Computer-Assisted Teaching of Translation Methods

Chi-Chiang Shei
Chang Jung University, Taiwan

Helen Pain
University of Edinburgh, UK

Abstract

This paper introduces an intelligent tutoring system designed to help student translators learn to appreciate the distinction between literal translation and liberal translation, an important and forever debated point in the literature of translation, and some other methods of translation lying between these two extremes. We identify four prominent kinds of translation methods commonly discussed in the translation literature—word-for-word translation, literal translation, semantic translation, and communicative translation—and attempt to extract computationally expedient definitions for them from two researchers’ discussions on them. We then apply these computational definitions to the preparation of our translation corpus to be used in the intelligent tutoring system. In the basic working mode the system offers a source sentence for the student to translate, compares it with the inbuilt versions, and decides on the most likely method of translation used through a translation unit matching algorithm. The student can guess where on the literal and liberal continuum their translation stands by viewing this verdict and by comparing their translation with other versions for the same sentence. In the advanced working mode, the student learns some translation techniques such as the contrastive analysis approach to teaching translation, while appreciating the working of translation methods in relation to these techniques.

1 Introduction

It is arguable that, in teaching translation, the concept of ‘degree of freedom’ or ‘amount of latitude’ (Zhou, 1996) is one of the first important concepts the student should know. According to Zhou, there is a continuum of translation methods available between the two extremes of word-for-word translation and adaptation, which differ in the degree of freedom allowed while translating. In Zhou’s model, word-for-word translation has the lowest degree of freedom because the translator is allowed the least room to manipulate structure when translating. The...
adaptation method, on the other hand, has the highest degree of freedom as the translator can change structure and adapt meaning at will. Zhou offers a model of translation methods on such a continuum as in (1), ordered by the degree of freedom they are allowed:

(1)
- word-for-word translation;
- literal translation;
- semantic translation;
- communicative translation;
- free translation;
- adaptation.

A similar model was proposed earlier in Newmark (1988), which discusses the varieties in (1) under the rubric of ‘translation methods’. Newmark organizes the translation methods according to whether the emphasis of the translator is on the source language (SL) or the target language (TL), as shown in the two separate hierarchical lists in (2):

(2)
SL emphasis:
- word-for-word translation;
- literal translation;
- faithful translation;
- semantic translation.

TL emphasis:
- adaptation;
- free translation;
- idiomatic translation;
- communicative translation.

This model shows that word-for-word translation, for example, is the closest in form to the original structure of the source text; whereas adaptation puts the most emphasis on the fluency of the target text. The significance of this distinction to a translation learner should be clear—in the first place, a translator must know when to adopt which method in order for his or her work to fit in all kinds of demands for translation.

In this paper we are mainly concerned about the development of an intelligent tutoring system (ITS) which uses bilingually aligned corpora and some machine translation (MT) techniques to help translation apprentices learn how to vary their styles of translation along the ‘degree of freedom’ continuum, i.e. how to appreciate the fine distinctions between the translation methods and to produce the target text at a desired level. We start by explaining how the translation methods are defined in the translation literature and adapted to our ITS. It should be noted that in practice it is neither easy nor useful to distinguish so many kinds of translation methods as presented in (1) or (2). Newmark (1988)
himself, for example, only contrasts semantic translation and communicative translation in his examples of translation. In our ITS environment, we consider it appropriate to introduce four levels of translation methods—word-for-word, literal, semantic, and communicative methods.

2 Translation Methods

The following discusses how the translation methods are defined in Zhou’s and Newmark’s models, and how they are adapted to fit in our computational framework. The direction of translation in our discussion of translation methods is translating from the foreign language (English) into the mother tongue (Chinese). As our targeted users are the students in the translation department of Chang Jung University, Taiwan, who are themselves intermediate to advanced learners of English as a foreign language, there is little possibility for them to vary their translation based on different translation methods in the case of translating into the second language, because their ability to produce idiomatic L1–L2 translation is questionable (see Shei and Pain (2001) for discussion on this point).

2.1 Word-for-word translation

For the word-for-word translation method, Newmark says, ‘This is often demonstrated as interlinear translation, with the TL immediately below the SL words.’ (1988, p. 45). Zhou, on the other hand, proposes that the word-for-word translation is to ‘translate each word based on the first definition of such word in a bilingual dictionary, keeping the original word order’. The definition for this method is straightforward and so is the machinery for producing the translation. We need only an electronic bilingual dictionary (in this case a English–Chinese dictionary) and the translation procedure consists only of replacing each word in the source text with the first definition of such word in the dictionary. The Chinese example sentence in (3a) is translated into English by the word-for-word method in (3b):

(3)

(a) Source text

經濟 不 景氣，失業 率 不斷 攀升

ECONOMY NOT PROSPEROUS UNEMPLOYMENT RATE INCESSANTLY CLIMB UP

(b) Word-for-word translation

Economy not prosperous. Unemployment rate incessantly climb up.

