Research on Modern Higher Education 1, 02007 (2017)
DOI: 10.24104/rmhe/2017.01.02007
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Analysis and research of influence factors ranking of fuzzy language translation accuracy in literary works based on catastrophe progression method

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ABSTRACT: This paper researches the problem of decline in translation accuracy caused by language "vagueness" in literary translation, and proposes to use the catastrophe model for importance ranking of various factors affecting the fuzzy language translation accuracy in literary works, and finally gives out the order of factors to be considered before translation. The multi-level evaluation system can be used to construct the relevant catastrophe progression model, and the normalization formula can be used to calculate the relative membership degree of each system and evaluation index, and make evaluation combined with the evaluation criteria table. The results show that, in the fuzzy language translation, in order to improve the translation accuracy, there is a need to consider the indicators ranking: A2 fuzzy language context → A1 words attribute → A3 specific meaning of digital words; B2 fuzzy semantics, B3 blur color words → B1 multiple meanings of words → B4 fuzzy digital words; C3 combination with context and cultural background, C4 specific connotation of color words → C1 combination with words emotion, C2 selection of words meaning → C5 combination with digits and language background.

Keywords: heuristic algorithm; cloud computing; open course education; optimal structure

1 RESEARCH BACKGROUND

In the literary translation, the issue of accuracy is related to the emotional expression of literary works, so the translation accuracy is always concerned by many translators, but the language vagueness often leads to decline in the translation accuracy. For many Chinese works, in order to be accepted by foreign scholars, translation is critical. Different expressions and different cultural backgrounds will lead to mistranslation in the translation process. Gao Yanjie and other people research the digital meaning in the work, and points out that digital meaning in the literary works not only represents the size of numerical value, but also combines with the cultural and historical background behind the work, leading to digital vagueness in translation. The vagueness greatly reduces the translation accuracy, but it also has its benefits. Xiong Liyun points out that the vagueness of the fuzzy language is also another beautiful manifestation of Chinese characters, with a certain aesthetic value. To embody such a beauty in the translation process can further enhance the value of translation. Moreover, the vagueness of Chinese language not only reflects the aesthetic value of the characters, but also creates an artistic atmosphere. Zhang Ying points out that, in the literary translation, to embody the artistic atmosphere of the character can better express the historical connotation and cultural background of the characters. Therefore, this paper proposes many factors to analyze the accuracy of fuzzy language in literary translation based on catastrophe theory, and ranks the importance of factors, thus improving the translation accuracy and providing direction for the future translation.

2 RELEVANT RESEARCH

2.1 *Catastrophe progression method*

There are often multi-factor problems in real life, and there is also a complex relation between various factors, forming a complex network of intertwined factors. In the factor network, it is very necessary to sort

out the key factors that are beneficial to solve problems.

Typically, the principal component analysis or factor analysis can be given to multi-factor problems, important factors can be screened, and unnecessary factors can be eliminated. However, for many factors with vague meanings and digits, it is difficult to solve by these two methods. Therefore, for solving such problems, AHP, fuzzy comprehensive evaluation method and multi-factor comprehensive evaluation methods are proposed, including the catastrophe progression method.

For the catastrophe progression method, there is a need to integrate multi-level evaluation index, establish index rating system, analyze and discuss index at each level, and finally carry out quantization calculation combined with the catastrophe theory. Among them, the potential function is the core of its calculation, and the normalization formula is the main means.

The index evaluation method has been widely used in many practical problems. One prominent method is the evaluation of ecosystem. Wei Ting and other people point out that, biota is a large group, including biology, natural environment, social environment, human and various kinds of groups, and the evaluation criteria and evaluation elements of each group are very different. In order to find out the optimal evaluation system among these factors, there is a must to screen step by step.

This evaluation model is also applied in the evaluation of the productive capacity of enterprise and development speed. Ding Lin and other people point out that the enterprise development is closely related to the employee work ability, leadership management ability and leadership ability. Meanwhile, the product quality, market sales condition, customer reflection and after-sales services are its important embodiment. It is very critical to find out the factors that can embody the enterprise growth to a maximum extent among many factors. The application for the catastrophe model solves this problem.

