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Third Person Referring Expressions in English  
英語における3人称の指示表現

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Referring expressions in English may lexicalize as full noun phrases, reduced noun phrases, or pronominal expressions, or they may be elided. In this paper, we discuss the factors that determine the surface form for English third person referring expressions: their position in discourse, their relationship to the center of the utterance, the politeness level at which they are phrased, and whether they are used for clarification or contrast. We include suggestions for incorporating these factors into a machine translation system. More problematic issues concerning restrictions on pronominalization, noun-noun coreference, retaining the noun form, and definiteness are also addressed. The constraints identified in the initial portion of the paper are discussed as they apply to the current corpus and to a new corpus designed to illustrate more clearly the functioning of these constraints in natural English discourse.

梗概

英語で(3人称の)事物を参照する方法には、“完全な”名詞句を用いる方法、縮退した名詞句を用いる方法、代名詞を用いる方法、などによる明示的な方法、さらに、省略を用いる暗黙的な方法がある。本稿では、これらの中から適切な表現手法を決定するための要因について検討する。

本稿で要因として挙げたのは、1) 談話における出現位置、2) 発話の中心(center)との関係、3) 発話の丁寧さの度合、4)(確認や対照のために使われているかどうかといった)聞き手に与える情報の質、の4つである。これらの諸要因をもとに翻訳システムにおいて名詞句決定を行なう方法について考察する。さらに、代名詞化、名詞間照応、名詞形の継続、定・不定の制約に関するより困難な問題についても言及する。

また、本稿の最初の部分で示す諸制約を、ATRのモデル会話コーパス、および、より多くの指示表現を含む新たな会話テキストを対象として適用し、その有効性について議論する。

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English and Japanese utilize different conventions for lexicalizing third person referring expressions; Japanese tends to use full noun phrase forms or zero pronouns for the most part, and pronominal forms infrequently, while English uses noun phrase forms somewhat less frequently, zero pronouns only under tightly controlled situations of identity with a previous noun phrase, and pronominal forms more extensively. In this paper, we will be concerned with characterizing the generation of appropriate forms for referring expressions in English sentences generated from Japanese conversation. We draw on examples from three different sources: an expanded version of the Mset for SL-TRANS<sup>1</sup>, in which all natural variants of third person referring expressions are used (Appendix 1), an invented dialogue which better illustrates the constraints discussed here, and examples modelled on or taken from other work in this area.

### Initial issues

The problem of generating appropriate referring expressions in English has several aspects. First of all, the Japanese source conversation may contain full noun expressions which would be considered repetitive in English. A good illustration of this situation is in dialogue 1. In this conversation, "registration form" is introduced and, in the Japanese conversation, it is repeated in full noun phrase form in two later utterances; in English, it is more appropriate to use pronominal forms in both those utterances:

I would like to apply for the conference 1-6  
What kind of procedure should I go through? 1-7  
Please proceed by using the registration form ("touroku-youshi"). 1-8  
Do you already have one ("touroku-youshi")? 1-9  
No. 1-10  
Not yet. 1-11  
All right. 1-12  
Then we will send you one ("touroku-youshi"). 1-13

The first difficulty is how to identify this type of situation: under what conditions are the noun phrases used in Japanese repetitive in English? Then there is the further problem, of course: how *should* these referring expressions be lexicalized in English? Should they be expressed as a reduced noun phrase, expressed as a pronominal expression, or "expressed" with an elision<sup>2</sup>?

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<sup>1</sup>The Mset, or "model set," dialogues consist of ten, somewhat idealized conversations between a client and a conference office. We will refer to them below as "dialogue one," etc.

<sup>2</sup>For example, "the registration form" might be expressed as "the form" (reduced noun phrase), "it" (pronominal form), or omitted altogether (elided form).

The contrary situation may also hold: an argument of a verb may not be given lexical expression in the Japanese conversation when it must be expressed in English. There are numerous examples in the Mset in which a Japanese zero pronoun *must* be expressed in English as some overt lexical item (usually most appropriately a pronoun). The problems here are similar: first, to identify the contexts in which those arguments occur, and then, to determine what English referring expressions should fill those positions. Of course, there are always the cases, as well, in which the Japanese and English argument specifications coincide; the problem here is marking where those cases occur so that translation can simply proceed.

Clearly, a general account of the use of referring expressions in English would enable us to handle all of these situations in a coherent way; such an account would lay out the principles by which it is possible to determine where full noun expressions, pronominal expressions, and elisions are appropriate. In the discussion below, we have outlined a number of constraints that operate to determine the appropriate lexical representation for referring expressions in English. Given a complete semantic description of a Japanese utterance and discourse information, then, a generation grammar incorporating these constraints could predict where each type of expression is most appropriate in the generated English translation.

A crucial aspect to such prediction is the availability of the subcategorization specifications of English verbs. These specifications will include, in particular, an account of the argument structure of the verb: which arguments are obligatory, and which are adjunct. This information plays a critical role in at least two ways. First, it allows us to recognize when it is necessary to provide overt arguments in the English version where zero pronouns occurred in the Japanese utterance. Utterance 2-15 provides an example.

\*Please transfer  $\emptyset$  to the bank account which is mentioned in the announcement. 2-15

In the Japanese utterance, the object of the verb is omitted; for the corresponding verb "transfer" in English, the object must be present. Thus, we must supply the object "the payment" in this sentence. (General pronominalization principles discussed below will determine whether it is possible to use a pronominal form of this noun phrase in this position.)

Secondly, such information will dictate when elision of an argument is impossible (when the argument is strictly subcategorized for), and when elision of an argument is possible (when it is an adjunct).<sup>3</sup>

<sup>3</sup>This information may have to be fairly subtle. For example, when "transfer" is used of a

There are many examples where subcategorization requirements block the elision of a phrase; every sentence containing a subject which is a noun phrase repeated from a previous sentence (and thus a possible candidate for elision) could serve as an example. Because subjects are obligatory arguments in English, they must be retained even though the Japanese expression may contain no lexical subject. Utterance 7-16 is another type of example:

Then would you send that circular to me as soon as possible? 7-12 ...  
\*Then I will send  $\emptyset$  right away. 7-16

Elision of the noun phrase in 7-16 could occur under identity with the noun phrase "that circular" in 7-12; however, the subcategorization requirements for "send" include the information that "send" must have an overt object. The Japanese version of this sentence contains a zero pronoun in this position; a grammar incorporating subcategorization information can recognize the need for some lexical expression in this position in the generated English sentence and (given other general principles) generate an appropriate object for the English sentence. On the other hand, where subcategorization requirements for particular arguments are lacking, English (as well as Japanese) may elide the expression of those arguments. A number of such examples are discussed in the section below concerning ellipsis.

In the discussion below of a general account of referring expressions in English, we have assumed that lexical information about the argument structure of English verbs is available to the generating grammar.

### **Factors in determining third person pronoun usage in English discourse**

The phenomenon of pronominalization can be characterized in the following, extremely simplified way:

**Basic rule of pronominalization.** The first mention of a third person referring expression is made in full noun phrase form; subsequent mentions are pronominalized.

If we take that as a starting point for our description, our task then becomes to student transferring to a different college, it is possible to say "You should transfer," that is, in this sense "transfer" takes a single argument. However, when used of transferring money to a bank, you cannot say "You should transfer;" that is, in this sense, "transfer" is at least a two-argument verb, requiring an object: "You should transfer the money." In the latter sense, "to N" is also strongly implied, but other phrases are "more" optional: "by Monday," "for me," etc.

characterize in what principled ways actual instances of pronominalization deviate from that basic description. In the discussion below, we isolate and describe a number of factors that affect pronominalization in discourse:

the position of the expression in the discourse;

its relationship to the backward center of the utterance;

the level of formality of the discourse;

within-sentence pressures for coreference of pronouns or of pronoun and noun;

and the use of the full noun phrase for contrastive or clarifying purposes.

Since ellipsis is an alternate form to reference, we will also discuss some considerations involving differences between elision and the use of a pronominal form.

**Position in discourse.** The basic rule for pronominalizing noun references is that subsequent mention of the reference is always pronominalized. There are, of course, a large number of examples in the Mset to which this very general principle applies. To take only one, in the sixth conversation, the client calls to ask about the sightseeing tour.

