
FRAME SEMANTICS

Introduction

The term *frame semantics* refers to a wide variety of approaches to the systematic description of natural language meanings. The one common feature of all these approaches – which, however, does not sufficiently distinguish frame semantics from other frameworks of semantic description – is the following slogan due to Charles Fillmore (1977a):

Meanings are relativized to scenes.

According to this slogan meanings have internal structure which is determined relative to a background frame or a scene. The easiest way to understand this thesis is by way of example. The following one is from Fillmore (1977c):

Suppose that two identical twins Mark and Mike are both in a hospital sitting on the edge of their beds in exactly the same position. When a nurse walks by Mark's room, she says: *I see that Mark is able to sit up now*, and when she walks by Mike's room she remarks: *I see that Mike is able to sit down now*. Drawing on what we know about hospitals – our hospital background scenes or frames – we will interpret the two remarks of the nurse rather differently, thereby relativizing the meanings of her remarks to the relevant scenes. Another often cited example of Fillmore (1977c) clearly demonstrating the above thesis is the difference in meaning between the following two sentences:

- (1) I spent three hours on land this afternoon.
- (2) I spent three hours on the ground this afternoon.

The background scene for the first sentence is a sea voyage while the second sentence refers to an interruption of an air travel. This illustrates Fillmore's use of the term *frame* as an idealization of a *coherent individuable perception, memory, experience, action, or object* Fillmore (1977c).

In order to understand frame semantics, it is helpful to begin with a brief history. From here we will turn to an overview of the most important theoretical concepts. After this the relationship of frame semantics to one specific version of *Construction Grammar* will be introduced and some examples will be analysed. The paper will end with a short summary of applications of frame semantics and a note on formalisation. Usually frame semantics is taken to be a very informal approach to meaning, but nevertheless some approaches relating frame semantics to *Formal Semantics* exist.

History

There are at least two historical roots of frame semantics; the first is linguistic *Syntax* and *Semantics*, especially Fillmore's case grammar, the second is Artificial Intelligence (AI) and the notion of *frame* introduced by M. Minsky (1975) in this field of study.

A case frame in case grammar was taken to characterize a small abstract scene which identifies (at least) the participants of the scene and thus the arguments of predicates and sentences describing the scene. In order to understand a sentence the language user is supposed to have mental access to such schematized scenes.

The other historical root of frame semantics is more difficult to describe. It relates to the notion of frame-based systems of knowledge representations in AI. This is a highly structured approach to knowledge representation which collects together information about particular objects and events and arranges them into a taxonomic hierarchy familiar from biological taxonomies. However, the specific formalism suggested in the above mentioned paper by Minsky was not considered successful in AI.

Some Basic Theoretical Principles

The central theoretical concepts characterizing frame semantics are due to C. Fillmore and did not change much since his first writings on this approach. In order to explain the most important notions of frame semantics let us briefly consider a typical example of a frame, the *commercial transaction frame* which demonstrates the origin of frame semantics from Fillmore's case frames as well. In this case the concept *frame* is applied to verbs like *buy* with the intention to represent the relationships between syntax and semantics.

BUYER	buy	GOODS	(SELLER)	(PRICE)
subject		object	from	for
Angela	bought	the owl	from Pete	for \$ 10
Eddy	bought	them		for \$ 1
Penny	bought	a bicycle	from Stephen	

The verb *buy* according to the above table requires obligatorily a buyer, goods and optionally a seller and a price. Verbs with related meanings such as *sell* are expected to have the same meaning slots but in a syntactically different order. This clearly shows the relation to Fillmore's case frames. Combining these frames results in the commercial transaction frame about which the following table provides partial information:

VERB	BUYER	GOODS	SELLER	MONEY	PLACE
buy	subject	object	from	for	at
sell	to				
cost	indirect object	subject		object	at
spend	subject	on		object	at

Of course the PLACE-feature just marks the beginning of an open ended list, since every event in the above table can be further specified – for instance with respect to time. Moreover the collection of frames forms an ordered structure. For instance the commercial transaction frame itself is part of the more general transaction frame prototypically expressed by the ditransitive verb *give*. This indicates that the system of dependencies between frames forms an intricate hierarchical structure.

The concept *Prototype* is one of the most important concepts of frame semantics. Frames should be understood as prototypical descriptions of scenes. A prototype has the advantage that it does not have to cover all possible aspects of the meaning of a phrase; in other words a prototype does not have to provide necessary and sufficient conditions for the correct use of a phrase. Fillmore (1977b) illustrates the use of prototypes within frame semantics by an analysis of the concept *widow*. The word *widow* is specified with respect to a background scene in which people marry as adults, they marry one person, their lives are affected by their partner's death and perhaps other properties. The advantage of a theory of meaning based on the prototype concept compared to a theory which insists on stating necessary and sufficient conditions for the meaning of a phrase is that it does not have to care about certain boundary conditions; that is it does not have to provide answers for questions like *Would you call a woman a widow who has lost two of her three husbands but who had one living one left?* Fillmore (1977b). In a case like this whether the noun *widow* applies or not is unclear since certain properties of the background frame for this concept are missing.

