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From "Correct Translation" to "Great Translation": Research on Human–Machine Collaborative Translation and Translators' Digital Intelligence Literacy: A Comparative Analysis of Translations Produced by ChatGPT, DeepSeek, and Human Translators

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Abstract

In the context of generative artificial intelligence reshaping the translation industry, human–machine collaboration has become an irreversible new paradigm for translating social-science and humanities academic texts. Taking Cultural History of Thirty Keywords as the corpus, this study systematically compares three English translation versions produced by ChatGPT-5.4-nano, DeepSeek-V3.2, and human–machine collaboration. Based on a five-dimensional evaluation framework—cultural imagery, conceptual interpretation, logical expression, semantic-pragmatic correspondence, and norm-abiding output—the findings show that large language models perform exceptionally well in grammatical transformation and the transmission of surface-level information. However, when confronted with social-science texts that embed historical depth and value judgments, they remain clearly insufficient in terms of the depth of cultural interpretation, contextual fit, and ethical prudence. Translator intervention is therefore still necessary to accomplish "in-depth post-editing." Building on these results, the paper proposes that translators enhance digital intelligence literacy in three areas: the ability for technological co-orchestration, the ability for critical review and optimization, and the ability for ethically grounded subject decision-making. This shift reframes translators from "tool users" to "top-level designers" and "quality reviewers," thereby establishing a sustainable complementary mechanism between algorithms and the humanities.

Keywords
ChatGPT; DeepSeek; Human-machine collaborative translation; Translator's digital intelligence literacy; Post-editing

1. Introduction

We are living through a period of transformation driven by AI-generated content (AIGC). The technological wave centred on large language models (LLMs) is reshaping the language-services industry and its work practices, while expanding the horizons of content production. Translation tools and workflows have moved from the localised use of computer-assisted

translation (CAT) systems, through the efficiency gains of statistical machine translation (SMT) and neural machine translation (NMT), to the rise of LLM-based platforms such as ChatGPT, DeepSeek, Kimi, Gemini, and Claude. This development signals a shift from "assistance" and "automation" to an era of "generation" and "collaboration": LLMs can execute a range of complex tasks in response to translators' natural-language instructions, thereby reconfiguring the human–machine relationship from a translator-led, tool-assisted model to a more interactive and collaborative partnership.

Wang and colleagues (2025; 2026), drawing on a systems perspective, examine the evolution of translation modes from machine-translation post-editing (MTPE) to AI post-editing (AIPE) and investigate translation ethics in the age of generative AI. From the standpoints of ethics and the sociology of professions, Anthony Pym (2014) anticipates AI-driven stratification in translation markets and the concomitant reconfiguration of translators' professional identity. With a focus on human–machine collaboration, research has expanded from MT–PE models to interactive machine translation (IMT) and to process-oriented accounts that treat AI as a collaborative counterpart; future collaboration is expected to involve deeper integration grounded in dialogue, feedback, and iterative refinement. Regarding the composition of translator competence, scholarship has moved beyond traditional frameworks to propose plural and multidimensional models: Hwang and Lee (2024) discuss AI translation; Siu (2023) addresses the potential of LLMs in translation; Bowker (2020) examines translation ethics; Moorkens and Lewis (2019) consider data governance; and Shetzer and Warschauer (2000) explore digital literacy.

A review of the literature suggests that substantial room remains for further inquiry. First, there is a shortage of fine-grained, comparative empirical studies that evaluate the translation performance of specific tool types on particular complex genres. Second, although notions such as "digital literacy" and "technological literacy" have been advanced to capture the competencies required of translators in the AIGC era, "digital–intelligent literacy" distilled inductively from situated human–machine collaborative practice and empirical analysis still requires more concrete case-based evidence and further theoretical elaboration in terms of its scope, components, and pathways for development.

This study poses the following core questions: in the context of AIGC, how do AIGC tools represented by ChatGPT and DeepSeek perform when translating complex academic–historical texts in the social sciences? What strengths and limitations do they exhibit? What implications do these findings have for designing effective human–machine collaborative translation models? And how should translators enhance their "digital–intelligent literacy" in order to strengthen their core competitiveness?

Methodologically, this study adopts qualitative text-based comparative analysis and descriptive research. The corpus is drawn from the subsection "Classical Extensions · China" in Cultural History of Thirty Keywords, which contains abundant culture-bound expressions and historical allusions, making it an ideal test case for assessing AIGC tools' capacity to handle complex semantics and culturally dense discourse. The study will conduct human post-editing of the ChatGPT-5.4-nano and DeepSeek-V3.2 translations of this text and will then undertake a three-dimensional comparative analysis, with a view to illuminating the mechanisms and trajectories of human–machine collaborative translation in the AIGC era.