I understand there is a **city sightseeing tour** during the conference. 6-3  
Is it still possible to participate in it? 6-4

In fact, if the second mention is immediate (a term which needs further clarification), as it was in the previous example, pronominalization is (virtually) obligatory. Again, this is amply illustrated in the Mset.

If you look in the second circular, you will find the titles listed. 7-9  
Would you please take a look at it. 7-10

It would not be appropriate to replace "it" in 7-10 with "the circular."<sup>4</sup>

These examples illustrate one aspect of the principle of pronominalizing subsequent references, that is, the case in which the subsequent reference immediately follows a full noun form. In the addendum are listed all variations for each utterance wherever alternative referring expressions or ellipsis were possible. In situations in which a number of adjacent utterances each have several variations, it is not the case that all combinations of all of the variations are appropriate. Referring expressions should be in pronominal form not only

<sup>4</sup>In fact, where not blocked by subcategorization requirements, elision is also possible in such cases:

I understand there is a city sightseeing tour during the conference. (6-3)

\*Is it still possible to participate in the tour?

Is it still possible to participate in it?

Is it still possible to participate? See below for further discussion.

when they immediately follow full noun forms, but when they immediately follow pronominal or elided forms as well.

For example, in conversation 4, 4-3 and 4-7 (separated only by very short utterances) each have a number of possible alternatives. Some combinations are fine:

Do you have an announcement about the conference? 4-3  
The conference will be held at xx from xx to xx. 4-7

Do you have an announcement about it? 4-3'  
It will be held at xx from xx to xx. 4-7'

Do you have an announcement about the conference? 4-3"  
It will be held at xx from xx to xx. 4-7"

But some are not as appropriate:

Do you have an announcement about it? 4-3'''  
?The conference will be held at xx from xx to xx. 4-7'''

Do you have an announcement? 4-3''''  
?The conference will be held at xx from xx to xx. 4-7''''

The use of the full noun phrase after a pronominal form or after elision is not "natural;" pronominal forms are preferred in this context.

The general rule given above states that the first mention of a noun in the discourse is not pronominalized. But this is really a special case of a broader phenomenon, that is, that the first mention of a noun in any discourse *segment* (as defined in Grosz and Sidner 1986) is not pronominalized, (even though it may have been mentioned, and even pronominalized, in previous discourse segments). For example, recall the example from the sixth conversation above. The first mention of the tour is a noun reference (6-3). Immediately after that reference, the next reference is made with a pronoun. In this segment, the client is establishing whether it is possible for him to join the tour. The next segment begins where the office gives more information about the tour:

The tour will visit xx on xx. 6-7

Notice that the first reference to the tour in that segment is made with the noun form.

In fact, even within the same discourse segment, if there has been an intervening discourse segment, the re-mention of a noun after the intervening segment is (usually) not pronominalized.<sup>5</sup> For example, recall the discussion of the first conversation above in which the office and the client are discussing the registration form. The initial mention of the registration form was in full noun phrase form (1-8). This was followed by two references to the registration form using a pronoun (1-9 and 1-13), all within the same discourse segment. Then comes a subordinate discourse segment in which the office gets the client's name and address, etc. After that intervening segment, the next reference to the form, even though it is in the same discourse segment as the first noun phrase expression and the later pronominal references, is made with a noun phrase (1-18):<sup>6</sup>

Then we will send you **one**. 1-13

Your name and your address, please? 1-14

The address is xx. 1-15

The name is xx. 1-16

All right. 1-17

We will send you the **registration form** immediately. 1-18

We must be careful here, however. We have been discussing discourse segmentation as if it were uncontroversial; in reality, it is not. In fact, some accounts of discourse segmentation determine discourse segment boundaries by where it is and is not possible to pronominalize a referring expression (that is, the discourse segment boundary is determined by pronominalization), while in other accounts (such as what we have described above), the reverse is true: the possibilities for pronominalization are determined by discourse segment boundaries. Discourse A contains a good illustration of this difficulty:

<sup>5</sup>There is some variation here dependent upon how long the intervening material is and how closely related it is to the topic of the discourse segment it interrupts. Basically, if the noun is still salient even after intervening discourse, it may be pronominalized. See discussion of ellipsis below for more (but not too much more) on the notion of "salience." Bolinger (1979) discusses this type of phenomenon from a slightly different perspective. He talks about the "reintroduction of the noun referent" rather than the lack of pronominalization. He makes the same point: "the speaker will find it most natural to reidentify the referent--by repeating the noun--after a break of some kind." (p. 298) He considers breaks between main and "loosely connected" subordinate clauses sufficient to license the non-pronominalization, or, in his terms, reintroduction, of a noun phrase.

<sup>6</sup>Quirk, Greenbaum, Leech and Svartvik (1985) recognize this tendency: "...where textual material puts identification of an antecedent even momentarily in doubt [because of the "relative remoteness" of the antecedent from the later referring expression], a pro-form will be avoided--however 'grammatical'--and an alternative means of expression found." (p. 1460)



Do you already have a registration form? A-6

No. A-7

Not yet. A-8

I see. A-9

Then I will send you one. A-10

Your name and address please. A-11

My address is xx. A-12

My name is xx. A-1

I see. A-14

I will send you the registration form immediately. A-15

The "one" in A-10 is the problem here. The pronoun form is quite natural in this case, more natural than the full noun form. However, the pronoun form should not be possible given the proposed discourse structure: since A-10 is the first utterance of a discourse segment, by the principle described above, it should not contain any pronouns. There are two available solutions here. First, we could reanalyze the discourse structure and put A-10 in the previous discourse segment as part of the acknowledgement to the response to A-6. This type of solution is typical of accounts which determine discourse structure on the basis of pronominalization possibilities. On the other hand, we could place some sort of constraint on the nature or length of the intervening material, or on some quality of the referring expression (such as "salience" [see below]) so that in some cases (such as A-10), pronominalization is possible, while in other cases (such as 6-7), pronominalization is not possible. This type of solution is characteristic of accounts which define pronominalization possibilities based upon discourse segments.

The prohibition on pronominalizing after an intervening discourse segment is prone to similar difficulties. In the example below, 7-13, 14 and 15 seem to comprise a discourse segment interrupting the discourse segment made up (in part) of 7-12 and 7-16. However, it is still natural to pronominalize "that announcement" in 7-16.

Then please send me that announcement as soon as possible. 7-12

My address is xx and my name is xx. 7-13

It's xx and xx, right? 7-14

Yes. 7-15

Then I'll send it as soon as possible. 7-16

As in the example above, it is possible either to redefine the discourse segments or to appeal to some notion such as "salience" to override the prohibition on pronominalization in discourse-segment-initial utterances. Until independent means to determine either pronominalization or discourse segment boundary

possibilities are available, there is no *a priori* way to know which of these solutions is preferable.

**Relationship to the center.** There are at least three ways in which centering information affects the lexicalization of third person referents. The centering algorithm (Brennan, Friedman and Pollard 1987; Grosz and Sidner 1986) makes predictions about how pronouns in utterances are likely to be interpreted. They claim that this algorithm captures a strategy used by speaker/hearers to interpret pronominal reference in discourse. A further extension of this characterization, then, is that where the predictions made by the centering algorithm do not match the speaker's intended meaning, the speaker will tend not to pronominalize the expression so that clarity of reference can be maintained. (This sort of extension seems similar to other strategies speakers use to ensure that they will be understood by their hearers.) Thus, a speaker can use centering algorithm information as a check on how an utterance will be understood.

In the first case, then, a translation system can use centering algorithm information in much the same way. Instead of a speaker who knows what his intended reference is, we have the semantic input from the source language in which coreference is already specified. If the centering algorithm predicts that the pronominalization of a particular zero pronoun will make it seem to be coreferent with some NP other than the NP it is coindexed with in the semantic representation, then the translation system will express that zero pronoun in full noun phrase form.

