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RESEARCH ARTICLE

The evaluation and reception of the translation quality of three translation modalities in live-streaming contexts: computer-assisted simultaneous interpreting, machine translation (MT) with human revision and raw MT

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ABSTRACT

This paper compares a complicated trio of testing the translation quality of different translational modalities in live-streaming contexts. These are computer-assisted simultaneous interpreting (CASI), machine translation with human revision (MTHR) and machine translation (MT). The data for the present study included 80 translation-majored undergraduate and postgraduate participants and their responses to a questionnaire and post-experiment interview. The investigation revealed that, based on participants' self-perception, MTHR outperforms CASI mostly in accuracy, efficiency and clarity in thematically diverse live-streaming contexts ranging from chat shows, sports news and academic talks. However, informed by the emotion-driven NTRE model, which is adapted from Romero-Fresco's (2017) NTR model, their self-appraisals differ, with CASI being slightly better than MTHR. Moreover, MTHR largely facilitates CASI, mainly supported by intra-lingual subtitles, although it maintains imperfections, mainly including punctuation issues, omissions, mistranslation and inappropriate collocation. This paper suggests that the evaluation and reception of live-streaming translations are text-type-specific and translation-mode diverse, offering critical insights into the theoretical, methodological and pedagogical contributions of novel practices, such as machine-assisted simultaneous interpreting and MT with human revision.

1. Introduction

Although the incorporation of machine translation (MT) into different audiovisual translation modes is rapidly proliferating (de Los Reyes Lozano and Mejías-Climent 2023), relatively less research has been conducted on how AI-based tools, such as computer vision, speech recognition, and speech synthesis, are creating new dynamics and profiles across contexts and modalities. Adopting a reception-based experiment, this study

examined viewers' engagement with three different types of translations – computer-assisted simultaneous interpreting (CASI), machine translation with human revision (MTHR), and MT – under thematically diverse, live-streaming topics. It attempts to understand what type of translations cater to optimising audiences' viewing experience and their reception in the context of live streaming. As one of the most popular methods of communication, live streaming reshapes how information is circulated, reaching an audience situated anywhere in the world (Yang and Xuan 2023). It is essential to conduct thorough academic analyses of how AI-assisted tools function and to what position they are in the most recent human-centred AI process, in which AI is used to enhance human capacities and improve user experiences rather than replacing humans through automation (Rogers 2022). Therefore, it is worth researching the translation quality and audiences' reception of live-streaming translations, as they can be viewed as representative forms in the global media landscape. As the translator's role is being queried under new terms such as post-editor and text localiser in the digital age (Pym 2013), our study examines the transformative role of the translator, extending to multiple roles of scriptwriter, translator, interpreter, host, live streamer, post-editor and viewer in the creative context of live streaming.

Live streaming generally focuses on its commercial potential (Aliprandi et al. 2014), consumers' shopping intention (Febriyantoro et al. 2024) and entertainment (Massidda 2023). Extending to the commercial and entertainment nature of live streaming, we investigate the broader non-commercial settings as an emerging form of social interaction (Chen, Mustafa, and Ling 2024) to maximise user's quality of experience for live events Zhang et al. 2024, 780). These real-time programmes are often subtitled by respeaking, a speech-recognition-based technique first used in 2001. Live streaming particularly appeals to millennials who 'crave interactive, real-time and reality content', becoming a mainstream activity that adds complexity to the global media landscape (Alizila 2016). Except for the speed (d'Ydewalle and De Bruycker 2007; Romero-Fresco 2009), segmentation (Perego et al. 2010; Rajendran et al. 2013) and quality (Romero-Fresco 2016; Romero-Fresco and Pérez 2015) of respeaking, very little research has been conducted on the evaluation and reception of live subtitles (Eugeni 2009) in the Chinese non-commercial, live-streaming context. To fill this gap, this article presents the results of the first assessment of students' reception of the effects of live subtitles in China across different translation modalities and diverse live-streaming topics. The selection of these machine-generated translation modalities as the subject of our study is appropriate because they are feasible and functional for novice translators, interpreters, subtitlers and post-editors to effectively rotate roles in our live-streaming context supported by machines.

CASI involves interpreters' interlingual respeaking with live subtitles. In our study, the language pair investigated was Chinese-to-English because we used the Tencent Meeting platform, whose automatic speech recognition (ASR) quality is relatively higher from the language direction from Chinese to English in terms of meaning[1] (Tencent Cloud 2020). Machine-generated translation with human revision combines automatic voice recognition for intralingual and interlingual subtitles, followed by real-time human editing thanks to the live chatbox. Unlike the common type of machine translation post-editing (MTPE), which is a pre-prepared process aimed at improving machine-generated translations to a quality equivalent to that of a human translator (Rakhimova, Karibayeva, and Turarbek

2024, 4), this present form of machine-generated translation with human revision requires audiences to shift their gaze between the screen and the chatbox to observe how human subtitlers simultaneously identify and correct real-time mistakes made by the machine. Raw MT refers to two sub-modes: automatic voice recognition for intralingual subtitling and MT for interlingual subtitling.

