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Abstract	In summary, this paper has demonstrated that the method adopted by Ellsworth et al. in their frame-based contrastive text analysis, which builds on the existing FrameNet convention to analyze only the semantics of frame-evoking predicates, is not suffi cient to describe complex interactions between lexicon and grammar. Such interactions should be recorded and accounted for, in order for us to understand how languages encode the same scene differently and still allow us to come up with comparable construals of the scene, no matter in which language we read. This paper also proposed a way to represent interactions between lexical units and grammatical constructions, as an extension of the current FrameNet annotation methodologies. By addressing the necessity for representing interactions between lexicon and grammar in English and Japanese FrameNets from the viewpoints of contrastive text analysis, it is hoped that this paper will contribute to the development of "Constructicon" proposed by Fillmore 2006.
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A Frame-semantic Contrastive Text Analysis:
Toward Representation of Lexicon and Grammar in FrameNets

Kyoko Hirose Ohara

1. Introduction

This paper discusses findings of a frame-semantic contrastive text analysis of English and Japanese, using the large-scale and precise descriptions of semantic frames provided by the FrameNet project (Baker 2006, Fillmore 2006, Fontenelle 2003).[1] FrameNet is a lexicon-building project, which has been analyzing meanings of English lexical units in terms of the semantic frames they evoke. It annotates corpus example sentences with frame-semantic analyses and incorporates them into the lexicon. This paper points out that even though the FrameNet methodology allows us to compare languages at a more detailed level than previous studies, in order to investigate how different languages encode the same events, it is necessary for the frame-semantic lexicon to specify the grammatical affordances of its entries. Based on a contrastive text analysis of an English-Japanese aligned parallel

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1   Even though the official name of the project is "FrameNet," in this paper the term "English FrameNet" is also used, in order to emphasize the fact that we are contrasting Japanese with English. There exist Spanish FrameNet and German FrameNet, in addition to Japanese FrameNet, which employ similar methodologies in lexicon building and which work closely with the FrameNet project.

corpus and on the lexicon-building project of Japanese FrameNet (Ohara et al. 2006), the paper proposes a way to record cross-referencing between lexicon and grammar, as an extension of the current FrameNet and Japanese FrameNet methodologies.

The rest of the paper is structured as follows. Section 2 gives a background to the study, by first giving brief introductions to Frame Semantics and to the English and Japanese FrameNet projects, which are the basis of the present study. It then summarizes a previous analysis, which adopted the FrameNet methodology in order to contrast texts in different languages. After the problems with the previous study are presented in Section 3, Section 4 proposes how the problems can be solved by extending the current FrameNet and the Japanese FrameNet methodologies. Finally, Section 5 concludes the discussion.

2. Background

2.1. Frame Semantics and the English and the Japanese FrameNets

Frame Semantics, originating in Fillmore's seminal papers in 1970's (e.g. Fillmore 1976), is a research program in empirical semantics which emphasizes the links between language and experience. In Frame Semantics, each word is described in terms of the conceptual *frame* it evokes. Here, frame is defined as "a script-like conceptual structure that describes a particular type of situation, object, or event along with its participants and props" (Ruppenhofer, et al. 2006: 5).[2] In this respect, the term *frame* in Frame Semantics refers to something different from the term *case frame* in Fillmore's

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2 It should be noted in passing that the term *frame* is used differently in natural language processing in which it is used to refer to a syntactic frame in which a verb occurs.

earlier Case Grammar, although Frame Semantics should be understood as a refinement and reformulation of Case Grammar (e.g. Fillmore 1968). In Case Grammar, a case frame initially referred to a set of very abstract case roles that a verb can take, such as agent and patient. It was, however, recognized later that abstract case roles are insufficient to characterize all the different types of interactions of participants that are encoded linguistically (Hasegawa and Ohara 2006, Baker 2006).

Notions comparable to *frame* in Frame Semantics have developed in other fields, especially in artificial intelligence and cognitive psychology. *Frame* as used by Marvin Minsky is more or less similar to the concept of *frame* in Frame Semantics. Roger Shank's term *script* to talk about situations such as eating in a restaurant is also related to the concept of *frame*. In discourse analysis, the term *frame* was used by Erving Goffman and has been popularized more recently in books by Deborah Tannen and by George Lakoff. *Frame* as used in Frame Semantics, however, refers to any system of **linguistic** choices that can be get associated with prototypical instances of *scenes* (including not only visual scenes but also familiar kinds of interpersonal transactions, standard scenarios, familiar layouts, institutional structures, enactive experiences, body image, and in general, any kind of coherent segment, large or small, of human beliefs, actions, experiences, or imaginings).[3] In other words, *frames* are basically **linguistic**, while *scenes* are basically **cognitive**. In English and Japanese FrameNets, which will be discussed in the following two sections, building a lexicon thus involves defining frames connected to **language**.