2. Definition of Core Concepts

Generative artificial intelligence—AIGC (artificial intelligence generated content), refers to a set of AI-based technical approaches, including generative adversarial networks and large pre-trained models, which learn from and recognize patterns in existing data and, with an appropriate degree of generalization, generate relevant content (Li et al., 2026). In the AIGC era, translation technology is characterized by several salient features—deep contextual understanding, interactive collaborative capacity, knowledge enhancement and transfer, and multi-modal content generation. Taken together, these features constitute the technological foundation of translation in the AIGC era and provide the technical preconditions for re-configuring human–machine collaborative relations.

AI literacy, as an integrative competence framework, is increasingly regarded as a core capability for responding to transformations brought about by generative AI (Wang et al., 2026). It can be understood as an upgraded conceptualization built on digital literacy. Whereas digital literacy emphasizes operational competence with digital tools and the ability to process information, translators in the AIGC era need not only to "use tools" but also to "work collaboratively with intelligent agents". For translators, AI literacy functions as a micro-level competence core: it is key human capital enabling effective participation and value enhancement within human–machine collaborative modes, and it serves as a conversion hub that links technological possibilities to realized translation quality.

In this study, human–machine collaborative translation in the AIGC era is defined as a dynamic mode of translation practice in which generative AI acts as a collaborative partner, natural-language interaction serves as the mediating channel, and iterative feedback operates as the driving mechanism, thereby enabling deep integration between translators' agency and machine generativity. Its core features include: a partner-like relationship, in which AIGC is no longer a passive tool; an interactive process, in which translators can intervene at any stage to re-calibrate direction; and a division of cognitive labour, whereby the machine undertakes basic routinized tasks while the translator leads higher-order work requiring deep understanding and creative thinking. In short, collaboration is not substitution but complementary capability; and the human–machine relationship is not a zero-sum game but a value-adding partnership.

3. Comparative Analysis of ChatGPT, DeepSeek, and Human–Machine Translations

3.1. Research Design

3.1.1 Text selection and rationale

This study selects, as a closed corpus for comparative analysis of translation examples, the "China" subsection in Chapter 1 "Classical Extensions" of Cultural History of Thirty Keywords by Feng and Nie (China Social Sciences Press, 2021). The subsection offers a systematic philological and conceptual account of the semantic evolution of the term "China" across three millennia—from the Western Zhou bronze inscription on the He zun ("Dwelling here in the Central Region") to the modern formation of the nation-state concept—tracing a chain of meaning shifts from "capital" to "Central Plains," to "Zhu Xia," to "the centre of tianxia," and ultimately to "one among the nations." The reasons for selecting this text are as follows:

First, it features a high density of culture-bound terms and is therefore representative. The text

contains frequent, layered culture-specific items such as “Huaxia,” “Jiuzhou,” “Sihai,” “tianxia,” “the Hua–Yi distinction,” “the king has nothing beyond,” “Seres,” and “Zhina,” and it also draws on historical canons and documentary citations, including the He zun, the Treaty of Nerchinsk, the Treaty of Nanjing, and “On Young China.”

Second, historical concepts are densely layered and require interpretive depth. Each semantic shift of “China” is intertwined with transformations in political institutions, adjustments in ethnic relations, and shifts in worldviews; such complexity cannot be exhausted by simple terminological equivalence. The subsection foregrounds the superimposition and evolution of three dimensions—geographical centre, political centre, and cultural centre—thereby placing high demands on the translator’s capacity to reconstruct historical context.

Third, the register is heterogeneous and exhibits genre tension. The subsection combines the rigour of academic exposition with the literariness of a cultural essay, featuring both evidential, philologically oriented long sentences and more essayistic passages. Different registers call for different translation strategies, providing multiple analytical entry points for comparison.

3.1.2 Tool characteristics and selection criteria

This study selects ChatGPT and DeepSeek, two domestically developed large language models, as the objects of comparative analysis. The selection is justified as follows: ChatGPT is noted for its capacity to handle long contexts, with advantages in metaphor explication and contextual coherence; DeepSeek performs strongly in preserving culture-bound terms through literal rendering and in reconstructing rhythmic structures, and multiple studies have already shown that it delivers stable accuracy and relatively strong literary re-creation in the translation of literary texts.

