Analyzing End Rhyme Translations and Emotional Continuity through Prosodic Features

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Abstract: Poetry translation is a unique and complex task that requires balancing the aesthetic qualities of the original with linguistic and cultural differences in the target language. Among the central challenges is the rendering of end rhyme, a key prosodic feature that plays a significant role in shaping the rhythm and emotional resonance of poetry (Bassnett, 2013). This study investigates how different translation strategies for end rhyme affect the emotional and rhythmic transmission of poetry, using two English translations of Ode to the West Wind as case studies. By applying theories of prosody and emotional continuity, the research examines the pitch and duration of final rhyming vowels in the original poem and its translations, using Praat software for acoustic analysis and t-tests for statistical comparison. The comparative findings suggest that the preservation of prosodic features may support emotional continuity, but also highlight the complexity of achieving equivalence.

Keywords: Poetry translation; End rhyme; Prosody; Emotional continuity; Acoustic analysis; Ode to the West Wind; Praat

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1. Introduction

Poetry is a literary form that emphasizes the beauty of sound and rhythm, with end rhyme being its most essential manifestation and a crucial element in conveying emotions (Kwong, 2009). In poetry translation, handling end rhyme is often a key concern for translators (Bassnett, 2013). On one hand, it is important to preserve the original meaning rather than sacrificing it for the sake of rhyme. On the other hand, while maintaining the original meaning, translators must also consider whether the prosodic effects and the associated emotional impact of the original text can be effectively conveyed in the target language.

Common approaches to translating poetry include maintaining rhyme fidelity to the original form and prioritizing semantic accuracy while reconfiguring end rhyme. Previous studies suggest that the production of poetic rhythm and the transmission of emotions are closely linked to the rhyming of vowels of the same type (Fabb, 1997). This indicates that the way end rhyme is translated plays a crucial role in determining whether the translated poem can preserve the prosodic and emotional effects of the original.

This study applies theories related to the prosodic features of end rhyme and emotional continuity, using two translated versions of *Ode to the West Wind* as case studies. By extracting the pitch and duration of the final rhyming vowels in each line from the original poem and its two translations using Praat, this study visualizes their prosodic characteristics through line graphs. The comparison will use t- test to evaluate more precisely the pitch and duration data between the original poems and the translations, which aims to analyze which approach to handling end rhyme better retains the emotional characteristics of the original poem.

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2. Previous Studies on End Rhyme and Emotional Continuity

In this section, empirical studies on the working definition, translation strategies, and prosodic features of end rhyme, as well as its relationship with emotional continuity, will be reviewed. Additionally, an analysis of the research material in the mentioned aspects will also be included.

(1) Features and analysis of end rhyme

In this section, studies on the definition and features of end rhyme, as well as analysis of the research material will be reviewed.

1) The Working Definition of End Rhyme in the Present Study. Poetry is a series of sounds out of which a certain meaning arises (Dahlgren, 2005). End rhyme is an important element in the fusion of sense and sound that constitutes poetry (Kwong, 2009, p. 189). End Rhymes represent pairs of words that are phonologically identical from the last accented vowel to the end of a word (e.g.,ball/fall; Fabb, 1997, p. 118). In other words, end rhymes in metered poetry temporally structure both single verses and their configuration within the multi-verse unit of the stanza (Obermeier et al., 2013, p. 2). They do so by placing additional emphasis on metrical patterning and by producing a phonological resonance between two selected words, or syllables, in the ante-caesura position, i.e., the final word/syllable of a verse (Fabb, 2009).

Based on the empirical studies mentioned above, the working definition of end rhyme in the present study is "a pair of words that are phonologically identical from the last accented vowel to the end of a word". Pitch and duration data of the last accented vowel will be extracted and analyzed in the following experiments.

2) Reasons for Prioritizing End Rhyme in the Present Study. Shelley's ingenious use of sound in *Ode to the West Wind* effectively echoes the poem's theme, enriching its emotional depth through varied rhythms, such as alliteration, end rhyme, chain rhyme, spondee, pyrrhic, caesura, run-on line, run-on stanza (Zhao & Long, 2014), making the poem flow in a beautiful rhythm and rich in emotion. Although other types of rhythm are also essential to express emotion, the present study mainly focuses on end rhyme of the poem and its reflection on emotion. Several reasons can explain the prioritization of the end rhyme in the present study.

Firstly, many studies have proved that end rhyme is a distinct feature and is more closely related to emotion. According to Obermeier et al., in poetry, (end) rhyme structures a poem at the level of the verse by strongly marking the ends of single verses and hence the onset of the caesura between two verses (p. 2; cf. Turner and Pöppel, 1983). End rhymes are very salient temporal and phonological markers in poetry and therefore the presence or absence of a rhyme should lead to rather robust effects (Obermeier et al., 2013, p. 3). Zhao & Long (2014) mention that the end rhyme is an important feature that distinguishes poetry from prose, novel, and other style. Kwong (2009) also emphasizes that end rhymes are particularly potent in their final position, as they establish a sense of closure and completeness (p. 191).

Therefore, we can say that end rhyme plays a crucial role in the emotional and structural aspects of poetry. Additionally, this study will utilize speech synthesis applications such as Praat to analyze the precise parameters of prosodic features. Compared to other types of rhythm, end rhymes are easier to characterize with accurate data, making comparisons between translations and the original poem more feasible.