Based on the main purposes of live-streaming programmes, this study proposes the NTRE model that adds emotional energy (E), 'the sustained exhilaration or enthusiasm that viewers feel in a live-streaming video, which induces initiative responses' (Xu et al. 2019). In online streaming videos, attractiveness and interactivity with audiences influence viewing experiences, which can 'motivate the viewers' endured exhilaration' (ibid.). Our study argues that this positivity also applies to live subtitles. In other words, the emotional energy displayed in live subtitles, either spoken [respeaking via simultaneous interpreting (SI)] or written (MTHR and raw MT), is the key element in forming an appealing live-streaming viewing environment, which in turn guarantees enduring pleasure for watching.

This article presents a triangulated experiment to assess the quality of three live subtitles and to compare audience reception in Chinese live-streaming practices. It maintains three-fold aspects to substantiate the live subtitling practice by proposing a theoretical model for assessing live subtitles, questionnaire-led data analysis and post-interviews. To achieve this, we aimed to address the following three research questions:

(a) Among these three translation modalities, which one(s) is/are well received by the Chinese participants?
(b) Which translation modality displays higher translation quality in the Chinese live-streaming contexts, based on the NTRE model?
(c) Do specific text types of live-streaming demonstrate different levels of emotional energy that may direct a specific selection of translation modalities?

2. Literature review

In today's rapidly evolving media landscapes, new technologies have altered the way we prosume audiovisual content via social media and streaming platforms, which have proliferated due to cloud ecosystems (García-Escribano and Díaz-Cintas 2023). Live subtitling, or real-time captioning, known in the United States, is defined as 'the real-time transcription of spoken words, sound effects, relevant musical cues and other relevant audio information' (ITU 2015). It was once used to accommodate deaf or hard-of-hearing community to follow a live audiovisual programme, but now it is extended to generalist and specialised use to either facilitate viewing experience including the sound quality of the original audiovisual products or improve interpreting practice that enables online revision during the process of interpreting (remembering, note-taking, production and coordination) (Chen and Kruger 2024, 2014). Owing to its error-prone and delayed nature, it is commonly considered one of the most challenging and supportive modalities within media accessibility (Romero-Fresco and Pöchhacker 2017). The following section will thereby revolve around literature specifically on machine translation, machine translation and post-editing and respeaking, which are closely linked with SI in terms of form in live-streaming settings.

More research efforts have been made to compare MT quality to human translations in the current mediascape (Läubli and Orrego-Carmona 2017). However, the mere application of MT is insufficient to create publishable text in a broader scope, as it always requires human intervention to fix errors included (O'Brien 2022, 105). Given that the end-products of MT are proliferating on social media platforms, further post-editing is imperative to ensure quality. The types of post-editing at least range from pre-editing, post-editing, revision, proof-reading, quality control and post-quality control, viewing from the perspective of its workflow and process (Bolaños García-Escribano and Declercq 2023, 576).

More systematic training and translation curricula of professional post-editing skills are urgently needed with the rising requirement of post-editors in the media localisation industry. However, both trainees and professional subtitlers in the field of video-on-demand streaming platforms expressed their unwillingness to undertake post-editing professions (García-Escribano and Díaz-Cintas 2023; Moorkens et al. 2018) due to unclear rates and the required scope of the service, schedule, text types and error types (Pérez 2024, 36), albeit three MTPE pricing methods commonly used in the industry depending on word, time and effort (Girletti and Lefer 2024). Therefore, it is a prerequisite to ensure the accessibility of machine-translated raw output and the quality of human-revised-based post-editing (BSI 2015). Hu and Cadwell (2016) explained that two main types of post-editing – light and full – can be found. Pérez (2024) argued that given the movable, unstable quality of the post-edited text, it is challenging to define them straightforwardly. She proposed a refined MTPE guideline that is better adapted to different text-type-specific cases, in which the translator can effectively predict the nature of the task and types of errors concerned. In our study, the types of errors drawn on live subtitles generated by MT are classified to cater to actual thematically heterogeneous live-streaming texts. However, confirming what to expect from the language-specific MT output remains ambiguous, as do the solutions to take regarding different text-type-dependent errors. This is the research gap this paper intends to fill, taking MT and human editing of live-streaming texts as a departure.

To ensure a higher gratification of using CASI, MT and MTHR and to enhance different translation modality's readability and comprehensibility featured with machine-generated live subtitles, we employ a newly adapted NTRE assessment model. 'N' is for number, 'T' for translation, 'R' for recognition and 'E' for emotional energy, adapted from the NTR model (Romero-Fresco and Pöchhacker 2017) to assess translation quality (accuracy, synchrony and fluency) and emotion energy (attractiveness and para-social interaction) of real-time subtitles. The NTR model originates from the WER and NER models. WER models represent the basic principle of word error rate to evaluate the accuracy of speech recognition of live subtitles (Levenshtein 1966), specifically used to detect three types of errors: deletions, substitutions and insertions (Romero-Fresco and Pöchhacker 2017, 151). Extra human intervention is needed to review whether deletion errors have caused a loss of information (Dumouchel, Boulianne, and Brousseau 2011), and insertions are not always necessary.