The FrameNet project is creating an on-line lexical resource for

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3   Fillmore acknowledges that Ronald W. Langacker's *base* and *profile* are also similar in meaning with *frame* (Hasegawa and Ohara 2006: 36).

English, based on Frame Semantics and supported by corpus evidence. The aim of the project is to document the range of semantic and syntactic combinatory possibilities (valences) of each word in each of its senses, through computer-assisted annotation of example sentences and automatic tabulation and display of the annotation results (http://framenet.icsi.berkeley.edu/).

Active research projects are now seeking to produce comparable frame-semantic lexicons for other languages, and Japanese FrameNet is one of them. The goal of Japanese FrameNet is to create a prototype of an online Japanese lexical resource in the FrameNet style, by describing the senses of each word with respect to the semantic frames it evokes and by annotating corpus examples of each word with frame-semantic tags. Important research questions being asked by Japanese FrameNet are: to what extent is the Frame-semantic approach suitable for analyzing the Japanese lexicon; and to what extent are the existing English-based semantic frames applicable to characterizing Japanese lexical units. Also, while purporting to retain the richness of semantic information in FrameNet, Japanese FrameNet pays close attention to typological differences in lexicalization patterns between Japanese and English (http://jfn.st.hc.keio.ac.jp/).

2.2. A Previous Analysis

Ellsworth et al. 2006 contrasted semantic frames involved in motion descriptions in an English novel and its corresponding Japanese, Spanish, and German translations, using the semantic frames defined in English FrameNet. They found regularities of translation which had not been fully discussed previously. In the scene described in (1) below, the primary conceptualizations in English are the fog's motion toward the viewpoint (*came*) and turbulent circular motion (*rolled*). The Japanese, however, describes the blurring of the scene (*usuboyakete*) and its being engulfed by the fog

(*makikom-areteitta*). The linguistic materials in English encoding motion and their corresponding segments in Japanese are shown in the bold type.

(1)

E: *As we watched it the fog-wreaths* **came crawling** *round both corners of the house and* **rolled** *slowly* **into one dense bank**, *on which* ...

(Arthur Conan Doyle. 1901-02. *The Hound of the Baskervilles*)

J: *yagate atari wa   itimen ni   **usuboyakete**,*

   soon   area TOP all.around blur

   *sidai ni   kiri no naka   e   **makikomarete itta** ga, ...*

   gradually fog GEN inside GOAL engulf-PASS-PAST CONJ

   'Soon the area was blurred all around [the house] and (it) was gradually engulfed inside the fog ...'

(Transl. Ken Nobuhara. 1955. *Basukaviru ke no inu*)

In the current FrameNet methodology, frame-evoking words are first identified and then the specific frames that the words evoke are examined. In the following, the frame-evoking predicates shown in bold type are labeled with the relevant frame names:

(1')

E: *As we watched it the fog-wreaths* **came** [Motion] **crawling** [Motion] *round both corners of the house and* **rolled** [Moving_in_place] *slowly* **into one dense bank**, *on which* ...

J: *yagate atari wa   itimenni **usuboyakete** [Eclipse]'*

   soon   area TOP all.around blur

   *sidaini kiri no naka   e   **makikom** [Cause_motion]**-areteitta** ga, ...*

   gradually fog GEN inside GOAL engulf   -PASS-PAST CONJ

Came and *crawling* in the English original sentence in (1') evoke the `Motion` frame and *rolled* evokes the `Moving_in_place` frame. The `Motion` frame is currently defined in English and Japanese FrameNets as "some entity starts out in one place and ends up in some other place, having covered some space between the two," and the `Moving_in_place` frame as "a THEME moves with respect to a FIXED_LOCATION, generally with a certain PERIODICITY, without undergoing unbounded translational motion or significant alteration of configuration/shape".[4]

Usuboyakeru and *makikomu* in the Japanese translation in (1'), on the other hand, evoke the `Eclipse` frame and the `Cause_motion` frame respectively. The former is defined as "an OBSTRUCTION blocks an ECLIPSED entity partially or completely from view," while the latter is defined as "an AGENT causes a THEME to undergo directed motion."

Why does not *usuboyakete*, the Japanese segment corresponding to *came crawling*, encode motion? If we notice that the `Eclipse` frame (conveying blurring or hiding) describes a state which is dependent on location, we can see that the Japanese translation is describing a viewpoint implicit in the motion of the obscuring fog in English. In other words, while the English text focuses on the **motion** of the fog, the Japanese translation focuses on the **state change** of the whole scene after the fog has moved.

