

TR-IT-0178

Report on the Japanese-English Generation System

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概要

This report concerns the J-E output of the TDMT system, based on its performance on all the examples in the corpora accessed via: JE-closed/JE-japanese, JE-closed/JE-original, and JE-original/JE-training. Over a period of 4 months I worked on the output of the J-E system, with a goal of improving the naturalness of the English output. This goal was achieved with good success given the current TDMT system.

This report provides an overview of the kinds of generation problems that I initially encountered, and then briefly discusses the changes made. Finally, I discuss the various remaining problems, which all involve contextual information.

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# Introduction

This report concerns the J-E output of the TDMT system, based on its performance on all the examples in the corpora accessed via: JE-closed/JE-japanese, JE-closed/JE-original, and JE-original/JE-training.

Over a period of 4 months I worked on the output of the J-E system, with a goal of improving the naturalness of the English that is generated. By now, most of the changes that can be determined on the basis of sentence-internal information have been put in, and the output has improved. In this brief report, I will present an overview of the kinds of changes that we have made, and of the kinds of sentence-internal information that the generation system can make use of. Then, I will present the kinds of problems that still remain, and try to make some simple suggestions regarding them.

The relevant files that I have used or created can all be found in `/usr/local/TMDT/sells/` and there is a `README` file.

## Part 1

# The Problems

Initially, I went through each dialog in the corpus and made notes on specific changes that needed to be made. Here is an example from my notes:

[1] こちらジョンフィリップスなんですがこの辺りで京都らしい料理を食べたい  
んです

```
((SEN (*SUB "i") (*BEV "am") (SUB (DET "this")) (BEV "be") (PROPN  
"john") (PROPN "phillips"))) ". (SEN (*SUB "i") (AUXV "would" "like"  
"to") (V "eat") (OBJ (ADJ (PROPN "kyoto")) (CN "cuisine") "worth  
speaking of") (PLACE (DET "this") (PREP "around"))))
```

This is john phillips . i would like to eat kyoto cuisine worth  
speaking of this around

\*\*[1] Modal change: the translation of らしい as "worth speaking of"  
does not work in English; I think it only works in a negative context  
(e.g., "we have no French restaurant worth speaking of").

\*\*[2] Preposition: there's a big problem here with "this around",  
which is not English: it would have to be something like "in this  
area".

The output is now:

"This is john phillips . i would like to eat typical kyoto cuisine  
around here".

Here is another example:

[10] はい河原町通りをまずまっすぐ北へお進みください

```
((TOP-ADV "yes" ",") COM-SEN (TOP-ADV "please") (TOP-ADV "first of  
all" ",") (V "go ahead") (TO "to" (CN "north")) (OBJ (ADV "straight"))
```

(ON "on" (PROP.N "kawaramachi street"))

Yes , please first of all , straight go ahead to the north on kawaramachi street

\*\*[1] Reordering: the order "first of all" and then "please" is much more natural in English.

\*\*[2] Wrong ADV categorization. "straight" is a directional complement, and therefore cannot appear before the verb, as its categorization as ADV predicts. "straight go ahead" is ungrammatical in English. It cannot be an END-ADV, as it should follow the verb immediately.

++[2] Reordering: "go ahead straight" would be acceptable, but it is not very natural. "go straight ahead" is the way any speaker would say it.

The output is now:

("Yes , first of all , please go straight ahead to the north on kawaramachi street" .

And one more:

[11] またまっすぐ行きますと角にバス停がございますのでそれを右に曲がってください

((TOP-ADV "and" ",") (SEN (ADV-CLAUSE "if" (SEN (\*SUB "you") (\*SUB "i") (\*AUXV "will") (V "go") (OBJ (ADV "straight")))) (COMMA ",") (SEN (THERE "there") (BEV "is") (OBJ (CN "bus stop")) (PLACE "at" (CN "corner")))) ".") (SEN COM-SEN (TOP-ADV "please") (V "turn") (OBJ (CN "right")) (PLACE (PRON "there"))))

And , if you straight go , there is the bus stop at the corner. please turn the right there

\*\*[1] Adverb: it must be "if you go straight".

\*\*[2] Article change: it should be "a bus stop".

\*\*[3] Article deletion or other change: it should be either "please turn right" or "please turn to the right".

The output is now:

"And , if you go straight , there is a bus stop at the corner . please turn to the right there".