3) End Rhyme Analysis of *Ode to the West Wind*. Percy Bysshe Shelley (1792-1827) was a representative poet of the English Romantic period. In the poem, Shelley demonstrated his unique talent of using rhyme and meter to achieve perfect unity in sound, form and meaning, and expressed his praise for nature. He depicts the west wind destroying the old world and nurturing the new world with its destructive force, expressing his revolutionary optimism. According to Zhao and Long, the end rhyme of *Ode to the West Wind* applies ABA BCB CDC EE format, progressing gradually, as if the west wind is whirling and howling, pushing the poet's emotions to a climax (p. 100). Take line 7, line 8 and line 9 as an example:

7 The winged seeds, where they lie cold and low,

8 Each like a corpse within its grave, Until,

9 Thine azure sister of the Spring shall blow.

Zhao & Long analyze that line 7 and 9 rhyme with /əu/. The line 7 uses "cold and low", compares autumn to "a corpse within its grave". The vowel sounds can evoke a sense of depth and heaviness, contributing to the imagery of something descending or sinking, evoking a sense of depression and despair (Johnstone & Scherer, 2000). In contrast, line 9 looks forward to the sight of a sunny spring, with "Thine azure sister of the Spring shall blow" giving a sense of hope. Both lines are rich in symbolism, and although the rhymes are the same, the poet aims to create a stark contrast, satirizing the crumbling old world while looking forward to the new world after the revolution. Additionally, the end rhymes often fall on explosive sounds such as /d/ and /t/, and fricatives such as /f/, /s/, and /θ/. Explosive sounds like /d/ and /t/ lend a sharp, definitive closure, evoking feelings of assertiveness, certainty, or even aggression within the poem. Conversely, fricatives such as /f/, /s/, and /θ/ contribute to a softer, more fluid transition between lines, imbuing the poem with tones of gentleness, vulnerability, or whispered intimacy depending on the context and emotional intent (Johnstone & Scherer, 2000).

These sounds mimic the west wind sweeping across the old world, highlighting its powerful destructive force, enhancing the sense of power, and emphasizing the west wind's role in the devastation of the crumbling old world (Zhao & Long, p. 100). However, many studies only draw general conclusions from an aesthetic point of view. Few studies have precisely analyzed the end rhyme of this poem and its emotional and aesthetic resonance by delving into prosodic aspects.

(2) Prosodic features of end rhyme and emotional continuity

In this section, empirical studies of the relationship of the prosodic features of end rhyme and the emotional continuity will be reviewed.

1) Prosodic Features. The prosodic features of end rhyme exemplify the application of prosodic phonology in poetry. Prosodic phonology, a branch of generative phonology, investigates the relationships among prosodic structural units in human language and their connections with phonology and grammar. Anthony Fox mentioned in his book, *Prosodic Features and Prosodic Structure: The Phonology of Suprasegmentals*, that prosodic features are defined as elements of speech that extend over more than one sound segment. These features include intonation, stress, rhythm, and pitch. They play a crucial role in conveying meaning, emotion, and structure in spoken language (Fox, 2002, p. 4). If end rhymes are "pairs of words that are phonologically identical from the last accented vowel to the end of a word, then we can say those pairs have the same prosodic features, conveying the same meaning and emotion.

2) Prosodic Features of End Rhyme and the Emotional Continuity. Dahlgren (2000) argues that a poem rarely presents nonsense sounds without any relation to semantic meaning. Stress, pitch, recurrence, rhythm, assonance, and alliteration collectively form the phonological essence of poetic discourse, crucial for its impact on readers (Dahlgren, 2005). Numerous studies confirm that the prosodic features of end rhyme are closely linked to emotional expression. For instance, Obermeier et al. examine how pitch and duration of rhyme and meter, and their interaction with lexicality influence the aesthetic and emotional perception of poetry. Many authors conclude that proponents of aesthetics and cognitive poetics assert rhyme and metrical structures enhance beauty, aesthetic liking, and emotional engagement in poetry (Jacobsen and Höfel, 2002; Jacobsen et al., 2006; Di Dio et al., 2007, p. 2). Some studies do not focus on end rhyme, but examin prosodic features like pitch, duration, intensity, and rhythm, pivotal in conveying emotions (Juslin & Laukka, 2003, p. 772; Scherer, 2003, p. 233). These elements shape a poem's affective tone, where higher pitches suggest excitement and tension, and lower pitches convey calmness and seriousness (Banse & Scherer, 1996, p. 615). What's more, Hayes mentions that the duration of syllables and their internal

segments, such as vowels, is a crucial factor in the construction of metrical patterns in poetry" (1989, p. 214). Juslin and Laukka emphasize the importance of prosodic features in conveying emotional nuances. These elements combine to create an emotional landscape that listeners can interpret, regardless of whether the medium is spoken language or musical performance (pp. 775–776). Their findings highlight the universality of these cues across different channels, reinforcing the idea that our vocal and musical expressions are deeply intertwined in conveying our emotional states.

Moreover, sound symbolism can also explain the sound-meaning connection. Sound symbolism has been defined roughly as "the relationship between sound and meaning" (Burridge & Stebbins, 2015) and described as "the most general term for the natural, or apparently natural, connection between sounds and their meanings or referents" (Ferber, 2019, p. 87).