To improve this, the NER model features a three-level error grading for translation and recognition to calculate the accuracy rate of intralingual live subtitles (Romero-Fresco and Pöchhacker 2017). 'N' is the number of words in the subtitles. 'E' refers to the edition errors in which losses of idea units and miscomprehension are classified as a three-level grading

scale of minor, standard and serious errors, while 'R' means recognition errors. However, NER is mainly used to assess intralingual subtitling, insufficient to account for interlingual translation errors.

The fine-tuned NTR model is thereby devised. 'E' is exchanged for 'T', referring to translation errors. They are subdivided into content and form, where the former includes omission, addition and substitution, while the latter maintains correctness (grammar and terminology) and style (appropriateness, naturalness and register) of the live subtitles (ibid., 159). However, it seems unfit to put 'style' under the category of 'form' in our live-streaming context, as style contains expressive meaning showing 'feelings, attitudes to what is said and the personality of the speaker' (Machin and van Leeuwen 2005, 579). Therefore, we alter the sub-type of 'content' in NTR and add 'style' under the category of translation, as illustrated in Figure 1.

Tomkins's (1963, in Hemmings 2005) affects theory, referring to having 'a complex, self-referential life that gives depth to human existence through our relations with others and with ourselves' (ibid., 552), is used to evaluate the affirmative effect drawn on the live-streaming context in live translations. Affect can 'enable the satisfaction of a drive or interrupt it' (ibid., 552). This is useful for our study in evaluating the reception of these three live translations to maximise each translation modality to its fullest from the perspective of audiences' reception and perception. It is again proven that understanding the effects of live subtitles would be seen in association with the myriad ways that affect a feeling of delight in consumerism and fundamentalism, a sense of community through empathy and shared experience, and a sense of belonging that strengthens rather than challenging a dominant social order (Berlant 1997). According to Pérez-González (2016,
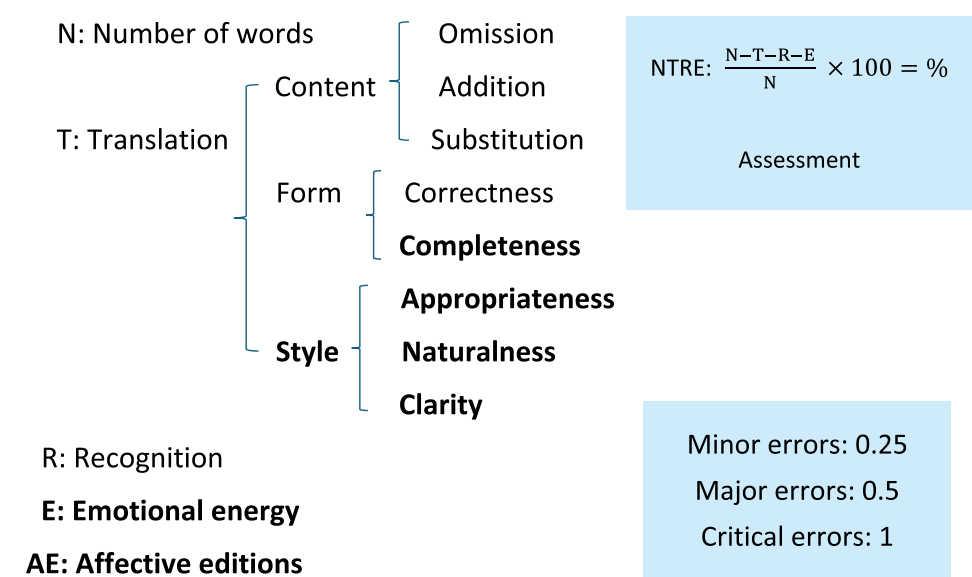

Figure 1. The NTRE model.

120), the affective potential shines through the digital mediascape by netizens' self-mediation practices rather than the actual media content that represents reality.

3. Conceptualising the NTRE assessment model in live-streaming translation practice

Drawing on the NRT model and the nature of the expressiveness of the live-streaming programme, we propose the NTRE model using a similar formula and the same error grading. 'E' is newly created accounting for improvement for emotional energy suitable for the live-streaming context. In our model, the category for deviations from the source text that do not involve a loss of information and that enhance the emotional effectiveness of the live subtitles is called 'affective editions' (AE), developed from NTR's 'effective editions' (EE), which mainly concerns effective communication. Compared with the NTR model, all newly created elements of the NTRE model are highlighted in bold in Figure 1. In the equation, 'E' stands for 'emotional energy' and has been added for accessing translation quality. 'AE' stands for affective editions, meaning the affective effects of the quality of the live translation, not the actual elements in the equation, therefore, it has not been included in the equation.