There are other kinds of problems that I identified, but which still remain:

[3] 次の角を右へ曲がられますとしばらく行きますと橋の手前に豆水楼というお店がございます

```
((ADV-CLAUSE "if" (SEN (*SUB "you") (*SUB "you") (V "turn") (CN "right")) (PLACE "at" (ADJ (CN "next")) (CN "corner")))) (COMMA ",") (SEN (ADV-CLAUSE "if" (SEN (*SUB "you") (*SUB "i") (*AUXV "will") (V "go")) (END-ADV "for a moment")) (COMMA ",") (SEN (THERE "there") (BEV "is") (OBJ (CN "store") (CALLED "called" (PROPN "tosuiro")))) (PLACE (PREP "before") (CN "bridge"))))
```

If you turn the right at the next corner , if you go for a moment , there is the store called Tosuiro before the bridge

\*\*[1] Context: Here the extent over which しばらく is measured is, in a sense, one of space rather than time, and "for a moment" sounds strange, as it cannot express the directional complement that "go" would take in this context. If we modify しばらく to "for a bit", this will work for both time and space expression. However, "for a bit" is perhaps a bit (!) colloquial.

Here, we have not changed the adverb translation yet. I think "a little way" would be a good translation, but I'm not sure how general this would be as a translation for しばらく. So the output is now:

"If you turn right at the next corner , if you go for a moment , there is a store called tosuiro before the bridge"

Here is another example:

[8] ではどの辺りから説明いたしましょうか

```
((TOP-ADV "well" ",") YN-Q (*SUB "i") (*AUXV "could") (V "explain") (FROM "from" (WH (ADJ "which") (CN "area"))))
```

Well , from which area could i explain ?

\*\*[1] This English is not very natural, even though it may be a faithful translation of the Japanese.

There has been no change in the translation, as there is no obvious good English expression of this meaning that corresponds to the Japanese input that we have.

All of my original notes can be found in  
/usr/local/TDMT/sells/reports/report1/.

## Part 2

# Changes in the analysis process

Part of my time has been spent creating minor variations on existing analysis patterns in the rules, to give us better output. This has given us a bit more flexibility, and made it easier to get more natural output. The system has certain limitations, though, given the way it analyzes Japanese sentences and then generates English ones.

The biggest problem, I think, is that we sometimes throw away what turns out to be useful information. For example お待ちしております and お待ちしています are treated as identical, yet the distinction seems to be important in the following segment:

((J "では見つかりしだいお電話いたしますので")  
("Well , as soon as i find it , i will call you" . 1.4999999e-5))

((J "はいお待ちしております")  
("All right . i am looking forward to your coming" . 0.0))

\*\*\*problem, should be "I am waiting"\*\*\*

While お待ちしております is consistently and correctly translated as "I am looking forward to your coming", it is clear from the context here that お待ちしています, without the humbling information contained in おります, has the literal meaning of "I am waiting". As we come to integrate more discourse information, the particular forms of verb endings will become important, I think.

## Part 3

# Changes in the generation process

Most of my time has been spent altering the patterns within the generation rules, or the dictionaries, in order to get better English output. I think it would be very boring to discuss these, so I will not do that here.

Here is a sample output:

```
< No. 1 / 1 ; Mode :J-E >
*** Input ***
シングルのお部屋をご用意させていただきます
*** Output ***
We will get a single room (1.0e-5)

*** Distance calculation in Transfer ***
0.000000 :: (MASU) SM :(?X ます) => (we will !X) .... ((用意する))
0.000000 :: (MARKER-CN-V) NP :(?X <CN-V> ?Y) => (!Y !X) .... ((部屋) (用意する))
0.000000 :: (KAKUJO-NO-N+N) N+N :(?X の ?Y) => (!X !Y) .... ((シングル) (部屋))
0.000000 :: (~DIC) : (普通名詞 シングル) => ((CN single))
0.000005 :: (SETTOU-O) TERMINAL :(お ?X) => (!X) .... (())
0.000000 :: (~DIC) : (普通名詞 部屋) => ((CN room))
0.000000 :: (MODAL-SETEITADAKU-REG) PM :(?X せていただく) => (!X) .... ((用意する))
0.000005 :: (SETTOU-GO) TERMINAL :(ご ?X) => (!X) .... (())
0.000000 :: (~LOCAL) : (本動詞 用意する) => ((V get))
TOTAL DISTANCE = 0.000010

*** Distance calculation in analysis ***
LEXICAL-TRANSFORMATION ...
0.000000 :: (SAHEN-VERB-SURU) 3 : (用意 さ) => (用意さ)
0.000000 :: (GOUSEI-SETEITADAKU) 3 : (せ ていただき) => (せていただき)
0.000000 :: (GO-V) 5 : (ご 用意さ) => (ご用意さ)
```

```
0.000000 :: (O-CN) 7 : (お 部屋) => (お部屋)
LOCAL-TRANSFORMATION ...
0.000000 :: (CN-V) 3 : (お部屋 ご用意さ) => (お部屋 <CN-V> ご用意さ)
TOTAL DISTANCE = 0.000000
```