3.2 Research Procedure

The development of translation work modes can be divided into three stages: human translation, machine-assisted translation, and human–machine collaborative translation (Wang, 2024). In this study, the research follows a three-step workflow: source-text segmentation, machine translation, and human post-editing.

3.2.1 Source-Text Segmentation and Case-Selection Principles

From the “China” subsection, four types of representative passages are extracted, with 1–2 cases selected from each category. The case selection follows the principles below:

i. Coverage across the stages of meaning evolution: from “Dwelling here in the Central Region” (zha ci zhongguo) to “Young China,” thereby capturing the diachronic depth of conceptual history;

ii. Coverage of diverse linguistic phenomena: including culture-bound terms, historical allusions, classical rhetorical devices, complex long sentences, and discourse cohesion;

iii. Coverage across levels of translation difficulty: including terminological consistency, cultural compensation strategies, logical explicitation, and register adaptation.

3.2.2 Machine translation: design of standardized prompt templates

To control variables to the greatest extent possible, this study adopts a uniform, standardized prompt template and sends translation instructions separately to ChatGPT and DeepSeek. The prompt design is as follows:

[Please translate the following Chinese passage into English. "The text is drawn from historian Feng Tianyu's Cultural History of Thirty Keywords, and it combines an academic expository style with the sensibility of a cultural essay. It contains culture-bound terms, historical allusions, and classical quotations. Accurately convey the original semantic meanings and cultural connotations, while maintaining the formality of an academic register. For culture-specific proper nouns/items, you may choose strategies such as 'literal rendering plus implicit compensation' or 'adaptation plus explicit clarification,' but you must not add explanatory footnotes or notes that are not present in the original. Output only the translation, without any additional commentary."]

Prompt rationale/structure: task setting (textual attributes and style positioning), translation strategy (allowing a limited degree of compensation while restricting extra-text external annotations), and output format (translation-only to facilitate side-by-side comparison).

3.2.3 Human post-editing: following the translation-generation guidelines

Building on the author's in-depth understanding of the source text's historical context and academic register, systematic post-editing is carried out on the initial translations produced by ChatGPT-5.4-nano and DeepSeek-V3.2 to generate an optimised "reference translation." Zhu (2018) distinguishes between the ability to translate and the quality of translation; accordingly, the post-editing procedures comply with the following standards:

i. Terminological consistency: establish a uniform rendering for the same culture-bound concept across the entire text;

ii. Cultural compensation: compensate for implicit cultural information that remains insufficiently explicated in the machine translation, for example by adding appositive modifiers, adjusting attributive structures, and other appropriate strategies;

iii. Logical explicitation: rectify the machine's misinterpretation of logical relations in complex long sentences, and improve the information hierarchy through restructuring clause relations, adding or deleting connectives, and related measures;

iv. Style calibration: harmonise the register throughout the whole text, ensuring that the formality of academic exposition is coordinated with the rhythmic sensibility of literary quotations.

Formatting standards: correct formatting errors in punctuation, letter case, numerals, symbols, and related elements.

3.3 Case Analysis

3.3.1 Cultural imagery

Analysis: In their main-text renderings, both ChatGPT and DeepSeek achieve semantic accuracy and grammatical correctness; no mistranslation or omission is observed. Both models

are able to perform differentiated style adaptation in accordance with the source text's stylistic characteristics. DeepSeek employs a more refined diction, whereas ChatGPT uses a plainer, more accessible wording, demonstrating strong capacity for stylistic transfer. With respect to paratexts, ChatGPT adds pinyin transliterations to the Chinese title, thereby balancing academic conventions with readers' needs for search and retrieval, which reflects an effective learning of established practices in academic translation.

Table 1. "Young China" and "Chinese Youth"

Source text (hereafter referred to as ST)	"美哉，我少年中国，与天不老！壮哉，我中国少年，与国无疆！" ——梁启超《少年中国说》（Feng et al., 2021:45）
Translation of ChatGPT-5.4-nano (hereafter referred to as CGT)	"How magnificent, our Young China, ageless as the heavens! How robust, our Young China, boundless as the nation!" -- Liang Qichao, On Young China (Shàonián Zhōngguó Shuō)
Translation of DeepSeek-V3.2 (hereafter referred to as DST)	How majestic is our young China, coeval with the heavens! How magnificent is our youthful China, boundless in unity with the nation! -- Liang Qichao, Young China
Human-machine collaborative translation (hereafter referred to as HMT)	Hooray for my young and timeless Heaven! Hooray for my young and boundless China! -- *Ode to the Young China*, written by Liang Qichao Trans. Notes.: *Ode to the Young China* is an essay written by Liang Qichao, a modern thinker and writer, in 1900 after the failure of the Hundred Days' Reform. The essay extols the youthful vigor of China's youth and calls on and inspires them to strive for the creation of a youthful China.

