# Dependence on Context
# in case of English–Japanese Machine Translation I – 15

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# 英和機械翻訳における文脈依存性 I – 15

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**Abstract**

This is the fifteenth of a series of articles on the context dependency analysis in case of English-Japanese machine translation system which we call "US system". In this issue we examine the examples taken from Lesson 15 and 16 of two English textbooks for the first year grade Japanese junior high school students; namely, New Crown 1 (Sanseido), and New Horizon 1 (Tokyo Shoseki).

The main subjects to be examined in this issue are the followings: (1) Which is the better choice for interjection 'well' between 'eeto' and 'sore-de-wa' ? (revisited) (2) How to translate questions and answers starting from an interrogation using interrogative pronoun "which" ? (revisited) (3) The selection of Japanese for "all right" among "hai", "yoroshii" and "chanto" (revisited). (4) The pronoun subject should be deleted in the Japanese translation of the respance sentence to a question lead by "Where is/are ...?". (5) Example of translating "they" into "kanojo-tachi" (the third case). (6) Grammar rule which changes the Japanese translation "chuudan" for "break" into "kyuukei". (7) Selection of the Japanese for "they" and "their" (revisited). (8) Is the verb transitive or intransitive (in case there is no noun phrase in the rear)? (9) Examples of choice rules which exclude "Sensei" from the candidates for "Mr." or "Mrs." And (10) the difference of Japanese answer expressions according to whether the verb in the question sentence is in the progressive form or not.

Key words: machine translation, context dependence, context inherited from the preceding sentences, US system.

1. Which is the better choice for interjection 'well' between 'eeto' and 'sore-de-wa' ?（revisited）

In the ninth arcle [5] of this series, we explained that interposition 'well' appearing at the head of a conversational sentence has two Japanese translations;

namely the one, 'eeto', which is to take pause before answering the question, and the other, 'sore de-wa', which is to change the topic of the conversation. In example （6）in [5], the Japanese translation of the preeceding sentence terminated with interrogative postposition "ka ?" and the following choice rule

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decided that 'well' in [5] should be translated as 'eeto'.

XX;*ええと;2;E0=Well;FT;E1=,;PJS=*か？」; x670;

This time we consider the following example sentences.

> Where is New York? ........................................................ (1)
> ニューヨークはどこにありますか？
> Nyuuyooku wa doko-ni ari-masu-ka?
>
> *Well*, look at this.
> ええと、これを見なさい。
> *eeto*, kore wo mi-nasai.

Here we don't have the parentheses for the indication of conversation. So we have to be a little bit more careful to verify that the preceding sentence is really an interrogative sentence in conversation. The criterion condition "PJS=*か？」;(-ka ?")" is replaced by "PJS=*ますか？;(-masu-ka?)"

XX;*ええと;2;E0=Well;FT;E1=,;PJS=*ますか？; x685;

2. How to translate questions and answers starting from an interrogation using interrogative pronoun "which" (revisited).

In the ninth arcle [5], we also investigated the choice rule for the interrogative pronoun "which". In Japanese, we use differnt words for chosing between two objects (「どちら」) and three or more objects (「どれ」). The choice rule for the former case was exhibited there.

55;*どちら;2;E0=which;FT;J1=1;T1=h;T2=v;SZ=F;SZ=h;SZ=K;SZ<>xX;BS=*They are ; g150;

This time we present the latter case.

> These points show some big cities in the USA.
> これらの点は米国の（いくつかの）大都市を示しています。
> kore-ra no ten wa Beikoku no（ikutsuka no）daitoshi wo shimeshite-i-masu.

> *Which* is New York, this or that? ......................... (2)
> ニューヨークは*どれ*ですか？これですか、それともあれですか？
> Nyuuyooku wa *dore* desu-ka? kore desu-ka, soretomo are desu-ka?

The choice rule applied to choose the adequate Japanese for "Which" in (2) above is the following;

22;*どれ;2;E0=which;FT;T0=O;T0=?;T1=v;PJS=*（いくつかの）; K320;

This rule checks the conditions that the "which" in question is placed at the head (FT) of the sentence with 'W' in the upper case letter (T0=O), that the sentence to be translated is an interrogative sentence (T0=?), that the following word is the be verb (T1=v), and finally that the preceding Japanese translation (PJS) contains （いくつかの）＝（ikutsu-ka no) meaning 'some' or 'several'. Then the rule above chooses 「どれ」（「dore」）for three or more objects instead of 「どちら」（「dochira」）for two objects.