The translation happens to be quite all right because the sentence structure is straightforward and Chinese and English do share the same basic word order of SVO. In other cases where Chinese and English differ syntagmatically, word-for-word translation can be nonsensical, such as that in (4b):

2 We thank the anonymous reviewer of this paper for drawing our attention to Newmark’s recent thinking (Newmark, 1993, 1998) about translation methods, in particular about ‘superseding’ the distinction between semantic and communicative translations with other concepts. However, as we find that Newmark’s new ideas in this regard do not seem to have materialized fully, we feel it is still valuable to make a model based on the current distinctions, which can be modified later when the new theory is more established.
Whereas the original meaning of the Chinese sentence in (4a) is 'There is a king who loves to dress up', the word-for-word English translation is not only ungrammatical but also likely to cause misunderstanding.

2.2 Literal translation

For literal translation Newmark (1988) proposes: 'The SL grammatical constructions are converted to their nearest TL equivalents but the lexical words are again translated singly, out of context' (p. 46). The point is then for the structure in the TL to be grammatical, eliminating the possible random, gibberish word strings produced by the word-for-word method. Zhou (1996) gives further hints for the degree of grammaticality the liberal translation method should accomplish. According to Zhou, what the literal method does on top of the word-for-word method is: 'In response to target language grammar, make minimum adjustment of word order and addition or omission of words, still disregarding co-text of discourse altogether' (p. 24). A useful computational definition for this method could thus include 'rearranging the word order of SL to that of TL, adding or deleting functional words where appropriate to meet the minimum local grammatical requirement'. This can be illustrated by the following example, where the English sentence I read books is translated into Japanese through two different translation methods:

(5)

<table>
<thead>
<tr>
<th>Source text</th>
<th>Word-for-word translation</th>
<th>Literal translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I read books</td>
<td>* watakusi yomu hon</td>
<td>watakusi wa hon wo yomu</td>
</tr>
<tr>
<td></td>
<td>I READ BOOK</td>
<td>I 'Topic marker' BOOK ‘Object marker’ READ.</td>
</tr>
</tbody>
</table>

In (5b), the Japanese translation is ungrammatical because of the wrong word order and the lack of function words. In (5c), however, the Japanese sentence is correct as the literal translation method has rearranged the word order and added in functional words as appropriate. Let us take
another example—the Chinese sentence in (3). We now translate it on the basis of the literal translation method, into the English text in (6):

(6) Literal translation
The economy is not prosperous. The unemployment rate climbs up incessantly.

It should be noted that the function word the previously not existing in word-for-word translation has now been added, climb has been changed to climbs to reflect the number of the subject, and the word order is slightly adjusted. The literal translation method is a good way to produce quick and, in many cases, minimally understandable translations.

2.3 Semantic translation
For practical reasons it seems advisable to conflate Newmark’s definition for faithful translation and that for semantic translation into a single category and keep the name of semantic translation. According to Newmark, ‘A faithful translation attempts to reproduce the precise contextual meaning of the original within the constraints of the TL grammatical structures’ (1988, p. 46). According to him, the method ‘transfers’ cultural words and preserves the degree of grammatical and lexical “abnormality” . . . in the translation’. That is, it ‘attempts to be completely faithful to the intentions and the text-realisation of the SL writer’ (1988, p. 46). More concretely put, the method tries to be faithful to both the meaning and the form of the source text, probably constantly seeking a good balance between the two. On the other hand,

Semantic translation differs from ‘faithful translation’ only in as far as it must take more account of the aesthetic value (that is, the beautiful and natural sound) of the SL text, compromising on ‘meaning’ where appropriate so that no assonance, word-play or repetition jars in the finished version (Newmark, 1988, p. 46). It seems then that Newmark’s faithful translation and semantic translation methods differ not in principle but in some minor linguistic points. On the other hand, Zhou (1996) suggests that the translator following the semantic translation approach will ‘try to keep the form of the original text and maintain the intention of the author, while at the same time attempt to make the translation natural and fluent’ (p. 24), which seems a good summary for Newmark’s semantic and faithful translations put together.