2.2 *Fuzzy language and translation*

Literary language is a way to express human emotion. However, due to the characteristics of the words and different cultural backgrounds, there are often words and sentences with vague meaning in literary translation. Correct translation of these sentences and words determines the emotional expression of the entire work, which requires the fuzzy language translation accuracy.

In literary translation, how to define "vagueness" is also crucial. For its accurate meaning, there is always a certain degree of controversy, but widespread and accepted meaning is: vagueness does not mean ambiguity in words, or ambiguity in words semantics, which is established in the field of words. If one word is unclear of its field, or simultaneously spans several fields, it is called as "fuzzy words".

There are many reasons causing words vagueness. For example, different cultural backgrounds, different specific attributes of words, different Chinese and foreign historical development and different ethnic aesthetics will result in the language vagueness in the process of expression.

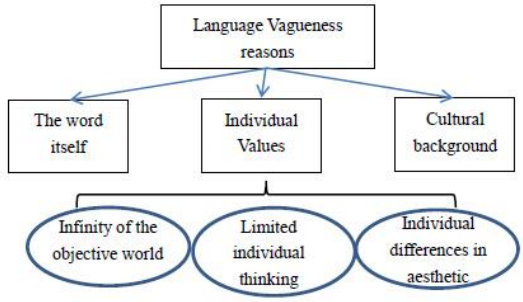

Figure 1. Language Vagueness reasons

Due to the presence of "vagueness", the reasons causing inaccurate translation are classified into the following categories:

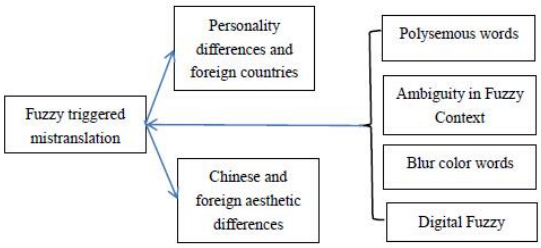

Figure 2. Fuzzy triggered mistranslation

For this reason, this paper proposes the catastrophe progression method to research the "vagueness" in literary translation, and ultimately obtains the ranking of influence factors.

3 ALGORITHM DESIGN AND IMPLEMENTATION

The catastrophe progression method is one of methods in multi-factor comprehensive evaluation, which is similar, but not identical to the fuzzy comprehensive evaluation method. It has its own theoretical basis, that is, catastrophe theory. The principle of catastrophe theory is: based on the constantly changing factors in the actual problem, to construct a dynamic system, and establish subsystems and factor indicators in each system, and ultimately form a progression structure, in order to solve practical problems, make a reasonable description of the practical problems and predict the development prospects.

In the theory, the most basic mathematical function is the potential function $V=V(x,u)$, of which u represents the control variable, and x represents the state variable. If x is one-dimension, the following types of catastrophe model can be obtained:

Type I fold catastrophe (Fold): control variable u=1;
Type II cusp catastrophe (Cusp): control variable u=2;
Type III swallowtail catastrophe (Swallowtail): control variable u=3;
Type IV butterfly catastrophe (Butterfly): control variable u=4;

The above types of catastrophe model are as follows:

Type I: $V(x)=x^3+u_1x$;

Type II: $V(x)=\frac{1}{4}x^4+\frac{1}{2}u_1x^2+u_2x$;

Type III: $V(x)=\frac{1}{5}x^5+\frac{1}{3}u_1x^3+\frac{1}{2}u_2x^2+u_3x$;

Type IV: $V(x)=\frac{1}{6}x^5+\frac{1}{4}u_1x^4+\frac{1}{3}u_2x^3+\frac{1}{2}u_3x^2+u_4x$;

Its bifurcation set is as follows:

Type I: $u_1=-3x^2$;

Type II: $u_1=-6x^2$; $u_2=8x^3$;

Type III: $u_1=-6x^2$; $u_2=8x^3$; $u_3=-3x$;

Type IV: $u_1=-10x^2$; $u_2=20x^3$; $u_3=-15x^4$; $u_1=4x^5$;

Its normalization formula is as follows:

Type I: $X_{u_1}=\sqrt{u_1}$;

Type II: $X_{u_1}=\sqrt{u_1}$; $X_{u_2}=\sqrt[3]{u_2}$;

Type III: $X_{u_1}=\sqrt{u_1}$; $X_{u_2}=\sqrt[3]{u_2}$; $X_{u_3}=\sqrt[4]{u_3}$;