3. The selection of Japanese for "all right" among "hai", "yoroshii" and "chanto" (revisited).

In the 11th article [7] of this series, we explained that there are three Japanese translations for "all right" in our system dictionary, namely, "hai" an interjection, "yoroshii" an adjective, and "chanto" an adverb. Of course the choice is made by analysing the preceding sentence.

In the article [7] we explained about the following two choice rules which select the Japanese interjection 「はい」;

5X;*はい;2;FT;LT;E0=all right;BS=*please;E2<>you; j250;
5X;*はい;2;FT;LT;E0=all right;BS=*?; j265;

The former one is applied in case the preceding sentence containes "please" (i.e. a request), and the latter one is applied in case the preceding sentence containes "?" (i.e. an interrogation). This time we exhibit the case where the preceding Japanese translation containes "なさい。」", i.e. an imperative sentence.

Jane: Yes. We are making a big cake. Come and help us.
ジェーン「はい。私達は大きなケーキを作っています。来て、私達を手伝い**なさい**。」
Jeen: "Hai. Watashitachi wa ookina keeki wo tsukutte-i-masu. Kite, watashitachi wo tesudai ***nasai***.

Nancy: *All right.* ............................................. (3)
ナンシー「**はい**。」
Nanshii: "***Hai***.*"

The choice rule for "All right" in（3）above is this;

5X;*はい;2;FT;LT;E0=all right;PJS=なさい。」; j220;

This rule checks that the preceding Japanese translation contains "なさい。」"（= nasai.")，mening that the preceding sentence is an imperative sentence and the "All right" in（3）is an affirmative answer to it.

4. The pronoun subject should be deleted in the Japanese translation of the responce sentence to a question lead by "Where is/are …?"

In order to avoid unnecessary repetation of a noun, a pronoun is used instead in English while the subject is simlply vacated in Japanese. It is exactly because of this difference that the pronoun subject should be deleted in the Japanese translation of the responce sentence to a question lead by "Where is/are …?".

Mother: Where is Father?
お母さん「お父さんはどこにいますか？」
Okaa-san: Otoo-san wa doko ni i-masu-ka?

Nancy: He is in the living room. ............................. (4)
ナンシー「居間にいます。」
Nanshii: Ima ni i-masu.

In the process of generating the Japanese translation sentence, the following grammar rule deletes the translated subject pronoun before composing it with the predicate part of the translated sentence.

9;23;X;0;FT;LT;EB=Where is ;E0=he;SZ=h;SZ=?;SZ <>xXW;T1=v;T1=B;J0#Z;J1#VR;J1#DES; S895;

Before connecting the pronoun subject with the predicate part, the rule above verifies that the preceding English sentence started with "Where is", that the pronoun in question is "he", that the attribute set SZ of the subject of the preceding sentence contains 'h'（= human）and '?'（= interrogative sentence）but none of 'x'（= plural form），'X'（= plural conception）nor 'W'（= woman）. The grammar rule also checks that the predicate part contains be verb（T1=v）and some word concerning 'place'（T1=B）. When all these conditions are satisfied, the rule deletes the pronoun（J0#Z;）and forms a complete sentence in Japanese.

5. Example of translating "they" into "kanojo-tachi"（the third case）

In the sixth and the seventh articles［3］，［4］of this series, we showed the cases where the pronoun "they" is translated into "kanojo-tachi"（females）corresponding to the subject of the preceding sentence. This time we present an analogous case when 'they' corresponds to the object of the preceding sentence.

Mrs. Smith is talking with Jane and Nancy.
スミス夫人はジェーンやナンシーと話しています。
Sumisu hujin wa Jeen ya Nanshii to hanashite-i-masu.

*They* are having a very good time. ................... (5)
*彼女達*はとても楽しい時を過ごしています。
*Kanojo-tachi* wa totemo tanoshii toki wo sugoshite-i-masu.

The choice rule applied to 'They' in（5）above is the following.

22;*彼女達;2;E0<>those;T0=O;OZ=h;OZ=FxX;OZ =W; K725;

The object of the preceding sentence is recorded here as "ジェーンやナンシー"（= "Jane and Nancy"）and its attribute set OZ consists of 'OKhWFOKhW',

where 'O' means an uppercase letter, 'K' a proper noun, 'h' human, 'W' woman, and 'F' implies 'and/or'. On the other hand, the subject of the preceding sentence registered here is "スミス夫人" (= Mrs. Smith) and its attribute set SZ consists of 'OMuWOhK' lacking either of the "plural" symbols F, x or X..