Consider the following example from conversation 3. The client introduces his concerns and then makes his request:

I would like to present a paper at the conference. 3-3

Please tell me about the conference. 3-4

How would 3-4 have been interpreted if the translation system had generated "Please tell me about it"? Because "a paper" is a higher ranked forward center in 3-3, "it" in 3-4 would have been taken as the backward center referring to "a paper." In fact, of course, the speaker meant that reference to refer to "the conference," (and that reference in the semantic representation would have been coindexed with "the conference" and not with "a paper"). Thus, a full noun phrase must be generated here to avoid a misinterpretation correctly predicted by the centering algorithm.

A second aspect of the effect of the position of the center on the possibilities for pronominalization is captured in Rule 1 of Brennan et al. (1987)'s centering algorithm: "If some element of  $C_f(U_{n-1})$  is realized as a pronoun in  $U_n$ , then so is

$C_b(U_n)$ ." This is illustrated in conversation 2.

I would like you to tell me about the attendance fee of the conference. 2-3  
How much is the attendance fee if I apply for the conference now? 2-4

The client calls to inquire about the attendance fee, introduces his question (2-3), and then asks it (2-4). The same two noun phrases occur in both utterances: "the attendance fee," and "the conference." "The attendance fee" is the backward center in 2-4 (because it is the highest ranked forward center of 2-3 realized in 2-4). If the speaker chooses to refer to "the attendance fee" with the full noun expression (possibly for reasons of politeness that will be discussed below), that still leaves the unpronominalized second mention of "the conference" to be accounted for. Rule 1 blocks the pronominalization of "the conference:" since the  $C_b$ , "the attendance fee," is not pronominalized, "the conference" cannot be either.

A third aspect of the effect of the position of the center on pronominalization involves the introduction of new referents into the discourse. In the centering algorithm as described by Brennan et al. (1987), the "focus of attention" of an utterance is its backward center. By definition, this reference is (at least) a second mention of a forward center from the previous utterance. That is, it must have been realized in at least the previous utterance. However, it seems that there are times when a *new* referent is intended as the "focus." (As the "focus," this should be called the  $C_b$ , but because it is not backward-looking, having never appeared before, we will simply call it the "focus.") This would seem to be supported by the fact that other potential  $C_b$ 's in the utterance are not pronominalized, as they would not be under Rule 1 if a different referent were acting as the "focus."

This point is illustrated in a portion of the conversation that follows 2-4 above:

It is Y35,000 per person right now. 2-6  
If you apply next month, it is Y40,000. 2-7  
The proceedings fee and the reception fee are included in the attendance fee. 2-8

"The attendance fee" can be pronominalized in 2-6 and 2-7 and is clearly the focus in 2-4, 2-6, and 2-7. However, new information concerning the proceedings fee and the reception fee is given in 2-8, and "the attendance fee" is again given in noun form (and in fact, would not be appropriate in pronominalized form). We propose the following interpretation: "the attendance fee" is acting as if some other center were the  $C_b$ . Since that could only be "the proceedings fee and the reception fee," and that reference is a noun reference,

then, according to Rule 1, "the attendance fee" must be a noun reference as well.

On the other hand, there could be a different interpretation. Introduction of new material usually happens at the beginning of a discourse segment. It might be that 2-8 begins a new discourse segment and that that explains why "the attendance fee" did not pronominalize. That seems unlikely in this example, but given the concerns expressed above about the determination of discourse segment boundaries, this question cannot be resolved here. In either event, it is clear that the centering algorithm makes no provision for the status of newly introduced material. Although these referents cannot be  $C_b$ , being unrealized in previous utterances, they seem, nevertheless, to be the new "focus of attention." We will return to this idea briefly below in the discussion of the notions of "clarity" and "contrast."

**Politeness.** The possibilities for pronominalizing the second mention of a noun referent in discourse seem to pattern along a scale of most to least polite (or most to least formal). In the least formal cases (and where the phrase is not one that is subcategorized for in the syntactic context of the utterance), the reference can be omitted completely. The next level of formality is pronominalization; the next is the deletion of any descriptors in the phrase, and the most formal possibility is the use of the full noun phrase.<sup>7</sup>

Utterance 2-14 answers the question "How can I pay the attendance fee?" Possible answers are any of the following:

You can pay <b>the attendance fee</b> by bank transfer. 2-14	
	most polite: full noun phrase
You can pay <b>the fee</b> by bank transfer.	reduced noun phrase
You can pay <b>it</b> by bank transfer.	pronominal form
You can pay $\emptyset$ by bank transfer.	least polite: elided form

["By bank transfer"] is another possibility according to our previous analysis of

<sup>7</sup>Perhaps not surprisingly, we found an analogous scale to hold for answers to wh-questions, where the least formal answer is simply the answer phrase itself, with all else deleted; the next levels involve varying amounts of deletion of adjunct material; and the most formal answer is the repetition of the entire clause, with answer included. The following gives some of the possibilities, including least and most formal:

Q: How much is the cost from Kyoto Station to Kitaoji Station by taxi?  
A1: The cost from Kyoto Station to Kitaoji Station by taxi is Y3000.  
A2: The cost from Kyoto Station to Kitaoji Station is Y3000.  
A3: The cost is Y3000.  
A4: It is/It's Y3000.  
A5: Y3000.

wh-answers.]

Of course, politeness is not a hard and fast concept and it interacts with the other considerations we have already discussed. Where the second mention "immediately" follows the first mention, it is not possible to get the "most polite" version described above. Instead, as we said above, the noun reference must (virtually) be pronominalized. So, in 8-13, it is not appropriate to use the full noun phrase form of "the application form" since it immediately follows an utterance which contains the same noun phrase:

There is a specific application form so please fill it in. 8-12  
I will send you the form so please give me your address. 8-13  
I will send it to you so please give me your address. 8-13'  
\*I will send you the application form so please give me your address. 8-13"  
[\*I will send you  $\emptyset$  so please give me your address. "Send" requires a direct object argument when the indirect object is present in most American speech. See above.]

The choice to be more or less polite may also affect the possibility of pronominalizing across discourse segment boundaries.<sup>8</sup> If the speaker wants to be more casual, he/she can pronominalize the second occurrence of a noun phrase even when it occurs in a different discourse segment from the first mention. For example, the client in conversation 5 wants to cancel his registration. He makes that request, and it is confirmed that he has paid part of the attendance fee. He then begins a new discourse segment by asking if that fee can be refunded (5-13). As discussed above, this should require a full noun reference for "attendance fee" (despite the fact that it has been mentioned before). However, a speaker wishing to be more casual could use the pronominal reference.

Could you refund the attendance fee?	Expected
Could you refund it?	Casual

**Ellipsis.** Above, we dealt with ellipsis as the "endpoint" of the politeness scale for choices in pronominalizing expressions. However, ellipsis may serve a more general function. "Whatever grounds there may be for expressing oneself with maximum explicitness [and these grounds would certainly include politeness], there are generally strong preferences for the most economical variant, viz the one which exhibits the greatest degree of reduction....This generally means preferring ellipsis to the use of proforms," Quirk, Greenbaum, Leech and Svartvik (1985). Some examples of ellipsis in the Mset illustrate this tendency.

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<sup>8</sup>Keeping in mind in this discussion all the reservations expressed about discourse segment boundaries above.

For a double [room, the rates are] Y9,500 to Y60,000. 10-9  
The Kyoto Hotel [is closer to the conference hall]. 10-12  
We are able to [get the room]. 10-29

In the case of ellipsis as the least formal end of the politeness scale, an utterance with an elided phrase alternates with utterances with pronouns, reduced noun phrases or full noun phrases. But, in fact, there are other examples of ellipsis which do not alternate with pronouns or reduced noun expressions. Consider again the possibilities for 2-8, this time with the elided variant added:

The proceedings fee and the reception fee are included in the attendance fee. 2-8

?The proceedings fee and the reception fee are included in the fee. 2-8'

?\*The proceedings fee and the reception fee are included in it. 2-8"

The proceedings fee and the reception fee are included. 2-8'''

Above, we discussed two possible reasons why the use of the full noun phrase "the attendance fee" is preferable to the use of the pronoun "it," reasons having to do with clarity of reference. However, although there may be problems interpreting the reference for "it," there is no ambiguity in interpreting the elided example; "include" presupposes "in something," but there is no doubt that the elided phrase should be "in the attendance fee." Why?