Analysis: In their main-text renderings, both ChatGPT and DeepSeek achieve semantic accuracy and grammatical correctness; no mistranslation or omission is observed. Both models are able to perform differentiated style adaptation in accordance with the source text's stylistic characteristics. DeepSeek employs a more refined diction, whereas ChatGPT uses a plainer, more accessible wording, demonstrating strong capacity for stylistic transfer. With respect to paratexts, ChatGPT adds pinyin transliterations to the Chinese title, thereby balancing academic conventions with readers' needs for search and retrieval, which reflects an effective learning of established practices in academic translation.

Both models, however, render the character "说" in a straightforward manner as either "On" or by omitting it directly; neither model recognizes the source text's stylistic marker of an ancient argumentative/discourse genre. Moreover, neither model offers any background-knowledge compensation. The advantage of human translation lies precisely in addressing the strategy blind spots of large language models. Human translators creatively rename the title—for example, using "Ode" to make the genre orientation explicit—and transform "论" into a form of "praise/ode," enabling English readers to intuitively grasp the text's motivating and exhortatory function. Human–machine collaboration, through the use of footnotes to provide translators' notes, helps readers consult relevant materials more effectively and comprehensively; this can be considered a pinpoint insight that large language models cannot easily replace. By means of the translators' notes included in the paratext, the translation fully accounts for the writing background, the author's identity, and the core thesis, extending translation activity into cross-cultural knowledge dissemination.

The limitation, meanwhile, is that to achieve affective equivalence, some concessions are made in terms of literal correspondence: the conceptual distinction between "Young China" and "Chinese Youth" is merged in the target text. These findings suggest that large language

models are good at "translating correctly," whereas human beings are good at "translating well." The core of translators' digital and intelligencized literacy lies in precisely mastering the boundary of this division of labor.

3.3.2 Culture-bound terms

Table 2. "The Sovereign Has No Borders"

SL	"此语初出《公羊传》："天王出居于郑。王者无外，此其言出何？不能乎母也。"(Feng et al., 2021:57)
CGT	The phrase originally appears in the Gongyang Commentary: "The Son of Heaven departed to reside in Zheng. For the King, there is no outside; why then does the text employ the term departed? [He] could not [maintain proper relations with] his mother."
DST	This notion first appears in the Gongyang Commentary: "The Heavenly King took up residence in Zheng. For the sovereign, there is no 'outside'; why then does the text speak of his 'taking up residence'? It is because he failed to fulfill his duties toward his mother."
HMT	The phrase first appeared in Gongyang Zhuan: The Emperor resides in Zheng. His mighty rules all, so it is inappropriate to say the emperor left his world. Can't he serve his mother?

Analysis: A comparative review of the three renderings shows that the human–machine collaborative version performs notably better in terms of depth of conceptual explication and effectiveness of academic dissemination. Although the ChatGPT version is accurate, it remains overly constrained by literal form. By contrast, the human–machine collaborative rendering interprets "His mighty rules all" as "The Sovereign Has No Borders," transforming the subtle yet substantive implications of the Gongyang Zhuan into discourse that speaks to universal political philosophy. This explicatory translation strategy reflects the human translator's deep engagement with established traditions of interpreting classical texts.

With regard to rhetorical effect, the human–machine collaborative version renders "不能乎母也" as "Can't he serve his mother?" in the form of a rhetorical question. Compared with ChatGPT's declarative statement and DeepSeek's causal explanation, this more precisely recreates the exegetical pattern characteristic of the Gongyang Zhuan. The moral urgency carried by the rhetorical question is precisely the argumentative core of "The Sovereign Has No Borders"—the Son of Heaven is compelled to relocate because he cannot attend to his mother. Moreover, the human–machine collaborative rendering replaces "Gongyang Commentary" with "Gongyang Zhuan" (pinyin). While this choice sacrifices some readability, it preserves the source text's cultural specificity and aligns with contemporary sinological conventions for citation.

3.3.3 Historical concepts

Analysis: A comparative review of the three renderings indicates that the human–machine collaborative version achieves the best balance between academic accuracy and communicative effectiveness. Although the ChatGPT version is comprehensive, it is somewhat redundant: it piles up technical terms such as "novel exegesis" and "categorical distinction," and also invents the obscure expression "perishing of all-under-heaven." By contrast, the DeepSeek version renders "亡" as "all/rain," thereby weakening Yan Wu's life-and-death metaphor regarding civilization's continuance and survival.

