

Readability and Translatability Judgments for ‘Controlled Japanese’

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Abstract

We report on an experiment to test the efficacy of ‘controlled language’ authoring of technical documents in Japanese, with respect both to the readability of the Japanese source and the quality of the English machine-translated output. Using four MT systems, we tested two sets of writing rules designed for two document types written by authors with contrasting professional profiles. We elicited judgments from native speakers to establish the positive or negative impact of each rule on readability and translation quality.

1 Introduction

It is widely acknowledged that the typological ‘distance’ between Japanese and English (the most common European target language for MT from Japanese) hampers the achievement of high-quality translation. We seek to address this challenge by investigating the feasibility of developing a ‘controlled Japanese’ with explicit restrictions on vocabulary, syntax and style adequate for authoring technical documentation.

Our starting point is sentences extracted from two types of document: consumer user manuals (UM) and company-internal documents articulating the know-how of key employees (KH). UM are produced by professional technical authors, while KH are written as ‘one-offs’ by the employees themselves, capturing their own know-how. Thus, there is a sharp difference in the ef-

fort the two groups of writers can be expected to invest and the linguistic knowledge they bring to a controlled authoring task.

In outline, our experiment entailed formulating a set of writing rules (‘authoring guidelines’) for each document type. Sentences violating the rules were extracted from the original data and rewritten (‘pre-edited’ in this experimental setting) in accordance with the respective rule. The original and rewritten sentences were then translated by different MT systems; finally, the inputs and outputs were submitted to human evaluation.

Since the readers of the original Japanese and the readers of the translated English are equally important, we devised protocols to assess what we termed the ‘readability’ of the Japanese source sentences and their ‘translatability’ as gauged by the perceived quality of the English target sentences.

In interpreting the results, we try to identify the most promising avenues for further development.

2 Controlled Language and MT

The general principles of controlled language (CL) and the challenges posed by its deployment are clearly summarised by (Kittredge, 2003; Nyberg et al., 2003). Evidence of the effectiveness of CL in cutting translation costs has been in the public domain for some 30 years, from (Pym, 1990) in the automotive domain to (Roturier, 2009) in the software domain.

More specific studies have been undertaken to identify those rules which have the greatest impact on the usability of MT output (e.g., O’Brien and Roturier, 2007).

Overwhelmingly, controlled language studies have focused on English as source language. This is not to say that CL varieties do not exist for languages other than English. Among recent work, Barthe (1998) relates the process of developing GIFAS, the ‘rationalised’ French counterpart of the AECMA documentation standard for the aerospace industry, while Lieske et al. (2002) describe a controlled German.

In the case of Japanese, the application of the CL notion dates back to (Nagao and Tanaka, 1984), who describe a framework for assisting authors in producing what they termed ‘machine-readable’ Japanese. Yoshida (1987) outlines a framework for designing a ‘standardised’ Japanese for MT. Kaji (1999) offers a few Japanese examples.

More recent computational work has focused on automatic re-writing of what we can term ‘MT-intractable’ Japanese (e.g., Shirai, 1998; Matsuyoshi et al., 2004). Since such re-writing is a machine-internal process, these studies are not necessarily directly applicable to guiding the authoring of human-readable texts.

Morita and Ishida (2011) provide protocols to enable monolingual users to converge on a correct Japanese/English machine translation, but no a priori writing or editing rules are proposed.

The proposals in (Sato et al., 2003) are motivated by personal rather than technical communication. Matsui and Magnusson (2011) require language learners using online Japanese-to-English MT to apply six ‘revision’ rules to their input, including insertion of pronominal subjects (Japanese is a pro-drop language) and of the determiner *その* before nouns. However, to generalise such insertions is unnatural and potentially misleading for human readers.

Finally, the rules proposed in (Ogura et al., 2010) are intended for technical writers, but no empirical evidence of their efficacy is presented.