\*\*\* Process \*\*\*

```
>>> morphological analysis
(シングルのお部屋ご用意させていただきます)
LEXICAL-TRANSFORMATION ...
(シングルのお部屋ご用意させていただきます)
>>> analysis
LOCAL-TRANSFORMATION ...
(シングルのお部屋<CN-V>ご用意させていただきます)
>>> transfer
(シングルのお部屋<CN-V>ご用意させていただきます)
NIL
```

We also added, or should add in my opinion, various new components in the generation program itself.

## 1 Articles

### 1.1 'There'-Sentences

In order to select articles correctly, we look for the noun phrase associated with *there* in sentences of the form *there is(n't)*... and the corresponding questions. Then, unless the article is specified as *the*, we change it to *a*. (DONE.)

### 1.2 Checking the Verb

We can make a few useful changes in article selection by just looking at the verb. In all examples so far, the objects of the verbs *look for* and *ask about* should be indefinite.

### 1.3 Checking the Noun and the Verb

We can make significant improvements by generating *your name* instead of *the name* by checking the local context. In every example where the output should be *your name*, the main verb of that (local) sentence is either *tell (me)* or *have* or *write*. To get it right, we need to change just (お)名前 but not ... の(お)名前.

For *address*, a safe change would be to make the article be *your* just in case *your name* preceded (or followed) it. As the object of the verb *write*, it seems that we want *your address* too.

For *signature*, it only appears two times, but it should be *your signature* in both cases.

We can make similar improvements with *reservation*, by noticing the following:

- a. make A reservation
- b. made (but not HAVE MADE) THE reservation
- c. change(d) THE reservation
- d. confirm(ed) THE reservation
- e. hold THE reservation
- f. cancel THE reservation
- g. arrange(d) THE reservation (one problem in DT130022)
- h. (the time) of THE reservation
- i. extend THE reservation

Currently, the default article for *reservation* is *a*, and this seems to be right. If we could change the article to *the* in cases (b)–(i), that would improve things a lot.

When the object of *recommend* is just the plain NP *hotel*, that object should be indefinite too.

## 2 Simple editing

It's just a small point, but often one finds cases where two words are unexpectedly combined into one, as in English *some+thing* and *any+thing*. It would presumably be easiest to write some post-editing routines that merge such sequences into one word; we may also encounter *any+person*, which should become *anyone*.

Similarly, we might also want to do post-editing for examples like this:

((J "はいまず京都駅から地下鉄烏丸線に乗っていただきます")  
("Yes , first of all , you could get on the subway karasuma line from  
kyoto station" . 2.0e-5) )

Here, in contrast to the Japanese structure, the most natural English would be "Karasuma subway line".

### 3 Classifiers/Counters

Here are some cases where we may need a bit more editing, as part of the generation process. We really need a translation like "two adults" in the examples below with 人. If we delete the middle two words of "two people an adult" and then get the plural marking right, we can get "two adults".

source : "二十九日の土曜日の午後大人二人でお願いします"  
target : "For two people an adult on the afternoon of saturday the twenty ninth , please" (0.0)

source : "税込みで大人一人四ドル五十セントになっています"  
target : "It is four dollars fifty cents for one people an adult including tax"

To get the agreement to work out ("two adults"), we presumably need to do this during the generation process.

In the next example, the final word *people* is redundant and quite strange in English.

source : "お昼頃に京都に着きたいのですけれども人数は二人です"  
target : "I would like to arrive in kyoto at around noon and the number of people is two people" (5.0e-6)

I'm not sure what we can do here other than look for English sequences of the form "the number of X is N X", and delete the second X.

If we take the strategy outlined above for 人, we can perhaps apply it to this example too:

source : "はいじゃその便の席を一名チケットを一枚買いますのでクレジットカードで払います"  
target : "Yes , well , i will buy one ticket a ticket the seat on the flight for one people . i will pay by credit card" (1.4999999e-5)

Here we would delete "ticket a" from "one ticket a ticket", to leave "one ticket".

