

Learning Discourse Profile Constructions: Implications for a Usage-Based Grammar



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1. Discourse Profile Constructions

- Wittgenstein (1953): for many cases, “the meaning of a word is its use in language.”
- However, the use from which the meanings of morphemes, words, or constructions emerge is a fluid, ill-defined concept.
- Different approaches under the overarching umbrella of Usage-Based linguistics suggest different accounts of this notion.
- Dattner (2015) showed that the use from which the meanings of the Hebrew dative emerge can be conceptualized as a **Discourse Profile Construction**: emergent form-function conventional correlations which are defined by different clusters of formal and functional information.
- Discourse Profile Constructions include information from multiple sources, such as event types, participant roles, affectedness, and subjectivity.
- The concept is built on a multivariate statistical corpus analysis (Multiple Correspondence Analysis, and Hierarchical Clustering on Principal Components) of 10,000 Hebrew sentences that contain a dative pronoun.
- Dattner (2015) concluded that traditional analyses of dative roles are not reflected in usage, to the extent that there are different traditionally-defined roles that show no difference in terms of their usage pattern. That is, from a usage-based perspective, it is not the fine-grained differences between very similar semantic roles which is important for interpretation, but rather the Discourse Profile Construction the token resembles.
- For example, the following sentence contains non-lexical datives which, considering a lexical/syntactic approach, should pose a problem for interpretation:

(1) merkaz ha-mexkar hexin **lanu** niyar emda
center the-research prepared **dat.us** paper position
‘The research center prepared **us** a position paper.’
- The Discourse Profile Constructions approach: what guides the interpretation of the dative in (1) is its Discourse Profile Construction.
- This sentence shares a multifactorial usage pattern with other tokens of the language.
- The Discourse Profile Construction this sentence belongs to is the Extended Transitive Discourse Profile Construction, which emerges out of a set of utterances that are characterized as having a transitive predicate that belongs to a specific class of verbs, a realis mode, a three participant event in which the affected participant is highly affected and the affecting participant has high agentivity and volition.
- That is, it is a non-subjective clause with high transitivity, that construes a relation between a two participant event and a third participant.
- Figure 1 presents the first two dimensions of a Multiple Correspondence Analysis map, and the result of a Hierarchical Clustering on Principal Components process: The 9,694 dative tokens in the map are colored according to the cluster they belong to.
- Dattner (2015) shows that each such cluster of tokens sharing a usage pattern can be treated as a Discourse Profile Construction.

