Multicollinearity is a serious problem for Logistic Regression and occurs when 2 or more of the factors are too highly correlated, that is, they predict in too similar a way. This exaggerates the accuracy of the model and may lead to false predictions. Of the two remaining models, Affect and Theme or Agent and Theme, Agent proved to be a better predictor than Affect. The analysis was performed in R and the model is presented below:

```
Binomial Logistic Regression
Construction ~ Theme + Agent

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.9986  -0.6330   0.2825   0.6712   2.0376

Coefficients:
                      Estimate Std. Error z value Pr(>|z|)
(Intercept)           0.319657   0.384230   0.832 0.405442
Theme_Family         -2.535217   0.699139  -3.626 0.000288 ***
Theme_Health        -17.879458 522.211504  -0.034 0.972687
Theme_Pers_Entertain -2.059555   0.727649  -2.830 0.004649 **
Theme_Pers_Misc      -1.825373   0.380873  -4.793 1.65e-06 ***
Theme_Pub_Entertain  -1.984569   0.635572  -3.122 0.001793 **
Theme_Religion       -2.261638   0.569255  -3.973 7.10e-05 ***
Theme_Soc_Misc       -1.946970   0.551445  -3.531 0.000415 ***
Theme_Uni-School     -1.349863   0.638618  -2.114 0.034539 *
Agent_Event           2.881617   0.259185  11.118  < 2e-16 ***
Agent_HumNSp          0.006164   0.705198   0.009 0.993026
Agent_HumSp           1.262592   0.421347   2.997 0.002730 **
Agent_State           0.504517   0.403608   1.250 0.211293
Agent_Thing           1.018456   0.371297   2.743 0.006089 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

    Null deviance: 866.28  on 627  degrees of freedom
Residual deviance: 586.06  on 614  degrees of freedom
AIC: 614.06
Number of Fisher Scoring iterations: 15

Summary of Model      Preditive Power of Model
Model L.R.: 280.22    Pseudo R2:      0.481 (0.468 penalised)
D.f: 13               C:              0.844 (0.843 penalised)
P: 0                  Somers' Dxy:    0.687 (0.687 penalised)
```

Adding interactions between the predictors did not improve the model; changing the order in which the levels were introduced did not affect the results in a considerable way, and comparing the AICs did not suggest that a stepwise regression improved the model. In case of possible over-fitting in the model, a Penalised Maximum Likelihood measure was determined and added. This simply adds a penalty factor to the estimations.

Before we interpret the results, let us consider the accuracy of the overall model. Beneath the table of coefficients and degrees of freedom, we have a small list of figures. We want to know what proportion of the variance the model explains and how well it can predict the outcome as either Agentive or Predicative. The Nagelkerke Pseudo R^2 is calculated from log-likelihood ratios. Any figure above 0.3 is sign of a predictive model. However, a true R^2 calculation is not possible for Logistic Regression and many scholars consider this an unreliable score save when one is comparing different models. It was one of the key factors in choosing this model over the Theme and Affect model. The C-score is perhaps the most important here and is an index of the correlation between predicted probability of expected response and actual response. For the C-score, 0.5 is pure chance, 1 is perfect. Any value over 0.8 is an explanatory result. The score at C-0.844 is a strong result. The D_{xy} is another way of measuring C, based on a rank correlation of probabilities and responses. For this score, 0 is randomness and 1 is perfect prediction. Our score of 0.687 also represents a strong result.

The model was checked for issues of multicollinearity. The variance inflation factors were calculated and no problems were found. Only the level 'ThemePers_Misc' revealed a figure of any consequence (3.056959). This is, however, still well beneath the most conservative figures for multicollinearity. Over-dispersion does not appear to be a serious problem - residual Deviance and Degrees of Freedom are relatively close, and a *Chi-square* confirms the two figures are not significantly different (586.06 on 614, *p* - 0.7854219 *Chi-square*).