Although live subtitles seem static, they do not function in isolation. Instead, they apply to media in tandem with speech, music and effect (Kress and van Leeuwen 2001, 7) and 'how technologies are specialised or multi-purpose' (ibid., 4). When technology comes into use, it is challenging to assess live subtitles based only on their linguistic parameters. Communicative functions, such as attractiveness and para-social interaction in the live-subtitling process, are also considered. In contrast to linguistic accuracy, we use Carroll's (1966) proposals of testing translation quality concerning 'comprehension, readability and naturalness' (House 2014, 259) to guide our assessment of live-streaming translation practice throughout.

4. Research materials and methodology

4.1. Experiment setup

To understand participants' evaluation and reception of the three live translation modalities, three experiments were conducted to collect quantitative and qualitative data. All participants ($N = 80$) were translation-majored students with Chinese as their native language, enrolled in a 16-week *Machine Translation Post-Editing* training where a 1-hour task-based lesson was designed and taught at one Chinese university at undergraduate and postgraduate levels in 2024. They were chosen because they had prior knowledge and had completed the courses of different computer-assisted translations, including SI and MTPE training as the requirement of these experiments. The experiments were designed in the form of a presentation, and the participants were assigned to play different roles as interpreters, post-editors, hosts, broadcasters and audiences in each live-streaming topic during the training. Three live programmes (chat shows, sports news and academic events) and a post-experiment interview were used for the experiments, the rationales for the selections of them and procedures of which are detailed below.

Since the three translation modalities aim to investigate the effects of audiences' reception in different modalities, dynamic communication is equally essential so that translation can harness social justice and education inclusiveness (Bahadır 2011). Under this prism, diverse live-streaming topics, including career goal interviews, sports news, and academic talks, are devised to examine the effects of these different modes of live subtitles and their audiences' reception to enhance social parity. Additionally, these three topics are considered non-commercial content, with the chat shows also characterised by entertaining elements.

Each of the three live-streaming practices lasted 5 minutes using the Tencent Meeting. Inspired by neutral machine translation (NMT), this study adopts the Tencent Cloud Speech-to-Text API[2] integrated into the Tencent Meeting software Version 3.30.30(420) as the ASR technology throughout the three translation modalities of the study. Before engaging with the actual practice and viewing the actual online live-streaming show, participants playing different roles were informed that there would be a quiz for their evaluation and perception of the three live-streaming translations when the experiments were completed. Questions on the quiz were formulated based on their evaluation, comprehension, preference, usefulness, reliability and error types of the three different live-streaming translations. Specifically, participants were asked to rank the translation quality of three types of subtitles based on the NTRE model via 10-point-based Likert scales. They were briefed on the nature and severity of the errors found in CASI, MT and MTHR.

Participants were provided with all three translation modalities simultaneously across three thematically diverse live-streaming practices. On this account, an overloaded screen might have impacted audience reception. To reduce the cognitive load of their reception, participants were divided into three groups, with each group engaging in one particular live-streaming practice, assigning as host, broadcaster(s), interpreters and post-editors as the main participants and then rotated as the roles of viewers in the other two live-streaming practices. For the remaining two thematically different live-streaming practices, those participants who have acted as main participants will only engage in watching experience. The participants are would-be subtitling professionals who were exposed to subtitle MT and post-editing at the beginner level, so the respeaking rate had been set at 80–100 words per minute (wpm) (Maranzana 2018, 47), and the maximum number of characters per line at 42 (García-Escribano and Díaz-Cintas 2023, 120). For the modality of CASI, interpreter(s) can refer to the machine-generated live bilingual subtitles for their interpreting practice, as much as audiences are provided with both sets of intralingual and interlingual subtitles on the screen. For the last modality of MTHR, audiences can read the live comments produced by the post-editors thanks to the chatbox at the bottom of the commenting area of the Tencent Meeting. Participants, as audiences, were allowed to freely choose translation modalities with which they were interested to consume in the synchronic online live-streaming viewing experience.

For the MTHR modality across three live-streaming contexts, post-editor participants had to fix errors they encountered in the machine-generated bilingual subtitles, for which they were given a set of instructions for reference (Table 1). Pérez (2024) argued that more specific instructions are necessary to give the ambiguous classification of light and full MTPE; therefore, a two-step guideline (check and correct) is devised to guarantee the quality threshold in the MTHR practice. However, based on the temporal constraints of

Table 1. Instructions shared with post-editor participants, inspired by O'Brien (2011) and Pérez (2024).

	Error type	Minor	Major	Critical	Total
Translation	Completeness				
	Readability				
	Clarity				
Linguistic	Spelling				
	Punctuation				
	Capitalisation				
Technical	Synchrony				
	Segmentation				
	Line breaks				
Emotional	Attractiveness				
	Interactivity				

live streaming featured with emotional energy in the temporal–spatial limitations of subtitling setting, an error-type-based instruction under four categories of translation, linguistic, technical (O'Brien 2011) and the newly added emotional parameters is adapted from Pérez (2024) to guide post-editors working in the live-streaming environment.