3 Formulation of Authoring Guidelines

As we noted, we are dealing in this case with authoring in two very different settings, distinguished by the professional background of the authors themselves, the purpose of the documents they write and the characteristics of their readerships. Accordingly, we adopted different rationales for selecting what can be formally described as *rules*, which are presented to the writers as *guidelines*. Nyberg et al. (2003) identify prior writing expertise as a key factor in the successful deployment of CL.

3.1 Settings and selection process

In the case of UM, we are dealing with professional authors producing instructions for consumer-users whose perception of the appliances will depend in part on the quality of the documentation. As for KH, the authors have no prior training in technical documentation. Their task is to write down the conceptual and procedural know-how underlying their own job in order to share it with other staff both in Japan and in overseas operations. Their readers are ‘insiders’ with experience of the corporate culture and can be expected to tolerate some infelicity of expression provided the content is understandable.

The purpose and motivation in selecting the guidelines differ somewhat between the two settings. While the training of the UM authors allows some guidelines that require sophisticated linguistic knowledge, the guidelines for the KH setting need to prioritise ease of implementation by non-professional writers unaccustomed to writing with translation in mind. The trade-off for this gentle learning curve is incomplete coverage of problematic linguistic features by the guidelines.

The UM guidelines were developed through a combination of bottom-up and top-down approaches. From a corpus of 38,527 Japanese-English translation units we selected all Japanese segments of length greater than 150 bytes. We translated the resulting 10,026 segments with Google Translate¹ and Systran 7 Premium Translator². Given that the data was judged to be typical of user manuals in Japanese, we emphasised improving MT quality. We manually identified segments with flagrant translation errors induced by structural features of the source text. This search was guided by the categories identified in (Ogura et al., 2010). The outcome was a set of 20 problem features, described in section 3.2.

For the KH guidelines, we proceeded top-down. Our corpus consisted of three documents comprising 33, 20, and 53 pages, or 177,742, 10,433, and 32,366 characters respectively. Unlike the UM corpus, the KH showed little homogeneity in wording and style. General technical and business writing guidebooks³ provided suggestions for some of the guidelines we formulated. Others were chosen to remedy known problems of Japa-

¹ <http://translate.google.com/>

² <http://systransoft.com/>

³ 日本語スタイルガイド 第2版 (一般財団法人テクニカルコミュニケーション協会編著), 説得できる文章・表現 200の鉄則 (日経BP社出版局)

nese to English MT. An initial set of some 40 candidate guidelines was filtered according to two criteria. First, some of the problem features occurred either not at all in the corpus or with very low frequency. Second, some guidelines were judged to require meta-linguistic knowledge which could not safely be assumed on the part of non-professional writers or imparted in a necessarily brief training session. The outcome was a set of 10 guidelines, described in section 3.3.

3.2 Authoring guidelines: UM

Table 1 lists the 20 problem features from the UM corpus which we experimented with. These gave rise to 28 pre-editing rules formulated as ‘Omit ...’, ‘Replace with ...’ or ‘Add ...’.

F1	Long sentences (> 50 characters)
F2	Sentences of 3 or more clauses
F3	Negative expressions
F4	Verb + nominaliser こと
F5	Nominaliser もの
F6	Verb + ように (‘it is suggested that’)
F7	Topicalizing particle は
F8	Coordinating conjunction または (‘or’)
F9	Modal れる・られる (‘can’)
F10	Verb 見える (‘can be seen’)
F11	Compound noun strings
F12	Particle など (‘and so on’)
F13	Single use of conjunction たり (‘either’)
F14	Katakana verbs
F15	Suffix 感 (‘sense of’)
F16	Verb かかる (‘start’)
F17	Verb 成る (‘become’)
F18	Verb 行う (‘perform’)
F19	Case-marking particle で (‘with’, ‘by’)
F20	Verb ある・あります (‘exist’)

Table1. ‘Avoid’ features of UM guidelines

Table 2 shows examples of (a) original and (b) re-written sentences for three of the features.