Having established that the model is statistically significant, explanatorily powerful, and will not produce false predictions, we can interpret the results. The column on the left is a list of the different linguistic features, belonging to the two factors, Agent and Theme, that go into the model and predict the outcome of an example as Predicative or Agentive. On the far right, there is a list of probability scores. These rate statistical significance and should not be confused with explanatory importance. They should be read as typical *p*-values. The stars are there to facilitate quick reference. Once we have identified which of the levels, or linguistic features, are significant, we may look at the estimates of the coefficients. This is the list of figures on the left, where each coefficient is accompanied by its estimated standard error and a Wald *z*-value. In the first list, a negative number predicts for one outcome and a positive coefficient predicts for the other. In our case, a positive figure means that it is contributing to the prediction of a Predicative Construction, and a negative, to an Agentive Construction. For

these scores, the greater or smaller the number, the more important this feature is in predicting the outcome.

Remembering that a positive figure predicts for Predictive Constructions, let us consider the list of coefficients. Agent 'event' is clearly the most important. This confirms the high association seen in the Correspondence Analysis. The Agents 'Specified Human' and 'Thing' are also important predictors of the Predicative Construction. For the Theme features, we see that the coefficients are negative numbers, which means they contribute to predicting an Agentive Frame Construction outcome. The first level, or linguistic feature, i.e., Theme 'Cyber Society', is not listed because the other levels are calculated relative to this. All of the listed features are significant, save Theme 'health'. As a rule, any figure higher or lower than +/-1 is a relatively important predictor. Since all of the significant Themes are approximately -2, we can suppose that each is a reasonably strong indicator of the Agentive Construction.

This section has shown how confirmatory techniques, based entirely on highly subjective annotation, not only produce coherent results but results that can accurately predict the data. With the use of just these two factors, we are able to accurately predict whether an example will be Predicative or Agentive for more than two thirds of the examples. This, in turn, confirms which semantic features are typical of which constructions.

4.3. Summary

This short study has proposed an, albeit incomplete, semasiological map of the verb *bother*. It must be remembered that 'bother' is an emotion concept and so identifying, and indeed predicting, in what situations the term is used puts subjective analysis to the test. The results above come from an operationalised, verified, and statistically confirmed treatment of an extremely subjective object.

Relative to three constructions, and with the caveat that these are tendencies in usage, both semantically and as form–meaning pairings, we can propose three senses of *to bother*.

Sense 1 – Pain

Affect: The experiencer feels hurt by physical pain through emotional pain to general psychological stress

Agent: Friends and family and other known individuals, states and abstract states of affairs

Form: This use is associated with the Agentive Frame and Direct Transitive Construction

Sense 2 – Annoyance

Affect: The experiencer feels imposed upon or prevented from doing what he or she wishes to do

Agent: People, especially people that the experiencer does not personally know

Form: This use is associated with the Agentive Frame and Oblique Transitive Construction

Sense 3 – Hassle

Affect: The experiencer feels put out by the need to do something that involves the use of energy

Agent: Events, basically 'having to do things'

Form: This use is associated with a cluster of constructions where the Agent and the Patient are encoded by the same actor, termed, in this study, Predicative Constructions

Confirmatory analysis, at a more coarse-grain level, proved that the difference between the Agentive (Pain and Annoyance) uses and the Predicative use was statistically significant. It showed that the factors of Agent and Thematic Topic of Discourse were the two crucial in features in distinguishing their use, or 'meaning'.

4.4. Theoretical implications

More generally, these findings have two important implications for polysemy research:

– *No discreet senses*. Similar semantic features group together, suggesting "senses" of the lexeme, but without discreet differences

– *No pure semasiology*. These sense groupings were associated with certain formal variants of the same word, creating a small onomasiological field 'within' the lexeme

Firstly, the different senses identified represent tendencies, not discreet categories. Lakoff (1987: case study 2) assumes distinct lexical senses and Langacker (1994) overtly argues that senses, like linguistic forms, are necessarily discreet. The results here suggest that such positions are erroneous. They further supports Geeraerts (1993) who has theoretically shown that a reified understanding of meaning is merely a result of the Structuralist framework.