However, the concept prototype is not unproblematic either. Note that Fillmore does not use this concept with respect to words but with respect to frames or scenes. Some words like *bird* certainly have prototypes but others may not have a corresponding prototype. What is a prototypical *vegetable* for instance or a prototype corresponding to the adjective *small*? Moreover, applications of prototype theory often involve two different measures for category membership. A penguin, for example, is certainly not a prototypical bird, but nobody hesitates to judge it as a bird. The other measure of category membership is typically used in the analysis of vague predicates, for instance colour adjectives. It may sometimes be hard or even impossible to assign a given object to the category of pink or red entities.

Another central notion within frame semantics is the concept *profiling*. Langacker (1987) uses the example of *hypotenuse* for explaining this concept. One can easily draw a mental picture of the concept *hypotenuse*. The interesting question concerning this mental picture is this: Can you imagine what a hypotenuse is without imagining the whole right triangle? The answer is clearly: no. The triangle and the plane it is included in is a frame, and the term *hypotenuse* and *right triangle* are interpreted with respect to this frame but they profile different parts of the frame.

The following example taken from Goldberg (1995) illustrates lexical profiling of participants. Consider the following differences between the closely related verbs *rob* and *steal*.

- (3) a. Jesse robbed the rich (of all their money).
- b. *Jesse robbed a million dollars (from the rich).
- (4) a. Jesse stole money (from the rich).

b. *Jesse stole the rich (of money).

These distributional facts can be explained by a semantic difference in profiling. In the case of *rob* the victim and the agent (the thief) are profiled, in the case of *steal* the agent and the valuables are profiled. Representing profiled participants in boldface, Goldberg proposes the following argument structure for *rob* versus *steal*:

rob <**thief target goods**>

steal <**thief target goods**>

However, Goldberg's main concern is with *constructions* for which she uses frame semantics in order to provide highly structured rich meanings for them.

Construction Grammar: A Closely Related Framework

What are constructions? Here is A. Goldberg's definition.

A construction is defined to be a pairing of form with meaning/use such that some aspects of the form or some aspect of the meaning/use is not strictly predictable from the component parts or from other constructions already established to exist in the language Goldberg (1995).

There is no doubt that constructions exist. Morphemes for instance satisfy Goldberg's definition. But do constructions different from morphemes exist? This is of course what defendants of construction grammar try to show. Here we will take the existence of constructions other than morphemes simply for granted. Consider the following examples:

(5) Margaret baked Peter some cookies.

(6) Martin sneezed the napkin off the nightstand.

The peculiarity of example (5) is due to the fact that the verb *bake*, which normally has two arguments, is used with three arguments here. Particular as this sentence is we nevertheless can make sense of it. Margaret baked some cookies with the intention to give them to Peter. Note that this interpretation helps us to make sense of the recipient role which is not provided by the verb *bake*; i.e. we think of this sentence as an instance of the *ditransitive construction* of which a more standard example is:

(7) John gave Mary a present.

The crucial claim of construction grammar is that this is not due to different basic meanings of the verb *bake* but due to the integration of this verb plus its meaning into the ditransitive construction which has a meaning of its own. Therefore construction grammar distinguishes the semantics of argument structure constructions from the semantics of the verbs which instantiate them. An advantage of this approach is that it accounts for novel uses of verbs in specific constructions. In (6) the intransitive verb *sneeze* has to be integrated into the *caused motion construction* and therefore is forced to be interpreted as some kind of action.

Both verbs and constructions are associated with frame semantic meanings. However, in contrast to the rich frame semantic representations of verbs the basic construction are associated with a more abstract semantics. These basic constructions

and their frames are supposed to be independent of a particular language. They are cross cultural structures which are deeply entrenched in human experience. This is the content of Goldberg's Scene Encoding Hypothesis.

Scene Encoding Hypothesis: Constructions which correspond to basic sentence types encode as their central senses event types that are basic to human experience Goldberg (1995).

Applications

Frame semantics has a wide range of applications reaching reaching from subfields of linguistic theorizing such as *Morphology to Typology*, *Discourse Analysis*, and *Language Acquisition*. However, the central and most successful application seems to be (computational) lexicography. In a frame based lexicon the frame accounts for related senses of a single word and its semantic relations to other words. A frame based lexicon therefore offers more comprehensive information than the traditional lexicon. An example is Petruck (1986) which studies the vocabulary of the body frame in Modern Hebrew.

An example of computational lexicography is the FrameNet-System (see Boas (2002)).

Formalization

Although frame semantics does not lend itself easily to formalisation there is an early approach by Gawron (1983) in which basic insights of frame semantics were formalised by LISP-like notations in combination with situation semantics. A more recent approach is van Lambalgen/Hamm (2005) in which scenarios – a concept closely related to the frame concept – are formalised as certain kinds of logic programs. An explicit formalisation of the combination of frame semantics and construction grammar based on this work can be found in Andrade-Lotero (2006).

- Fritz Hamm

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For more information the interested reader is advised to consult the *Frame Semantics Bibliography* drawn up by Jean Mark Gawron.