Presumably, the "search" for the referent for the elided phrase is not bound to the sentence, but can be supplied by a larger context.<sup>9</sup> Since the entire conversation concerns the attendance fee, and, in fact, "the attendance fee" has been the center up to this point, the best candidate for "filling in" the elided phrase is "the attendance fee."

Another example shows a similar configuration of possibilities, but for a different reason. Consider the set of possibilities for 3-8:

By the way, what is the official language of the conference? 3-8

\*By the way, what is the official language of it? 3-8'

By the way, what is the official language? 3-8"

In this example, "by the way" clearly signals a marked change to a new discourse segment; thus, we should expect the full phrase of the expression to

<sup>9</sup>Clearly this is true for pronominal reference as well, yet the fact that 2-8' and 2-8" are "bad" defines a difference between these phrases and elliptical phrases. The former are closely bound to the sentence; the latter, seemingly not at all. See the next section for a discussion of the boundedness of pronoun reference.

be used, and the pronominalized form to be unacceptable, which is, indeed, what we find. However, the elided form is also quite acceptable. Just as elision is not bound to the sentence for its referent, so, it seems, is it not bound to the discourse segment. It is possible to interpret an elided phrase on the basis of its identification with a contextually salient possibility. Clearly, "the conference" is contextually salient, being, after all, the *raison d'être* of the phone call in the first place.

Grosz and Sidner (1986) speculate that it may be possible to define salience in terms of the focusing process; "the focusing process associates a focus space with each discourse segment; this space contains those entities that are salient." (p. 179) It could be, then, that the determination of pronoun referents can be constrained by centering processes (and other principles), while the determination of references for elided phrases can be constrained by focusing processes which define salient entities in the discourse.

To summarize: much of the ellipsis in the Mset is interpretable on the basis of identification with previously expressed full noun phrase forms in much the same way as referents for pronominal forms are interpreted. However, it may also be the case that, unlike pronominal forms, the "connections" to referents for elided phrases may extend beyond sentence limits and discourse segment boundaries to more generally discourse-salient phrases. It is not clear exactly what the limits on those "connections" might be. If it is possible to define "salience" on the basis of focus spaces, then it would be an interesting question to determine if that notion can be used to characterize the context in which elided phrases are appropriately interpretable.

**Co-reference within sentences.** Thus far we have examined the constraints on pronominalization across utterances in cases in which there is only one pronominal form. Pronominalization of two or more referents within one utterance presents its own difficulties. Where there is some difference in gender, number, or definiteness that would allow the unique determination of referents for each of the pronouns, pronominalization is appropriate and interpretation is straightforward. We encounter potential difficulties, however, if two pronouns in the same utterance are in the same form. In that case, the two pronouns tend to be interpreted as coreferring.

In addition, a hearer "seeks" an antecedent for a pronoun inside the utterance in which the pronoun occurs first. If the hearer "finds" a possible antecedent, she strongly tends to interpret the pronoun as co-referring with the potential antecedent inside its own utterance. Both of these tendencies, first, for two pronouns of the same form to be interpreted as coreferring and second, for a hearer to try to interpret a pronoun as having an antecedent in its own utterance, override centering predictions. That is, even though the centering algorithm may

make a clear prediction about which pronoun refers to which expression (either in the same or a previous utterance), the tendency of identical pronouns within the same sentence to be interpreted as coreferring still causes reference to be confused. Thus, where pronominalization would cause two identical pronominal forms to occur in the same utterance, pronominalization must be blocked.

Consider:

I would like you to tell me about the attendance fee for the conference. (2-3)  
How much is the attendance fee if I apply for the conference now? (2-4) cf.  
?How much is it if I apply for it now? (2-4')

Notice that the centering algorithm predicts that the most likely interpretation is the one in which first "it" refers to "attendance fee," while the second refers to "the conference."<sup>10</sup> This interpretation, however, is not the most natural one. In 2-4', the two "it's" are interpreted as both referring to "the attendance fee." In order for the second reference to be interpreted as referring to "the conference office," pronominalization cannot proceed and the full noun form must be used.

Similarly, in 3-11, the centering algorithm makes the correct prediction about the referent of a pronoun, but because of the tendency for the pronoun to be interpreted as having an antecedent within the same sentence, it is not possible to interpret the sentence correctly when it is verbalized with a pronoun:

By the way, what is the official language at the conference? (3-8)

English and Japanese. (3-9)

I do not understand Japanese at all. (3-10)

Is there simultaneous interpretation into English when the presentation is made in Japanese? (3-11)

?Is there simultaneous interpretation into English when the presentation is made in it? (3-11')

Notice that if "in Japanese" is replaced by "in it," the centering algorithm predicts (correctly) that the "it" is meant to refer to "Japanese." ("It" must be the  $C_B$  in 3-11' since it is the only pronoun, and it must refer to "Japanese" since that is the only possible realized referent in 3-11' from 3-10.) However, the hearer seeks an antecedent for "it" within the same utterance and finds "English," yielding the unintended interpretation that "it" and "English" are co-referring. For this reason, "Japanese" cannot be pronominalized in 3-11, even though the centering algorithm makes a correct prediction about how "it" should be interpreted.

**Clarification and contrast.** When a referring expression is used to contrast with or clarify another expression, it cannot be pronominalized. This factor may also interact with other considerations, notably that of "immediateness."

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<sup>10</sup>This assumes contraindexing for all pronouns. Since the mechanism for contraindexing is not well understood, we will leave the matter there.



In conversation 10, the client says he will "take a single room at the Kyoto Prince Hotel for Y7000." The office confirms with the clarifying statement:

You want the single room at the Kyoto Prince Hotel for Y7000, right? 10-20

Principles described above for ellipsis and pronominalization of immediately repeated expressions would predict something like this, instead:

You want it, right? 10-20'

However, because the statement is used for clarification, the full noun form cannot be pronominalized.

Similarly, 2-8 may also be explained as a case of contrast. The problem with 2-8 concerned the question of why "the attendance fee" did not pronominalize (when it had already been the center and pronominalized in immediately previous utterances):

The proceedings fee and the reception fee are included in the attendance fee. 2-8

It could be that "the attendance fee" is in its full form because it is being used to contrast with the other two types of fees.

**Summary of factors.** The considerations discussed above seem to account for most of the possible variation on noun/pronoun/elided reference found in the Mset. The concepts necessary to formalize such an account are:

Subcategorization requirements of verbs (provided by the lexical component). We have assumed that this information is accessible from the dictionary.

Discourse segmentation. As should be amply clear, this is a controversial area and one requiring a great deal of clarification in order to be useful.

"Immediate" repetition. This can probably be defined as "repetition in an adjacent utterance," although it seems to cover cases where there is minimal intervening material as well (e.g., "yes," "I see," and so on). The question of "how much intervening material is 'minimal'" is crucial here.

Centering algorithms. We have assumed these as discussed in Brennan et al. (1987). However, the tendency of two identical pronouns within the same

utterance to confer overrides centering algorithm predictions, and we have seen that the algorithm does not extend to the introduction of new material as the focus of attention. On the other hand, the algorithm does make crucially useful predictions outside these contexts.

**Politeness scale.** When it is desirable to define differing levels of politeness (rather than setting a single level for the entire Mset), considerations of possible variants for referring expressions (elision, pronoun, reduced noun phrase or full noun phrase) can help to define those levels.

**Ellipsis.** The referents for elided phrases can be determined in much the same way as the referents for pronominalized phrases. However, in some cases, antecedents for elided phrases may occur outside the discourse segment of the elided phrase (unlike pronominal antecedents). In these cases, the notion "discourse salience" seems to be useful. An investigation into the feasibility of using focusing processes to define salient entities would be of interest here.