F7	1a	ソングは「メロディー」と自動伴奏の組み合わせでできています
	1b	「メロディー」と自動伴奏の組み合わせでソングができています
F9	2a	1つのウェブフォームに割り当てられるキーバンクは最大128個までです
	2b	1つのウェブフォームに割り当てる

		ことができるキーバンクは最大128個までです
F20	3a	コードの詳細は64ページにあります
	3b	コードの詳細は64ページに記載されています

Table 2. Pre-edited UM sentences

3.3 Authoring guidelines: KH

These guidelines fall into three categories: notation (*a, b, c, d*); word/phrase structure (*e, f*); sentence structure (*g, h, i, j*).

a. Do not use single-byte Katakana characters

Katakana, used mainly for writing foreign words, is the only one of the three Japanese scripts that can also be written in single byte. Single-byte Katakana writes a voiced consonant with an unvoiced base character followed by a diacritic (underlined) that indicates voicing:

プロシ^ェクタ・スクリーン・ケー^フル

This can perturb tokenisation by MT systems.

b. Do not use symbols in sentences

MT systems can fail to identify the terms of the relationship (underlined) represented by symbols such as a minus sign signalling ‘the difference between A and B’.

実際の投入工数 - 基準時間との比較による能率管理

c. Do not use nakaguro (bullet) as a delimiter

MT systems can fail to distinguish parallel items delimited by nakaguro (underlined> from the surrounding text.

会社のステージ・業績に応じた賃金、賞与の水準

d. Avoid using inappropriate Kanji characters

This equates to spelling mistakes in English.

e. Avoid creating long noun strings

Nouns and stems of adjectives, adverbs, and verbs can be combined to form a compound noun.

f. Do not use ‘perform’ to create a *sa*-verb

Sa-verbs formed by adding a ‘do’ verb to a noun are widely used. Adding ‘perform’ or ‘execute’ (行う/実行する) instead of the simple する creates verbose texts and awkward output.

g. Avoid topicalisation

Japanese is ‘topic-prominent’, i.e., the topic is often given the particle は, which makes it look like the subject of the sentence, even if it is not.

- h. Do not connect sentences to make a long sentence
- i. Do not interrupt a sentence with a bulleted list

The first line of the example reads ‘When setting the standard unit price,’ and the last ‘must be specified.’ Kohl (2008) recommends combining these into a complete sentence, such as ‘The following items must be specified when setting ...’

基準単価設定は

- ・セット品の単価 (品番 : S1)
- ・単品部品の単価 (品番 : A、B)

の設定をしなければならない

- j. Avoid listing numerous parallel items in a sentence; use a bulleted list instead

4 Experimental Set-Up

For both the UM and KH settings our aim was to assess, using human judges, any gain or loss in (a) the readability of the Japanese sentences after pre-editing, and (b) their translatability as gauged by the perceived quality of the English translations produced by MT. Table 3 shows the size of the data sets and the numbers of judges.

	UM	KH
Rules tested	20	10
Sentences per rule	5	6
JAO sentences	100	60
JAR sentences	100	60
JA judges	31	20
MT systems	3	2
ENO sentences	300	120
ENR sentences	300	120
Human reference	100	0
EN judges	28	8

Table 3. Data sets and judges

4.1 Japanese test corpus selection

In the case of UM, we selected five sentences for each of the 20 features of Table 1 by randomly ordering our 38,527 segments and choosing the first five sentences to satisfy the condition and for which the human reference translation contained no added information. With KH, for each guideline described in Section 3.3 we selected six sentences that violated it. In both cases, when a sentence contained more than one type of problem, we changed only the part that was subject to the applicable guideline. Thus, we had sets of original sentences UM-JAO and KH-JAO and rewritten sentences UM-JAR and KH-JAR.

4.2 English test corpus generation

Using two online MT systems, namely, Excite⁴ and Google Translate, we translated all the JAO and JAR sentences into English (ENO and ENR, respectively). We used them ‘off the shelf’ via the internet, with no user dictionary or any sort of customisation. The UM Japanese sentences were also translated using Systran 7 Premium, with the benefit of user dictionaries extracted from the available English human (reference) translation of the manual.