Type IV: $X_{u_1}=\sqrt{u_1}$; $X_{u_2}=\sqrt[3]{u_2}$; $X_{u_3}=\sqrt[4]{u_3}$; $X_{u_4}=\sqrt[5]{u_4}$;

These are all calculation formulas related to the catastrophe model. Therefore, the steps of establishing the catastrophe model related to the practical problems based on the catastrophe progression method are as follows:

(1) To analyze all kinds of influence factors contained in the problem based on the background of practical problems, including systemic factors, subsystems and original evaluation indicators, thus establishing a multi-level evaluation system;

(2) To construct a catastrophe progression model combined with the catastrophe theory and based on multi-level systems;

(3) To process the raw data by the above normalization formula, and finally get the relative membership degree;

For this reason, in the analysis of fuzzy language translation accuracy, according to the above theory and analysis steps, this paper establishes the relevant model, and finally ranks and analyzes all kinds of influence factors and evaluation indicators, and concludes top-priority factors before translation, in order to increase accuracy.

4 SIMULATION AND TEST

For the language translation accuracy in literary works, due to uncertainty of fuzzy language, there is also a certain difficulty in the evaluation of translation accuracy. Therefore, the catastrophe progression method is used for the comprehensive evaluation of multi-level factors, and finally ranking and analysis of the factors influencing the translation accuracy, and constructing the catastrophe progression model of the fuzzy language translation accuracy in literary works.

First, it determines the index system of the evaluation model. The language vagueness in literary works is related to many factors, which is classified into three evaluation systems.

(1) Words attribute: Chinese words are extensive and profound, and every word has its own specific meaning, and each word does not only have one meaning, because polysemy is widespread. In addition, in a different context, the words meaning also changes;

(2) Fuzzy language context: in Chinese, with same words, but with different tones, one sentence may express different meanings in different occasions, thus embodying its ambiguity;

(3) Specific meaning of digital words: In many sentences, digits are often used to quantitatively express the meaning, but these digits do not only represent the number, but they are also closely related to the language background of the sentence.

The above three evaluation systems point out many factors influencing the language vagueness in literary works, which are also the key to work translation.

For the above three evaluation systems, the indicators contained in each system are summarized as follows (see Table 1):

Table 1. Summary of evaluation indicators

Evaluation system	Classification factors	Evaluation indicators
A1words attribute	B1 multiple meanings of words	C1 combination with words emotion
		C2 selection of words meaning
A2 fuzzy language context	B2 fuzzy semantics	C3 combination with context and cultural background
	B3 blur color words	C4 specific connotation of color words
A3 specific meaning of digital words	B4 fuzzy digital words	C5 combination with digits and language background

For this reason, now, the catastrophe model related to influencing the fuzzy language translation is proposed, as shown below:

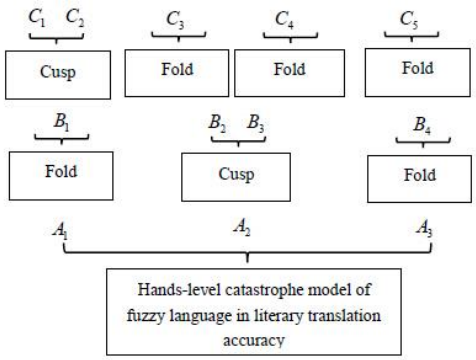

Figure 3. Fuzzy language translation of catastrophe model

In order to calculate the membership degree of each evaluation indicator in above model, the following steps are proposed: the known evaluation indicator of each system has been given out. Assuming that the relative membership degree of the indicators at the lowest level is equal, taken as x, so the total value of the membership degree of the entire system is also x.

In this case, the following five evaluation levels are regulated as follows: greatly different, inaccurate, more accurate, accurate and very accurate.