Secondly, we saw how the tendencies towards different uses, or lexical senses, were associated with different formal variants of the lexeme. Again, this should come as no surprise for Cognitivists, who assume that variation in form is motivated by variation in meaning. However, it is interesting to note that despite this, most cognitive studies of lexical meaning remain at a very coarse level of analysis of either the lemma or the word. The results here support Newman (2008; this vol.) and Glynn (2009, 2010), arguing that the semasiological – onomasiological distinction is not theoretically tenable and that more fine-grained formal variation must be included in semasiological study. This runs contrary to Geeraerts *et al.* (1994) and Geeraerts (2006) who argue this distinction is fundamental. The results here suggest that a continuum of granularity exists between the study of semasiology (uses of a single form) and onomasiology (the choice between forms). This is because, at some fine-grained level (in constructional, morphological, or prosodic variation), there is always a choice between forms and this choice in form, to some extent, relates to semantic variation.

5. Conclusion

This study has shown that even highly subjective semantic categories such as the emotional state experienced by a Patient, the Cause of that Affect, and the Theme of discourse can be operationalised in manual annotation. Three methodological steps permit sound and meaningful results from even highly subjective analysis in corpus linguistics.

- Operationalisation
- Inter-Coder Verification
- Confirmatory Statistics

Although these steps do not offer objectivity, they afford a means for verification and facilitate the empirical cycle of proposing hypotheses and testing them. Step one allows other research to check and improve upon exist-

ing analyses; step two increases accuracy; step three offers statistical significance and a measure of explanatory power. Although statistics does not verify the semantic analysis *per se*, if the analysis was unduly inaccurate, the modelling would not produce coherent results. In brief, this final step gives us a way of testing a hypothesis. Since, in Cognitive Linguistics and in corpus linguistics, we have no grammatical rules or propositional semantics, we cannot use negative evidence to disprove our proposals about how language works. This does not mean we should not propose hypotheses. On the contrary, it makes it all the more important that we are explicit about such things. Statistical significance and the explanatory power of multivariate models are important means for testing those hypotheses.

The study has not attempted to cover the semantic variation of the verb entirely and it has only included the bare minimum of formal variation. Moreover, it has excluded most of the sociolinguistic dimensions that need to be included in such research. Tummers *et al.* (2005), Grondelaers *et al.* (2007, 2008), Glynn (2009, submitted), and Geeraerts & Speelman (2010) are examples of how such an approach integrates with sociolinguistic parameters of language. The method employed in this study directly meets such research and integrating such extralinguistic variables is straightforward.

Importantly, the results here further confirm two theoretical positions. Firstly, it was shown that meaning should not be treated as reified senses, rather as emergent and multidimensional. This supports positions forwarded by Geeraerts (1993) and Kilgarriff (1997). Secondly, we saw further evidence that the semasiological – onomasiological distinction needs to be placed on a continuum of granularity. Highly schematic studies can work with formal distinctions at the level of words, morphemes, and constructions, but as a study considers more fine-grained semantic structure, it needs to include other formal variation. Any variation in person, number, tense, aspect, syntax, mood, prosody and so forth, represents semantic variation. One can never be sure the meaning identified for a given lexeme does not change in a different grammatical construction, tense or voice. Therefore, just as formal types of structure fall on a continuum from lexis to syntax, so too must the semasiological – onomasiological division. These results confirm the position of Newman (2008; this vol.) and Glynn (2009, 2010).

To summarise, the strong tendency for corpus-driven research to be shy of purely semantic analysis is, in itself, a good tendency. Interest in the method is largely motivated by a desire to move away from introspective

methodology. However, as the method matures and as Cognitive Linguistics adopts it, we should be careful not to think that linguistics will ever be a purely objective science. Linguistics is a social science and the difficulty of our object of study is precisely its human element. As Cognitive Linguists, we believe that language is semantically motivated, and as such, at some stage, we will have to apply these techniques to semantics. The study has shown, in a small way, why we should think that this will be possible. Knowing this, Cognitive Semantics in its study of highly abstract grammatical semantics, cognitive models, and metaphors should consider adopting quantitative corpus-driven methods.