Note that it was not the MT systems themselves that were the focus of our evaluation, but the writing guidelines. We wanted to see whether rules had a positive impact irrespective of system.

4.3 Judges

Ideally, the quality of a text should be evaluated by readers who are similar in profile to the actual target readership. Since the UM data related to consumer electronic audio and music equipment, we recruited as plausible readers Japanese native-speaker university students and English native-speaker graduate students with no knowledge of Japanese (which might allow them to compensate for mis-translations).

In the case of the KH judges, both the Japanese native-speakers and the English native-speakers were recruited from within the company. They were, therefore, ideally suited to the task.

4.4 Questionnaire design

The quality of the Japanese source text written according to the guidelines must be as good as or better than that of the text written without guidelines. With the UM-JA data, we presented the judges with pairs of sentences A and B in which the ordering of JAO and JAR was randomised. They had five options: A much more readable than B; A more readable than B; A and B equally readable; B more readable than A; B much more readable than A.

However, such a pairwise comparison does not tell whether one or both are acceptable or not. In order to overcome this shortcoming, with KH-JA the judges were again shown a pair of ‘before’ and ‘after’ sentences at a time; but were asked to evaluate each of them on the four-point scale in Figure 1 (English gloss of the questions, which were written in Japanese).

⁴ <http://www.excite.co.jp/world/> Note that Excite changed their MT engine (from Fujitsu to Toshiba) between the time of the UM experiment and that of the KH experiment.

The following two sentences convey the same content but are written using different words. Please evaluate the readability of each sentence.

A 欠勤・早退・遅刻・離業など、業務に従事していないときの賃金は、原則として支払いません。

B 欠勤・早退・遅刻・離業など、業務に従事していないときは、原則として賃金を支払いません。

How readable is A? Tick the closest option:

Easy Fairly easy Fairly difficult Difficult

How readable is B? Tick the closest option:

Easy Fairly easy Fairly difficult Difficult

Figure 1. Question to judges of KH-JA

We surmised that showing two sentences at a time would lead the judges to focus on readability in terms of expression rather than content. Therefore, we used the word ‘readable’ (読みやすい) rather than ‘understandable’ (わかりやすい), to avoid the results being affected by any gaps in the judges’ content knowledge. Moreover, although the judges were not explicitly asked to compare the two and decide which was better, we thought that, if they perceived a difference in readability between the two texts, they might differentiate between them in their judgment.

In evaluating the English translations we adopted the same approach for KH-EN as for UM-JA, that is, judges were asked to say whether they thought sentence A more readable than B, B more readable than A, or A and B equally readable. This decision was dictated by the small number of judges available (eight).

For UM-EN we were able to employ more judges. Given that we were dealing with (mostly ill-formed) MT output, we preferred to elicit judgments of sentences independently rather than pairwise, in case judges were more ‘forgiving’ of a better or less bad member of a pair. Thus, judges were shown a single sentence at a time and asked the question in Figure 2.

In addition, setting can be cancelled even by the fact that another song is chosen.

How well did you understand the sentence?

Fully Mostly Partly Not at all

Figure 2. Question to judges of UM-EN

4.5 Administration of questionnaires

The questionnaires were posted online and each judge was given a unique password. Only one question was presented at a time and the judges

were asked not to return to a question after ticking their preference. Unanswered questions were flagged. The judges clicked the submit button once the whole questionnaire was completed.

With UM-JA, each of the 31 judges saw all 100 sentence pairs, with a 10-minute break in the middle. The ordering of presentation of the pairs was randomised and the ordering of JAO and JAR within the pair was equally distributed. With KH-JA, each of the 20 judges saw 30 of the 60 sentence pairs (again, randomly presented, such that each question set was unique), which yielded 10 judgments for each pair.

With UM-EN, as Table 3 shows, we had 700 sentences, including the human reference, which did not always receive the best score (see Section 5.3). Each of the 28 judges saw 100 sentences in random order, with a 10-minute break in the middle. No judge saw two translated versions of the same JAO source sentence or translations of both members of a JAO/JAR pair. Again, the presentation order was randomised.

