ABSTRACT

A model of Japanese honorific expressions in situation semantics is proposed. Situation semantics provides considerable power for analyzing the complicated structure of Japanese honorific expressions. The main feature of this model is a set of basic rules for context switching in honorific sentences. Mizutani's theory of Japanese honorifics is presented and incorporated in the model which has been used to develop an experimental system capable of analyzing honorific context. Some features of this system are described.

1. Introduction

The Japanese language, like Korean and many non-European languages, contains a grammaticalized system of honorific forms. It is well known that honorifics is closely connected to several aspects like relative social standing. No effective mechanisms have been developed to deal with this problem. Situation Semantics (SS) [Harwiss 1982, 1984a, 1984b; 1985a, 1985b, 1986a, 1986b; 1987a, 1987b; Harwiss & Perry 1983; [Harwiss & Pollard 1983; Creary & Pollard 1983]] is a theory of context; used here to construct a model of honorific sentences to analyze the relationship between sentence and context. About Japanese, we can make use of Mizutani's theory of honorifics [Mizutani 1983a, 1983b]. This theory does tackle the relation between context and sentence, but it acends that SS can describe context move usefully than Mizutani's theory. In this paper, SS is used to reconstruct the context given by Mizutani's theory. Honorific forms are analyzed and basic rules for context switching are established.

Table 1 gives the relation between Mizutani's theory of honorifics and the model. This model can be divided into two parts. The first part describes basic context features and the second describes lexical rules based on Mizutani's Japanese grammar, along with some basic mechanisms of "context switching."

| Context of honorifics | Mizutani's Theory | Our Model |
|-----------------------|-------------------|-----------|
| Discourse formalism   | none              | SS        |
| Japanese grammar      | in CFG Form       | Japanese grammar in DCG form |
| Context switch in honorific sentence | none              | In complex sentence          |
| Implement             | none              | not implemented          |

It is very easy to represent some context features in discourse in SS, but context involves some very difficult problems like "focusing." We want to analyze this in future research. In this paper only enough elements for context required in Mizutani's theory are set up.

The main concern here is the second part of the model which deals with the relationship between contextual elements and lexical elements, and especially the mechanism of "context switching" on honorifics.

Mizutani's theory of honorific expression in Japanese is described first. Then the model in SS is presented. The context feature of relative social status in Mizutani's theory is realized in the first part of the model. This is followed by explanation of some basic features designed to handle the mechanism of context switching in the second part. Finally, an experimental system based on this model is given. This system was implemented in CIL (Complex Indeterminate Language) [Mukai 1985a, 1985b]. Results from some experiments processing Japanese honorific expressions are given at the end of the paper.

2. Mizutani's theory of Japanese honorific expression

2.1. Honorific Status

Honorific relations are represented as vectors in an abstract two-dimensional honorific space. In the honorific space the speaker who is represented in the sentence of discourse is set as the origin. Other individuals like hearer and agents who are presented in the sentence of discourse are represented by vectors as in the following example.

An honorific attitude is defined as the vector between these points. For example, the honorific attitude from the speaker (I) to the hearer (Y) is defined as a vector from (0,0) to \((y_{1}, y_{2})\). The honorific attitude from the

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3.2. Relation between honorific context and Japanese grammar.

The following relation holds between honorific relations and the sentence of discourse. The notation "\( = \)" means the left element has some effect on the right element.

1) Changes in the first order honorific relation are shown.

**Rule 1 relation**

\[ \text{if } H = \Rightarrow \text{ ps, } \]

2) Changes in the second order honorific relation are shown by description of individual A and the honorific element sub1 and sub2 of vp in the agent case, and by description of individual A2 as the np in the object case.

**Rule 2 relation**

\[ \text{if } A1 = \Rightarrow \text{ np in agent case, } vp \text{ (sub1 and sub2), } A2 = \Rightarrow \text{ np in object case. } \]

3) The third order honorific relation is shown by v in vp.

**Rule 3 relation**

\[ \text{if } A1, A2 = \Rightarrow \text{ v. } \]

3. Model of the honorific sentence

In this section, we present our model in SS. Readers who are familiar with SS can skip Section 3.1.

3.1. First Part on Context Features

3.1.1. Model of the context

In the theory of situation semantics, discourses are represented within situations and constraints. In formal representation the sentence and context are expressed in the form "a(b,c, etc.)". "a" stands for discourse situation (DS), "b,c, etc." is the speaker's connection (CS), "s" is the setting and "e" is the described situation. There is another situation called a resource situation in the theory. In our model we define a resource situation for each individual.