Sidhu et al., (2018) review five mechanisms of sound symbolic association, highlighting the complexity of how sound patterns evoke emotional responses and suggesting avenues for further research into the cognitive and neural mechanisms underlying sound symbolism. Kate and Stebbins argue that close front vowels such as short /ɪ/, long/i:/, and neutral /i/ are commonly associated with smallness as in "teeny weeny" and "itsy bitsy," or with the idea of femininity as in "Mimi" and "Fifi," whereas open vowels seem to suggest larger size as in "Many a mickle makes a muckle" (p. 205). Their studies all indicates that high-pitched sounds often symbolize small, light, and cheerful entities, whereas low-pitched sounds symbolize large, heavy, and somber entities. This symbolic connection helps the brain associate specific pitches and durations with certain emotions. Therefore, by maintaining the same prosodic features of the last accented vowel in each line, the emotional continuity between the original poem and the translation can be achieved.

However, so far, no systematic investigation has precisely measured the two prosodic features—pitch and duration—to determine whether the end rhyme or final vowel sounds in translations align with those of the original poem to convey the same emotion and maintain emotional continuity. Furthermore, no studies have applied prosodic analysis to the comparison of translated and original poems.

(3) Translation strategies of end rhyme

This section reviews translation strategies for end rhyme, including general discussions and studies on the Chinese translations of *Ode to the West Wind*.

1) General Discussions of End Rhyme Translation. The challenge of translating end rhyme lies in preserving the original poem's sound effects and the emotional and aesthetic resonance these effects create (Bassnett, 2013). The sound effects in poetry often contribute to its emotional impact. The choice of words, their sounds, and their arrangement can evoke specific feelings and moods. Translators must find ways to recreate these emotional and aesthetic effects in the target language, which often involves creative reimagining (Bassnett, 2013, pp. 81–85). Poetry translation, therefore, must grapple with maintaining these auditory qualities in a different language, a task that can significantly affect the translated poem's rhythm and emotional impact.

According to Jones, attitudes towards ST rhyme range from abandonment to re-creation, with partial preservation (replacing full by half-rhyme, say) as a compromise (2011, p. 174). Those who advocate recreating a source poem's rhyme scheme, whether mimetically or analogically, admit that this requires technical skill, but argue that rhyme is an integral part of the poem's meaning: "if one disapproves of rhyme in poetry, one should not translate poems that rhyme" (Barnstone, 1984, pp. 50–51).

2) Studies of Chinese Translations of *Ode to the West Wind*. A number of studies focus on comparing and analyzing Chinese translations of *Ode to the West Wind* by different translators. Most studies focus on a stylistic perspective (Chen & Duan, 2013; Qin, 2018) or applying a functional approach (Hu, 2017). Chen & Duan (2013) examine how different translators capture the poem's rich imagery and metaphors, affecting the overall aesthetic quality. Qin (2018) highlights the significance of the poem and examines four notable translations by Wang Zuoliang, Jiang Feng,

Fu Yonglin, and Zha Liangzheng, making a brief comment on the communication of the ideological content and the reproduction of the artistic style. Hu (2017), applies a functional approach, assessing how well the translations convey the poem's thematic elements and underlying messages. However, fewer studies focus on analyzing the prosodic features of end rhyme in the translations and the emotional continuity with the original poem.

Some critics argue that preserving the original style better aligns with the emotions conveyed in the original poem (Wei & Zhou, 2020). However, others believe that if the translations are unique and could retain the poem's inherent charm and grand lyricism, the failure to follow the original rhyming scheme will not affect the emotional expression (Chen & Duan, 2013). With diverse opinions, it's challenging to objectively evaluate which approach to translating end rhyme better captures the poem's emotions conveyed in the end rhyme and disregarding other types of rhyme or stylistic features, as this is the sole criterion being discussed. However, fewer studies have analyzed the end rhyme features of the translations and their emotional continuity with the original poem. In terms of two translation approaches—maintaining the original rhyming scheme versus opting out of the original scheme and focusing on recreation—most empirical studies conduct text analysis and make comparisons subjectively based on various stylistic features. Future research could compare strategies for handling end rhymes to balance aesthetic sound qualities with emotional conveyance, offering new perspectives for the study of translated poetry. If sufficient empirical research has proved the relationship between the prosodic features of the last accented vowel in each line and the emotion, comparing the pitch and duration of vowel end rhymes offers an objective, novel method to assess emotional continuity and differences between the two translations applying different methods and the original poem.

(4) Summary

Based on the literature review above, research gap and research questions will be presented in this section.

1) Research Gap. Based on the above literature review, discernible research gaps can be identified as follows

① Limited research uses data on speech synthesis and acoustic processing to verify if the prosodic features of end rhyme match that of the original poems.

② Few studies examine the sound-meaning relationship and explore how end rhyme translation affects emotional continuity in poetry.

2) Research Questions. Two research questions can be raised based on all the discussions

① Between the two translations of *Ode to the West Wind*, does the one that recreates or the one that maintains the original rhyme scheme better preserve the emotional continuity of the original poem, concerning the duration and pitch of the last accented vowel of the end rhyme?

② What insights can be gained regarding limitations and practical suggestions for translation strategies from the comparison between the English poem and its Chinese translations?

3. Research Methodology

Research parameters, research materials and methods of data extraction will be presented in this section. After that, data being presented in tables and tables will be described.