The principal requirement for the semantic method is thus for the translation to accurately express the meaning intended by the author in reasonably fluent target text that maintains the author’s original structure and wording as much as possible. As Newmark (1991, p. 51) later comments, in semantic translation ‘the text remains embedded in the source language culture’. We go back to (3) again and translate it this time with the semantic translation method, with the following result:

(7) Semantic translation
The economy declines, and the unemployment rate climbs up incessantly.
Computationally, we might say that a semantic translation is a translation that attempts to find the best lexical and grammatical equivalents in the target language to express the meaning of the source text as accurately as possible.

2.4 Communicative translation

The difference between the semantic translation and the communicative translation is that in the semantic translation method the translator should maintain a certain degree of meaning-and-form correspondence in the source language while endeavouring to transfer the correct meaning of the source text to the target text. In the case of communicative translation, however, the translator is mainly concerned with searching for expressions in the target language to better communicate the message to the reader, ignoring the concerns about finding lexical or structural equivalents altogether. In the latter case, ‘readability’ in the target language is a stronger concern than ‘faithfulness’ to the form and structure of the source text. In Newmark’s (1991) words, the communicative translation is:

a text set in an appropriate social style or register, where the units or stretches that express individual character are normalised for the sake of the readership, therefore converted to natural usage (p. 51).

With respect to computational definitions, whereas in principle a semantic translation can be produced by what Arnold et al. (1994) call the ‘transformer architecture’, where the SL wording and structure can be preserved by a carefully designed transformation rule, the communicative translation method, on the other hand, must rely on what they call the ‘linguistic knowledge architecture’, where not only are sentences analysed into underlying representations but a TL grammar is fully functional to produce grammatical target sentences. If semantic translation is defined to be something like ‘a translation produced by taking both semantic representation and lexical/grammatical information extracted from the source text into consideration when generating the target text’, then for the communicative translation, as readability is a more important concern than faithfulness to the original structure, the target text should be generated based solely on the meaning of the source text, disregarding the original lexical/grammatical information altogether. Hence the generator on the side of the TL relies entirely on TL rules in producing the target text, referring to the semantic representation extracted from the source text while ignoring the lexical/structural information.

In Newmark (1988) there is a level called ‘idiomatic translation’ beyond the communicative translation method. Newmark says, ‘Idiomatic translation reproduces the “message” of the original but tends to distort nuances of meaning by preferring colloquialisms and idioms where these do not exist in the original’ (p. 47). We find it helpful in practice to incorporate the essence of idiomatic translation into the communicative translation, i.e. the ‘colloquialisms and idioms’ bits. We propose that
idiomatic translation be defined computationally as communicative translation plus the refinement of collocations, idioms, and ‘lexicalised sentence stems’\(^3\) to make the translation more fluent and native-like. Again, the Chinese sentence in (3) is translated into English, this time via the communicative translation method, in (8):

(8) Communicative translation
The unemployment rate continues to rise with the economic downturn.

A noticeable fact about the communicative translation, as defined in our framework and illustrated in (8), should be the abundance of collocations (e.g. *economic downturn*) and the use of sentence stems (e.g. *NP continue-TENSE to VP with NP*), both of which contribute greatly to the native-like fluency.

2.5 Free translation
According to Newmark (1988), ‘Free translation reproduces the matter without the manner, or the content without the form of the original. . . . Usually it is a paraphrase much longer than the original, . . . and not translation at all’ (p. 47). Because ‘matter’ and ‘content’ are too vague and difficult to define and to be ‘understood’ by a computer, and the method is ‘not translation at all’ according to Newmark, we will not deal with it any further in our paper. But an illustration of what it could be like is supplied in (9), again translating from (3):

(9) Free translation
*The current economic situation in Taiwan is worse than the time of the previous government, and the unemployment rate has reached a new high since the new government took office.*

3 Text Preparation
The prototype translation teaching ITS, nicknamed TMT (Translation Method Tutor), has a preinstalled corpus consisting of the first chapter of the English novel *Pride and Prejudice* (Austen, 1813)—henceforth the P&P corpus—and four different versions of Chinese translation based on the four translation methods previously discussed: word-for-word, literal, semantic, and communicative translation methods. The system draws on this translation corpus for its teaching and practice materials. Before describing how the system works with the corpus, we explain how the translations are prepared for use in the system.

3.1 Fully automatic MT
The word-for-word translation version is produced by fully automatic machine translation, although it may be inappropriate to call the technique ‘translation’ in this case. The procedure is simple, the essential tools being an English–Chinese dictionary and a trivial computer program for searching and extracting. In (10), a sentence fragment from Austen (1813) is translated into Chinese by the word-for-word method:
The result of word-for-word translation in the case of (10) is an ungrammatical Chinese phrase because, for one thing, the phrase in possession of is broken down to its ingredients and translated separately, and of course the result will not be acceptable in any target language. Also, in Chinese a specific ‘classifier’ must precede the noun when a number word is used. So for English a fortune we must say yi-bi caichan instead of *yi caichan, where bi is the correct classifier for the noun caichan.