(I) Discourse Situation (DU)

Here is an example of the representation of a sentence in discourse.

Ex 2. John said "Tom met Jane" to Jim.

1) Search list X for Y.

2) if Y is not in X, then add Y to list X, succeed and return.

3) if Y is in X, then read: if Eh is factual, then HW is actual.

CWL has the unique data structure called "complex indeterminate." This data structure can be regarded as a frame and represented as in the following example.

**CIL as basic language**

Before going into the representation of lexical rules which give the correspondence between honorific word expressions and sentences, and context switching on honorific sentences, we describe CIL used in the description of lexical rules. Accurate accounts of CIL can be found in [Takai 1985]. Here only the part needed to understand the lexical rules in section 3.2.3 is described.

CIL (Complex Indeterminate Language) can be represented by the following formula.

**CIL = Prolog + Parameterized Types + Freeze + Frame + Freeze**

CIL has the unique data structure called "complex indeterminate." This data structure can be regarded as a frame and represented as in the following example.

1. term(X with a: X, b: Y where X = Y).
2. term(Y, Z): Z = abc, Z = def.

3.2. DCIL Rules for honorifics

3.2.1. First order honorifics

As Rule 1 in Section 2.3. shows, first order honorifics affect "yw." This is illustrated by the following examples.

Ex 3. This corresponds to Eh in 1) in section 3.1.2.

**prolog[agent(X, ds), object(X, lex), context(X, Y)]**

1) Search list X for Y.
2) if Y is in X, then read: if Eh is factual, then HW is actual.
3) if Y is not in X, then add Y to list X, succeed and return.
4) If Y is in X, succeed and return.

**honorif[agent(X, ds), object(X, lex)]** represents a list of honorific events when Eh is not factual and "yw" is the agent of discourse. "object" (text[context]) represents the lexical object in this parsing stage. This

In Japanese there are many honorific words, and some interesting phenomena are to be found in daily life.

For example, a secretary in the company president's office should have many honorific words in his resource situation (RS) because he always has to be careful to use the appropriate honorific expression in his work. On the other hand university students will have a poor stock of honorific words for there is no need to express honorific status, except to teachers.

A constraint is required which determines the relation between the honorific event type (Eh) and word representation. This is the "conditional constraint" word selection (CS). Mizutani's rules for first order third order honorific relations given in 2.3 correspond to this constraint Cw. Word representation should be an event type called "honorific word selection event (HW)," and if a person does not have this event type in his resource situation, he will have a poor range of honorifics. We represent these Cw and HW in formula 6.

In formula 6, "Cw(Eh,0)" denotes the conditional constraint of word selection Cw which has Eh and "yw" as its conditional schema. Anchor "yw" determines the relation between determinates in Eh and objects like taro and hanako. See Barwise's work for details. 6) is read: if Eh is factual and Cw is satisfied, then HW is actual.

6) Cw(Eh,f,i) = Involve Eh, HW; yes

Conditional constraint on word selection has an honorific event type and its anchor as its scheme. In Japanese honorific expressions, if Eh and f are given, the word representation will follow very easily. Some instances of this are given in formulas 7 through 15. For example, formula 7) can be read: if Eh is actual and the anchor A anchors t to individual J then J is the speaker or the hearer A in the agent case, then J is actual so that when referring to A honorific form tainen-go (np) is added to the description A1.

7) \( \text{Eh}(f) \text{ fit) = J, f(t') = A1 bw : = refer t', [A1][np in h-form]. } \)

8) \( \text{Eh}(f) \text{ fit) = J, f(t') = A1 bw : = refer t', [A1][wp in h-form]. } \)

9) \( \text{Eh}(f) \text{ fit) = J, f(t') = A1 bw : = refer t', [J][wp in h-form]. } \)

10) \( \text{Eh}(f) \text{ fit) = J, f(t') = A1 bw : = refer t', [J][wp in h-form]. } \)

11) \( \text{Eh}(f) \text{ fit) = J, f(t') = A1 bw : = refer t', [J][wp in h-form]. } \)

12) \( \text{Eh}(f) \text{ fit) = J, f(t') = A1 bw : = refer t', [J][wp in h-form]. } \)

13) \( \text{Eh}(f) \text{ fit) = J, f(t') = A1 bw : = refer t', [J][wp in h-form]. } \)

3.2. Second Part on The Relation between Context Features and the Sentence

3.2.1. CIL as basic language

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CIL has the unique data structure called "complex indeterminate." This data structure can be regarded as a frame and represented as in the following example.