Alternatively, it might be useful to add analysis/generation rules which can convert something like [きっぷを三枚] 買った into (*I bought*) *three tickets*, where the adverbial 三枚 is converted directly into an adjective (determiner?) for the preceding CN.

## Part 4

# Context

### 1 Various problems

There are many people at ATR who know more about discourse, discourse structure, and discourse processing than I do, so I will not make any large-scale proposals. It is clear that encyclopedic knowledge of the domain, and knowledge of human plans and actions, would be necessary in order for a fully correct translation system to be in place, even for our restricted domain.

However, at the moment, the English generation system has no discourse processing built in to it at all (I believe), so the right thing to do at this stage would be to decide what is feasible as an approach to (some of) the problems enumerated below.

We have very difficult problems in the following domains:

- choice of subject

The system cannot distinguish between the Representative and the Traveller, nor between the Traveller and the Conveyance. In this example, the choice of subject is wrong.

tcs13022[4] そこから十二分ほどで北大路駅に着きます

I will arrive at kitaoji station in about twelve minutes from there

\*\*[1] Wrong subject: it should either be "you will arrive ..." (as the passenger) or "it will arrive ..." (as the train).

These would presumably be the first problems that should be worked on. There is more discussion of this example below.

- grammatical number

In the next example, someone is trying to sell a helicopter ride to a prospective traveller. The traveller would be much more interested if there was more than one famous building that the helicopter would pass.

o22002[3] ミッドタウンの有名なビルの上空を飛びます  
I will fly over a famous building in midtown

\*\*[1] Context: the translation should be "we will fly over famous buildings in midtown".

The next example is even more problematic in terms of communication. The traveller is trying to buy two tickets, and in fact has done so, but the output here suggests that only one has been bought.

ths33001[9] こちらがチケットでございます  
Here is a ticket

\*\*[1] Context: the passenger has just bought two tickets, and so the translation must be "Here are the tickets".

Both of these examples present very difficult problems, that maybe cannot be solved with just information from the discourse, but also require knowledge of human actions, what is interesting, and so on.

- deictic forms

tss22001[4] 今ホテルに滞在してるんですがそちらの番号でいいですか  
I am staying at the hotel now . is your number good ?

\*\*[1] Deixis: here, in Japanese, そちら refers to the speaker's location (i.e. the hotel), so "your" is wrong. The closest English seems to be: "Is that number good?".

If I understand this correctly, even though the speaker is referring to his own location, he uses そちら.

Here is another example:

tas32002[3] かわりにバス付のツインルームをお一人様でご使用いただけます  
がこちらでいかがでしょうか

Instead you could use a twin room with a bath for one people . how about this one ?

\$\$[1] Deixis: here the most natural English would have "How about that?"

I do not think there is any realistic solution to these problems in the short- or even longer-term.

- article selection

Consider now this example:

tcc22034 [5] お客様のお荷物が何かの間違いでほかのお客様のお部屋に運ばれたということも考えられます

It is possible that your luggage were carried into a room of the other guest by some mistake

\*\*[3] Articles again: should be "your luggage was carried into the room of some other guest by some mistake".

%%[4] For many speakers "by mistake" would be preferable to "by some mistake".

Beyond the questions of article selection based on previous mention, and who the main protagonists are, there are examples like these with "room" and "guest" which also require some routines for choosing the correct article, presumably depending on world knowledge and expected relationships (e.g., for each guest, there is usually just one room that they stay in, so we have "THE room").

- lexical choice

These next cases are very tricky; I haven't been able to think of a general solution for dealing with them, so we may just have to just be very careful how we do the generation, with some contextual information being accessed. Here, the correct output should be something like "How long will it take (me) to get better?". However, the same sentence occurs elsewhere, in the context of a broken air-conditioner, and of course the translation should be different, involving "repair".

The guest is ill, and takes some medicine.

((J "どのくらいで直りますか")

("How long will it take to repair ?" . 0.0))

In the next example (the second utterance), we have a general problem in what to do with ご利用ください. This dialog is about a man trying to rent a car, which he decides to do:

((J "特に問題もなさそうなので妻と相談してから予約をお願いしたいと思います")

("It seems that there isn't the problem in particular , so i would like to make a reservation after consulting with my wife" . 0.0))

((J "ええぜひご利用ください")

("Yes , please be sure to use" . 1.4999999e-5))

The Representative replies ご利用ください, but it is not clear exactly how to translate it.