Although the reader may wonder about the value of including word-for-word translation in the ITS environment for practising translation, we feel this is still useful for our system from at least two perspectives. First, we think Newmark’s (1988, p. 46) remark that word-for-word translation can be used ‘to understand the mechanics of the source language or to construe a difficult text as a pretranslation process’ applies to the translation trainee as well, especially for the beginning learners and those who are second language learners. Second, because word-for-word translation involves the extraction of the first (most frequently used) definition of a word in a dictionary, which is frequently wrong as a translation in a given context, and because our system has a matching algorithm (to be explained later) to determine which translation method is most probably used by the learner to produce a given translation, it is valuable to keep the word-for-word version so as to discover whether the translation learner indeed adopts this brute translation method unwittingly to a certain degree.

3.2 MT with post-editing

Another translation method that could be helped by MT is literal translation. Previously we have defined the literal translation method as ‘rearranging the word order of SL to that of TL, adding or deleting functional words where appropriate to meet the minimum local grammatical requirement’. In principle, to prepare the literal translations for the corpus in TMT, the basic requirement is a series of word-order rules, which work on part-of-speech tagged Chinese sentences. The system runs the result of the word-for-word translation through these rules and corrects any assumed errors in word order. On top of the word-order rules, a series of simple and local rules can be devised to handle these ‘minimum adjustments’. For example, there is a classifier-adding rule, which, when encountering a quantity word like a, will look up the noun following it,
and retrieve (from a precompiled table) the correct Chinese noun classifier for the noun. For the example in (9), we would then have the more appropriate *yi-ge nanzi* rather than the unusual *yi nanzi* if the classifier *ge* is added, and *yi-bi caichan* rather than ‘*yi caichan*.

Further examples of these local rules are the collocational rules, which examine certain word combinations to see whether they are habitual co-occurrences in Chinese. For example, a collocational rule would locate the word before *de* (which is probably an adjective) along with the word after the same *de* (which is probably a noun) and search a collocation database to see if they partially match an adjective–noun collocation in Chinese. For the example in (9), *danyi* and *chengnian-nanzi* should be extracted from the structure *danyi-de chengnian-nanzi* and checked against the adjective–noun pairs in the collocation library. As a result, the correct collocation *danshen nanzi* (‘single man’, or ‘bachelor’) is found, which happens to be the correction translation as well in terms of meaning. Following this technique, the net result of the literal translation for the English text in (10) will thus be something like the Chinese sentence in (11):

(11)

(a) Source text
a single man in possession of a good fortune

(b) Literal translation:

<table>
<thead>
<tr>
<th>Chinese</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>yige danshen nanzi</td>
<td>a single man</td>
</tr>
<tr>
<td>zai yi bi hao de</td>
<td>in possession of a good</td>
</tr>
<tr>
<td>de</td>
<td>fortune</td>
</tr>
</tbody>
</table>

However, as the authors are not actually involved in the development of MT systems, we run the P&P corpus through an online MT system: Golden Bridge Translation Center (no date) and, for (12a), we obtain the Chinese translation in (12b):

(12)

(a) Source text
a single man in possession of a good fortune

(b) Machine translation

<table>
<thead>
<tr>
<th>Chinese</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danshen nanzi zai yi bi hao de</td>
<td>a single man</td>
</tr>
<tr>
<td></td>
<td>in possession of a good</td>
</tr>
<tr>
<td></td>
<td>fortune</td>
</tr>
</tbody>
</table>

The problem with (12b), a translation offered by a contemporary Chinese–English commercial MT system, is that it is better than word-for-word translation in some aspects, but is ‘equally bad’ or even worse in other aspects. The translation in (12b) is better than the word-for-word translation in (10) with respect to word order and syntax, but the choice of word is inferior: the phrase *in possession of* and *fortune* are both given the wrong sense (*occupy* and *destiny* respectively) in Chinese by the MT system. In fact, in the forty-five full Chinese sentences produced by the

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4 See, for example, Shei and Pain (2000) for a detailed discussion on the processing of collocations.
MT system out of the fifty-five source sentences, there are less than a quarter that do not have obvious grammatical problems. A typical ill-formed sentence produced by the MT is in (13):

(13)

(a) Source text
this truth is so well fixed in the minds of the surrounding families

(b) Machine translation
*這事實如此被好在環境家庭的心裡修理
THE FACT SUCH 'passive' GOOD IN ENVIRONMENT FAMILY'S HEART REPAIR

Apart from committing some critical errors in diction (e.g. fixed being translated using the repair sense rather than the settle sense), the MT system also produces a completely ungrammatical sentence that may even be more difficult to understand than a word-for-word translation. The MT output needs to be drastically revised for it to be useful for our pedagogical purposes.