Notes

1. This research was completed with a grant from the University of Leuven. I would like to thank the entire QLVL team at the University of Leuven for their help. I would also like to thank B. Holmquist, K. Krawczak, and J. van de Weijer for their help. Oversights, omissions, and errors are entirely my own.
2. The corpus is based on the LiveJournal personal diary service. The data were extracted with their permission and the corpus compiled by D. Speelman at the QLVL research unit, the University of Leuven.
3. Correspondence Analysis has enjoyed less popularity within the cognitive community than other exploratory techniques. Szelid & Geeraerts (2008) and Glynn (2009; 2010) are examples of its application. Glynn (in press) offers a summary of the techniques and a tutorial on how it is used.
4. Within Cognitive Linguistics, there exists a strong tradition of using Logistic Regression Analysis. Examples include Heylen (2005), Bresnan *et al*. (2007), Grondelaers *et al.* (2008), Diessel (2008), Speelman & Geeraerts (2010), Speelman *et al.* (2010) and, Szmrecsanyi (2010). Speelman (in press) offers an explanation of its use. Several other studies employing the technique are included in Glynn & Robinson (in press).
5. See Bayaan (2008), Speelman (in press) for an explanation on the tests for the validity of a Logistic Regression model.

References

Baayen, R. Harald
2008 *Analyzing Linguistic Data: A practical introduction to statistics using R*. Cambridge: Cambridge University Press.

Bresnan, Joan, Anna Cueni, Tatiana Nikitina and Harald Baayen
2007 Predicting the Dative alternation. In *Cognitive Foundations of Interpretation*, Gosse Bouma, Irene Kraemer and Joost Zwarts (eds.), 69–94. Amsterdam: Royal Netherlands Academy of Science.

Divjak, Dagmar
2006 Delineating and structuring near-synonyms. In *Corpora in Cognitive Linguistics. Corpus-based approaches to syntax and lexis*, Stefan Gries and Anatol Stefanowitsch (eds.), 19-56. Berlin / New York: Mouton de Gruyter.

Diessel, Holger
2008 Iconicity of sequence. A corpus-based analysis of the positioning of temporal adverbial clauses in English. *Cognitive Linguistics* 19: 457–482.

Geeraerts, Dirk
1993 Vagueness's puzzles, polysemy's vagaries. *Cognitive Linguistics* 4: 223-272.
2006 *Words and Other Wonders: Papers on lexical and semantic topics.* Berlin / New York: Mouton de Gruyter.
2007 Contextualisation and methodology: 30 years of Cognitive Linguistics, Plenary Lecture, 10th International Cognitive Linguistics Conference, Kraków.
2010 Recontextualizing grammar: Underlying trends in thirty years of Cognitive Linguistics. In *Cognitive Linguistics in Action: From theory to application and back*, Elżbieta Tabakowska, Micha Choinski and Łukasz Wiraszka (eds.), 71–102. Berlin / New York: Mouton de Gruyter.
this vol. The doctor and the semantician.

Geeraerts, Dirk, Stefan Grondelaers and Peter Bakema
1994 *The Structure of Lexical Variation. Meaning, naming, and context.* Berlin / New York: Mouton de Gruyter.

Glynn, Dylan
2009 Polysemy, Syntax, and Variation. A usage-based method for Cognitive Semantics. In *New Directions in Cognitive Linguistics*, Vyvyan Evans and Stephanie Pourcel (eds.), 77-106. Amsterdam / Philadelphia: John Benjamins.
2010 Synonymy, lexical fields, and grammatical constructions. A study in usage-based Cognitive Semantics. In *Cognitive Foundations of Lin-*

guistic Usage-Patterns, Hans-Jörg Schmid and Susanne Handl (eds.), 89-118. Berlin / New York: Mouton de Gruyter.