The above pair of sentences may well be yet another example of the contrast between focus on a part of a scene and focus on the whole scene; or

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4 In order to examine to what extent the existing English-based semantic frames are applicable to characterizing Japanese lexical units, Japanese FrameNet keeps the same frame definitions as those in the English FrameNet as much as possible. Also, currently in Japanese FrameNet, frame definitions are written in English, in order to make them accessible for non-native speakers of Japanese and for multilingual FrameNets.

between focus on an action and focus on a state, which has been discussed by Ikegami (e.g. Ikegami 1991). Such dependencies are easily described by Frame Semantics and thus in the English-Japanese contrastive analyses based on the current English and Japanese FrameNets. In other words, the frame-semantic contrastive analyses of lexical units by Ellsworth et al. reveal detail that is not covered by Talmy and Slobin's semantic typologies, which are based on classification of languages into verb-framed *vs.* satellite-framed languages (Talmy 2003, Slobin 2004).

3. Analysis

Ellsworth et al. 2006, which is based on the current FrameNet methodology, however, is limited to investigating frame-bearing predicates and thus fails to account for pairs of English and Japanese sentences such as below. In (2), the English original text does not mention motion, as seen by the fact that no motion verb is used, while a state verb *lay* appears in the sentence. The Japanese translation, in contrast, employs a motion verb *oriru* 'fall.'

(2)

E: *... said the detective ..., glancing ... at the huge lake of fog which* **lay**
   [Being_located] *over the Grimpen Mire.*

(ibid.)

J: *... keibu   wa ... gurinpen no oo-zoko-nasi   numa   no   ue   ni*
   detective TOP   GEN great-bottom-less mire GEN over LOC

   ori **[Motion_directional]** **te iru**   *koi kiri   o miwatasita.*
   fall   PROG..PRESENT thick fog ACC glanced

   '.. the detective glanced at the thick fog which <u>had fallen </u>over the great bottomless Grimpen Mire.'

(ibid.)

In FrameNet, *lie* is currently analyzed as a predicate evoking the Being_located frame ("A Theme is in a stable position with respect to a Location"). In Japanese FrameNet, *oriru* 'fall' is analyzed as evoking the Motion_directional frame ("A Theme moves in a certain Direction which is often determined by gravity or other natural, physical forces"). According to the analysis, it thus seems as if whereas the English sentence describes a scene in terms of a state, the Japanese translation encodes the same scene as a motion. This pattern seems to be rare, although the opposite tendency (i.e., English describing a scene as a motion, while Japanese describing the same scene in terms of a state) has been noted by linguists including Ikegami (ibid., cf. Section 2).

It turns out that the Japanese sentence as a whole, however, describes a state resulting from a 'motion' of the fog, rather than a motion itself. In general, action verbs in Japanese, including motion verbs, cannot be used to describe a state. It is necessary to attach the auxiliary form *te iru* after the verb to describe the state which exists after an event takes place. In other words, in Japanese, an achievement verb such as *oriru*, together with the immediately following auxiliary verb *te iru*, encodes the perfect meaning of "a state exists as a result of an event" (Jacobsen 1982).

Similarly in (3), as the segments highlighted in bold show, the English original sentence employs *tied*, which evokes the Being_attached frame ("An Item is attached by a Handle, via a Connector, to a Goal, or Items are attached to each other."), while the Japanese translation pertains to *sibaritukeru* 'bind,' evoking the Attaching frame ("The Attaching frame covers two situations: a scene in which an Agent causes an Item to be physically connected to Goal; or a scene in which an Agent causes two Items to be connected to each other."). Here, if we compare the semantics of the frame-evoking predicates only, then we are forced to say that whereas

English describes a state, Japanese describes an action, which again does not seem to be a preferred pattern in pairs of corresponding English and Japanese sentences.

(3)

E: *To this post a figure was* **tied** [Being_attached]*, so swathed and muffled in the sheets which had been used to secure it that one could not for the moment tell whether it was that of a man or a woman.*

<div align="right">(ibid.)</div>

J: *kono hasira ni   siitu o   guruguru to   makitukete,*
   this   pillar LOC sheets ACC MANNER COMPL swathed
   tyotto mita no   de   wa otoko ka onna ka
   little seeing NOM COP TOP man Q woman Q
   wakaranai ningen ga   hitori **sibarituke** [Attaching] **te atta**
   tell-NEG person NOM one bind   RESULT
   'To this pillar a person, who was swathed in sheets and whom one could not tell whether it was a man or woman, had been bound .'

<div align="right">(ibid.)</div>

It is more plausible to analyze the entire Japanese sentence as describing a state resulting from an action. That is, the verb *sibaritukeru*, together with the auxiliary verb *te aru*, "focuses on the resultant state of a past action rather than the action itself" (Hasegawa 2005: 229).