The human–machine collaborative version sets up a clear parallelism between "the death of the state" (Guo, i.e., state) and "the death of the world" (All-under-Heaven, i.e., world).

It preserves the semantic force of the ultimate finality in “ 亡 ”, while, through the explicit and transparent syntactic strategy of “distinguishing… by explaining,” converting the source text’s dialectical structure into a logical chain that conforms to English academic prose. Both ChatGPT and DeepSeek adopt an academic-style approach of transliteration plus bracketed explication. While the semantics remain precise, the information density becomes excessively high.

Table 3. “Guo” and “All-under-Heaven”

SL	顾炎武（ 1619–1692）对 “国”与 “天下” 作新的诠释， 力主区分 “亡国”与 “亡天下”：有亡国， 有亡天下。亡国与亡天下奚辨？（Feng et al., 2021:48）
CGT	Gu Yanwu (1613-1682) advanced a novel exegesis of guó (state) and tiānxià (all-under-heaven), forcefully arguing for a categorical distinction between “perishing of the state” (wáng guó) and “perishing of all-under-heaven” (wáng tiānxià): There is the perishing of the state, and there is the perishing of all-under-heaven. How, then, are these to be differentiated?
DST	Gu Yanwu (1619-1692) offered a new interpretation of “state” (guo) and “world/all-under-heaven” (tianxia), strongly advocating for a distinction between “the fall of the state” (wang guo) and "the ruin of the world” (wang tianxia): There is the fall of the state, and there is the ruin of the world. How do we distinguish the fall of the state from the ruin of the world?
HMT	Gu Yanwu (1619 A.D. - 1692 A.D.) offered a new interpretation of the “state” and the “world”, distinguishing “the death of the state” from “the death of the world” by explaining. There are “the death of the state” and “the death of the world”. What is the difference?

The human–machine collaborative rendering decisively removes the pinyin annotation and keeps “state” and “world” as the only running terms. For a popularizing text, reducing cognitive load is more important than cluttering the discourse with technical terminology. Machines can only follow instructions, whereas human beings understand for whom to translate and why to make deletions. The treatment of the concluding question is particularly persuasive. ChatGPT uses a passive long sentence, DeepSeek an active complex clause, whereas the human–machine collaborative version ends simply with the six-word question “What is the difference?” In this moment, the translator completes the leap from “translating its words” to “transmitting its spirit.”

3.3.4 Citations from canonical texts

Table 4. “Shina” as It Changes Over Time

SL	黄摩西《普通事科新大辞典》“支那”条诠释曰：“我国秦时，已与中亚洲诸部交通。中亚人称国为斯坦（如今之土耳其斯坦）。故称我国为秦斯坦。”（Feng et al., 2021:65）
CGT	The entry for “Zhina” (Zhīnà 支那) in Huang Moxi’s New General Encyclopedia (Pǔtōng Shìkē Xīn Dàcídiǎn) explicates: During the Qin period, our country already maintained communications with various Central Asian polities. The Central Asian term for state was stan (as in present-day Turkestan). Hence our country was denominated Qin-stan.
DST	In the entry for “Zhina” (an old term for China) in Huang Moxi’s General Science New Encyclopedia, the interpretation states: “During the Qin Dynasty in China, there was already communication with various tribes in Central Asia. The Central Asians referred to countries as “stan” (as in present-day Turkistan). Therefore, they called our country ‘Qin-stan.’ ”
HMT	Huang Moxi’s The New Dictionary of General Encyclopedia on the item “Chinas” explains: During the Qin dynasty, our country was already in communication with the tribes of Central Asia. The people of Central Asia called the country Stan (nowadays Turkish Stan). Hence, we were called Qin-stan.

Analysis: A comparative review of the three renderings shows that the human–machine collaborative version has a clear advantage in terms of academic normativity. Although both ChatGPT and DeepSeek handle the transliteration of terms (e.g., Zhina/Qin-stan), the human–machine collaborative version—through the plural form Chinas and the italicized title The New Dictionary of General Encyclopedia—accurately captures the semantic development of historical terminology and conforms to bibliographical conventions for scholarly citation, details that are difficult for AI to grasp autonomously. Particularly noteworthy is the treatment of culture-bound terms: the human–machine collaborative version renders "Stan" consistently as Stan with an initial capital letter. It uses Turkish Stan in place of Turkestan, thereby preserving etymological transparency while avoiding the spelling confusion found in the DeepSeek version (where the term actually refers to Turkestan). This control over terminological consistency demonstrates the human translator's deep involvement in translating social-science and humanities materials. In addition, the human–machine collaborative version renders " 诸部 " as "tribes" rather than ChatGPT's "polities," which better matches the ethnographic discourse context of the late Qing and early Republican period (c. 1840s–mid-1920s).