4.2. Hypotheses

Prior to the experiment, three hypotheses were formulated to anticipate the possible results to map on to the three research questions accordingly. First, audiences prefer CASI over MT with human revision and raw MT. Individuals tend to prefer the affective participation that interfacial encounters have on people (Thomsen, Kofoed, and Fritsch 2021), which aligns more with SI than subtitling. Second, live subtitles generated by machines do not necessarily perform worse than those enabled by humans, and those produced collaboratively between humans and machines. This echoes Pražák et al.'s (2020) findings that machine-translated texts do not necessarily lead to the translation of inferior quality. Third, MTHR functions relatively better for specialised (sports events and academic events) and creative texts (chat shows) over the other two translations modalities in the live-streaming context.

4.3. Data and analysis

4.3.1. Evaluation and reception of live subtitles

This section reports the statistical data collected in the three experiments and their statistical analysis via IBM SPSS Statistics. We aimed to elicit the participants' opinions on their evaluation and reception of the reliability of the three translation modalities across different live-streaming contexts. However, rather than rating specific live subtitles' assessment score of various translation modalities, which will be presented later in Section 4.3.3, emphasis of this current section is placed on how the respondents received each translation modality in the overall dynamics of live-streaming settings. As shown in Table 2, over half of the participants (55%) prefer MTHR than CASI (42.5%) across three live-streaming experiments, with a marginal number (2.5%) of the participants having selected MT as a preferred translation modality. MT has yet to be included in the main assessment because audiences have rated it as a marginal factor impacting overall live-streaming practice (Table 2) at the initial stage of the experiment. Therefore, this study focuses on CASI and MTHR at the core

Table 2. The participants' reception of three translation modalities in a live-streaming context.

Translation modality	Number (N)	Percentage (%)	Cumulative percentage (%)
Computer-assisted simultaneous interpreting	34	42.5	42.5
Machine-generated live subtitles	2	2.5	45
Machine translation with human revision	44	55	100
Total 80		100	100

stage of the experiment. Please note that MT still plays an equally important role in searching for effective translation modalities in a live-streaming context. The participants were finally asked to complete the post-survey interview with open-ended questions to bring out fine-grained solutions to use translation modalities with the assistance of the machine. It has been proved that the human–AI system outperforms humans or AI alone (Vaccaro, Almaatouq, and Malone 2024), which has been well applied to our trans-translation-modal and cross-thematic-live-streaming context.

Based on the popularity gained from participants' preference for MTHR and CASI in our live-streaming practice, we further asked respondents' evaluation related to the (un) usefulness of these machine-generated live subtitles for the practice of SI, as Table 3 suggests. A significantly higher percentage (86.25%) of participants firmly believed that machine-generated live subtitles played an effective and supportive role in SI. If S. Chen and Kruger (2024) substantiate that machine-generated live subtitles can largely improve interpreting quality in terms of completeness and accuracy, what our study adds is that apart from accuracy, machine-assisted and human-revised live subtitles can also enhance simultaneous interpreters' productivity and efficiency in multiple ways. They include helping interpreters spend less time and energy to improve the detriment of latency with less cognitive load but receiving more precise information with the help of reading live subtitles rather than solely listening to the speaker (Li and Chmiel 2024). Participants prefer MTHR over CASI because of a higher level of accuracy, synchrony, processing time, less energy, fewer technical issues, less cognitive load and higher level of operability. It is more user-friendly for them to bother less with the technical issues; meanwhile, the overall quality and clarity of the live subtitles are satisfactory (Romero-Fresco 2016). However, for those few participants who are unsatisfied with the quality of live subtitles in SI, they advocate that MTHR distracts interpreters as delays may occur in the recognition of live subtitles, inappropriate segmentation and mistranslation.

Table 3. The participants' evaluation of the (un)helpfulness of MT for simultaneous interpreting (SI).

Question	Answer	Number (N)	Percentage (%)	Cumulative percentage (%)
In the live translation practice, how do you evaluate the machine-generated subtitles in the simultaneous interpreting process?	Helpful	69	86.25	86.25
	Unhelpful	7	8.75	95
	Others	4	5	100
Total		80	100	100

Table 4. Participants' preference of accuracy in terms of intralingual and interlingual subtitles.

Question	Selection	Number (N)	Percentage (%)	Accumulative percentage (%)
Which one is more reliable in the intralingual and interlingual subtitling practices?	The intralingual subtitles	62	77.5	77.5
	The interlingual Chinese-to-English subtitles	18	22.5	100
Total		80	100	100

4.3.2. Identification of errors in live subtitles

Regarding the translation quality of the live subtitles, as Table 4 illustrates, the intralingual subtitles were significantly higher than that of the interlingual subtitles from Chinese into English, with intralingual subtitles more than triple as accurate as that of the interlingual. Since there is such a large proportion of mistakes found in the live subtitling practice across translation modalities in various live-streaming contexts, it is crucial to identify the specific error types on the question.