"Clarification," and "contrast." "Clarification" (or "confirmation") seems to be a possible candidate for an Intention; in fact, it is already an Intention category in the Sadanobu et al. (1991) system of speech acts. It would be fairly simple, then, to prohibit pronominalization in utterances of the Confirmation class. "Contrast" is a slightly more difficult notion to define operationally, but it might be possible to interpret it in terms of centers of focus. It might be possible to define "contrast" as the introduction of a new focus in the same sentence with the  $C_b$  of the previous utterance. In that case, a hearer might expect the  $C_b$  to continue to be the focus (especially since the new material can't be a  $C_b$ , and thus under the current interpretation of centering, it can't be a focus, since it did not appear in the previous utterance). However, if there were some mechanism for designating the new material as the new focus, the "old"  $C_b$  could not be pronominalized (by Rule 1 of the Brennan et al. (1987) centering algorithm) and the fact that it occurs as a full noun phrase would simply follow from the algorithm. It seems intuitively reasonable that contrast involves some sort of overt comparison with new material that has the same "level" of focus. The problem remaining is how to amend the centering algorithm to confer focus status on newly introduced material.

### **Additional issues**

The factors given above combine to account for most of the phenomenon of pronominalization in discourse as we see it in the possible variants for the utterances in the Mset. However, there are a number of additional issues which are somewhat more peripheral, though still problematic. Below I will give a brief discussion of some of them with special attention to their significance for the

examples in the Mset.

**Restriction of pronominalization to adjacent utterances.** Dale (1988; 1989) suggests restriction of pronominalization of a noun phrase to its occurrence in an utterance immediately following its first occurrence. (It is easy to see that this is not quite right; he himself mentions examples of "long-distance" pronominalization.) Might it be the case that a simple restriction of pronominalization to adjacent utterances could replace some or all of the constraints discussed above?

Dale's suggestion is basically a slightly different version of the first two considerations discussed above, namely, that immediate repetition of the referent is pronominalized, and that the referent is not pronominalized after intervening discourse. It is consistent with those considerations, except for the cases in which pronominalization after "trivial" intervening discourse is acceptable.

However, there is still a need for the centering algorithm, including Rule 1 blocking pronominalization of noun phrases other than the center. Dale's suggestion would incorrectly pronominalize these noun phrases as long as their referent occurred in the previous utterance. This is unacceptable if the center is not pronominalized. In addition, in cases where the center shifts to a lower-ranked  $C_f$ , it cannot be pronominalized; the centering algorithm correctly predicts the mis-assignment of center in these cases (see discussion of 3-3 and 3-4 above).

In addition, speakers may choose not to pronominalize a second mention in an adjacent utterance for reasons of politeness, and the retention of the noun phrase rather than the use of the pronominal form is essential as well in cases of contrast or clarification. Further, simple pronominalization in adjacent utterances cannot account for the difficulties of coreference of identical pronouns in one utterance; nor does it give any account of the possibilities for ellipsis.

Thus it seems clear that the restriction of pronominalization to adjacent utterances does not adequately characterize the phenomenon, and that, in fact, the constraints discussed above are still needed even if such an assumption were made.

**Restriction of pronominalization to center.** Nevertheless, it is clear that pronominalization is severely constrained. In our corpus, pronominalization is restricted to the center itself. There is already a rule as a part of the centering algorithm that precludes the pronominalization of any NP other than the center if the center itself is not pronominalized. Let's examine the possible support for the

further restriction that *only* the center is pronominalized, a restriction that would eliminate the occurrence of *any* pronoun other than the center.

There is some negative support for this position in the fact that every case of pronominalization in the Mset is a case of pronominalization of the center. There are no cases where an NP which is not the center is pronominalized.

Now recall examples 2-3 and 2-4:

I would like you to tell me about the attendance fee for the conference. 2-3

How much is the attendance fee if I apply for the conference now? 2-4

??How much is it if I apply for it now? 2-4'

In the discussion above, we said that the reason 2-4' is unacceptable is because two pronouns in the same sentence tend to co-refer (and the two "it's" are not meant to corefer in this sentence). However, if we assume that only the center can pronominalize, then we can explain why pronouns in the same utterance should co-refer: they co-refer because only the center is allowed to pronominalize and so both pronouns must be the center. It follows, then, that they must both refer to the same thing. The restriction of pronominalization to the center allows us to explain what was noted before simply as a "tendency."

This is all very well and good, but it is clear that NP's other than the center can certainly pronominalize:

1. I met Jane last week.
2. Lyn works with her at ATR.
3. She likes her.

Centering algorithms predict that we will interpret "she" as Lyn in (3) and "her" as "Jane," which, in fact, seems consistent with our intuitions. But now consider the following examples:

1. I met Jane last week.
- 2'. Lyn manages her at ATR.
- 3'. She reports to her about all her projects.

We are left simply confused about who is who in 3'. It seems that the centering algorithm alone cannot always make the appropriate assignment of referents. The semantic requirements of the verb involved will also have an effect on how pronouns are interpreted.

In fact, Quirk et al. (1985) imply that this semantic knowledge, coupled with world knowledge, is the essential key to a hearer's interpreting a conversation: "The interpretation of text depends upon the recipient's common sense and his

knowledge acquired independently of the text ... Grammar [also read "the centering algorithm"] has potential in establishing plausible interpretations but it is not required to provide unequivocal cues."<sup>11</sup> They give a clear example of two utterances in which lexical and world knowledge (rather than any centering information) are the sole determinants of interpretation:

The police<sub>1</sub> prohibited the strikers<sub>2</sub> from demonstrating because they<sub>1</sub> anticipated violence.  
they<sub>2</sub> advocated violence. (p. 1431)

How should this evidence be interpreted? It seems clear that pronominalization of any NP other than the center is extremely restricted: it depends not only on the pronominalization of the center itself (Rule 1 of the centering algorithm), but also on the semantics of the verb involved, and on the other kinds of restrictions mentioned above: being within the same discourse segment with no intervening segment, politeness considerations, and whether it is being used for clarification or contrast. Clearly it is not entirely true that only the center can pronominalize; on the other hand, there are severe restrictions on when any NP other than the center can pronominalize.

**Noun-noun coreference.** This is used for what Bolinger (1979) calls "elegant variation," in which a different, but coindexed, noun is used at a subsequent occurrence of the referent. To cite his example: "Had **Shakespeare** not written *The Tempest*, he would have deprived the world of one of **the Bard's** most sensitive works."

The use of a different noun form to lexicalize a second mention of a referent is a matter of what can loosely be called "style." Although a full account of English pronominalization should characterize this phenomenon, we will handle it in a straightforward way by simply translating each of the nouns used in the Japanese utterance. Subsequent or intervening pronominalization will be assumed to refer to the last mentioned noun, as the centering algorithm predicts. There is, in fact, a good example of noun-noun coreference in the Mset:

First of all we would like to have a 200 word **letter** from you by xx. 8-6  
We will evaluate **it** and send you the results on xx. 8-7  
If your **outline** is accepted, we will send some special paper also. 8-8  
Can you send your **transcript** to us by June xx? 8-9  
I understand. 8-10  
How would you like **it** written? 8-11

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<sup>11</sup>Brennan et al. and others working in the centering framework would, I think, certainly agree with the latter statement. I should not imply that centering algorithms are meant to determine "unequivocally" the interpretation for pronouns in an utterance.

These are three different nouns in Japanese, translated with three different nouns in English. The "it" in 8-7 is straightforwardly interpreted as referring to "letter," while that in 8-11 is clearly interpreted as referring to "transcript."

**Retaining the noun.** Bolinger (1979) and Quirk et al. (1985) describe a number of cases in which some stylistic effect is achieved by not pronominalizing the second occurrence of a noun phrase: to highlight the topic; to maintain clarity of reference; to lay emphasis on the nature of the referent; to reject an alternative; to be ironic. The only examples of this sort of thing that we see in the Mset have to do with maintaining clarity or providing contrast, and these were discussed above. The other motivations they discuss lie outside the current requirements of the corpus.

**Definiteness.** There are a small number of cases in the Mset in which indefinites are pronominalized. This poses no problem as long as the information that the phrase is indefinite is available; in that case, pronominalization will proceed using "one" instead of "it," for example.