## 6. Grammar rule which changes the Japanese translation "chuudan" for "break" into "kyuukei"

In our machine translation system, the Japanese words for "break" are registered in the system dictionary as "sakeme" (= rift) and "chuudan" (= interruption). In the following example sentence, a choice rule for "break" selects "chuudan" as adequate, but in the process of generating the Japanese translation by usage of grammar rules, it is overridden as "kyuukei".

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Each teacher has his or her classroom.
それぞれの先生が彼の、あるいは彼女の教室を持っています。
Sore-zore no sensei ga kare no, arui-wa kanojo no kyoushitsu wo motte-i-masu.

So students change classrooms every period.
それで生徒は毎授業教室を交換します。
Sore-de seito wa mai jugyou kyoushitsu wo koukan-shi-masu.

The *break* between classes is very short.
...................................................... (6)
授業の間の*休憩*はとても短いです。
Jugyou no aida no *kyuukei* wa totemo mijikai desu.

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The grammar rule below overrides "中断 (= chuudan = interruption)" by "休憩 (= kyuukei = recess);

2;81;1;0;E0=the;DJ0=その;FT;T0=O;E1=break;E2=between;J3=1;T3=x;J4=3;DJ1<>OJ$;DJ1<>SJ$;PJS<>*DJ1;J0#Z;J1#Z;J1#+休憩:kyuukei; 3820;

The rule checks that "break" in question is followed by "between" and then by a noun in the plural form and further by a verb. Before overriding "中断 (chuudan)" by "休憩 (kyuukei)", the rule verifies

that "中断 (chuudan)" does not agree with neither the subject nor the object of the preceding translated sentence and that it is not contained in any part of the preceding translation. If one of the last conditions above is not satisfied, the Japanese candidate "中断 (chuudan)" is likely to be respected..

## 7. Selection of the Japanese for "they" and "their" (revisited)

In the fifth article [2] of this series, we examined the Japanese candidates "karera", "kanojotachi", "hitobito", "sorera" for pronoun 'they', and in the tenth article [6], we examined the similar problem for 'their'. The choice rules explained in those areticles were mainly concerned with the ones which select the inanimate candidate, or equivalently, reject animate (human) candidates as follows;

22;*それら;2;E0=they;T1=v;J2=12;T2<>h; D500;
22;*それら;2;E0=they;T1=v;J2=8;J3=5;J4=1;T4=x;T4<>h;SZ<>h;OZ<>h; D510;
88;彼女;2;E0=their;SO<>W;J-1=3;T-1=x; v850;
88;u;1;E0=their;J-1=3;J-2=1;T-2=OK;T-2<>xX;SO<>h; v945;

This time, our example sentence selects the animate candidates "彼等 (karera)" and "彼等の (karera no)".

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These are lockers for the students.
これらは生徒の為のロッカーです。
korera wa seito no tame no rokkaa desu.

*They* can put *their* bags and textbooks here.
...................................................... (7)
*彼等*はここに*彼等の*かばんと教科書を置く事が出来ます。
*karera* wa koko ni *karera no* kaban to kyoukasho wo oku koto ga deki-masu.

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The Japanese words for "they" and "their" in (7) above are selected by the following choice rules;

88;*u;1;E0=their;E1<>impact;SO=h;SO=FxX; v970;
22;*彼等;2;E0=they;T0=O;SZ=FxX;SZ=h;SZ<>W;
K050;
88;*彼等の;2;E0=their;DJA=彼等の; v800;

Here the attribute 'u' implies 'human' as 'h', but 'h' is attributed only to nouns and pronouns, and 'u' is used for verbs (= '3'), adjectives (= '5') and articles (= '8'). "SO" in the lefthand side of equalitiy or inequality implies "either the subject's attribute set or the object's attribute set of the preceding sentence containes" or the negation of that, respectively. The subject and the object of the preceding sentence here are "ロッカー（locker）" and "教室（classroom"), respectively. Their respective attribute sets consist of SZ = xBd+heyつ人 and OZ = uFueByつ, respectively. These values are picked up by the orders of the grammar rules during the generation process of the translation and usually contain not only the attributes of the subject and the object words themselves but also those of the modifying words and phrases of them.

## 8. Is the verb transitive or intransitive (in case there is no noun phrase in the rear)?

In the fifth article [2] of this series, we examined the choice rule which selects intransitive interpretation of a verb placed at the end of the given sentence. We also exhibited in the eleventh article [7], an analogous problem concerning a verb followed by a preposition. This time we show a choice rule which selects intransitive interpretation of a verb having no noun phrase in the rear. This condition is seemingly verified by checking that there is no noun, pronoun, article, gerund or relative.