In Figure 2, a total of 186 error types were collected for analysis. 38% of the errors belong to punctuation. According to the NTRE model in Table 5, they are typo mistakes under the category of linguistic mistakes. The rest of the major errors include omission (25%), mistranslation (23%) and inappropriate collocation (10%), which tap into the classification of translation in line with its sub-type completeness, clarity and readability, respectively. The respondents have not specified which 'other errors' refer to. Technical and emotional rubrics have yet to be discussed among participants, either. Therefore, these under-explored parts will be further analysed in the post-interview section for clarification.
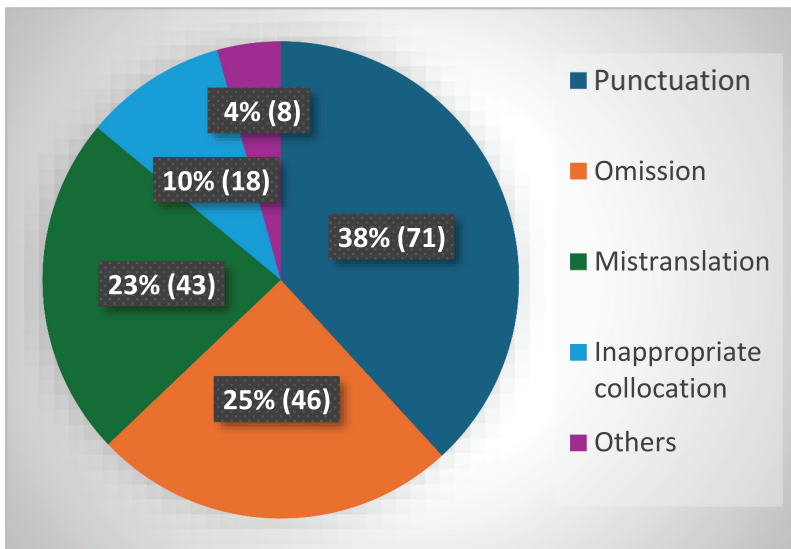

Figure 2. The participants' identification of error types in live subtitles.

Table 5. Assessing two major translation modalities across different live-streaming contexts.

Assessing categories	Assessing content	Minor	Major	Critical	Total
Computer-assisted simultaneous interpreting (CASI)	Accuracy Synchrony Fluency Attractiveness Interactivity				
Machine translation with human revision (MTHR)	Accuracy Synchrony Fluency Attractiveness Interactivity				

4.3.3. Live-streaming-text-specific analysis

In this section, we intend to assess the translation quality of three live-streaming-text-type -specific translation modalities: chat shows, sports news and academic talks. The collected data were checked for missing data if they were incomplete questionnaires and suspicious responses such as straight-lining (Hair et al. 2022), as detailed in Table 6. Overall, participants received these two major translation modalities favourably, with an average mean rating all above 8.3 out of 10. The CASI has an average mean rating of 8.52, slightly higher than the rating of 8.34 for MTHR. The result shows that participants' self-appraisals based on the NTRE model contradict their reception of using different translation modalities. Such minute differences show that participants' degree of evaluation varies slightly between CASI and MTHR. Moreover, the fine-grained rubric under each key component, such as 'accuracy, synchrony, fluency attractiveness and interactivity' does add specificities and nuances to scrutinise the sophistication of live-streaming translations' quality in both CASI and MTHR forms. Given that the difference in the average mean rating between CASI and MTHR is merely 0.18, it is safe to neglect such statistic insignificance. It can be inferred that working with technology in AVT industry, including translation modalities of CASI and MTHR, is growing significance as ASR and machine-generated translation prove to be an effective assistant in SI, though it can also result in multiple errors (Li and Chmiel 2024) as illustrated in Figure 2, to which requires our special attention.

Specifically, different live-streaming text types yield different emotional energy levels, as our case study shows. By comparing the average mean rating across different live-streaming text types of the investment of emotional energy in terms of attractiveness and para-social interactivity, sports news (8.57) matters most to viewers' reception, followed by academic talks and chat shows. The latter two are almost identical to each other,

Table 6. The participants' perception of the live-streaming translation quality of CASI and MTHR based on the NTRE model.

Translation modalities	Theme	N		Mean	Median	Std. deviation
		Valid	Missing			
CASI	Chat shows	256	51	8.64	9.00	1.321
	Sport news	223	41	8.44	9.00	1.272
	Academic talks	238	69	8.48	9.00	1.255
	Total	717	161	8.52	9.00	1.285
MTHR	Chat shows	256	51	8.30	8.00	1.580
	Sport news	223	41	8.35	9.00	1.366
	Academic talks	240	67	8.37	8.00	1.375
	Total	719	159	8.34	8.00	1.447

Table 7. The participants' perception of the emotional energy that impacts live-streaming translation quality based on the NTRE model.