In the following, as long as "discount" is marked indefinite, pronominalization with "one" is straightforward:

Is there a discount of the attendance fee? 2-10

We are not giving one at this time. 2-11

Similarly for "someone," the indefinite animate pronoun:

Please inform us in advance if a substitute attends. 5-20

All right. 5-21

I will inform you if we decide to send someone else. 5-22

However, there is a distinction made in reference in English that causes some problems in one example. The distinction is between what philosophers call the "*de re*" and the "*de natura*" senses of a word. In the *de re* sense of a word, the word refers to the object itself; in the *de natura* sense, it refers to the nature of the object. So the noun "registration form" can refer either to the piece of paper itself (*de re*) or to the structure of the form (*de natura*). As it is used in the Mset, in the former sense (*de re*) "registration form" may be either definite or indefinite (either a particular piece of paper that is a form, or one of any number of such pieces of paper); in the latter sense, "registration form" is definite: there is one and only one specific structure to the one kind of form used for the conference.

Consider the most natural translation of examples 1-8 and 1-9, given here:

Please proceed by using the registration form. (*de natura*; thus definite; "the" is used) 1-8

Do you already have one? (*de re*; in this case, indefinite; "one" is the appropriate pronominal form) 1-9

Because of the use of the same lexical item in two adjacent utterances, pronominalization does occur; however, despite the fact that the first occurrence is definite, the pronoun used must be indefinite to fit the sense of the sentence. Whether feature specification this subtle will be available for use in determining the appropriate translation is still an open question.<sup>12</sup>

One other example that seems to fall in the general category of definiteness has to do with the use of the demonstrative "that." In some cases, it is possible to "pronominalize" using "that (NP)" instead of "the NP" or "it."

I understand there is a city sightseeing tour during the conference. 6-3

??Is it still possible to participate in the tour?

Is it still possible to participate in it?

Is it still possible to participate in that tour? 6-4

This is a subtle stylistic distinction and it is not clear under exactly what circumstances it is used. However, it seems that the same kind of stylistic alternative is available in Japanese, where it has a similar syntactic form; thus it is possible simply to translate the examples that appear into the corresponding English syntactic form.

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<sup>12</sup>Recall that I said "the most natural translation." Other possibilities are simply not natural, though they may be interpretable:

?Proceed by using a registration form.

Do you already have one?

Or:

Proceed by using the registration form.

??Do you already have it?

Quirk, et al. (1985) distinguish "substitution" of proform for noun form and "coreference" of proform and noun form. "Coreference" labels the case in which a definite pronoun is used to refer to a coindexed noun; almost all of what we have called pronominalization in this corpus is of this type. In a case of "substitution," on the other hand, a proform stands in for an antecedent, and the two may not necessarily be exactly coreferential. In particular, the proform may differ morphologically from its antecedent. Utterance 1-9 seems to be a clear case of substitution rather than coreference. However, it is not clear how to implement such a distinction or indeed whether its implementation would "buy" anything for the translation system.

If you look in the second information circular, you will find the titles listed. 7-9  
 Would you please take a look at that ("sochira"). 7-10  
 OK. Then would you send that circular ("sono NP") to me as soon as possible. 7-11/12

**Application of constraints: to the Mset**

Many of the constraints discussed above include concepts too vague to be useful in machine translation (notions such as "salience," "immediate," and so on). A much simpler characterization is necessary. We propose the following as the relevant translation rule for handling pronominalization in this particular corpus:

**Japanese full noun phrases should be translated as English full noun phrases. If a subsequent occurrence of a referring expression is a zero pronoun in Japanese, pronominalize it in English<sup>13</sup>.**

What of the constraints discussed above? Is there no need to invoke any of them? Below we examine each one in turn to see how it is manifested (or not) in our corpus.

**Constraints on first mention: the first mention of a referring expression in a discourse segment must be in full noun form.** In fact, in the Mset, no discourse-segment-initial utterances contain pronouns. Thus it would seem that this constraint is unnecessary for our corpus.

**Conditions on second mention: Express the zero pronoun in full noun form instead of in pronoun form if:**

**There is too much intervening material or an intervening discourse segment.** For the Mset, the translation rule works without the

<sup>13</sup>In order to determine the appropriate form for the pronoun, the NP bearing the same index as the zero pronoun must be located and the feature specifications must be copied for human, number, and definite. An initial, rough, estimate for the lexical realizations of possible combinations are listed below.

	Definite		Indefinite	
	Singular	Plural	Singular	Plural
+human	he/she	they	someone	some people
-human	it	they	something	some

Note that no mention is made of the procedure for translating third person Japanese pronouns into English. Third person pronominal forms are rarely used in Japanese discourse and, in fact, the Mset contains no examples of such forms.



addition of this constraint except for example 6-7, which contains a zero pronoun (which would be translated as a pronoun in English) where a full noun phrase is highly preferred.

**The presence of two pronouns within one utterance confuses reference (because they try to corefer).** In this corpus, no examples with inappropriately referring identical pronouns are generated. This constraint is not necessary.

**The full form is needed for clarification or confirmation.** In the Mset, the Japanese utterances also use full noun forms in these contexts, and are translated appropriately as full noun phrases in English. This constraint is not necessary.

**It is in an utterance with a non-pronominalized backward center.** (This is one of the conditions imposed in the centering algorithm of Brennan et al. (1987).) No violations of this constraint are found in the examples generated in this corpus. This constraint is not necessary.

**The utterance is very polite.** If zero pronouns are realized as noun phrases in very polite forms and as pronouns in other forms, then, for a limited number of utterances, we have defined a two-level system of politeness, with only a slight change to the translation rule. (This account makes no use of ellipsis, however.) However, the utterances generated in the Mset seem to be at the appropriate level of politeness for this context.

**Implications.** Two points need to be made here. First, although the translation rule works fairly well for this corpus, it may not be adequate in linguistically richer dialogues. Even in this corpus, the translation rule results in a slightly unnatural translation (usually because it is too formal), although the generated results are quite understandable. For example, only in the very most formal of situations would an English speaker repeat "registration form" as often as it is repeated here:

What kind of procedure should I go through? 1-7

Please proceed by using a registration form. 1-8

Do you already have a registration form? 1-9

No, not yet. 1-10, 11

All right. Then, we will send you a registration form. 1-12, 13

Thus, in fact, the non-application of the constraints discussed here to the Mset

indicates, not the uselessness of the constraints, but the lack of variety in the corpus in this area, with a generous helping of tolerance for less-than-natural English utterances thrown in. In the next section, then, we introduce a new dialogue designed to illustrate the function of the constraints in a much clearer way.

On the other hand, it may be the case that the lack of application of these constraints to the Mset is due, not to the impoverished nature of the corpus in this area, but to the fact that (some or all of) these constraints are true of Japanese as well as of English, or may, in fact, be universal. If this is the case, then the constraints are operating in the production of the Japanese utterance and do not need to be invoked during the translation process. In fact, it is not at all clear how universally these constraints apply; certainly, this question needs to be answered before they are incorporated into any machine translation system. To the extent that they are universal, the translation process can be somewhat more streamlined.

### **Application of constraints: . to a new corpus**

Below we give a dialogue created to illustrate the constraints on pronominalization discussed above. Although it is not a "real" dialogue, it is a quite natural one. After the dialogue itself, we discuss the various pronominalization issues that it involves.

#### **Dialogue.**

- DS1 C-1 Is this the conference office?
- C-2 Yes, it is.
- DS2 May I help you?
- C-3 Yes.
- DS3 C-4 Yes, I can. It is Y35,000 if you apply for the conference now.
- DS4 C-5 I'm sorry, I couldn't hear you. Would you mind repeating it?
- C-6 Sure. The attendance fee is Y35,000 if you apply now. It is Y40,000 if you apply next month. You should send it in with the registration form that was included in the conference announcement.

- Do you have an announcement?
- DS5 C-7 No I don't.  
Would you send me one?
- C-8 I'm sorry, I can't send you an announcement right now, because the secretary is sick today. But I will send you one as soon as possible.
- Could you give me your name and address?
- C-9 Sure. My name is Sherry Burnette. B-u-r-n-e-t-t-e
- C-10 OK. And would you spell your first name?
- DS6 C-11 Yes, I will. S-h-e-r-r-y.
- C-12 OK. Your address?
- C-13 3133 Brown Street, Boston Massachusetts 02130
- C-14 3133 Brown Street, Boston Massachusetts 02130, right?
- C-15 Yes, that's right.
- DS7 Could you send an announcement to a colleague of mine in Thailand, too?
- C-16 Yes, we could if you give us his name and address.
- C-17 Thanks. His name is John Marshall, but I don't know his address right now.  
I will call you back when I find it.
- C-18 That will be fine. We can send him<sup>14</sup> the information as soon as you call us back.
- DS8 Meanwhile, I'll send you the announcement and the form as soon as I can. I hope I can send them by the end of the week.
- C-19 Thank you very much. If I don't receive them by the end of the month, I'll let you know.