Mike has a pet.
マイクはペットを飼っています。
Maiku wa petto wo katte-i-masu.

He eats a lot. ................................................................. (8)
彼はたくさん食事を取ります。
kare wa takusan shokuji wo tori-masu.

The following choice rule is applied to the verb 'eat' in (8) above.

33;*j;1;DJ0<>VR$;DJ0<>VR2$;T1<>Gr;DJ1<>' ;J2<
>3;DJZ<>「;DJ-1<>」;T0<>pP;E-1<>to;J-
1<>#;DJ-2<>う事;JZ<>128;E1<>…;TA<>qr; Y060;

There are many conditions to be required, but the essential one is "JZ<>128;" which means there is no noun, pronoun or article in the rear. Two context conditions "DJ0<>VR$;DJ0<>VR2$;" should also be verified so that the verb in question was not already used as a transitive verb in the preceding sentence nor in the sentence before the preceding sentence. Thanks to this rule, the usual interpretation of the verb 'eat' as a transitive verb is rejected in (8).

## 9. Examples of choice rules which exclude "Sensei" from the candidates for "Mr." or "Mrs."

In the third [1], sixth [3], seventh [4] and eleventh [7] articles of this series, we examined various rules which select the adequate Japanese for "Mr.", "Mrs." and "Miss". For example, we presented in [7] the following rule which rejects "Sensei" for the Japanese translation and adopt "San" instead when the 'e' (= education) attribute is absent in the context;

88;*さん;2;FT;J2=0;SO<>e;T4<>e;T5<>e; w125;

This time, look at the following example sentences.

Mr. Smith is drinking coffee. ..................................... (9)
スミス氏（さん）はコーヒーを飲んでいます。
Sumisu shi（san）wa koohii wo nonde-i-masu.

He is listening to music on the radio.
彼はラジオで音楽を聞いています。
Kare wa rajio de ongaku wo kiite-i-masu.

Mr. Smith is smiling. .................................................... (10)
スミス氏（さん）はほほえんでいます。
Sumisu shi（san）wa hohoende-i-masu.

Mrs. Smith is talking with Jane and Nancy.
.................................................... (11)
スミス夫人はジェーンやナンシーと話しています。
Sumisu hujin wa Jeen ya Nanshii to hanashite-i-masu.

For "Mr." in （9）, the following choice rule is applied and the candidate "先生（Sensei）" is rejected.

88;先生;2;T0=M;SO<>e;TA<>e;TZ<>e;JZ<>%; w210;

For "Mr." in （10）, the candidate "先生（Sensei）" is rejected by the rule

88;先生;2;E0=Mr.;J1=1;T1=K;T1=h;E0=EB2;JS2=*D J1;JS2<>*先生; v320;

, which requires the conditions that "Mr." in question is followed by a human propernoun and that this propernoun appered in the sentence before the preceding sentence, but that its Japanese translation does not contain "先生（Sensei）". So the choice is made to preserve the consistency with the translation of the sentence before the preceding sentence.

For "Mrs." in （11）, the pairing of "Mr." and "Mrs." is taken in consideration. The following choice rule

88;先生;2;E0=Mrs.;J1=1;T1=K;T1=h;E1=*BS;E0<>* BS;BS=*Mr.; v270;

rejects "先生（Sensei）" as the Japanese for "Mrs." when it is followed by a human proper noun which already appeared in the preceding sentence with "Mr." In such a case, "Mr." and "Mrs." are considered to be a couple.

10. The difference of Japanese answer expressions according to whether the verb in the question sentence is in the progressive form or not.

In question-answer conversational context, answer sentences "Yes, it is." and "Yes, they are." etc are usually translated into Japanese as "Hai, soudesu." But in case the verb in the question sentence is in the progressive form, the "be" verb in the answer is in fact not a copula but an auxiliary verb with the succeeding gerund abbreviated. In Japanese, the gerund part can not be abbreviated but is repeated. See the following example.

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> Are Ken and Kumi in the same class?
> 健と久美は同級生ですか？
> Ken to Kumi wa doukyuusei desu-ka?
>
> *Yes, they are.* ................................................................. （12）
> はい、そうです。
> *Hai, sou-desu.*

The generation rule for the answer sentence （12） above checks that the respective attribute sets of the verbs of the preceding sentence and the sentence before the preceding sentence do not contain 'G'（= Gerund）as follows.

3;6023;X;0;FT;LT;T0<>N;T3=v;T3<>ijk;VZ<>G;VZ 2<>G;J2#Z;J3#Z;J3#+そうです:sou-desu; 9755;

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