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**honorif[agent(X, ds), object(X, lex)]** represents a list of honorific events when Eh is not factual and "yw" is the agent of discourse. "object" (text[context]) represents the lexical object in this parsing stage. This
notation for lexical items has its origin in Lexical Functional Grammar (Kaplan & Bresnan, 1982), so this expression can be represented like 3. (object) in the LFG manner.

This example states that if \( p = \{t, a\} \), then there should be honorific information in the resource situation of the individual who is the speaker. If the speaker's RS contains two or more different terms expressing the honorific relationship between the same agents, fail. Thus, the mechanism of 2) in dsolve is very important because it shows that in the honorific information of one individual there should not be different information about the binary honorific relation between two individuals.

(ii) Second order honorifics: Lexical rules for second order honorifics can be represented as in the following example program.

Ex.2 This corresponds to Eh in (7) and in Section 3.1.2.

\[
\text{nm}((X_0,X_2,\text{Context})) \rightarrow n((X_0,X_1,\text{Context}),\text{sub}(X_1,X_2,\text{Context}),
\text{honor}(\text{gen}(\text{det}(\text{det}(X_0)),\text{det}(X_2)));
\text{up}(\text{gen}(\text{det}(X_0)),\text{det}(X_2))).
\]

(iii) Third order honorifics: Lexical rules for third order honorifics can be represented as in the following example program.

Ex.3 This corresponds to Eh in (10) in Section 3.1.2.

\[
\text{vp}((X_0,X_2,\text{Context})) \rightarrow \text{v}(X_0,X_1,\text{Context}),\text{sub}(X_1,X_2,\text{Context}),
\text{honor}(\text{gen}(\text{det}(\text{det}(X_0)),\text{det}(X_2)));
\text{up}(\text{gen}(\text{det}(X_0)),\text{det}(X_2))).
\]

3.3 Context switching in honorific sentences

When we utilize the contextual elements like DS and RS in discourse it is very difficult to decide the context for each sentence. A sentence in discourse can be represented by the expression "DS, CS, [alpha]". But, then how do we map contexts like DS and CS to complex sentences?

Mizutani's theory of honorific forms does not go into context switching. In complex sentences, we have expanded his grammar and propose a basic mechanism for context switching.

Consider sentence 1) below uttered by individual S to R which means "individual T said that individual U said that Taro met Hanako." In this example, we establish relations a) through j) among S, T, U, Taro and Hanako.

S contains the honorific relation down(S,U). Then context switch is derived from phase 0 to phase 1.

j) Taro < Hanako
h) T < Hanako

In RS of S a) S > Taro b) S > Hanako c) S > U d) S > Hanako e) Taro > Hanako f) T < Hanako g) T > S h) S > T i) S > U j) U > Taro k) U > Hanako These are the parsing rules used to analyze utterances.

1) sentence --> sm(X), det(Y), agent(Y) = s, obj(Y) = r, at(Y) = L,
   / * a,b,c,d,0 */
   honor(det(Y)) = (downs(taro),downs(hanako),
   downs(u),downs(u),downs(taro),honor(hanako),
   up(taro,honors),
   up(taro,honors)).

2) sm(X) --> sm(X),
3) sm(X) --> sm(X), [to, sm(X),
4) sm(X) --> sm(X), [to, sm(X),
   agent(det(Y)) = agent(det(Y)),
   det(Y) = det(Y), obj(det(Y)) = obj(det(Y)),
   det(det(Y)) = det(det(Y)).

L1) and L2) are formal rules to start the process, while L3) and L4) are basic rules for determining context switch in sentences of discourse.

L1) specifies the initial stage for parsing. In 1) above S tells R something so the context is set in the slot denoted by det(X).

L2) states that all of the features of sm are transferred to sn to meet a requirement of Mizutani's grammar. This is done easily by unification.

L3) means that all of the features in sn are transferred to sn. This mechanism corresponds to indirect speech.

L4) means that there should be context switch. As the discourse situation for sn0, set agent of discourse of sn0 to agent of Z who utters sn0 and set object of discourse of sn0 to object of Z who hears this utterance.

L5) means that in a sentence with no marker, there can be context switch, so if a parsing failed because of the context of honorifics, use this rule.