in press Multiple Correspondence Analysis. Exploring correlations in multifactorial data. In *Polysemy and Synonymy. Corpus methods and applications in Cognitive Linguistics*, Dylan Glynn and Justyna Robinson (eds.). Amsterdam / Philadelphia: John Benjamins.

submitted Semantics of sociolinguistic variation. A quantitative study of dialect effects on polysemy. *Annual Review of Cognitive Linguistics.*

Glynn, Dylan and Justyna Robinson (eds.)

in press *Polysemy and Synonymy. Corpus methods and applications in Cognitive Linguistics*. Amsterdam / Philadelphia: John Benjamins.

Gries, Stefan and Anatol Stefanowitsch

2004 Extending collostructional analysis: a corpus-based perspective on 'alternations'. *International Journal of Corpus Linguistics* 9: 97-129.

Gries, Stefan

2006 Corpus-based methods and Cognitive Semantics: The many meanings of *to run*. In *Corpora in Cognitive Linguistics. Corpus-based approaches to syntax and lexis*, Stefan Th. Gries and Anatol Stefanowitsch (eds.), 57-99. Berlin / New York: Mouton de Gruyter.

Grondelaers, Stefan and Dirk Speelman

2007 A variationist account of constituent ordering in presentative sentences in Belgian Dutch. *Corpus Linguistics and Linguistic Theory* 3: 161-194.

Grondelaers, Stefan, Dirk Geeraerts and Dirk Speelman

2007 A case for a cognitive corpus Linguistics. In *Methods in Cognitive Linguistics*, Monica Gonzalez-Marquez, Irene Mittelberg, Seana Coulson and Michael J. Spivey (eds.), 149-169. Amsterdam / Philadelphia: John Benjamins.

Grondelaers, Stefan, Dirk Speelman and Dirk Geeraerts

2008 National variation in the use of *er* "there". Regional and diachronic constraints on cognitive explanations. In *Cognitive Sociolinguistics: Language variation, cultural models, social systems*, Gitte Kristiansen and Rene Dirven (eds.), 153-204. Berlin / New York: Mouton de Gruyter.

Heylen, Kris

2005 A quantitative corpus study of German word order variation. In *Linguistic Evidence: Empirical, theoretical and computational perspectives*, Stephan Kepser and Marga Reis (eds.), 241-264. Berlin / New York: Mouton de Gruyter.

Hilpert, Martin
2006 Distinctive collexeme analysis and diachrony. *Corpus Linguistics and Linguistic Theory* 2: 243-57.
2009 The German *mit*-predicative construction. *Constructions and Frames* 1: 29-55.
Kilgariff, Adam
1997 I don't believe in word senses. *Computers and the Humanities* 32: 91-113.
Kövecses, Zoltán
1986 *Metaphors of Anger, Pride, and Love. A lexical approach to the structure of concepts*. Amsterdam / Philadelphia: John Benjamins.
Lakoff, George
1987 *Women, Fire, and Dangerous Things. What categories reveal about the mind*. London: University of Chicago Press.
Langacker, Ronald
1994 The limits of continuity: Discreetness in Cognitive Semantics. In *Continuity in Linguistic Semantics*, Catherine Fuchs and Bénard Victorri (eds.), 9-21. Amsterdam / Philadelphia: John Benjamins.
Newman, John
2008 Aiming low in linguistics: Low-level generalizations in corpus-based research. *Proceedings of the 11th International Symposium on Chinese Languages and Linguistics*, National Chiao Tung University, Hsinchu, Taiwan. Available from <http://johnnewm.jimdo.com/downloads.php>, accessed 10 January, 2010.
this vol. Balancing acts: Empirical pursuits in Cognitive Linguistics.
Peirsman, Yves, Kris Heylen and Dirk Geeraerts
2010 Applying word space models to sociolinguistics. In *Advances in Cognitive Sociolinguistics*, Dirk Geeraerts, Gitte Kristiansen and Yves Peirsman (eds.), 111-138. Berlin / New York: Mouton de Gruyter.
Sandra, Dominiek and Sally Rice
1995 Network analyses of prepositional meaning: Mirroring whose mind - the linguist's or the language user's? *Cognitive Linguistics* 6: 89-130.
Schmid, Hans-Jörg
2000 *English Abstract Nouns as Conceptual Shells. From corpus to cognition*. Berlin / New York: Mouton de Gruyter.
Speelman, Dirk and Dirk Geeraerts
2010 Causes for causatives: The case of Dutch 'doen' and 'laten'. *Causal Categories in Discourse and Cognition*, Ted Sanders and Eve Sweetser (eds.), 173-204. Cambridge: Cambridge University Press.