3.3.5 Special characters

Table 5. "Oracle Bone Script"

SL	中国之“中”，甲骨文作  等、金文作  等，皆象有飘带的旗帜。(Feng et al., 2021:45)
CGT	The character zhōn 中 (middle/center) in the Chinese script appears in oracle bone inscriptions as ^ and in bronze inscriptions as ^, both graphically representing a banner or streamer-bearing flag.
DST	The character zhong (中), meaning "center" or "central," appears in oracle bone script as forms such as etc., and in bronze inscriptions as forms such as  etc., both of which depict a flag with streamers.
HMT	The Chinese character "Zhong" appeared as in shell-and-bone script and in metal script , both resembling flags with ribbons.

Analysis: A comparative review of the three renderings shows that the human–machine collaborative version achieves the best balance between academic normativity and readability. The ChatGPT version, although detailed, appears somewhat redundant—for instance, the phrase "graphically representing a banner or streamer-bearing flag" piles up modifiers. The DeepSeek version's repeated construction (e.g., "forms such as... etc.") is similarly drawn out. By contrast, the human–machine collaborative version renders " 甲骨文 " and " 金文 " with "shell-and-bone script" and "metal script," respectively, thereby preserving the visual letterforms of oracle-bone and bronze inscriptions—for example, the character " 中 "()—and supplementing them with in-depth explanation. This kind of formulation is characteristic of translations of historical sources in the social sciences, and it reflects the human translator's control over the rhetorical pacing of academic English.

In comparison, the translation outputs produced by large language models cannot identify oracle-bone and bronze inscriptions, and merely treat them as "^." Regarding the systematic construction of terminological networks, the human–machine collaborative version renders " 飘带 " as "ribbons." Compared with ChatGPT's "streamer-bearing" and DeepSeek's "with streamers," this choice better aligns with the ceremonial connotation of the ritual system in early Chinese paleography—namely, "The qí flags had numerous bells and streamers to command the multitudes," Shuowen jiezi. In English, "ribbon" simultaneously carries decorative and ritual functions, whereas "streamer" emphasizes physical fluttering. This principled selection of conceptual equivalents stems from the human translator's deep understanding of the ritual and music civilization of the pre-Qin era.

3.3.6 Complex sentence markers

Table 6. Word Polysemy

SL	“中”还演绎为动词（读 zhòng ， 第四声），意为“对上”（如射中、猜中）、“受到”（如中计、中枪）；演绎为形容词，意指“成、好”（适中）；演为量词，有 “中等”“半”意以及 “正”“得当” 等意涵。(Feng et al., 2021:46)
CGT	“The morpheme zhōng 中 has further undergone semantic derivation into a verb (pronounced zhòng, fourth tone), signifying ‘to hit upon the target’ (e.g., shèzhòng 射中 , ‘to hit [the mark] in archery’; cāizhòng 猜中 , ‘to guess correctly’), or ‘to suffer/receive’ (e.g., zhòngjì 中计 , ‘to fall into a stratagem’; zhòngqiāng 中枪 , ‘to be struck by a firearm’); into an adjective, denoting ‘appropriate, satisfactory’ (shìzhōng 适中 , ‘moderate, well-proportioned’); and into a classifier, carrying the semantic values of ‘medium,’ ‘half,’ as well as ‘proper,’ ‘fitting,’ and ‘equitable.’”
DST	The character “ 中 ” (zhōng) is also extended to function as a verb (pronounced zhòng, fourth tone), denoting meanings such as “to hit the mark” (e.g., 射中 , shèzhòng, hitting the target; 猜中 , cāizhòng, guessing correctly) and “to suffer" or "to fall into” (e.g., 中计 , zhòngjì, falling into a trap; 中枪 , zhòngqiāng, being shot). It is further extended to serve as an adjective, signifying “proper” or “good” (as in 适中 , shìzhōng, appropriate). Additionally, it evolves into a measure word, encompassing connotations of “medium,” “half,” as well as “correct” and “appropriate.”
HMT	The word “zhong” is also used as a verb (pronounced zhòng, fourth tone), which means “squarely” (to shoot squarely or to guess correctly), “to be subjected to” (to be tricked or to be shot), and as an adjective, meaning “suitable or good” (moderate). It can also be used as a quantifier, meaning “medium”, “half”, as well as “right”, “proper”, etc.