According to Somers (1998): 'Post-editing consists of tidying up the raw output, correcting mistakes, revising entire, or, in the worst case, retranslating entire sections' (p. 138). Although it is a daunting task to post-edit the MT output such as (13b), we think it is a worthwhile task when our goal is to produce literal translations. First of all, as contemporary MT systems work on the grammatical rather than the semantic level, we think it is a rather good basis, or a reasonably confined environment, for generating literal translations, which according to our definition do not involve semantic analysis. Second, by doing this kind of revising job with a research perspective, we will know where the weaknesses of the MT system are and how it can be improved to produce acceptable translations by the literal translation criteria. Thus the literal translations of our P&P corpus are produced consistently by the MT with post-editing method.

3.3 Importing existing translations
From our experience of using the state-of-the-art English–Chinese MT system, we realize it is still not possible for MT to generate anything like semantic translations for our purpose. The semantic translations in our ITS are thus directly imported from existing Chinese translations for the P&P text. This is partially due to the fact that the corpus adopted in this ITS is a literary text. According to Newmark (e.g. 1988, p. 248), semantic translation is appropriate for serious literature as it 'attempts to preserve the original's degree of deviation from natural language'. Thus, at least in theory, the translation of a literary text should meet the criteria of the semantic translation method. For example, a high-quality existing version of a Chinese translation of Pride and Prejudice can be found at Pride and Prejudice(Eng/Chi) (no date) and the translation it offers for the source sentence fragment in (9) is:

5 See Hutchins (1999) also for comments on the current state of MT.
6 We thank the anonymous reviewer again for reminding us of this point.
It should be noted that this is the only version so far that correctly identifies the source structure as an NP (noun phrase)—all previous translations look like some sort of Chinese clause. As discussed above, to preserve the original structure and wording of the source text while rendering smooth target text is an important trait of the semantic translation method. However, on the other hand, the Chinese translation in (14b) does away with the article *a* in the source text, which is often unnecessary for an NP in the Chinese discourse (though the article can still be preserved and read fluently). In this regard, the translation deviates from semantic translation and shows the characteristic of a communicative translation, as it modifies the original NP structure to some degree in exchange for more fluency in the target language. Thus although existing translations of literary texts tend to be semantic, they nevertheless need to be modified for our ITS to reflect the difference between semantic and communicative translations more adequately.

At the technical level, to prepare the semantic translations for the P&P corpus, we use the TRADOS WinAlign™ program to import from the existing bilingual text and to align the text at the sentential level. During the aligning processes, we also modify the target sentences where they differ ‘unnecessarily’ from the source sentences in terms of structure and word selection.

The only way to find communicative translations for our P&P corpus seems to be to translate the text by ourselves, as we have assumed that existing literary translations are of the semantic translation type. Furthermore, during the processes of carefully editing the existing translation of *Pride and Prejudice*, we have acquired a good sense of what a communicative translation should look like in contrast to the semantic translation. Thus, for example, for the bilingual pair reproduced in (14) from an existing translation, we can prepare a semantic translation in (15b) and a communicative translation in (15c):

(14)
(a) Source text
*a single man in possession of a good fortune*

(b) Target text
有錢的 單身漢
*WEALTHY BACHELOR*

It should be noted that this is the only version so far that correctly identifies the source structure as an NP (noun phrase)—all previous translations look like some sort of Chinese clause. As discussed above, to preserve the original structure and wording of the source text while rendering smooth target text is an important trait of the semantic translation method. However, on the other hand, the Chinese translation in (14b) does away with the article *a* in the source text, which is often unnecessary for an NP in the Chinese discourse (though the article can still be preserved and read fluently). In this regard, the translation deviates from semantic translation and shows the characteristic of a communicative translation, as it modifies the original NP structure to some degree in exchange for more fluency in the target language. Thus although existing translations of literary texts tend to be semantic, they nevertheless need to be modified for our ITS to reflect the difference between semantic and communicative translations more adequately.