4. Proposal

The above examples suggest that, in order to arrive at the precise meaning of a sentence, it is necessary to be able to represent how the semantics of frame-evoking predicates interact with the semantics of the grammatical

constructions in English and Japanese FrameNets. That is, there are at least two kinds of problems of representation within the current FrameNet methodologies, namely, 1) how to show, within a lexical entry, information about how a given lexical unit fits into the grammar; and 2) how to relate grammatical constructions to the lexical units that participate in them. Based on these observations, I argue that mutual dependencies of lexicon and grammar should be introduced in the FrameNet methodology (cf. Fillmore 2006). More specifically, the annotation process of FrameNet and Japanese FrameNet should be divided into two parts, namely, annotation of lexical information and annotation of constructional information. While the former specifies grammatical affordances of lexical units, the latter specifies the kinds of lexical units capable of occurring in specifiable positions within grammatical constructions.

How these two kinds of annotation can be realized is exemplified in the two figures below. Figure 1 is an example of specification of grammatical affordances of lexical units; Figure 2 is an example of specification of lexical unit types to grammatical constructions. FrameNet and Japanese FrameNet already have a means for annotating lexical information (cf. Figure 1), while tools for annotating grammatical constructions (cf. Figure 2) have not been implemented or made available yet.

In Figure 1, when the lexical unit *oriru* is created in the Japanese FrameNet lexicon, the verb's semantic type is also specified. Since *oriru* is an achievement verb, which refers to an instantaneous event, the semantic type of achievement is specified.

Figure 2 shows a suggested tool for annotating grammatical constructions in Japanese FrameNet. We have seen in Section 3 that achievement verbs such as *oriru* combine with the auxiliary form *te iru* to refer to a resultant state. In Figure 2, the sentence being annotated contains an instance
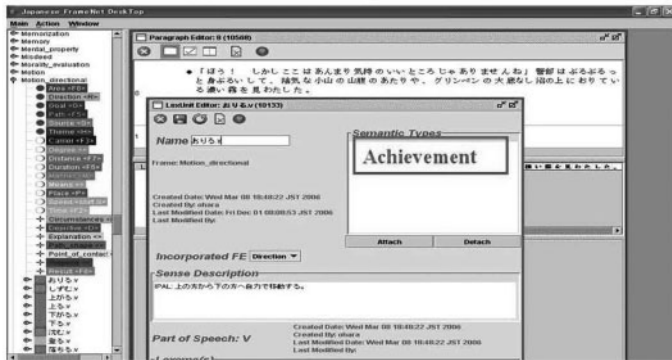
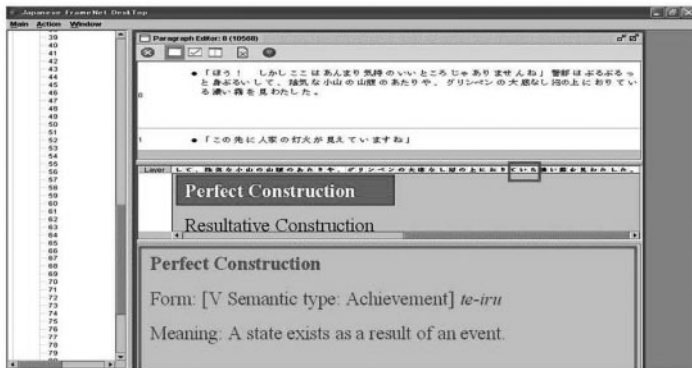Figure 1. Specifying a Grammatical Affordance of a Lexical Unit

Figure 2. Specifying a Lexical Unit Type to a Grammatical Construction

of *te iru*. It is selected and is about to be annotated with the name of the construction in which it participates. In the entry for the Perfect Construction, it is specified that the auxiliary verb *te iru* is preceded by a verb whose semantic type is achievement.

By devising a mechanism for annotating grammatical constructions and by making sure that interactions between lexicon and grammar are reported, it is possible to represent the meaning of an entire sentence.

5. Summary

In summary, this paper has demonstrated that the method adopted by Ellsworth et al. in their frame-based contrastive text analysis, which builds on the existing FrameNet convention to analyze only the semantics of frame-evoking predicates, is not sufficient to describe complex interactions between lexicon and grammar. Such interactions should be recorded and accounted for, in order for us to understand how languages encode the same scene differently and still allow us to come up with comparable construals of the scene, no matter in which language we read. This paper also proposed a way to represent interactions between lexical units and grammatical constructions, as an extension of the current FrameNet annotation methodologies. By addressing the necessity for representing interactions between lexicon and grammar in English and Japanese FrameNets from the viewpoints of contrastive text analysis, it is hoped that this paper will contribute to the development of "Constructicon" proposed by Fillmore 2006.

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