Analysis: This translation example differs from the preceding ones in that the original content is presented in a highly complex form. Punctuation marks, Chinese pinyin, and parenthetical elements are interwoven, which inherently creates multiple inconveniences and challenges for translation—especially for large language models to accurately parse and understand the source text. A comparison of the three versions shows that the human–machine collaborative version achieves the best balance between semantic accuracy and academic communication effectiveness.

Although both the ChatGPT and DeepSeek versions appear to restore the meaning of the source text in a near word-for-word manner, the result is nevertheless unsatisfactory. The translations are overly elaborate and redundant: they not only fail to convey the original intent precisely but also impair the reading experience. For instance, when large language models process textual information within the main text such as “(e.g., shèzhòng, cāizhòng) …” or explanations like “(適 中),” they cannot streamline complexity into clarity. Instead of doing so, they translate these elements as “(e.g., shèzhòng 射中 , ‘to hit [the mark] in archery’; cāizhòng 猜中 , ‘to guess correctly’)” or similarly proceed in a way that pursues “complete coverage, exhaustiveness, and fine-grained detail” without reaching the intended sense—producing an effect that is, in fact, the opposite of what is desired.

By contrast, the human–machine collaborative version simplifies complexity into clarity. It directly supplements the information by adopting an English definitional approach. As a result, the translation is concise, clear, and immediately legible. Presenting complex semantic fields through concise sentence structures significantly enhances the academic readability of the text.

3.4 Synthesis and Comparative Conclusion

3.4.1 Shared advantages: the fundamental competence of AIGC translation

First, the conversion of basic semantics is highly reliable. Across all cases, both models do not produce major semantic mistranslations or instances of information omission, and they identify the factual information in the source text with largely accurate results. Second, awareness of cultural translation strategies is notably enhanced. When confronted with culture-specific items such as “ 王者无外 ,” both models consciously adopt a foreignization strategy characterized by “primarily transliteration, with bracketed compensation as a secondary measure,” rather than following domesticated renderings that carry overt Western-centrist coloration such as barbarian and empire. Third, performance in grammatical normativity and format stability is excellent.

3.4.2 Differentiated features: tendencies of ChatGPT and DeepSeek

ChatGPT’s translation features: It tends to employ a sentence-splitting strategy for handling long sentences. By laying out information through coordinate structures, it produces strong readability and a low reading burden. For cultural compensation, it mainly provides concentrated explanations upon the first occurrence, and then preserves transliteration in subsequent instances, which helps readers gradually acquire the relevant knowledge. Its register leans toward general academic English: sentences are regular and orderly, yet literary rhetorical effects are comparatively weak.

DeepSeek’s translation features: It favors a nested compression strategy when dealing with long sentences. As a result, it offers high information density and clear logical hierarchies. For cultural compensation, it primarily uses transliteration plus immediate bracketed annotation; whenever a core concept appears, it adds explanatory information, thereby offering greater reader-friendliness. Its register tends toward formal written academic English, using relatively archaic diction and showing a higher fit with humanities and historical texts.

3.4.3 Capability boundaries: the core space for human post-editing

A comparative analysis indicates that AIGC translations exhibit systematic limitations across the following four dimensions, which constitute the core value space for human post-editing.

i. Lack of in-depth cultural explication. There is insufficient deep understanding of diachronic semantic layering beneath concepts, institutional contexts, and the intellectual-historical trajectories involved.

ii. Insufficient explication of implicit logical relations. For long sentences, control over the implicit logical levels, the relative importance of information, and the rhythm of argumentative progression is not stable; this may lead to either “flattened elaboration” or “over-compression,” representing two extreme tendencies.

iii. Limited ability to govern overall style. There is a lack of macro-level orchestration regarding the consistency of register throughout the text, the stability of academic formality, and the bookended coherence of cultural imagery. Human–machine collaboration should not be a linear process of “machine translation plus human editing” performed once; rather, it should be an iterative conversational cycle of “prompting—generation—evaluation—feedback—iteration.”

4. Pathways to Enhancing Translators’ Digital Intelligence Literacy

The analyses of translation examples above demonstrate that AIGC exhibits systematic limita-

tions in areas such as cultural depth, the explication of logic, rhetorical re-creation, and style control. Meanwhile, the value of translators' intervention is precisely reflected in compensating for and optimizing these core shortcomings. Wang (2023), from a digital humanities perspective, provides a detailed analysis of the main problems faced by the development of translators' digital literacy, and offers targeted recommendations from multiple aspects including governmental governance, educational development, ethical construction, and scientific research. Based on this, this chapter proposes pathways for enhancing translators' digital intelligence literacy along three dimensions: technical mastery for steering, critical proofreading and editing, and ethical decision-making capability.