<sup>14</sup>This is the only example we have dealt with in which a third person pronominal-type expression is used in Japanese: "ano hito." Clearly a differentiation will have to be made between the instances in which this phrase receives a literal translation as a demonstrative phrase and the cases in which it functions as the equivalent to an English pronoun (as it does in this example). Because the Mset does not contain examples of this kind, this is a question left to future work.

DS9

And I'll call back in a few days to give you John Marshall's address.

C-20 I'll be looking forward to your call.

C-21 Thank you again. Goodbye.

C-22 Goodbye.

**Discussion.** Below, we have put into boldface the factors that we isolated and discussed above as being necessary to a coherent account of third person referring expressions in English.

DS 3: "The attendance fee" is pronominalized in C-4 because it is a **second**, and **immediate, mention** of "the attendance fee" within the discourse segment. The **centering** algorithm correctly predicts that "attendance fee" is the antecedent for "it" in C-4, and not "the workshop" since "the attendance fee" is the higher ranked  $C_f$  in C-3. Notice that "the conference" in C-4 cannot be pronominalized because that would result in **two identical pronouns within the same sentence** and (because they tend to corefer) the interpretation would be: "The fee is Y35,000 if you apply for the fee now."

C-6: "The attendance fee" is repeated for **clarification**. After the first mention in C-6, it is used again **immediately** and pronominalized (twice). The **first mentions** of "registration form" and "announcement" are, of course, not pronominalized. However, the second mention of "announcement" is also not pronominalized (even though it is also used again immediately after its first mention). If it were pronominalized, the **centering** algorithm would predict that its antecedent would be "registration form" since it is higher ranked than "announcement" in the sentence before it. Thus, it is not pronominalized in order to avoid a misinterpretation predicted by the centering algorithm.

C-7: "One" can be used for "registration form" because it is the **second mention** in the same discourse segment.

C-8: Because the answer must be "no," the conference office feels an obligation to phrase the response in a slightly more **polite** manner. Thus, the office uses the full noun phrase form of "announcement" instead of continuing to pronominalize it. At the next mention, the pronominal "one" is appropriate because it **immediately** follows its antecedent. "One" is used instead of "it" because it is an indefinite reference.

C-13/14: The full noun phrase is repeated for **clarification**.

C-15: . "Announcement" is in full noun form because it is the **first mention in this discourse segment**.

C-17: "It" is appropriate because it is the **immediate** repetition of "address" in the same discourse segment.

C-18: "The information" is an example of noun-noun coreference. "Him" is the **second mention** of "John Marshall" and there is no confusion of reference since "John Marshall" is the only animate third person possible antecedent. "The announcement" and "the form" are in full noun form because they are the **first mention** of these noun phrases in the discourse segment. The **immediate second mention** is pronominalized.

C-19: "Them" is another **subsequent mention** of "announcement" and "form." "John Marshall's address" is in full noun phrase form because of the **intervening discourse segment** between it and C-17.

### **Future Directions**

Two crucial tasks face researchers who would attempt to make use of the constraints described above in a machine translation system. First, a similar examination of these kinds of constraints operating in Japanese conversation should be made. If there are identical or similar constraints operating in the production of Japanese utterances in conversation as well, then those constraints need not be stated in the translation system. For constraints that are different or particular to one or the other language, and thus must be incorporated into a machine translation system, some of the concepts involved are rather ill-defined and require more precise characterization before they can be useful. The notions of "immediateness," "salience," enough/too much intervening discourse material, politeness, and contrast all require such clarification if they are to be used in a translation system.

Of course, investigation into the principles governing pronoun use in conversation could go much farther than this discussion. The new corpus given as an example above illustrates the operation of the constraints as they apply in a "natural" English conversation. Clearly, however, when "real" conversational speech is examined, it may be the case that other constraints are necessary as well, or that these constraints need to be abandoned or modified. The claims we make for these constraints are limited: they are certainly operable in this particular conversational context and in these examples, but it is doubtful whether they will be adequate to characterize real conversation. However, the fact that they seem to be adequate in this context may have to be enough for now, as analysis of real conversation on such a scale is an enormously difficult task.

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## Appendix 1: Natural English version of the Mset

Below is the English version of the Mset (some of the utterances that were clearly not natural English have been "polished up"). Where alternative referring expressions or ellipsis were possible, all possibilities are listed, so that variations not listed can be assumed to be inappropriate. However, despite best intentions, it is quite possible that there are appropriate alternatives that were missed. Stylistic variations with "that NP" for "the NP" were not included.

### • 1

- Hello 1
- Is this the conference office? 2
- Yes 3
- That's right. 4
- May I help you? 5
- I would like to apply for the conference 6
- What kind of procedure should I go through? 7
- Please proceed by using the registration form. 8
- Do you already have one? 9
- No 10
- Not yet. 11
- All right 12
- Then we will send you one. 13
- Your name and your address please? 14
- The address is... 15
- The name is... 16
- All right 17
- We will send you a registration form immediately. 18
- We will send you a form immediately.
- Thank you very much 20(sic)
- Good bye 21

### • 2

- Yes 1
- This is the conference Office 2
- I would like you to tell me about the attendance fee for the conference 3
- How much is the attendance fee if I apply for the conference now? 4
- How much is it if I apply for the conference now?
- How much is it if I apply now?
- Yes 5
- The attendance fee is xx per person right now. 6
- It is xx per person right now.

- If you apply next month the fee is xx. 7

If you apply next month it is xx.

- The proceedings fee and the reception fee are included in the attendance fee. 8

The proceedings fee and the reception fee are included.

- I am a member of the Information Processing Society. 9

- Is there a discount of the attendance fee? 10

- We are not giving a discount this time. 11

We are not giving one this time.

- All right. 12

- How can I pay the attendance fee? 13

- You can pay the attendance fee by bank transfer. 14

You can pay the fee by bank transfer.

You can pay it by bank transfer.

You can pay by bank transfer.

- Please transfer the payment to the bank account which is listed in the announcement. 15

- And the deadline is the end of this year. 16

- All right. 17

- Thank you very much. 18

- You're welcome 19

- If there is a question, please ask us at any time. 20

- Good bye 21

• 3

- Hello 1

- This is the conference office. 2

- I would like to present a paper at the conference. 3

- Please tell me about the conference. 4

- The conference at this time covers various research fields which are related to Interpreting Telephony. 5

It covers various research fields which are related to Interpreting Telephony.

- It is expected that those who major in linguistics and psychology will attend.

6

- All right. 7

- By the way, what is the official language of the conference? 8

By the way, what is the official language?

- English and Japanese 9

- I do not understand Japanese at all. 10

- Is there simultaneous translation into English when the presentation is made in Japanese? 11

- Yes 12

- We are preparing simultaneous translation into English. 13

We are preparing simultaneous translation.



- All right. 14
- Thank you very much. 15
- Goodbye 16

• 4

- This is the conference office. 1
- Please tell me the details about the conference. 2
- Do you have an announcement about the conference? 3

Do you have an announcement about it?

Do you have an announcement?

- No 4
- I do not 5
- All right. 6
- The conference will be held at xx from xx to xx 7

It will be held at xx from xx to xx

- The attendance fee is xx 8
- If you would like to make a presentation, please submit a summary by

March 20. 9

- We will send you an announcement of the conference so please refer to it.

10

- Your name and your address please? 11
- Adam Smith. 12
- The address is xx 13
- All right 14
- We would like to ask the phone number also. 15
- yes 16
- xxx 17
- xxx, right? 18
- yes 19
- that's right 20
- thank you very much. 21
- Goodbye. 22

• 5

- Hello 1
- This is the conference office. 2
- Well, I have a request. 3
- I have applied for the conference. 4
- I would like to cancel my registration. 5
- Could I ask your name? 6
- yes 7
- xxx 8
- You have already transferred xxx of the attendance fee, right? 9

- yes 10
- that's right 11
- Could you refund the registration fee? 13(sic)

Could you refund it?