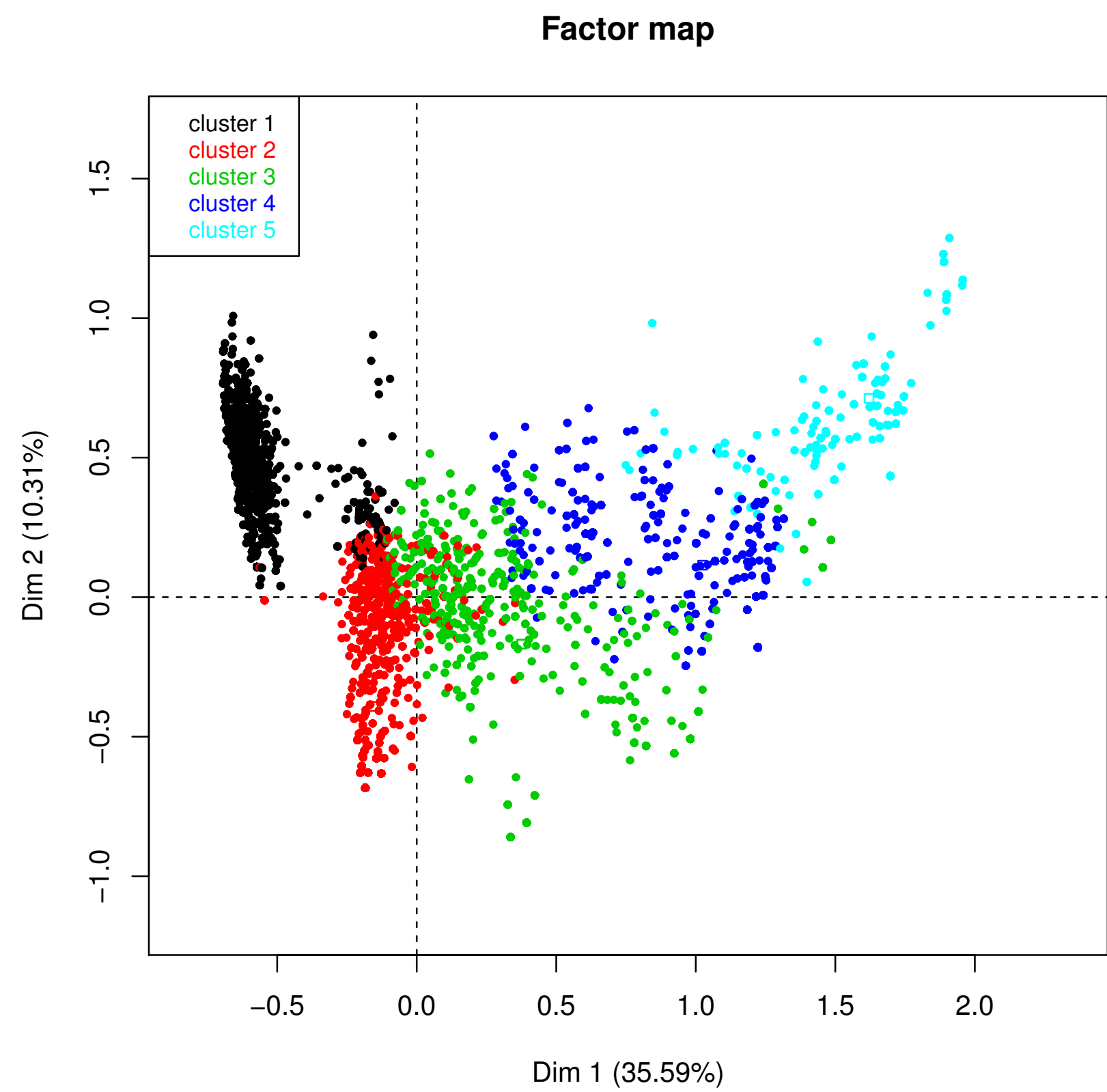


Figure 1: First two dimensions of the Multiple Correspondence Analysis, tokens colored according to the Hierarchical Clustering on Principal Components

2. Naive Discriminative Learning

- Dattner’s (2015) findings are grounded on frequent associations and co-occurrences, and are conceptualized within a framework that seeks abstract organizing principles and rules of association.
- Frequency, however, is not the only power that drives learning (Baayen et al. 2016).
- Baayen et al. (2016) show that it is discrimination, rather than mere frequency, that guides learning.
- The Discourse Profile Constructions presented in Dattner (2015) can thus be seen as the ever-changing result of a process of implicitly learning the weights of different features with respect to the use of the Hebrew dative.
- In such a process speakers learn how different clusters of formal and functional parameters (i.e., Discourse Profile Constructions) discriminate one experience of the world from others.
- While Dattner’s (2015) Discourse Profile Constructions are descriptively adequate, they do not provide psychologically real explanation regarding grammatical knowledge and learning.
- Here comes **Naive Discriminative Learning**.
- Naive Discriminative Learning is a computational modeling framework based on principles of human learning, unique in offering a direct mapping of form onto meaning, that has been shown to perform well in simulations of human processing (Baayen, 2010; 2011, Ramscar and Baayen, 2013).
- The Naive Discriminative Learning model assumes that learning to productively use language is an error-driven associative learning process, which is sensitive to the informativity of co-occurrences, rather than to their mere occurrence, thus going beyond frequency-based explanations and building on concrete experiences of associations between cues and outcomes.
- In order to test the hypothesis that Discourse Profile Constructions can be seen as the result of a discriminative learning process, I used Naive Discriminative Learning to model the form-function links represented as Discourse Profile Constructions.

3. Learning Discourse Profile Constructions

- Method:**
- Following Baayen (2011), I used the Danks’s (2003) equilibrium equations for the Rescorla-Wagner equations.
 - Thus I defined the association strengths (weights) from cues to outcomes for the situation in which these strengths no longer change (that is, the adult state).
 - The cues of the current model are partially abstract: the four lexical categories that constitute the formal structure of the token (main verbs are represented by their verbal paradigm, the *binyan*).
 - The outcomes of the current model are the five Discourse Profile Constructions defined in Dattner (2015).
 - Note that the formal categories used as cues in the present model were not used in the clustering process leading to the definition of Discourse Profile Constructions (except for the verbal paradigm, the *binyan*).
 - Table 1 exemplifies six tokens; their cues and their outcomes:

Frequency	Cues	Outcomes
1	CuesKAL.DatNP.NP.V	2
1	CuesADJ.DatNP.CL	4
1	CuesNP.HIFIL.DatNP.NP	1
1	CuesNP.KAL.DatNP	3
1	CuesADJ.DatNP.NP	4
1	CuesNP.HIFIL.DatNP.CL	2

Table 1: Cues and Outcomes of the Naive Discriminative Learning model: six tokens

- Results:**
- Model accuracy: 0.9497627
 - 10-fold cross-validation mean accuracy: 0.9498969
 - Table 2 shows a crosstabulation of observed and predicted values:

	1	2	3	4	5
1	2729.00	133.00	2.00	6.00	0.00
2	16.00	4096.00	12.00	3.00	0.00
3	1.00	245.00	847.00	3.00	4.00
4	0.00	0.00	38.00	1103.00	0.00
5	0.00	0.00	10.00	14.00	432.00

Table 2: crosstabulation of observed and predicted values

- Figure 2 shows permutation accuracy importance: reduction in accuracy for predicting the Discourse Profile Construction when a predictor is randomly permuted.
- The fourth word in the construction is marked as most important by the Naive Discriminative Learning model.