(1) Research parameters

In the present study, duration and pitch of the last accented vowel in of the end rhyme will be selected as the parameters representing the prosodic features of end rhyme. Ortleb (1937) experimented to explore the relationship between emphasis—often referred to as stress or accent—in dramatic and factual material when read aloud by

actors. The study observed that emphasis is conveyed through a combination of pitch, duration, and intensity. Emphasized syllables were characterized by longer duration, greater intensity, and a higher pitch compared to unemphasized syllables, and they also exhibited wider pitch inflections. Murray & Arnott also mention that the most referenced vocal parameters in the emotion literature are pitch (i.e., fundamental frequency, both its average value and range), duration, intensity, and the undefined term "voice quality" (1993, p. 1103).

Firstly, duration. Hayes mentions that the duration of syllables and their internal segments, such as vowels, is a crucial factor in the construction of metrical patterns in poetry" (1989, p. 214). In the present study, duration refers to the duration of the last accented vowel of each line, for which one would assume the maximal effect of the stylistic features (Obermeier et al., 2013).

As for Pitch, it is one of the key components of prosody, which includes other elements like stress and rhythm (Fox, 2000). It helps create intonation patterns that signal different types of utterances (e.g., statements vs. questions) and indicate emphasis or focus within a sentence (Fox, 2000, p. 45).

Intensity will not be included as a parameter in the present study. Black (1961) observed from experiments that speech intensity ranges within 30 dB (with normal speech being 10 dB above the "minimum vocal effort" and 20 dB below the maximum). He also noted that speech intensity tends to increase with pitch and that soft speech is characterized by a slower rate (p. 199). Therefore, we can assume that the intensity fluctuates in tandem with pitch and is not an important parameter in the present study.

(2) Research materials and data extraction

In this section, research materials will be introduced and the process of data extraction will be presented.

1) Research Materials. The present study will use the original poem *Ode to the West Wind* and translations by Guo Moruo and Jiang Feng as research materials because they employ distinct methods in translating the original end rhymes (Chen & Duan, 2013). Guo's translation deviates significantly from the original poem's rhyme scheme and structure, reflecting his belief that translations should embody the translator's creative spirit and transform the original work into something new and engaging for readers. In contrast, Jiang's translation adheres closely to the original poem's rhyme scheme and form, aligning with his theory that both form and spirit must be preserved in poetry translation (Chen & Duan, 2013). This contrast provides a rich basis for examining the impact of different translation philosophies on the emotional and aesthetic continuity of the poem.

2) Speech Synthesis and Data Extraction. First, the original text and two translations will be built into three speech corpora. Then, they will be transformed into audio files via Xunjie Text-to-speech app. Using Praat, the present study will segment the audio texts and extract pitch and duration data from the rhymed syllable of the last accented vowel to the end of a word according to the working definition.

The reasons for choosing speech synthesis in this study are as follows. Firstly, speech synthesis can ensure the objectivity and science of audio files obtained. Human voice is influenced by many factors such as gender, age, emotion, experience, speed of speech, and clarity that make the generated audio files inconsistent and too subjective, which will have a certain impact on research results. However, electronic speech is an artificial reading, which can make all speech materials have the same sound quality. The speed of speech can be adjusted to the same speed, and the volume can be set to ensure the clarity of speech. Second, speech synthesis technology has come a long way, producing enough results to support the study of human language simulation. Xunjie Text-to-Speech was distributed by iFlytek, which adopts artificial speech synthesis. It can provide the service for both Chinese and English speech synthesis and have the high-quality speech synthesis effect (Tech Wire Asia, 2012).

After speech synthesis, this research will use Praat to finish the next step. Praat, created by Professor Boersma and Professor Weenink, can analyze, synthesize, manipulate speech and ultimately provide high-quality images for research. Audio texts can be segmented by Praat, and the required duration and pitch data can be extracted.

According to the features of the text studied, the original corpus will be segmented into clauses, while English translations will be segmented according to Chinese poetry. After that, the t-test will be used to compare the data of the translation and the data of the original poem to test whether there is significant difference between the compared groups.

(3) Data Extraction and Presentation

The present study utilized Xunjie and Praat to collect duration and pitch data from three corpora. First of all, each line from the corpora was converted into verbal recordings (as shown in Figure 2). Subsequently, these recordings were analyzed using Praat to obtain precise data (as shown in Figure 3). In Praat, the duration and pitch contours were extracted separately. The collected data were then compiled in Excel, where the figures were generated.