Similarly general is the problem with どのくらい.

((J "三条から延暦寺まではどのくらいかかりますか")  
("How much does it take from sanjo to enryakuji ?" . 0.0)  
)

Here the most natural English would be "How long does it take ...", though in other contexts it could be (and is) better translated as "how much".

## 2 Missing Subjects and Speaker/Hearer

It was something of a surprise to me that our corpora don't have information about which speaker of each utterance was the 'Traveller' and which was the 'Representative'. Having that information would clearly help in predicting the English generation for missing Japanese subjects, which are of course quite common in the corpora.

My understanding is that the German generation system keeps track of the last-mentioned entity as a way of predicting missing subjects and definite articles. It would be worthwhile to evaluate how useful this is, to see if it should be added in the same way to the English system.

## 3 Exploit the Domain

The restriction of our domain of data to a particular kind of conversation doesn't seem to me to have any obvious benefits in terms of the grammatical analysis; in fact, it may mean that there are certain kinds of problems that a wider system would encounter that we haven't encountered.

On the other hand, the value of a restricted domain clearly can be seen when we consider how to deal with contextual information. For example, it might be not too difficult to come up with some semantic classification information relating to the following domains—the Traveller but not the Representative is usually:

- eating
- staying somewhere
- in motion/travelling

As an example of this last factor, consider this sentence:

((J "八時半の出発と十時の出発がございすが五時までには帰ってこれます")  
It is leaving at eight thirty and leaving at ten o'clock and i can  
return by five o'clock (0.0))

Here, the R. is giving instructions to the T., so the one in motion is T., and the subject of the last part should be "you".

This example, along with others, also shows it is also important to keep track of the main referents with regard to:

- person vs. conveyance (train, bus, etc.)

It ought to be possible to add/access some limited semantic knowledge to the generation system, and keep track of major participants: Traveller, Traveller's Destination, Representative, Conveyance.

## 4 Simple Illustrations

To illustrate what we need, consider the following two extracts from the dialogues. I have added in the information of R. and T., and numbered the utterances.

T1: ((J "はいお願いします")  
("Yes , thank you very much" . 5.0e-6))

R2: ((J "はいまず京都駅から地下鉄烏丸線に乗っていただきます")  
("Yes , first of all , you could get on the subway karasuma line from kyoto station" . 2.0e-5))

R3: ((J "そこから十二分ほどで北大路駅に着きます")  
("I will arrive at kitaoji station in about twelve minutes from there"))

R4: ((J "北大路バスターミナルから市バス五十九番に乗っていただきます")  
("You could get on the city bus the number fifty nine from kitaoji bus terminal" . 0.0))

R5: ((J "約二十分で竜安寺前に着きます")  
("I will arrive at ryuanjimaie in about twenty minutes" . 0.0))

T6: ((J "そうですか")  
("I see" . 0))

Here 2-5 are uttered by R., but our system currently does not have that information, and incorrectly generates the subject in 3 and 5 as "I" rather than "you" or "it". If it had that information, together with some of the basic concepts mentioned above, it would seem that this kind of problem could be solved.

In the next extract, the information we need in 2, to get the correct subject as "she", is contained in 1.

T1: ((J "朝から友達が何も食べてませんのでできればリゾットのようなものは作っていただけませんか")

("My friend hasn't eaten anything since the morning , so if possible , could you make a thing like a risotto ?" . 1.0e-5))

R2: ((J "さようでございますか食べていらっしゃらないんですか")

("I see . don't you eat ?" . 1.0e-5))

## Part 5

# Multiple Generations

My current output is in /usr/local/TDMT/sells/result/all.out. There are several sentences in there which produce multiple generations, marked by "xx". Usually, one generation is good but the others are bad. This will lead to problems when the system is used on open data, and it is PROBABLY QUITE IMPORTANT for someone to check the various generations, and to try to add in preferences or weights for discarding the unwanted generations. The problems mainly arise in examples which contain **conjunctions**, or examples in Japanese of the form "Z の N<sub>1</sub> の N<sub>2</sub>", where there is an ambiguity as to how to build the structure.

## Conclusion

For natural-looking output, the editing and classifier problems mentioned in part 3 should be addressed. The next step would be to work on correct subject prediction/selection. Also, in the near future, I think it would be very valuable to investigate examples which have multiple generations, and make an attempt to reduce the number of alternate generations.