Assessing element	Theme	N Valid	Missing	Mean	Median	Std. Deviation
EE	Chat shows	256	51	8.46	8.00	1.591
	Sport news	223	41	8.57	8.00	1.340
	Academic talks	240	67	8.49	8.00	1.420
	Total	719	159	8.51	8.00	1.459

accounting for the average mean rating of 8.49 and 8.46, as illustrated in Table 7. Acted as hosts and broadcasters, participants are required to perform emotionally attractive and interactive interpreting and post-editing styles to arouse audiences' attention and maintain their exhilaration. On this account, three translation modalities are given to participants to evaluate the levels across three text-type diverse live-streaming practices. For instance, the rubrics of 'attractiveness' and 'interactivity' under 'emotional energy' are measured based on broadcasters/hosts and post-editors' enthusiastic interpretation and interaction to draw audiences' attention to the charm of the live-streaming practices. Affective emotion is of utmost importance to maintain a higher level of interaction, gratification and social bonding (Tomkins 2008, 227), which is applicable in our case study's live-streaming context. SI, characterised by a relatively higher level of expressiveness, is more appealing to audiences than subtitling (Neves 2007). Therefore, it is advised to adopt the translation modality of SI when it comes to the emotionally affective live-streaming context, such as the most popular sports news, followed by academic talks and chat shows, albeit the reception difference between chat shows and academic talks is almost negligible.

4.3.4. Post-experiment interview

A post-experiment interview uncovers the ambiguities raised earlier, supplementing the under-developed issues throughout the experiment. Three interview questions related to the reception, difficulties and reliabilities of these three translation modalities in live-streaming translation were offered to 47 participants who were labelled as P1–P47 for reflections based on their experience in the experiment. First, we sought to find out the answer to the first interview question regarding participants' preferred translation modalities in live-streaming practices. 50% preferred MTHR, 20% preferred CASI, and the remaining 30% opted to combine all the three translation modalities in the live-streaming context. In the same vein, when answering the third interview question about the reliability of integrating live subtitles into SI, participants gave no clear-cut answers, as integrating MT into SI practice can be a double-edged sword. To start with the favourable factors, respondents reckoned the reliability of adopting machine-generated subtitles into SI lies in their higher level of readability ranging from punctuation and segmentation (P9), recognition of accent and dialogues (P30), accessibility for the deaf and hearing-impaired community (P10, P17, P42, and P45) and reducing interpreters' mental stress and maintaining a healthier mental status as a backup plan (P36). On the contrary, participants raised their concerns about the application of MT into SI, fuelling the need for improving the stability of technology (P27), the accuracy of the machine-generated subtitles and the professionalism of interpreters (P5, P11), the contextual

consideration (P7, P25) that may result in disjointed segments (P41), misleading culturally words when it comes to 'idioms or emotional nuances, professional knowledge' (P21), difficulty with homophones (P41), inappropriate punctuation, wrong terms and even omission (P16).

The above challenges in applying MT to SI also tap into the difficulties in the post-editing process, as reflected in the second interview question. To resolve this dilemma, respondents proposed feasible solutions. A three-step priority is advised for the collaboration between human and machine. First, ASR technology is used to generate live subtitles. Human post-editing is subsequently conducted to check and correct mistakes triggered by the first step (Pérez 2024). Simultaneous interpreters conclude by 'ensuring higher levels of accuracy and reliability, especially in complex and sensitive contexts' (P30). Admittedly, it is easier said than done. The most challenging part of post-editing in a live-streaming context is multitasking, in which the translator is required to work under tremendous pressure in limited temporal–spatial constraints in the meanwhile reading transcript by recognition system, hearing speakers' speech and justifying contextual appropriation (P18). Therefore, it is invaluable to resort to high-quality NMT and more comprehensive and generalisable models catered for different text types (Dai and Liu 2024) in the cognitive load-demanding live-streaming translation context.

5. Results and discussions

MTHR was more positively perceived than CASI, with MT being marginally regarded as satisfactory. However, results regarding participants' self-assessed translation quality scores based on the NTRE model suggest that the translation quality of CASI rated slightly higher than that of MTHR, taking emotional energy into account. The results do not necessarily suggest that the translation quality of MTHR was of a lesser quality than that of CASI, as both received a relatively higher average mean rating above 8.34/10. Our study also proves that the live-streaming text types of sports news stood out in terms of the investment of affective emotion and had the highest impact on viewers' reception, followed by the almost equally favoured academic talks and chat shows. It suggests that adopting the affective, emotion-loaded translation modality of SI is advised throughout these thematically diverse live-streaming types.

Additionally, in response to the hypotheses, given the reliability and helpfulness of MTHR in facilitating CASI, there is a positive correlation between participants' reception and adopting MTHR in the live-streaming context, which is contrary to the first hypothesis regarding audiences preferring CASI over MTPE or MT. However, regarding translation quality, the data do not allow us to suggest that the translation quality of MTHR is systematically perceived as being better than its CASI counterpart. Instead, it is reasonable to assume that CASI has a slightly higher level of translation quality than that of MTHR, given multiple errors identified in both sets of machine-assisted translation modalities in the live-streaming settings. For the last hypothesis regarding the specific translation modalities suitable for live-streaming texts, the finding is in line with our assumption that MTHR is better favoured by participants for live-streaming texts characterised by speciality (sports news and academic talks) and creativity (chat

shows). These results are insightful to standardise AI-led post-editing and SI practices as they are gaining prominence in the professional industry (García-Escribano and Díaz-Cintas 2023, 132).

6. Conclusion

We proposed an NTRE model that adds emotional energy to assess participants' reception and evaluation of the translation quality of three translation modalities in the live-streaming contexts.