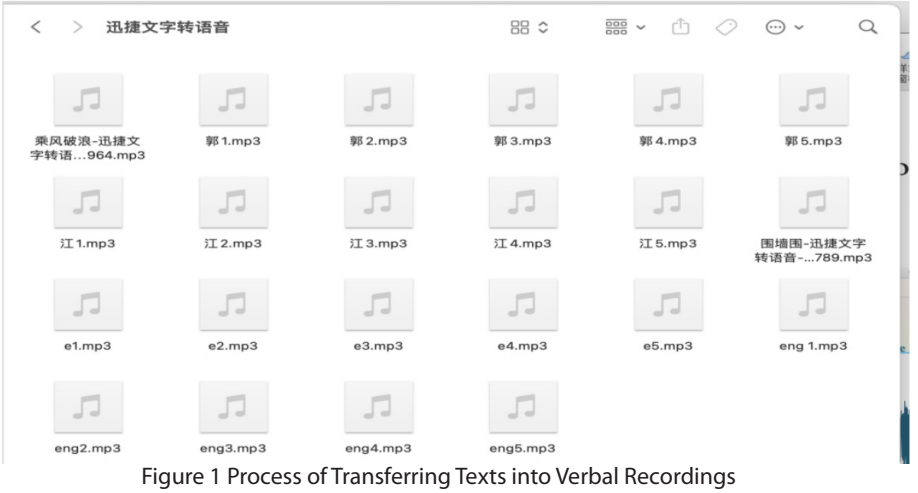

Figure 1 Process of Transferring Texts into Verbal Recordings

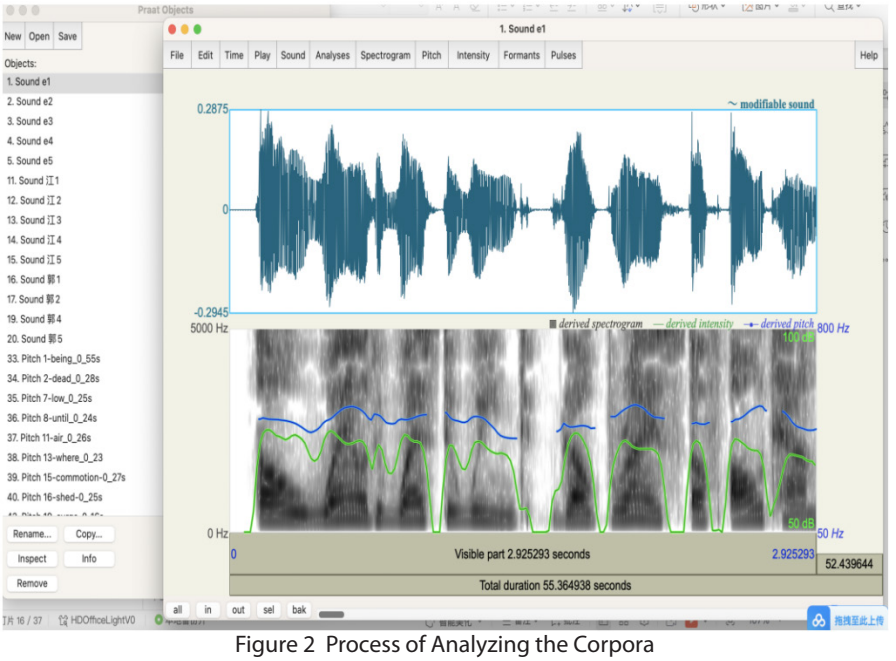

Figure 2 Process of Analyzing the Corpora

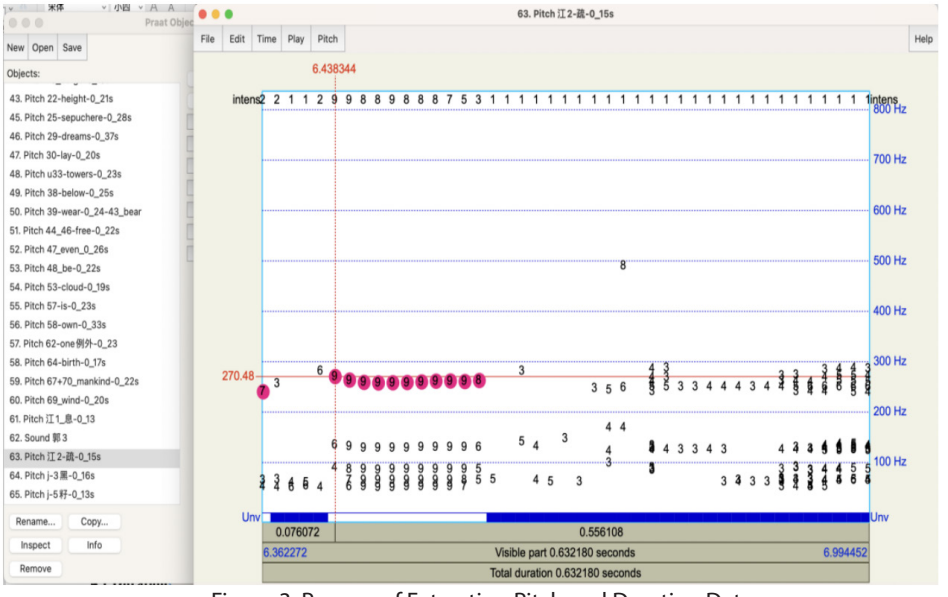

Figure 3 Process of Extracting Pitch and Duration Data

After all the collection, all the relevant data of the three corpora are presented in line charts for direct comparison. The precise pitch and duration data are provided in the Appendix. In the line charts, the horizontal axis stands for the line number, and the vertical axis stands for duration (seconds) and pitch (Hz) respectively. Every pitch and duration data of the three corpora will be presented in the same line chart for direct comparison.