4.1 Technical Mastery for Steering: From "Tool Operation" to "Strategy Coordination"

Technical mastery for steering is the foundational competence required for translators to enter the human–machine collaborative field; its improvement calls for a cognitive leap from passive use to proactive design. On the one hand, translators should master prompt engineering to ensure the precise transmission of intent. They must move beyond rudimentary instructions such as "Please translate …," "Please polish …," and "If I were …" Instead, they should learn to embed translational intentions into the machine generation process in a strategic manner through techniques such as role assignment, task decomposition, and stylistic constraints. On the other hand, it is necessary to build a multi-model collaborative calling mechanism. ChatGPT and DeepSeek each have strengths in logic processing, cultural compensation, and stylistic register; translators should establish multi-model backup options and dynamically select the most suitable tools according to text types, thereby achieving complementary advantages.

4.2 Critical Proofreading and Editing: From "Error Correction" to "Value Recasting"

The deficiencies of AIGC translations are often hidden quality issues of the type "correct, but not outstanding." Therefore, the focus of proofreading and editing must move from correction to optimization, and from grammatical normativity to cultural depth and aesthetic expression. First, establish a multidimensional evaluation framework to enable precise identification of defects. Translators should internalize a six-dimensional indicator system—semantics, culture, pragmatics, logic, style, and norms—into a proofreading and editing thinking model. When evaluating AIGC output, they should quickly scan for risk points across each dimension, so as to avoid the low-standard trap of treating "grammatically correct" as "qualified." Second, strengthen cultural sensitivity and rhetorical judgment. In response to AIGC's common weaknesses such as insufficient force in cultural explication and fragile rhetorical creativity, translators need to systematically enhance their abilities in historical-context reconstruction and English rhetorical control, and to actively intervene during post-editing.

4.3 Ethical Decision-Making: From "Efficient Execution" to "Commitment to Agency"

A deep engagement by AIGC shifts translation ethics-related issues from the periphery to the center. Translation ethics refers to the system of rules, mechanisms, and value ideologies used to regulate the conduct of relevant actors and their interaction relationships throughout the entire process of conducting translation activities (Liu et al., 2025). Ethical decision-making capability is the core foundation for translators to establish the legitimacy of their profession. First, clarify the boundaries of human–machine responsibility and establish the translator's position as the subject. No matter how enhanced AIGC's generation capabilities may become, the responsibility subject for translation quality remains the translator him/herself. Translators must establish a framework of rights and obligations in which "AIGC is the proposer and

the translator is the decision-maker." Second, enhance the ability to identify cultural bias and uphold professional ethical bottom lines. Translators need to sensitively detect latent risks in AIGC outputs, such as Orientalist discourse and cultural stereotypes, and actively replace translation choices that embed value assumptions with terminology that respects the agency of cultural subjects.

5. Conclusion

This study uses A Cultural History of Thirty Key Words as the analytical corpus. Through a comparative analysis of the translations produced by ChatGPT and DeepSeek, it systematically examines the practical forms of human–machine collaborative translation in the era of AIGC, as well as the construction pathways of translators' digital intelligence literacy. AIGC demonstrates strong performance in areas such as semantic accuracy, grammatical normativity, and awareness of terminology strategies. However, it exhibits systematic limitations across four dimensions: in-depth cultural explication, the explication of implicit logic, creative rhetorical re-creation, and overall style control.

Human–machine collaboration should therefore be upgraded from a linear model of "machine translation + human revision" to a cyclical dialogic process of "prompting—generation—evaluation—feedback." Translators must take the lead in higher-order stages such as cultural calibration, logical re-framing, style setting, and creative enhancement. Translators' digital intelligence literacy constitutes a three-dimensional integrated system encompassing technical mastery for steering, critical proofreading and editing, and ethical decision-making capability. Its improvement pathway points toward a role transformation in which translators move from being "tool users" to becoming "collaborative strategy orchestrators," "quality proofreaders/editors," and "value re-constructors."

As the proverb goes, "the bigger the storm, the more expensive the fish." The more rapidly technology iterates and innovates, the more human judgment and logical thinking remain the core competitive advantages of human–machine collaboration. The enhancement of translators' digital intelligence literacy is precisely the necessary path toward rebuilding the agentive subjectivity of translation professionals in the intelligent era.

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Ethics Statement

Not applicable.

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