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(15)
(a) Source text
*a single man in possession of a good fortune*

(b) Semantic translation
一位 坐擁 一筆 可觀 財富
*A 'classifier' SIT-OWNING A 'classifier' CONSIDERABLE FORTUNE*

的 單身漢
*‘adjective marker’ bachelor*
Both (15b) and (15c) are fluent Chinese sentences. Translation (15b), being a semantic translation, generally keeps the original structure and wording. For example, like (15a), (15b) is basically an NP construction with another NP nested in a modifier. Translation (15c), on the other hand, replaces the nested NP structure with a straightforward adjective youqian (‘wealthy’). In word selection, the communicative translation in (15c) uses an adjective weihunde (‘unmarried’) plus a common Chinese idiom gongzigeer (‘young elite’) to replace the original culturally neutral term a single man. This is a more lively translation than the semantic translation and has richer target culture connotations.

4 Translation Unit Matching

The section explains the matching algorithm, which compares the student translation with the existing translations in the system storage. The algorithm adopted is similar to that used in a translation memory (TM) system. According to Trujillo (1999), the translation memory system uses a search mechanism much like that used in information retrieval (IR). Here the query is the newly entered source sentence for translation, and the database (DB) is the translation memory. The basic principle is to find a sentence in the TM DB that has the highest number of same words as the input sentence. To avoid favouring longer sentences in finding a match, however, the similarity counts (numbers of identical words between two sentences) need to be normalized using a formula such as Dice’s coefficient (Trujillo, 1999, p. 62):

\[
M = \frac{2|I \cap T|}{|I| + |T|}.
\]

Here \(M\) is the similarity measure, \(I\) is the set of words in the input sentence and \(T\) is the set of words in the translation unit (TU) being considered. Let us suppose for the sentence How to write a good user review, we want to find the more similar sentence to it between (16a) and (16b):

(16)

(a) A user asked the author of the review how he could claim that the book was good.

(b) What does a good user review look like?

If we simply count the same words, then (16a) has four and (16b) has only three words that also appear in How to write a good user review, although in fact (16b) seems to be intuitively more similar to the input sentence. Now if we use Dice’s coefficient, we obtain:
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for (16a): \[ 2 \times \frac{4}{7 + 17} = 0.33 \]

for (16b): \[ 2 \times \frac{3}{7 + 8} = 0.4. \]

So in fact (16b) is the more similar sentence rather than (16a), as its \( M \) score is higher.

In the case of our ITS, the goal is to find the best match for the student translation among the system’s preinstalled translations for the same source text. So if we go back to the example Chinese sentence in (3a), let us suppose the ITS has the following translations in storage:

(17)

(a) Literal translation
The economy is not prosperous. The unemployment rate climbs up incessantly.

(b) Semantic translation
The economy declines, and the unemployment rate climbs up incessantly.

(c) Communicative translation
The unemployment rate continues to rise with the economic downturn.

Now let us suppose the student’s translation of the same source text is:

(18) Student translation
The economy is not promising and the unemployment rate keeps climbing.

The calculation to find which version in (17) matches (18) is as follows:

for (17a): \[ 2 \times \frac{8}{11 + 11} = 0.73 \]

for (17b): \[ 2 \times \frac{7}{11 + 10} = 0.67 \]

for (17c): \[ 2 \times \frac{5}{11 + 10} = 0.24 \]

As the translation unit in (17a) has the highest similarity measure, the system will suggest that the student translation is closest to the literal translation method. We admit that similarity in word selection does not equal similarity in the translation method adopted. In the future, more sophisticated matching algorithms should be developed, which consider not only word selection but also syntactic and semantic factors.

5 Implementation
Now that the corpus is properly organized and the matching algorithm determined, we go on to explain how the system works to put the source
and target texts into use. The basic form of application is for the system to be used as a stand-alone program to illustrate the nature and consequences of degrees of freedom in translation. Further discussion focuses on the possibility of integrating the basic machinery into a larger system and how to incorporate software of this kind into a translation teaching curriculum.

5.1 Basic form

The components and work flow of the TMT intelligent translation tutoring system are as follows (see Fig. 1). In the basic working mode, the system offers an English sentence for the student to translate. Upon finishing, the student submits the translation and the system compares it with its pre-stored versions of the same sentence, decides on the closest match based on the translation unit (TU) matching algorithm discussed above, and presents that version to the student, together with the name of the translation method. The student if he or she so desires can click on any other version of translation to compare and see if the system has made a fair judgement about the category of the student’s translation, as well as to appreciate the differences between the results of different translation methods.