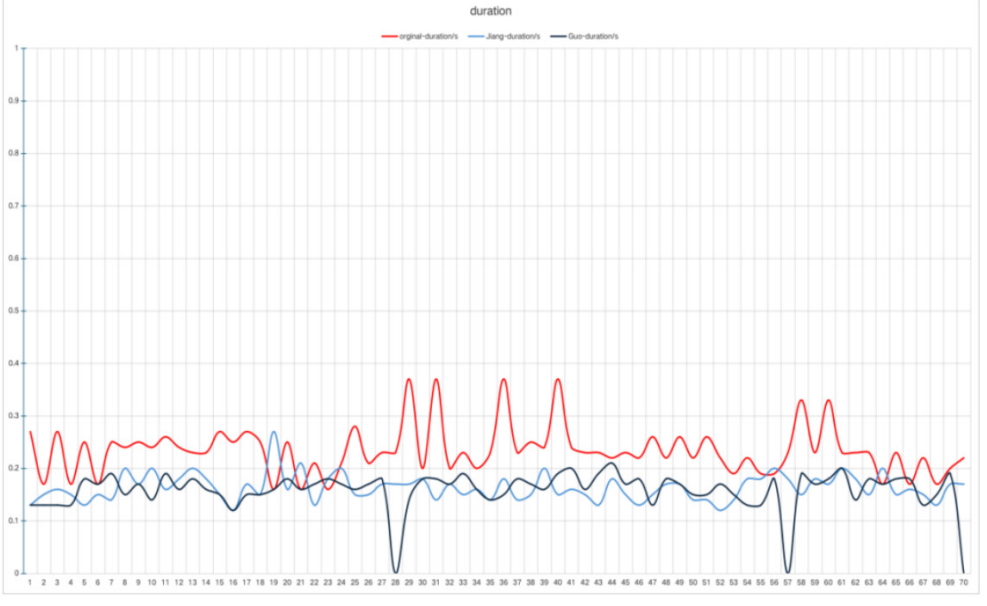

Figure 4 Duration Comparison of Vowels Sounds Among Three Corpora

Figure 5 Pitch Comparison of Vowels Sounds Among Three Corpora4 Findings

4. Findings

Based on the Figures in Section 3, research findings will be presented in this section.

(1) Duration

From Figure 4, it is evident that the final vowel duration in Jiang's and Guo's translations is shorter and more stable compared to the original poem. Jiang's translation exhibits minimal variation, while Guo's, despite deviating from the sonnet rhyme scheme, shows similarities in duration to Jiang's, with some inconsistencies.

In Jiang's translation, the duration of the last accented vowel is consistently stable, except for isolated instances of slight deviation. Guo's translation, not strictly adhering to the sonnet rhyme scheme, results in some lines not matching the original poem. However, apart from a few lines, the duration data from Guo's translation closely resemble those of Jiang's. Additionally, the original poem displays greater fluctuations in vowel duration, whereas the durations in both translations are generally more stable.

(2) Pitch

From Figure 5, the original poem maintains consistent pitch variation in the final accented vowel, characterized by a generally lower pitch level that conveys sadness or seriousness. In contrast, the two translations exhibit greater pitch variability, resulting in a multi-modal pattern that does not effectively convey the same emotional states. This suggests that there are no significant differences in the selected prosodic features between the two approaches to end rhyme translation. Both translations deviate to some extent from the original poem's emotional cadence. The pitch data from Figure 5 further illustrates that in the original poem, pitch variation in the last accented vowel of each line is notably more consistent compared to the translations. The consistent lower pitch levels in the original poem, associated with emotions like lament or seriousness as noted by Johnstone and Scherer (2000, pp. 230–235), are not as effectively conveyed in the translations. Instead, the pitch fluctuations in the two Chinese translations show considerable variability.

5. Discussion

Based on the theory and findings presented in Section 3 and Section 4, the Sections below will use t-test to evaluate more precisely the pitch and duration data between the original poems and the translations.

(1) T-test of pitch

The first dataset analyzed in this study compares pitch measurements across three conditions: original poem pitch, Jiang's pitch, and Guo's pitch. Each condition consists of 70 observations.

Firstly, the mean pitch were computed for each condition:

1)The mean original poem pitch $\overline{x_1}$was found to be 202.2 Hz.

2)Jiang's pitch $\overline{x_2}$ had a mean value of 219.8 Hz.

3)Guo's pitch $\overline{x_3}$ averaged at 207.4 Hz.

Standard deviations were computed to assess the variability within each group:

$$s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$$

1) S_1, the standard deviation of original poem pitch, was 7.731.

2) S_2, representing Jiang's pitch, had a standard deviation of 28.8473.

3) S_3, the standard deviation of Guo's pitch, was calculated to be 36.9452.

To determine if there were statistically significant differences in pitch among the three conditions, independent sample t-tests were conducted:

1) Original vs. Jiang's Pitch: t-value of each condition can be calculated in

$$t_{1-2} = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\frac{s_1^2}{70} + \frac{s_2^2}{70}}}$$

The calculated t-value was t_{1-2}=-0.6232, $|t_{1-2}|$=0.6232. The degrees of freedom=n_1+n_2−2 (n_1 is the number of observations in the first group, n_2 is the number of observations in the second group). So the freedom is 138. With 138 degrees of freedom (due to pooled variance) and a significance level ofα = 0.05, the critical t-value was approximately zhen±1.977. Since t_{1-2} < 1.977, the difference between original poem pitch and Jiang's pitch was not statistically significant (p < 0.05).

2) Original vs. Guo's Pitch:

The computed t-value for this comparison was t_{1-3}= 0.955, $|t_{1-3}|$=0.955. With 138 degrees of freedom and α = 0.05, the critical t-value is±1.977. The calculated t-value did not exceed the critical value, indicating no statistically significant difference between original poem pitch and Guo's pitch (p > 0.05).

Based on the results of the t-tests, the analysis revealed a statistically significant difference between original poem pitch and Jiang's pitch. However, no significant differences were found between original poem pitch and Guo's pitch, nor between Jiang's pitch and Guo's pitch. These findings suggest that both Jiang's and Guo's pitch does not show a significant difference from the original, since their t-value is much lower than the standard t-value and are very close to each other.