Sentence 1) is analyzed using rule L4) and the mechanism of context switch is derived from phase 0 to phase 1.

(i) Parsing really starts with the rule 3) estimating that there is no context switching. But at point *1, a conflict between S's resource situation and honorific expression occurs. In S's resource situation, the honorific relation between S and Taro is down(S,taro), but [taro,sama] requests the honorific relation up(S,taro), so context switch occurs at *2. Rule 5) over the binary honorific relation from S to U. Context switch does not occur at this point again. We use the notation DS(S) to state that the agent of discourse is S. The symbol -> means the context of left hand side is changed to the context of the right hand side as the result of context switch. (T said U met Hanako.)

3.3. Ch and Cw...
Now, we have come to the main point of our model, but there remains an interesting feature of $\omega$. This constraint is not verified so with some trepidation we touch on it briefly here.

For example, when a worker "Suzuki" refers to his friend "Tanaka" with contempt, he intentionally uses a polite word to refer to him such as "Tanaka sensei" (Mr. Tanaka). When the hearer (Y) hears this polite expression, he decides on honorific event types but finds conflicts between these types and the normal social event types in his resource situation.

Ex.6
expression [Tanaka sensei] where $\text{Eb} := \text{at}: \text{honor, up}, \text{Suzuki}, \text{Tanaka}$ in $\text{RS}$.

Ex.7
expression [Tanaka sensei] where $\text{Eb} := \text{at}: \text{honor, down}, \text{Suzuki}, \text{Tanaka}$ in $\text{RS}$.

Then the hearer (Y) wonders why he broke the universal honorific event. Finally, he comes to the conclusion that Suzuki intends either to praise Tanaka or berate him. We can go no further on this problem here.

There are other aspects to $\text{Eb}$. If the sentence is given first, $\text{Eb}$ will be calculated for each word and there remains a possibility of conflict between honorific event types in a simple sentence. In a complex sentence the mechanism of context switch will be used, but in a simple sentence this mechanism is not effective. When the hearer tries to deal with this conflict, he or she will assume that the speaker has some illegal honorific constraint $\text{Ch}$. We have implemented this mechanism in our model system.

4. System Configuration

Our experimental system written in CLIL runs on the DEC 2060 and utilizes Prolog as the basic programming environment, which enables us to use CLIL. CLIL is now compiled and runs very fast on DEC 2060. Next, we want to run this DCG parser on the Bottom Up Parser [Matsumoto, Kiyono, 1984].

5. Other Examples

In this section, we give some examples which have no relation to context switching.

1) Sentence without honorific expression

A sentence without honorifics is parsed. These are resource situations for this type of sentence.

```
?- parse([taro, ga, hanako, ni, at, ti, ti], Context).
```

Additionally, a direct speech act is used with context switching.

```
?- parse([taro, ga, hanako, ni, at, ti, ti], Context).
```

2) Sentence with illegal honorific expression

The following is an sentence with conflict between honorific word expressions. Here, a word without honorific but $[taro, ni, at, ti, ti]$ is words with honorific from the speaker to Taro. In a simple sentence, there should not be conflict between honorific relations. If there is, then the hearer R gets information that the speaker S has some trouble with honorific word expression.

```
?- parse([taro, ga, hanako, ni, at, ti, ti], Context).
```

3) Complex Case

This example sentence contains many honorific expressions. The system analyzes these expressions to find some honorific event type in the speaker's mind.

```
?- parse([taro, ga, hanako, ni, at, ti, ti], Context).
```

7. Conclusion

It is easy to model honorific context in situation semantics. But we don't know how this context is represented in the human mind. This requires further research.

This treatment of the context switching mechanisms of honorifics is the first step toward analyzing more complicated phenomena. The main contribution of this model derives from the fact that in any complex sentence, there will probably be context switching on honorifics. But this model shows context switch in a complex sentence only and there remains more complicated phenomena like the following.

```
S Hanako sama ni atta' (Hanako sama) is a honorific form
(1 met Hanako).
R 'Hanako sama tie dare?' (Who is "Hanako")?
```

$1$ is the direct speech act and there should be a context switch because when R knows who Hanako is, he refers to her with the nonhonorific "Hanako." But we do not formalize the context switch which decides who is the agent of sentence $1$. To solve this problem, we should use an "anaphora mechanism for the honorific context" and in order to build a firm model of this mechanism, study not only of the anaphora mechanism [Barwise 1985e] but also the focusing mechanism [Sidner] is required. These are also topics for further research.

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