Unfortunately with KH-EN, only eight English native-speakers were available, so, in order to obtain four judgments for each pair of sentences ENO/ENR-Excite and ENO/ENR-Google, each judge saw 60 pairs. Again, the ordering of ENO and ENR was randomised, each judge saw (in random order) an equal number of outputs from each MT system, and no judge saw translations of the same JAO/JAR pair by both systems.

5 Results and Interpretation

5.1 Japanese readability by guideline: UM

Figure 3 shows, in percentages, the judgments of improvement or deterioration caused by each of the 20 guidelines. The labeling of a rewritten text as ‘Better’, ‘Same’ or ‘Worse’ than the original derives directly from the relative rating given by the judges.

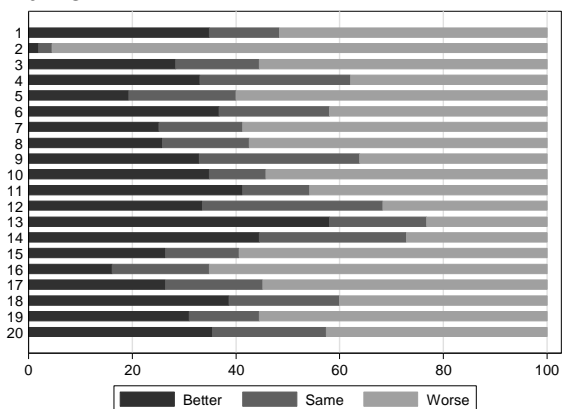
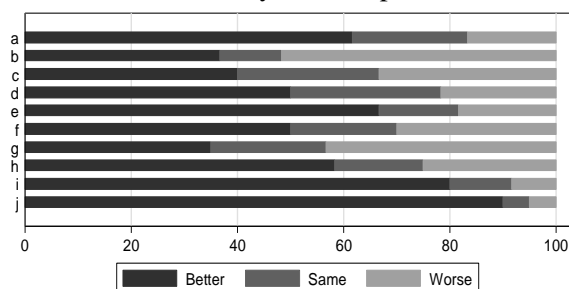


Figure 3. UM Japanese readability gains

Most rules were judged to make the Japanese less readable, (2, 3, 5, 7, 10, 16, 17) having a particularly severe effect. The exceptions were 13 and 14, although neither of these improves translatability (See Figure 5).

5.2 Japanese readability by guideline: KH

The questionnaire design (see Section 4.4) enables us to draw conclusions on both the relative and absolute readability of the Japanese text.



In relative terms, Figure 4 shows that most of the guidelines achieved the objective of improving or at least maintaining the quality of the text, in so far as they were valued as Better or Same by at least two thirds of the judges.

The exceptions were *b* (Do not use symbols in sentences) and *g* (Avoid topicalisation). Guideline *c* (Do not use nakaguro (bullet) as a delimiter) also received a rather low evaluation. These results for *b* and *c* suggest that the use of non-linguistic devices to relate meaningful parts of a sentence promotes concision. The result for *g* was somewhat expected, since topicalisation does not usually compromise readability for humans and editing sentences to eliminate topicalisation can result in wordiness.

The greatest positive impact on readability was registered by guidelines *i* (Do not interrupt the introductory sentence before bulleted lists) and *j* (Avoid listing parallel items in a sentence). While the use of bulleted list is regularly recommended in a number of writing guides, ‘avoiding interrupted sentences’ does not usually make a topic for guides targeting Japanese. Talking about English, Kohl (2008) recommends this practice to help MT systems, but regards it as ‘low priority’ for human translators and non-native readers. In the case of Japanese, our experiment shows that it also helps human readers.

To ground the absolute readability of the text, we converted the rating options to numbers as follows: ‘Easy to read’ = 4, ‘Fairly easy’ = 3, ‘Fairly difficult’ = 2, ‘Difficult’ = 1. Table 4

compares the median values of the evaluation results for JAO and JAR, and ENO and ENR.