(2) T-test of duration

The second dataset analyzed in this study focuses on comparing durations across three conditions: original duration, duration by Jiang, and duration by Guo. The dataset consists of 70 observations for each condition. The

original durations represent the control group, while Jiang and Guo durations represent experimental conditions.

Firstly, the mean durations were computed for each condition:

1) Original duration $\overline{x_1}$ was calculated as 0.235 seconds.

2) Jiang's duration $\overline{x_2}$ was found to be 0.163 seconds.

3) Guo's duration $\overline{x_3}$ was calculated as 0.158 seconds.

Standard deviations were also calculated to understand the variability within each group:

$$s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$$

1)S_1, the standard deviation of original duration, was 0.048.

2)S_2, the standard deviation of Jiang's duration, was 0.026.

3)S_3, the standard deviation of Guo's duration, was 0.039.

To determine if there were significant differences in durations between the original and experimental conditions, independent sample t-tests were conducted:

1) Original vs. Jiang's Duration: t-value of each condition can be calculated in

$$t_{1-2} = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\frac{s_1^2}{70} + \frac{s_2^2}{70}}}$$

The t-value calculated was $t_{1\text{-}2}$= 11.04, degrees of freedom=n_1+n_2-2

n_1 is the number of observations in the first group, n_2 is the number of observations in the second group. So the freedom is 138. According to the t distribution table (OBHRM, n.d.), the critical t-value for a two-tailed test at a significance level of α = 0.05 with 138 degrees of freedom is approximately ±1.977. This value is commonly used in statistical tables and software applications. With 138 degrees of freedom and a significance level of α = 0.05, the critical t-value was approximately ±1.977. The calculated t-value significantly exceeded the critical value, $|t_{1\text{-}2}| > 1.997$, indicating a significant difference between original and Jiang's durations ($p < 0.05$).

2) Original vs. Guo's Duration:

$$t_{1-3} = \frac{(\bar{x}_1 - \bar{x}_3)}{\sqrt{\frac{s_1^2}{70} + \frac{s_3^2}{70}}}$$

The t-value calculated was $t_{1\text{-}3}$ = 10.38. Similarly, with 138 degrees of freedom and α = 0.05, the critical t-value was ±1.977. The calculated t-value for original vs. Guo's duration also exceeded the critical value, $|t_{1\text{-}3}| > 1.977$, demonstrating a significant difference between original and Guo's durations ($p < 0.05$).

Based on the statistical analyses, both comparisons between original duration and each experimental condition (Jiang's and Guo's durations) revealed statistically significant differences. These findings suggest that both Jiang's and Guo's durations significantly differed from the original durations. The t-value of Guo's duration data (10.38) and

that of Jiang's duration data (11.04) is far deviated from the standard t-value, indicating the significant difference between two translations and the original poem in terms of duration data. However, the average duration data of the two translation is very close.

This difference can be attributed to the prosodic characteristics of Chinese and English. English is commonly classified as a stress-timed language, where the duration between stressed syllables tends to be more regular, while unstressed syllables can be notably shorter (Roach, 1982). In contrast, Mandarin Chinese is typically characterized as a syllable-timed language, meaning that each syllable generally maintains a more consistent duration regardless of stress (Roach, 1982). Consequently, the stressed syllables in the end rhymes exhibit longer duration compared to those in Chinese translations. Therefore, adhering strictly to the rhyming style of the original poem may not necessarily result in vowel duration in the end rhymes aligning closely with those of the original poem.

(3) Insights from the comparative analysis

As mentioned above, the objective t-test analysis above demonstrates that, in terms of pitch and duration of the last accented vowel of the end rhyme, there are no significant differences between the two translations. Whether maintaining the original rhyme scheme or opting for recreation does not significantly affect the preservation of emotional continuity in the present study. To better maintain emotional continuity, the focus should be on selecting strategies that closely adhere to the prosodic features of the original end rhyme. This provides new insights into the variations in end rhyme translations concerning these features, their impact on preserving the emotional continuity of the original poem, and the inherent challenges in poetry translation.

First, different vowel durations between Chinese and English is the intrinsic prosodic features of the two languages. Chinese often feature longer durations in end-rhyme vowels compared to English, reflecting profound implications for emotional expression and continuity. Previous research highlights that vowel duration plays a crucial role in conveying emotional nuances in speech, such as longer vowel durations are often associated with emotions like seriousness, contemplation, or melancholy (Scherer, 1986). When translating English poems with shorter vowel durations into Chinese, these linguistic disparities pose a challenge in preserving the emotional tone and rhythmic flow of the original work.

What's more, while the original poem maintains a consistent lower pitch level indicative of its lamentous or serious tone, the translations exhibit varied pitch patterns that deviate from this emotional nuance. This discrepancy shows the challenge of accurately preserving the original poem's emotional cadence through vowel pitch in translation.

Differences in duration and pitch of different languages can potentially disrupt the intended emotional continuity of the poem. Careful consideration in translation strategies are needed to maintain fidelity to both the linguistic integrity and emotional expression of the original. For example, translators can choose characters with a lower pitch and shorter duration to design the end rhyme for a sad lyrical poem, while choosing characters with a higher pitch and longer duration to design the end rhyme for an uplifting emotional poem.

In conclusion, while prosodic features are important, a holistic approach that considers a broader range of translation strategies is essential for achieving emotional continuity. Translators must balance the preservation of prosodic elements with the adaptation to the target language's unique characteristics to effectively convey the original poem's emotional depth and rhythmic beauty. This study highlights the need for a nuanced and flexible approach in poetry translation to maintain the original poem's emotional and rhythmic essence.