Figure 2 shows an example interface where all the above incidents happen. In this simple interface, the translation student presses the ‘Sentence’ button to obtain a source sentence for translation. A further ‘Context’ button could be pressed to access more surrounding sentences.
to obtain contextual information. After the translation is completed and submitted to the system, the system judges the kind of translation method being used and retrieves the pre-stored version of translation under the same translation method. Finally, the student can call up any version of translation of the same source sentence and observe their differences. It should be noted that although free translation and rewriting are not included in our computational model, the system does not preclude the possibility that the instructor may wish to include them, and offers a chance for the system administrator to produce these extra versions manually and include them in the pre-stored translation corpus.

5.2 Further application
It is possible to integrate TMT into another computer system for teaching translation skills. For example, one of the popular methods for teaching translation is through contrastive analysis (CA; see Hoey and Houghton (1998) for a discussion of CA and translation). The curriculum following this approach usually constructs the syllabus units based on parts of speech (Wu, 1982). In each instruction unit a part of speech (e.g. conjunction) is analysed contrastively in both languages, to allow students to understand the behavioural change of this part of speech when the translation task involves spans of text belonging to this category. When focusing on the translation of a certain part of speech, it is also interesting

![An example interface of TMT.](image)
to see how its behaviour can change following the change of translation methods. We take an example from Wu (1982):

(19)
(a) Source text
   *We are not gentle folk and troubadours*

(b) 'Bad translation'
   我們 也不是 紳士 和 行吟 詩人
   women bu-shi shen-shi han xing-yin shiren
   WE NOT-BE GENTLEMEN AND STROLL-SING POET

(c) 'Good translation'
   我們 也不是 紳士 也 不是 行吟 詩人
   women bu-shi shen-shi ye bu-shi xing-yin shiren
   WE NOT-BE GENTLEMEN ALSO NOT-BE STROLL-SING POET

Wu considers (19b) a bad translation as the direct translation of *and* causes an unusual usage of *han* ('and') in Chinese, making (19b) mean something like 'we are not gentlemen along with troubadours'. On the other hand, (19c) is a better translation because a repetition of *bushi* is used for the double negation, which is a more common usage in Chinese and allows (19c) to carry the correct meaning: 'we are neither gentlemen nor troubadours'. To use the terminology of translation methods, we can explain that (19b) is bad because the translator uses the word-for-word or the literal translation method, which may not be a good strategy for dealing with conjunctions in translation; (19c) is good because it reflects the spirits of semantic translation method, probing into the meaning of the source text while maintaining a minimum structural correspondence (*bushi . . . ye bushi . . .* is not a 'translation equivalent' of English *and*, but is a kind of correlative conjunction in Chinese). The basic TMT system incorporated into an ITS for CA-based translation teaching can have an interface as illustrated in Fig. 3.

The system lets the student choose which part-of-speech or structure he or she wants to work on. A sentence in the source language containing the desired word or structure is offered for translation. The student translates the sentence and then presses the 'Finish' button to see three things in the 'Explanation' area: (1) the version of translation of the source sentence closest to the student's translation offered by the system; (2) the translation of the source sentence in a particular category of degree of freedom selected by the student; (3) the explanation of how that particular part-of-speech or grammatical structure is dealt with generally and in terms of different approaches to the degree of freedom from the text supplied by the instructor and pre-stored in the system. The role TMT plays in this kind of system is to add another dimension for consideration, allowing the concept of degrees of freedom or translation methods to be integrated in the teaching of various skills in translation. We take another example to make the point even clearer: Liu (1997, p. 218) suggests five ways for translating English prepositions into...
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5.3 Curriculum integration

Our previous teaching of Newmark’s (1988) model for translation methods has generally been positively received by the students of CJU. In two instances, one of the top students in the translation class offered to explain whether the translation he submitted was based on semantic or communicative method, although he was not asked to do so. For example, an excerpt from Austen (1813) was given for students to translate. One graduate student, call him Mark, offered a particularly interesting and high-quality translation for a source sentence:

(20)
(a) Source text
Happy for all her maternal feelings was the day on which Mrs. Bennet got rid of her two most deserving daughters

Chinese: translating into verbs, translating into prepositions, translating into negatives, translating into modifiers, and translating into idioms. TMT can relate these techniques to the principles of translation methods and enhance the teaching activities in terms of their richness and clarity. For example, in translating the phrase to work against time into Chinese, we can say not only that there are five methods for tackling the preposition against, we can also say that using the first method corresponds to the communicative translation approach, the third method to the literal approach, and so on.
When discussing the strengths and weaknesses of his translation, the instructor (the first author) commented that Mark's translation represented very good Chinese prose and did not look like translation at all, whereupon Mark said that he tried to apply the method of communicative translation while translating. He explained that although there was no wording in the source text indicating an overt 'concession', he nevertheless thought it better to use the jinguan ... haishi ... ('although ... still ...') structure for two reasons: first, it read more naturally and more like the form to be used in the target culture in the given situation; second, it expressed the underlying message better (a mother's feelings at her daughter's wedding) than sticking to the original wording and structure. Both Mark's explanations are concerns springing from the communicative translation method. And indeed, Mark's translation looks very 'communicative'. It seems then that translation trainees will accept the distinction between different translation methods taught to them and will attempt to put the knowledge into practice. This desire to put principles to use should be particularly welcomed by the CATL (computer-assisted translation learning) instructor and must be properly guided. The place of a system like TMT in such an instruction module is to provide an interaction between abstract generalizations about translation and the immense, unsorted source text the students face in the external world.