	JAO	JAR	EXC	GOO
a	3	4	0	1
b	3	3	1	-4
c	3	3	0	-1
d	2.5	3	1	1
e	3	4	-3	3
f	3	3	3	-1
g	3	3	-1	3
h	3	3	-5	2
i	2	4	5	2
j	2	4	2	-2

Table 4. KH readability and translatability

The table highlights several results. First, overall readability for both JAO and JAR is rather good; there is no category whose median value is lower than 2. This is not surprising, however, since all sentences have been written by a human.

Second, there are no categories for which JAO received a lower score. This suggests that the set of guidelines we used for this experiment was generally successful in maintaining and even raising the quality of Japanese sentences.

Third, among the categories for which JAR received higher scores than JAO, namely, *a*, *d*, *e*, *i*, and *j*, the levels of improvement vary. While there is only a 0.5 point increase for *d*, there is 2 point increase for *i* and *j*, which demonstrates that these two guidelines have the highest impact on improving the readability of the Japanese text.

5.3 Translatability into English: UM

Table 5 gives examples of improvements induced by the guidelines (for input see Table 2).

F7 GOO	1a	Song is “melody” is made with a combination of auto-accompaniment.
	1b	Melody is a song made by a combination of automatic accompaniment.
F9 EXC	2a	They are a maximum of 128 key banks assigned to one wave form.
	2b	They are a maximum of 128 key banks which can be assigned to one wave form.
F20 SYS	3a	As for details of the cord/code there is page 64.
	3b	Details of the cord/code are stated in page 64.

Table 5. UM output: ENO and ENR sentences

Figure 5 shows that the rules for features 2 (three or more clauses), 7 (topicalisation), 18 (‘perform’) and 20 (‘exist’) are highly effective. Their ‘Better’ to ‘Worse’ ratio is greater than 3:1.

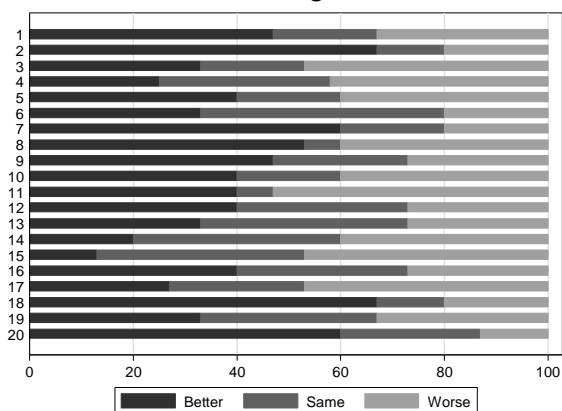


Figure 5. UM translatability gains

We interpreted responses to the question shown in Figure 2 by considering ‘fully’ or ‘mostly’ understandable as ‘acceptable’ and ‘partly’ or ‘not at all’ understandable as ‘inacceptable’. Figure 6 corroborates the impact of rules (2, 7, 18, 20). Taking the 47% acceptability of 2 and 7 as a lower threshold, we can add rules 4 and 12 to the set promoting translatability.

There is, however, no intersection between those rules that boost translatability and those that enhance readability. Indeed, 2 and 7 inhibit readability considerably.