Speelman, Dirk, José Tummers and Dirk Geeraerts
2010 Lexical patterning in a Construction Grammar: The effect of lexical co-occurrence patterns on the inflectional variation in Dutch attributive adjectives. *Constructions and Frames* 1: 87-118.

Speelman, Dirk
in press Modeling near-synonymy with logistic regression. In *Polysemy and Synonymy. Corpus methods and applications in Cognitive Linguistics*, Dylan Glynn and Justyna Robinson (eds.). Amsterdam / Philadelphia: John Benjamins.

Stefanowitsch, Anatol and Stefan Th. Gries
2003 Collostructions: Investigating the interaction between words and constructions. *International Journal of Corpus Linguistics* 8: 209-43.
this vol. Empirical Cognitive Semantics: Some thoughts.

Szelid, Veronika and Dirk Geeraerts
2008 Usage-based dialectology: Emotion concepts in the Southern Csango dialect. *Annual Review of Cognitive Linguistics* 6: 23–49.

Szmrecsanyi, Benedikt
2003 BE GOING TO versus WILL/SHALL: Does syntax matter? *Journal of English Linguistics* 31: 295-323.
2010 The English genitive alternation in a cognitive sociolinguistics perspective. In *Advances in Cognitive Sociolinguistics*, Dirk Geeraerts, Gitte Kristiansen and Yves Peirsman (eds.), 139-166. Berlin / New York: Mouton de Gruyter.

Talmy, Leonard
2007 Introspection as a methodology in linguistics. Plenary Lecture, 10th International Cognitive Linguistics Conference, July 2007, Kraków.
2008 Foreword. In *Methods in Cognitive Linguistics*, Monica Gonzalez-Marquez, Irene Mittelberg, Seana Coulson and Michael J. Spivey (eds.), xxi – xxi. Amsterdam / Philadelphia: John Benjamins.

Tummers, José, Dirk Speelman and Dirk Geeraerts
2005 Inflectional variation in Belgian and Netherlandic Dutch: A usage-based account of the adjectival inflection. In *Perspectives on Variation. Sociolinguistic, historical, comparative*, Nicole Delbecque, Johan van der Auwera and Dirk Geeraerts (eds.), 93-110. Berlin / New York: Mouton de Gruyter.

Wierzbicka, Anna
1995 Adjectives vs. verbs: The iconicity of part-of-speech membership. In *Syntactic Iconicity and Linguistic Freezes. The human dimension*, Marge Landsberg (ed.), 223-246. Berlin / New York: Mouton de Gruyter.

Wulff, Stefanie, Anatol Stefanowitsch and Stefan Th.Gries
2007 Brutal Brits and persuasive Americans: Variety-specific meaning construction in the into-causative. In *Aspects of Meaning Construction*, Günter Radden, Klaus-Michael Köpcke, Thomas Berg and Peter Siemund (eds.), 265-281. Amsterdam / Philadelphia: John Benjamins.

Zeschel, Arne
this vol. Exemplars and analogy: Semantic extension in constructional networks.

Glynn, D. 2010. Testing the Hypothesis. Objectivity and Verification in Usage-Based Cognitive Semantics. *Corpus-Driven Cognitive Semantics. Quantitaive approaches*. D. Glynn & K. Fischer (eds.), 239-270. Berlin: Mouton de Gruyter.