The design of TMT is for it to play a supplementary role in the translation curriculum, which is a little more ambitious than that contemplated by Higgins and Johns (1984), who suggest that 'CALL programs should perhaps be treated as resources, like books in a library, rather than as elements of the curriculum' (p. 86). The primary difference is that the TMT, being an ITS, gives feedback to the user (i.e. the evaluation of student translation from a certain perspective) and therefore is not just a passive resource. Also, we would like the instructor to use the ITS to illustrate teaching points, and in follow-up discussions after the students have gained some knowledge or formed some hypotheses through the use of the system in the given domain.

In a module called General Translation offered to the freshmen in the Department of Translation of Chang Jung University (CJU) as a two-credit compulsory course, a fortnightly one-hour practical in the lab is planned for the next academic year, where the students will practise with...
TMT and other translation-related tools. Our implementation model for this module takes hints from theories in language teaching syllabus and those in CALL methodology. First, from Graves (2000) we adopt the idea that the processes of course design should be represented as a cyclic flowchart rather than a linear list. In a traditional model of syllabus design, the processes of course development are largely linear and deterministic—for example, the processes of development, implementation, and evaluation of a curriculum introduced by Stern (1992, pp. 41–8). Graves’ model, in contrast, emphasizes that ‘there is no hierarchy in the processes and no sequence in their accomplishment’ (2000, p. 3). Graves takes a ‘system approach’ to syllabus design, where the processes of course development are interrelated: changing one component will influence the others. This model is particularly suitable to a language teaching syllabus incorporating CALL software (or a translation teaching syllabus incorporating CATL), as the integration of such software introduces more unpredictable variables into the syllabus, which need to be monitored and modified closely for the ultimate success of the syllabus.

The incorporation of the use of software into a traditional syllabus requires a specially contrived approach. Hubbard (1996) offers a framework that can be useful to us, especially its implementation module. Roughly speaking, Hubbard’s implementation model comprises three layers: the hardware component (the accessibility issues), the learner components (the use of courseware, and the preparatory and the follow-up activities), and the teacher components (teacher control, including authoring of the software, classroom management, student records, etc.). Based on this model, and the situation of the Department of Translation in CJU, we propose the following model for integrating TMT and other CATL software into a General Translation curriculum (see Fig. 4).

The model (Fig. 4) emphasizes the assumption that processes in syllabus design are cyclic—they inform and influence the refinement of each

![Fig. 4 An implementation model of a translation syllabus incorporating TMT.](image)
other. Standing in the middle are the initial goals and objectives of the syllabus represented by pedagogical statements concerning the fulfilment of translation knowledge and skills, which direct all the activities in the cycle as the one-way arrows indicate. The goals and objectives are revisable by the teacher, however, as the two-way arrow shows. The translation lessons and the translation software modules constitute the main class activities, which are mutually informative and modifiable. The teacher initiates the translation lessons and provides the translation-related software, both of which subsume learning activities in the classroom or lab. In the case of the use of TMT, for example, the lessons may consist of a reading of Newmark’s (1988) original text and an examination of existing translations in the light of translation methods. The lab sessions, on the other hand, consist of the use of TMT and possibly other supporting courseware. Based on the follow-up discussions between the students and the teacher, both the translation lessons and the translation software can be modified by the instructor for future sessions.

6 Conclusion

In this paper, we introduced an intelligent tutoring system designed to help illustrate a fundamental concept in learning to translate—the principles behind the variation of translation methods or the criteria by which the translator decides on the balance between being faithful to the source text and being devoted to the creation of natural text compatible with the target culture. We also discussed the possibility of the ITS being integrated into a larger system for teaching translation skills. The debate between literal translation and free translation is perennial and the issue is highly implicational for translation practice and translator training. For a novice translator to have a basic recognition of degree of freedom in translating is important in the beginning of his or her translation career, as many of the choices to be made in translating can be explained, at a certain level, by the trade-off between being faithful to the original author and being devoted to the readability of the target text.

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