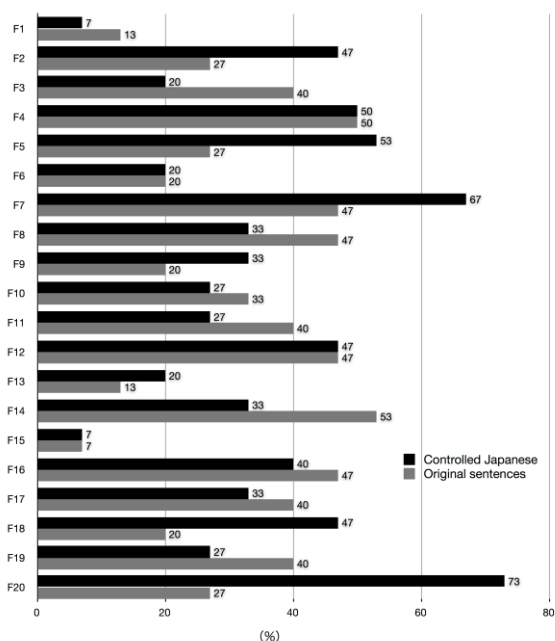


Figure 6. UM translation acceptability

The human reference was judged worse than both ENO and ENR MT outputs in 2% of cases, and no better in 10% of cases (median values). However, the cases varied between ENO and ENR, as Section 5.4 shows.

5.4 Translatability into English: KH

Since the impact of the rules on translation quality diverged markedly between Excite (RBMT) and Google Translate (SMT), we present them separately, in Figures 7 and 8.

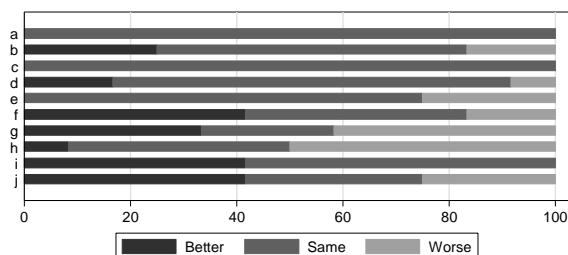


Figure 7. KH translatability gains – Excite

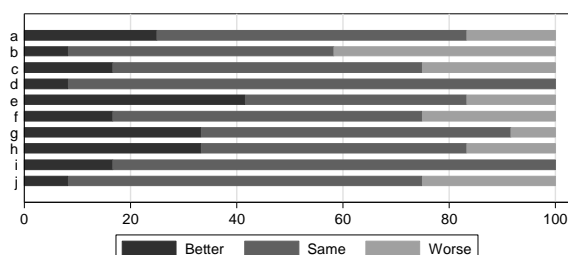


Figure 8. KH translatability gains – Google

Some differences are easy to explain: Excite handles single-byte Katakana while Google does not (rule *a*); scrutiny shows Excite to better handle long sentences (rule *h*), whose naturalness may then be impaired by unnecessary splitting.

Considering the relation between improved readability and improved translation quality, the last two columns of Table 4 give the net sum of the judgments comparing ENO/ENR-Excite and ENO/ENR-Google, respectively, in the range +12 to -12. Although there is no statistically significant correlation, it appears that Google Translate may track readability somewhat more closely than does Excite. Only with rules *d* and *i* do all three indicators improve.

In the case of rules that maintain readability without improving it, the effects are noticeably contrasting: rules *b* and *f* boost Excite but depress Google, while rules *g* and *h* have precisely the reverse effect.

Note that these are relative changes in the performance of the same system given modified inputs. We did not set out to compare MT sys-

tems. Limitations on the availability of competent judges prevented us from trying to ground the judgments in terms of the acceptability of the sentences, as we did with the UM-EN data.

6 Conclusions

We developed two sets of writing rules for use in two contrasting settings. The simple rules applied to the KH texts written by non-professional authors consistently maintained or improved readability, arguably from a relatively low baseline. This may motivate future writers to use them, even if only two rules also raise MT quality. The negative impact on readability of the great majority of UM rules may be due to their departure from de facto technical writing standards for Japanese already judged ‘good’. However, four UM rules boosted translatability to a point where post-editing costs might be considerably reduced. This is a trade-off to explore further. The intersections of the sets (1,2≈h, 7≈g, 11≈e, 18≈f), show little common promise.

Although the MT systems as such were not under investigation, the results overall suggest that their ‘reactions’ are quite idiosyncratic, even if Excite and Systran (both RBMT) behave similarly to each other (and differently to Google Translate). This suggests in turn the need to mutually tune MT system and writing guidelines. The obvious path is to create an authoring environment fully integrated with the MT resources.

Our future work will adopt a functional rather than surface-syntactic perspective on the goal of creating translation-ready documents.

Acknowledgments

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