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From patterns to meaning
Meaning Constitution as contextual activation in vector space
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English Summary

The subject of this thesis is a computational linguistic model of Meaning Constitution in linguistic units. Taking the phenomenon of variability of linguistic meaning as its starting point, Meaning Constitution is described as an information-processing step, which is then implemented and empirically tested in a series of linguistic experiments. In this thesis, Meaning Constitution is understood as a dynamic process in which the meaning of linguistic units only becomes concrete within local contexts in relation to their general meaning potential. This dynamic concept of meaning is based on a central assumption of Cognitive Semantics, according to which meanings do not exist independently of the context. The motivation for the implementation of a computational linguistic model of its own is the fact that the conception of meaning in Cognitive Semantics itself does not involve such an operationalisation – which, strictly speaking, means that it must be regarded as not falsifiable.

The modelling is carried out against the background of the Distributional Hypothesis according to Zellig Harris. By algorithmically extracting linguistic patterns and their relations in large text corpora, a representation of the meaning potential is made by means of vectors in word space. Based on these, the Meaning Constitution is modelled as an information-processing step, in the course of which a local adaptation of the initial representations takes place. The notion of pattern plays a central role here: Interpreted as patterns of use, it forms the basis both for the representation of the meaning potential and for the actual modelling of the process of Meaning Constitution.

By including the process of Meaning Constitution, an interpretation of the word space is made within this thesis, which deviates from the common structuralistic interpretation. Instead, the patterns of use encoded by the word vectors are transferred into the theoretical framework of Cognitive Semantics. Although the patterns of use are by themselves not suitable for explaining the dynamic conception of meaning of Cognitive Semantics, the patterns of use do also play a decisive role from a cognitive perspective, as they form the starting point for the process of Meaning Constitution. The patterns of use can thus be understood as a building block of semantic memory, on the basis of which the concrete meanings are formed locally. In the model proposed here, the patterns of use are therefore the decisive information carrier and supplier. In other words: when there is no pattern, there is no meaning.

The methodological principle guiding this thesis is an empirical-experimental approach to linguistic problems. The requirements to be considered for scientific experiments – control, reproducibility and variation – are taken into account by means of the software-technological implementation within the Text Engineering Software Laboratory (Tesla, see <http://tesla.spinfo.uni-koeln.de>). Tesla is a linguistic component system developed in the Linguistic Information Processing department at the University of Cologne. In analogy to a scientific laboratory, Tesla offers the possibility to segment and annotate textual data within experimental arrangements and to apply linguistically motivated computational methods. Tesla thus takes on the function of a virtual laboratory, in which the model is tested in a series of virtual experiments in order to draw conclusions about the explicative value of the underlying dynamic concept of meaning.

The main objective of the computational linguistic experiments is to show, by means of exemplary analyses of selected words, how the dynamic concept of meaning of Cognitive Linguistics can be modelled as a contextual activation in vector space via the process of Meaning Constitution. By examining ambiguous linguistic units, it is shown that the constitution of meaning can be understood as a process of the development of complex linguistic patterns. Beyond the experimental testing of the computational model, the connection between pattern formation and meaning constitution becomes the object of the investigation. The central assumption is that meaning can be modelled by a transformation of the extracted patterns of use. This also raises the question of the conditions and possibilities of a purely data-driven approach to the problem of determining meaning; this applies in particular to the question of the suitability of a purely distributional methodology for modelling a dynamic concept of meaning in the sense of the theoretical assumptions of Cognitive Linguistics.

In this thesis, knowledge about linguistic systems is not seen as a prerequisite, but rather as the consequence and result of the systematic analysis. In this context, information-processing systems are a central component of linguistic theory development, insofar as their use makes it possible to make contexts and conditions of use accessible for systematic analysis, independent of the implicit prior knowledge of human agents. Being located between fundamental linguistic research and computational linguistic application, this thesis illustrates the role of computational linguistics in cognitive science, particularly with regard to the modelling of a cognitively motivated theory of meaning: by enabling the simulation of cognitive processes and by providing tools for the empirical-experimental testing of the associated models, computational linguistics itself plays a central role in the formation of linguistic theory. With the formulation of concrete linguistic experiments and by providing the corresponding procedures and results by means of Tesla, the computational linguistic

modelling of Meaning Constitution in the course of this thesis is meant to be a contribution to a better understanding of the semantic dynamics of language.