Therefore, the expression of the relative membership degree of the indicators at the lowest level is:

$$x_i(x_i = 0/0.2/0.4/0.6/0.8/1)$$

Based on the above formula, combined with the catastrophe progression method, the calculation can be carried out to eventually obtain the total membership degree of the entire system, y_i, and then obtain the rate standard value of the catastrophe progression method, as shown in the following table (see Table 2):

Table 2. Evaluation level standard

Level	Total value	A1	A2	A3
Very accurate	>0.98	>0.97	>0.98	>0.96
Accurate	0.96~0.98	0.95~0.97	0.95~0.98	0.94~0.96
More accurate	0.94~0.96	0.91~0.95	0.91~0.95	0.87~0.94
Inaccurate	0.90~0.94	0.85~0.91	0.88~0.91	0.83~0.87
Greatly different	<0.90	<0.85	<0.88	<0.83

According to the above evaluation level standard, combined with the catastrophe progression theory, the relative membership degree is calculated. The formula of the membership degree of the relative accuracy is:

$$\frac{x - x_{\min}}{x_{\max} - x_{\min}} \qquad x_{\min} < x < x_{\max}$$

$$\frac{x_{\max} - x}{x_{\max} - x_{\min}} \qquad x_{\min} < x < x_{\max}$$

The relative membership degree of each system calculated is shown in Table 3:

Table 3. Relative membership degree

Level I	A1		A2		A3
Value	0.91		0.93		0.895
Level II	B1		B2	B3	B4
Value	0.94		0.95	0.97	0.92
Level III	C1	C2	C3	C4	C5
Value	0.92	0.91	0.96	0.98	0.93

Through comparison with the data in Table 3 and evaluation level standard in Table 3: the overall system accuracy of A2 fuzzy language context is high, followed by A1 words attribute and A3 specific meaning of digital words, indicating that, in literary works, in the fuzzy language translation, in order to improve the translation accuracy, there is a need to first consider the fuzzy context, and then consider the words attribute, including multiple meanings of words, and finally consider the digital meaning in works.

Through comparison with the level II evaluation indicator: the relative membership degree of B3 blur color words and B2 fuzzy semantics is high, and at the "accurate" level in the evaluation criteria, indicating that B3 and B2 are more important indicators in the translation, and give priority to improve translation accuracy, followed by B1 multiple meanings of words and B4 fuzzy digital words, which are at "more accurate" level in the evaluation criteria.

Through comparison with level III evaluation indicator: the relative membership degree of C3 combination with context and cultural background and C4 specific connotation of color words is high, and at the "accurate" level in the evaluation criteria, indicating that C3 and C4 are more important indicators in the translation, and give priority to improve translation accuracy, followed by C1 combination with words emotion, C2 selection of words meaning and C5 combination with digits and language background, which are at "more accurate" level in the evaluation criteria.

To sum up, in the fuzzy language translation, in order to improve the translation accuracy, there is a need to consider the following indicator ranking:

Evaluation system ranking: A2 fuzzy language context→ A1 words attribute→ A3 specific meaning of digital words;

Classification factors ranking: B2 fuzzy semantics, B3 blur color words → B1 multiple meanings of words → B4 fuzzy digital words;

Evaluation indicators ranking: C3 combination with context and cultural background, C4 specific connotation of color words→ C1 combination with words emotion, C2 selection of words meaning→ C5 combination with digits and language background;

In the fuzzy language translation, to give priority to refer to the indicator ranking can improve the translation accuracy, and reduce the incidence of mistranslation.

5 CONCLUSION

This paper researches the language "vagueness" in literary translation, and points out the decline in translation accuracy inevitably caused by "vagueness", thus proposing to use the catastrophe model for importance ranking of various factors affecting the fuzzy language translation accuracy in literary works, and finally gives out the order of factors to be considered before translation.

This paper first analyzes various factors affecting the fuzzy language translation accuracy in literary works, and constructs multi-level evaluation systems related to this problem, and then constructs the relevant catastrophe progression model based on the catastrophe theory, and finally uses the normalization formula to calculate the relative membership degree of each system and evaluation indicator, and makes evaluation combined with the evaluation criteria table. The calculation results show that, in the fuzzy language translation, in order to improve the translation accuracy, there is a need to consider the indicators ranking: A2 fuzzy language context → A1 words attribute → A3 specific meaning of digital words; B2 fuzzy semantics, B3 blur color words → B1 multiple meanings of words → B4 fuzzy digital words; C3 combination with context and cultural background, C4 specific connotation of color words → C1 combination with words emotion, C2 selection of words meaning → C5 combination with digits and language background.

The method of evaluation of influence factors based on the catastrophe model has a very considerable application prospect, which will be applied for performance evaluation, performance test, ability evaluation and other issues in the future.

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