This paper has drawn on insights from audiences' reception and evaluation to examine the intersections between affect theory to different translation modalities, instantiated here using the live-streaming practices of chat shows, sports news and academic talks. The most notable findings to emerge from the study relating to the reception of these three translation modalities, from Research Question 1, was that MTHR was most favourably received by participants in terms of their operability to improve accuracy and decrease cognitive load (Li and Chmiel 2024) and helpfulness in integrating MTHR in SI to maintain a relatively high level of clarity and sustain synchrony. Contrary to participants' preference for MTHR over CASI, the translation quality (Research Question 2) based on the NTRE model of CASI is slightly higher than that of MTHR, although this outcome was approximate. It proves that both translation modalities share higher levels of accuracy, synchrony, fluency, attractiveness and interactivity. Among these three text types, translating the expressive text type of sports news is emotionally more effective than the other two text types. In contrast, the deviation between academic talks and chat shows is almost identical. In such affective text type, translators may also deal with artistic elements beyond linguistic levels, resulting in an extra burden on their mental process (Wang and Daghigh 2024). Likewise, the expressive translation modality of CASI might meet the expectation of audiences' affective experience required in our live-streaming text types featured with attractiveness and interactivity (Frank and Wilson 2020).

Investigating the effect of three cutting-edge translation modalities in the rise of live-streaming contexts, this paper intends to bring methodological, theoretical and pedagogical contributions. Methodologically, qualitative content analysis and quantitative data analysis form a triangulation of data through experiment-based surveys, translation quality assessments and semi-structured interviews. The experiment-based survey and semi-structured interview allow us to identify categories and measure the frequency of opinions (Cramer 2003) relating to audiences' reception of the translation modalities across live-streaming text types, serving as a macro-level analysis. Data-based assessment complements a micro-level analysis to draw on statistical significance (Cramer 2003) of how participants assessed live-streaming translation modalities based on the NTRE model.

Our study also offers clear theoretical insights for introducing affect theory to the AI-led, live-streaming translation modalities. On the one hand, the live subtitles assessment model is updated by adding emotional energy (EE) in hybrid and onsite classroom settings (Orellana et al. 2024), recognising the creative potential of emotional alignment in live-streaming translation as a valuable aspect (De Higes Andino and Cerezo Merchán 2018). The live translation with effective, affective emotion resonates with participants to optimise their experience of immersion and exhilaration when consuming live-streaming AVT

materials. On the other hand, exploring the suitability of using specific AI-led translation modes in the live-streaming text type featured with emotional proximity can supplement the fact that AI lacks a nuanced understanding of the audiovisual context (de Los Reyes Lozano and Mejías-Climent 2023). The introduction of affect theory in AI-assisted translation modalities can open new avenues for research and theoretical development of translation technology through the lens of psychological constructs, raising translators' and audiences' awareness about the emotional impact of translation (Ameri 2024, 11).

Last, the multiple roleplays in this cross-translation-modalities live-streaming experiment cast an invaluable light on the pedagogical potentials of incorporating AI-assisted translation modalities into a wide range of non-commercial, educational, specialised and creative contexts.

It provides new insights into live-streaming translation linked to participatory culture enabled by MT and post-editing via synchronic, hermeneutic online comments. The once passive spectatorship transforms into 'active participants and co-creators of the visual content' (Zhang 2024), taking AI tools as effective collaborators in the dynamic of live-streaming translation practice. This would also equip would-be translators, interpreters, post-editors, broadcasters, etc., to better adapt to the challenges and opportunities AI offers in the multitasking setting and how they may adapt to maximise their competitiveness and mitigate their vulnerability.

Although more research is focused on comparing the translation quality between MT and human translation (Wang and Daghigh 2024), less study investigates the translation quality and audiences' reception among different AI-led translation modalities. Our study seeks to break new ground by offering the pioneering investigation of comparing participants' reception towards different AI-led, live-streaming translation practices across translation modalities. Through this multiple-role engagement in the new and exciting live-streaming translation domain, our study has brought about a much broader engagement with translation studies and vibrant disciplines such as translation technology, psychology and reception studies. Translation is viewed as 'a significant force in reshaping the globe' (Liang 2022, 264). Such powerful force dramatically changes the way we prosume AVT content ,thanks to technological progressivism (Baumgarten and Bourgadel 2023). However, the scope of this study is, inevitably, limited in terms of the number of participants, language pairs, identities of the translator, text types, translation modalities, etc. More efforts could be made to enrich the above cursory yet critical research directions, particularly using inferential statistical analyses as a supplement to our current descriptive analysis.

Notes

1. Though Tencent Meeting's ASR is more accurate from Chinese to English in terms of meaning based on its affluence of Chinese data, its ability to identify English pronunciation is better than Chinese, as each Chinese character maintains four tones that complicate the speech recognition process (Tencent Cloud 2020).
2. Tencent Cloud Speech-to-Text API can be accessed here: http://www.tencentcloud.com/?lang=en&pg= (26 Feb 2025).

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