Lexicon, Grammar, and Multilinguality in the Japanese FrameNet

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Abstract

This paper discusses findings of a frame-based contrastive text analysis, using the large-scale and precise descriptions of semantic frames provided by the FrameNet project (Baker, 2006; Fillmore, 2006). It points out that even though the existing FrameNet methodology allows us to compare languages at a more detailed level than previous studies (e.g. Talmy, 2003; Slobin, 2004), in order to investigate how different languages encode the same events, it is also necessary to make cross-references to grammatical constructions rather than limiting ourselves to analyzing the semantics of frame-bearing predicates. Based on a contrastive text analysis of an English-Japanese aligned parallel corpus and on the lexicon-building project of Japanese FrameNet (Ohara et al., 2006), the paper attempts to represent interactions between lexical units and constructions of Japanese sentences in terms of the combined lexicon and "constructicon," currently being developed in FrameNet (Fillmore, 2006). By applying the idea to the analysis of Japanese in Japanese FrameNet, it is hoped that the study will give support to working out the details of the new FrameNet directions.

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 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 grammatical affordances of its entries. Based on a contrastive text analysis of an English-Japanese aligned parallel corpus and on the lexicon-building project of Japanese FrameNet (Ohara et al., 2006), the paper attempts to represent interactions between lexical units and constructions of Japanese sentences in terms of the combined lexicon and "constructicon," currently being developed in FrameNet (Fillmore, 2006).

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 existing 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 summarizes 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 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

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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.

[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.

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 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 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 discussed previously in terms of semantic typologies proposed by Talmy (2003) or Slobin (2004). 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*
   soon   area TOP all.around
   usuboyakete, *sidai ni   kiri no   naka e*
   blur   gradually fog GEN inside GOAL
   makikomarete itta *ga, ...*
   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*
   soon   area TOP all.around
   usuboyakete [Eclipse], *sidai ni kiri no   naka e*
   blur   gradually fog GEN inside GOAL
   makikom [Cause_motion]-**areteitta**   *ga, ...*
   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 "a THEME starts out in one place (SOURCE) and ends up in some other place (GOAL), having covered some space between the two (PATH)," 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].

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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).

[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

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 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.

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 sentence 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 employs a coming-into-existence verb *oriru*.

(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*
   detective TOP   GEN great-bottom-less
   *numa no   ue   ni   **ori** [Motion_directional] **te iru***
   mire   GEN over LOC come.into.existence
   koi   kiri o   miwatasita.
   thick fog ACC glanced
   '.. the detective glanced at the thick fog which <u>had</u>

English, in order to make them accessible for non-native speakers of Japanese and for multilingual FrameNets.

<u>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* 'come into existence' is analyzed as evoking the `Coming_to_be` frame ("An ENTITY comes into existence at a particular PLACE and TIME which may take a certain Duration_of_endstate, have a CAUSE, or be formed from COMPONENTS"). 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 something coming into existence. This pattern seems to be rare in parallel texts of English and Japanese.

It turns out that the Japanese sentence as a whole, however, describes a state resulting from an appearance of the fog, rather than an appearance itself. In general, intransitive nonvolitional verbs in Japanese, including verbs of appearance, when followed by the auxiliary form *te iru*, describe a resultant state.

Similarly in (3), as the segments highlighted by 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 ("An AGENT attaches an ITEM to a GOAL by manipulating a CONNECTOR, creating an asymmetric relationship between the ITEM and the GOAL."). 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.*

(ibid.)

J: *kono hasira ni   siitu   o   guruguru to*
   this pillar LOC sheets ACC MANNER COMPL
   makitukete, tyotto mita   no   de   wa
   swathed   little   seeing NOM COP TOP
   otoko ka onna   ka wakaranai ningen ga
   man   Q woman Q tell-NEG   person NOM
   hitori **sibarituke** [Attaching] **te atta**
   one   bind
   '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.'

(ibid.)

It is more plausible to analyze the entire Japanese

sentence as describing a state resulting from an action. In general, transitive volitional verbs in Japanese, including verbs of attaching, when followed by the auxiliary form *te aru*, describe a resultant state of 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 Japanese FrameNet. 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 grammatical constructions; and 2) how to relate grammatical constructions to semantic frames. Based on these observations, I argue that mutual dependencies of lexicon and grammar should be introduced in the Japanese FrameNet annotation (cf. Fillmore, 2006). More specifically, the annotation process of 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 interactions between grammatical constructions and semantic frames.

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 interactions between grammatical constructions and semantic frames. Japanese FrameNet already has a means for annotating lexical information (cf. Figure 1), while tools for annotating grammatical constructions (cf. Figure 2) have not been 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 (cf. the Japanese sentence in (2)). Since *oriru* is an intransitive nonvolitional verb denoting an event, the semantic type 'event' is specified.

Figure 2 shows a suggested tool for annotating grammatical constructions in Japanese FrameNet. Here, the Japanese sentence in (2) is being annotated. The fact that the verb *oriru* and the following *te iru* are constructs of the resultant state construction is recorded. The resultant state construction has three constructional elements (CEs). They are: Event; Resultative_marker; and Entity. The first two CEs, namely, Event and Resutative_marker, combine to form a unit, which has a valence: Entity. The resultant state construction evokes the Resultant_state frame.

The noun modifying clause containing *ori te iru* in (2) is

changed into a finite clause in (2'). Here, the three CEs of the resultant state construction are shown in bold.
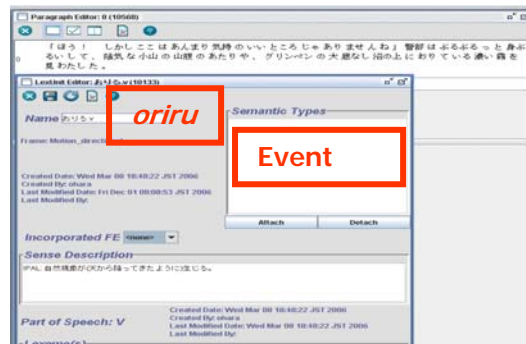

Figure 1: Specifying the semantic type 'event' to the lexical unit *oriru* 'come into existence'
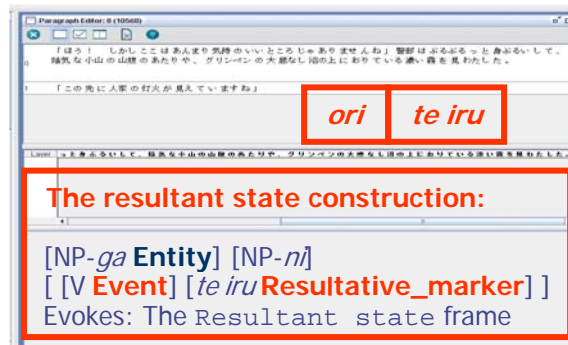

Figure 2: Specifying interactions between the resultant state construction and the Resultant_state frame

(2')
[*koi kiri ga* **Entity**] [*gurinpen no*
 thick fog   NOM   GEN
oo-zoko-nasi   numa no   ue   ni]
great-bottom-less mire   GEN over LOC
[*ori* **Event**]   [*te iru* **Resultative_marker**]
 come.into.existence
'A thick fog has fallen over the great bottomless Grimpen Mire.'

By devising a mechanism for annotating grammatical constructions and by making sure that interactions between lexicon and grammar via semantic frames are described, 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

which are mediated by semantic frames. 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 suggested a way to represent interactions between lexical units and constructions of Japanese sentences in terms of the combined lexicon and "constructicon," currently being developed in FrameNet. By addressing the necessity of representing interactions between lexicon and grammar in Japanese FrameNet 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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