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Appendix

The precise pitch and duration data of the three corpora are presented in the following tables.

Table 1 Duration Data in Three Corpora

line No.	orginal—duration/s	Jiang—duration/s	Guo—duration/s
1	0.27	0.13	0.13
2	0.17	0.15	0.13
3	0.27	0.16	0.13
4	0.17	0.15	0.13
5	0.25	0.13	0.18
6	0.17	0.15	0.17
7	0.25	0.14	0.19
8	0.24	0.2	0.15
9	0.25	0.17	0.17
10	0.24	0.2	0.14
11	0.26	0.16	0.19
12	0.24	0.18	0.16
13	0.23	0.2	0.18
14	0.23	0.18	0.16
15	0.27	0.15	0.15
16	0.25	0.12	0.12
17	0.27	0.17	0.15
18	0.25	0.15	0.15
19	0.16	0.27	0.16
20	0.25	0.16	0.18
21	0.16	0.21	0.16
22	0.21	0.13	0.17
23	0.16	0.18	0.18
24	0.21	0.2	0.17
25	0.28	0.15	0.16
26	0.21	0.15	0.17
27	0.23	0.17	0.18
28	0.23	0.17	0
29	0.37	0.17	0.14
30	0.2	0.18	0.18
31	0.37	0.14	0.18
32	0.2	0.17	0.17
33	0.23	0.15	0.19
34	0.2	0.16	0.16
35	0.23	0.14	0.14
36	0.37	0.18	0.15
37	0.23	0.14	0.18
38	0.25	0.15	0.17
39	0.24	0.2	0.16
40	0.37	0.15	0.19
41	0.24	0.16	0.2
42	0.23	0.15	0.16

Table 1 (continued)

43	0.23	0.13	0.19
44	0.22	0.18	0.21
45	0.23	0.15	0.17
46	0.22	0.13	0.18
47	0.26	0.15	0.13
48	0.22	0.17	0.18
49	0.26	0.17	0.17
50	0.22	0.14	0.15
51	0.26	0.14	0.15
52	0.22	0.12	0.17

53	0.19	0.14	0.15
54	0.22	0.18	0.13
55	0.19	0.18	0.13
56	0.19	0.2	0.18
57	0.23	0.18	0
58	0.33	0.15	0.19
59	0.23	0.18	0.17
60	0.33	0.17	0.18
61	0.23	0.2	0.2
62	0.23	0.18	0.14
63	0.23	0.15	0.18
64	0.17	0.2	0.17
65	0.23	0.15	0.18
66	0.17	0.16	0.18
67	0.22	0.15	0.13
68	0.17	0.13	0.15
69	0.2	0.17	0.19
70	0.22	0.17	0

Table 2 Pitch Data in Three Corpora

line No.	pitch-Original poem/hz	pitch-Jiang/hz	pitch-Guo/hz
1	206.625	269.045	239.065
2	197.9	264.335	270.88
3	206.625	266.82	229.01
4	197.9	200.42	168.595
5	208.24	198.705	183.75
6	206.625	200.42	183.25
7	208.24	182.355	187.42
8	200.07	183.8	185.495
9	208.24	207.465	187.98
10	200.07	220.105	237.125
11	210.025	184.645	187.42
12	200.07	272.18	254.595
13	193.08	190.41	195.92
14	193.08	272.625	199.03
15	183.32	227.29	186.435
16	211.305	191.875	211.375
17	183.32	192.835	245.83
18	211.305	238.575	186.435
19	196.03	188.82	234.395
20	211.305	251.245	216.345
21	196.03	171.495	251.445
22	193.47	194.115	170.045
23	196.03	192.75	194.865
24	193.47	221.04	191.855
25	202.735	218.955	228.39
26	193.47	218.44	220.185
27	193.08	222.12	195.92
28	193.08	256.935	0

29	206.62	202.555	200.14
30	195.03	234.395	234.395
31	206.62	168.145	252.57
32	195.03	183.17	234.02
33	210.72	225.7	187.42
34	195.03	203.675	195.92
35	210.72	242.205	228.335
36	195.43	196.4	200.14
37	210.72	187.725	195.01
38	195.43	243.175	192.07
39	208.805	202.115	276.08

Table 2 (continued)

40	195.43	245.76	272.065
41	208.805	279.37	201.515
42	193.08	277.985	220.185
43	193.08	220.37	187.42
44	197.055	265.985	196.47
45	193.08	215.73	270.03
46	197.055	215.685	241.955
47	224.275	183.86	239.065
48	211.375	222.53	190.62
49	224.275	182.585	222.53
50	197.055	236.93	242.66
51	224.275	209.815	190.62
52	197.055	233.085	256.905
53	210.135	239.25	190.62
54	224.275	220.505	159.07
55	210.135	182.415	219.105
56	210.135	188.22	0
57	186.95	206.47	250.39
58	209.59	216.515	187.42
59	186.95	199.145	276.615
60	209.59	214.45	272.62
61	186.95	236.6	201.515
62	190.59	199.145	192.42
63	186.95	227.9	250.39
64	205.64	191.5	276.615
65	186.95	233.1	194.865
66	205.64	277.985	234.395
67	208.355	227.95	227.865
68	205.64	232.655	212.64
69	240.375	256.935	200.89
70	208.355	256.935	0