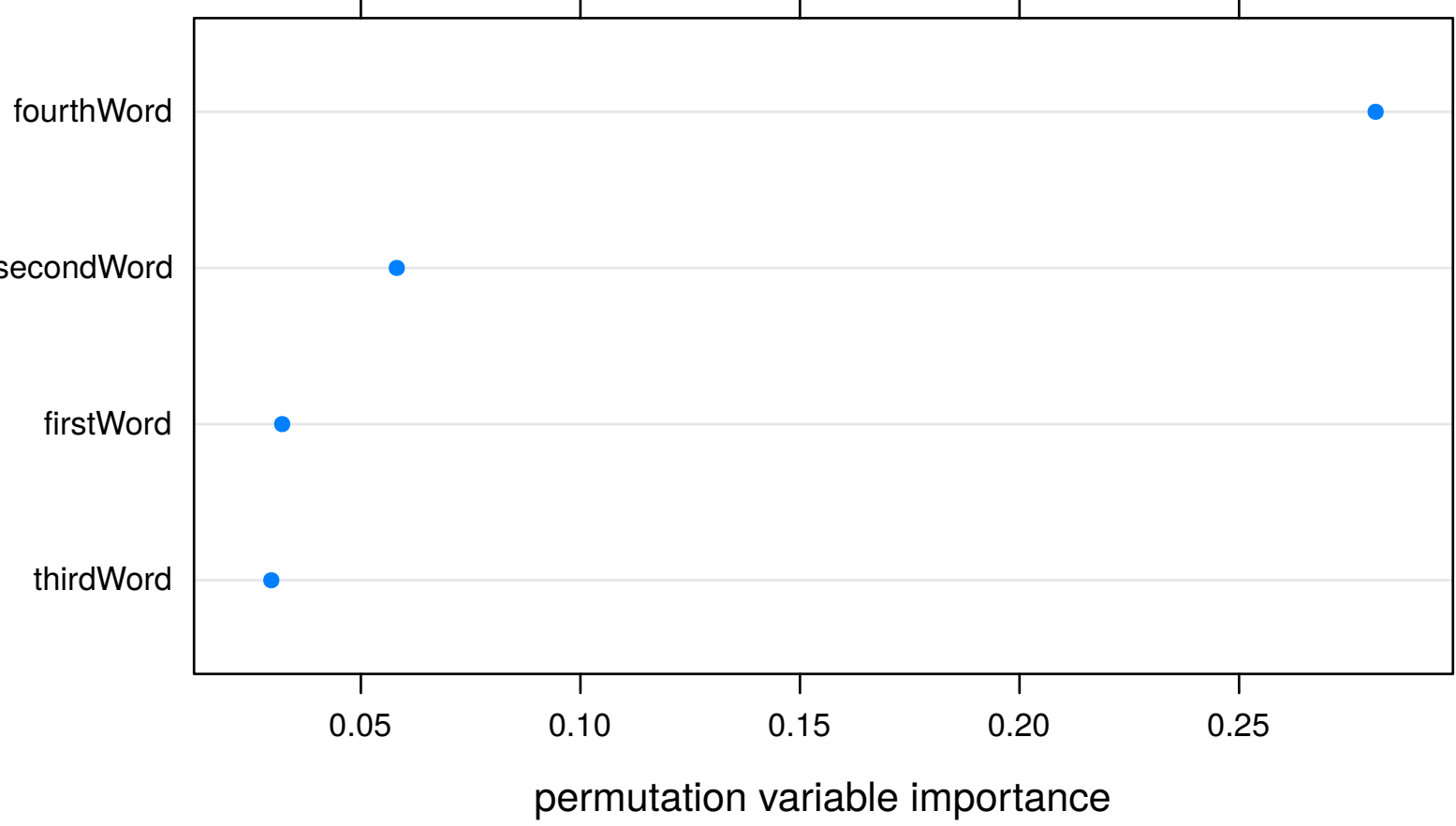


Figure 2: Permutation accuracy importance

- This can explain the difference in interpretation of the two datives in (2).
 - Both follow the same verb, but the first is incorporated in a *fourth word* = *V.inf* construction, while the second is in a *fourth word* = *NP* construction.
- (2) tnu **lanu** beynataym latet **lahem** darga zmanit.
give **to.us** meanwhile to.give **to.them** position temporary.
‘For now, **let us** give them a temporary position’ (Lit. give to us to give to them).

4. Conclusions and implications for a Usage-Based Grammar

- The present research adopts the hypothesis presented above and the discriminative motivated learning model, and further examines the Discourse Profile Constructions presented in Dattner (2015) from a learning approach, to show that the concept of Discourse Profile Constructions may aid in learning the associations between form and meaning.
- I show that by assuming grammatical knowledge to consists of Discourse Profile Constructions, rather than abstract syntactic rules, a psychologically motivated statistical learning algorithms can learn the association between concrete formal parameters and different construals of the world, in terms of event types, participant roles, affectedness, and subjectivity (all included in Dattner’s (2015) Discourse Profile Constructions).
- This implies that a Usage-Based grammar should take into account the concrete, multifactorial, multilayered concept of Discourse Profile Construction as its core form-function correlation, rather than concepts that consider abstract levels of the language in isolation.

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