- I am sorry that it is not possible. 14
- We have written it in the announcement 15
- Refund for cancellations after Sept. 27 is not possible. 16
- We will send you the program and the proceedings later. 17
- Then is it possible that somebody else attends instead of me? 18
- It does not matter particularly. 19
- Please inform us in advance if a substitute attends. 20

Please inform us in advance.

- All right. 21
- I will inform you if the substitute is decided. 22

I will inform you.

- Good bye. 23

• 6

- hello 1
- This is the conference office. 2
- I understand there is a city sightseeing tour during the conference. 3
- Is it still possible to participate in it? 4

Is it still possible to participate?

- Yes 5
- It is 6
- The tour will visit xx on the evening of xx 7
- Would you like to participate? 8
- How much is the participation fee? 9

How much is it?

- The fee is xx. 10

It is xx.

- And your dinner is also included. 11
- Are the speech presenters also taking part in the tour? 12

Are the speech presenters also taking part in it?

Are the speech presenters also taking part?

- Yes, some of the speech presenters will be participating. 13

Yes, some of the presenters will be participating.

Yes, some will be participating.

- Is that so? 14
- In that case, I would like to join the tour. 15

In that case, I would like to join.

• Then would you please give me your name and the number of people in your group? 16

- My name is xx 17

- My wife would like to go too. 18
- We will gather in front of the conference registration desk. 19
- Would you please pay the fees there? 20
- I understand 21
- Thank you very much. 22
- Then we will be looking forward to seeing you. 23

• 7

- hello 1
- This is the conference office. 2
- I would like to ask some questions about the topics at the conference? 3
- yes 4
- What can I do for you? 5
- This is in regards to the Automatic Translation topic that is in the circular. 6
- Can you give me the details on this topic? 7

Can you give me the details on this?

Can you give me the details?

- I am sorry but I can't help you on that topic. 8

I am sorry but I can't help you on that.

I am sorry but I can't help you.

- If you look in the second information circular, you will find the titles listed. 9
- Would you please take a look at it? 10
- OK 11
- Then would you send that circular to me as soon as possible. 12

Then would you send it to me as soon as possible.

- My address is xx and my name is xx 13
- xx and your name is xx, right? 14
- yes. 15
- Then I will send the circular right away. 16

Then I will send it right away.

- Is there anything else I can help you with? 17
- no 18
- No, that should about do it. 19
- Thank you very much. 20
- Goodbye. 21

• 8

- hello 1
- This is the conference office. 2
- I have a few things that I would like to ask of you. 3
- I would like to give a presentation at this coming conference. 4
- What are the procedures for applying? 5
- First of all we would like to have a 200 word letter from you by xx. 6

- We will evaluate it and send you the results on xx. 7
- If your outline is accepted, we will send some special paper also. 8
- Can you send your transcript to us by June xx 9
- I understand. 10
- How would you like the transcript (?) written? 11

How would you like it written?

- There is a specific application form so fill it in. 12
- I will send you the form so please give me your address. 13

I will send it to you so please give me your address.

- I understand. 14
  - My name is xx 15
  - My address is xx 16
  - xx, right? 17
  - And your address is xx, is this correct? 18
  - yes 19
  - that's correct. 20
  - Then I'll be looking forward to receiving the form. 21
  - yes. 22
  - I understand 23
  - I will send the form immediately. 24
- I will send it immediately.
- Goodbye 25

• 9

- Is this the conference office? 1
- yes 2
- This is the conference office.
- What may I do for you? 4
- I would like you to tell me how to get to the conference hall. 5
- I am now in Kyoto Station 6
- Please take the subway to xx 7
- From xx you can take a bus that goes to xx 8

From there you can take a bus that goes to xx

- You can also take a taxi from xx 9
- How much will it cost to go from xx by taxi to xx? 10
- From Kyoto Station, it would be around xx to go from xx by taxi to xx. 11

From Kyoto Station, it would be around xx.

- Then how much would it cost to go by taxi from xx to the conference hall? 12

Then how much would it cost to go by taxi from xx?

Then how much would it cost from xx?

- From xx it would be about xx to go by taxi to the conference hall. 13

From xx it would be about xx to go by taxi.

From xx it would be about xx.

- I understand. 14
- Thank you very much 15
- No problem 16
- You're welcome. 17

• 10

- hello 1
- yes 2
- This is the conference office. 3
- I would like to ask about overnight facilities at the conference. 4
- Can you give me any ideas? 5
- yes 6
- The hotels we are able to introduced are xx and xx. 7
- For a single room, the rates are from xx to xx 8
- For a double room, the rates are xx to xx 9

For a double room, they are xx to xx

For a double, they are xx to xx

For a double, xx to xx etc.

- Is that so? 10
- Which hotel is closer to the conference hall? 11
- The Kyoto Hotel is closer to the conference hall. 12

The Kyoto Hotel is closer.

The Kyoto Hotel.

- Then I would like to make arrangements at xx. 13

Then I would like to make arrangements there.

- Can you make the arrangements at the Kyoto Hotel for me? 14

Can you make the arrangements there for me?

Can you make them there for me?

Can you make them for me?

- yes 15
- Yes, we can make the arrangements for you at either place. 16

Yes, we can make the arrangements at either place.

Yes, we can make them at either place.

- Is that so? 17
- Well, then, I will take the single room at xx for xx. 18
- OK 19
- You want the single room at xx for xx, right? 20
- yes 21
- That is correct. 22
- When will you be arriving? 23
- From the evening of xx. 24
- Until the morning of the 8th. 25
- I understand. 26

- Just a moment please. 27
- I will check to see if we can reserve the rooms or not. 28
- We are able to get the room. 29

We are able to.

- So, I will need your name and address. 30
- My name is xx 31
- My address is xx. 32
- And your telephone number 33
- xx 34
- I understand. 35
- I have made arrangements at xx from xx to xx. 36
- Thank you very much. 37
- Goodbye. 38

## Appendix 2: Japanese version of the new corpus

C-1

そちらは国際会議事務局ですか？

C-2

はい。そうです。

C-3

(すみませんが、)ワークショップへの参加料がいくらか教えて頂けますか？

C-4

はい、わかりました。今、会議に申し込まれますと 35000 円です

C-5

すみません、聞こえませんでした。もう一度お願いできますか？

C-6

はい。今会議に申し込まれますと 35000 円です。もし、来月申し込まれますと 40000 円になります。(参加料は)会議の案内書に入っている登録用紙と一緒に送って頂かなくてはなりません。案内書はお持ちですか？

C-7

いいえ。持っていません。送って頂けますか？

C-8

済みませんが、本日秘書が病気なので、今すぐにお送りすることはできません。でも、出来る限り早くお送り致します。お名前とご住所をお願い出来ますか？

C-9

はい。(私の)名前はシェリーバーネット、B-u-r-n-e-t-t-e です。

C-10

はい。名前の綴りをお願いできますか？

C-11

はい。s-h-e-r-r-y です。

C-12

わかりました。ご住所は？

C-13

02130、マサチューセッツ州、ボストン、ブラウン通り、3133 です。

C-14

02130、マサチューセッツ州、ボストン、ブラウン通り、3133 ですね。

C-15

はい。そうです。この案内書をタイの私の同僚にも送って頂けますでしょうか

C-16

はい。お名前とご住所を教えてくださいればお送りできます。

C-17

ありがとうございます。名前はジョン・マーシャルですが、いまずぐには住所が分かりません。住所が分かり次第、改めてお電話致します。

C-18

それで結構です。お電話下さいましたらすぐに、その方に情報をお送り致します。その間に、案内書と登録用紙をそちらに出来る限り早くお送り致します。週末にはお送りできると思います。

C-19

どうもありがとうございます。月末までに届かない場合はお知らせします。それでは、2,3 日中にジョン・マーシャルの住所をお知らせします。

C-20

お電話、お待ちしております。

C-21

どうもありがとうございます。失礼致します。

C-22

失礼致します。