Artificial Intelligence and the Transfer of Cultural Meaning in Simultaneous Interpreting: A Comparative Study of AI and Human English-to-Arabic Real-Time Interpretation

Mohammed Jassim Mohammed [iD]

Department of Translation/ College of Arts
University of Mosul/ Mosul-Iraq

Ziyad Anwar Mahmood [iD]

Department of English /College of Arts
University of Mosul/ Mosul-Iraq

Article Information	Abstract

Simultaneous interpreting between English and Arabic poses challenges for interpreters as they have to achieve fluency, accuracy, and cultural equivalents concurrently. Although Artificial Intelligence starts to be being involved in the process of interpreting, little is known about how well it tackles the culturally embedded content of English–Arabic interpretation compared to human interpreters. This study focuses on the difficulties of simultaneously culturally interpreting cultural elements from English into Arabic. It investigates the output of professional interpreters with that of an AI-assisted interpreting aid, Google Translate Live. To achieve that, ten key culturally loaded structures were chosen to be simultaneously interpreted by three professional interpreters and by Google Translate Live as an AI tool. The study uses an excerpt of a presidential speech that is rich of political, religious, and cultural references. The data were analyzed qualitatively and quantitatively using Pöchhacker's taxonomy of interpreting strategies and Kalina's quality assessment framework. The study found substantial differences in cultural awareness, functional adaptation, and alignment between machine output and human interpreting performance. These differences are clearly identified as professional interpreters can use interpreting strategies such as reformulation, explication, and contextualization to effectively bridge cultural gaps. However, Google Translate Live delivered acceptable results in terms of lexical choices; it often did not preserve contextual meaning, rhetorical nuance, or adequate cultural equivalents.

الذكاء الاصطناعي ونقل المعنى الثقافي في الترجمة الفورية: دراسة مقارنة بين ترجمة الذكاء الاصطناعي والترجمة البشرية الفورية من الانكليزية الى العربية

محمد جاسم محمد*   **زياد انور محمود****

المستخلص:

تشكِّل الترجمة الفورية بين الإنجليزية والعربية تحديًا للمترجمين الفوريين، إذ يتعيّن عليهم تحقيق الطلاقة والدقّة وإيجاد المكافئات الثقافية في آنٍ واحد. ومع أن الذكاء الاصطناعي بدأ يدخل في مجال الترجمة الفورية، إلا أنه لايعرف سوى القليل عن مدى قدرته على معالجة المحتوى الثقافي في الترجمة بين الإنجليزية والعربية مقارنةً بالترجمة البشرية. تركِّز هذه الدراسة على الصعوبات التي تواجه المترجمين أثناء الترجمة الفورية للمحتوى الثقافي من الإنجليزية إلى العربية. تقارن الدراسة بين أداء مترجمين فوريين محترفين وأداء أداة ترجمة فورية مدعومة بالذكاء الاصطناعي، وهي الترجمة الفورية من Google Translate Live ولتحقيق ذلك تم اختيار عشر تراكيب لغوية ذات محتوى ثقافي ليقوم ثلاثة مترجمين فوريين محترفين بترجمتها فوريًا، بالإضافة إلى ترجمتها باستخدام أداة. Google Translate Live تقوم الدراسة على تحليل مقطع من خطاب رئاسي غني بالإشارات السياسية والدينية والثقافية حيث تم تحليل البيانات نوعاً وكمّاً باستخدام تصنيف Pöchhacker لاستراتيجيات الترجمة الفورية وإطار Kalina لتقييم الجودة. توصلت الدراسة إلى وجود فروق جوهرية في الوعي الثقافي، والتكيّف الوظيفي، والاتساق بين أداء الآلة وأداء المترجمين البشر. وتبيَّن أن المترجمين المحترفين يستخدمون استراتيجيات مثل إعادة الصياغة، والتفسير، واعادة النص في سياقه لسد الفجوات الثقافية بطريقة فعالة. ومع أن أداة Google Translate Live قدّمت نتائج مقبولة من حيث الاختيارات المعجمية، إلا أنها غالبًا لم تحافظ على المعنى السياقي أو الدقة البلاغية أو المكافئات الثقافية المناسبة.

الكلمات المفتاحية: الذكاء الاصطناعي، الخصوصيات الثقافية، الترجمة الفورية، النقل الثقافي.

Introduction

The rapid advancement of AI has ushered in a new world where technology is progressively designed to simplify everyday life and make things more convenient for people. Automatic machines, software, and smart-tech devices are constantly being improved by experts in almost all aspects of life. One of these key advancements in modern communication is the translation machine. According to Paranjape et al (2020, p.3) "translation machine is an automatic software designed to translate a text from one language to another without any human intervention". Similarly, the use of AI in interpreting has developed rapidly in the latest years, especially with the emergence of real-time speech interpreting tools such as Google Translate Live (Halimah, 2018). These tools enable immediate multilingual communication. However, their performance in high-pressure situations like culture specific contexts are still uncertain.

It is universally agreed upon that SI is a complex and demanding task that involves various cognitive processes. It requires textual and contextual knowledge that interpreters should have to cope with the linguistic and cognitive challenges (Christoffels, 2004). One of the problematic aspects that causes challenges for interpreters during SI is the interpretation of deeply embedded cultural references, such as political, historical, and religious expressions. These aspects are considered problem triggers that require wide cultural knowledge in both the SL and the TL (Gile, 1995).

This study investigates how AI tools tackle the transference of English cultural meaning into Arabic during an SI task; a comparison is made between the performance of Google Translate Live and professional interpreters. The corpus of this study is based on a presidential speech of the former US

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* قسم الترجمة /كلية الاداب/ جامعة الموصل/ الموصل – العراق .

** قسم اللغة الانكليزية /كلية الاداب/ جامعة الموصل / الموصل – العراق .

president Barack Obama in 2009 in Cairo. This speech is chosen due to its richness with cultural content such as political and religious structures. The study aims to evaluate how effectively each interpreting mode (AI and human) tackles culturally loaded content when interpreting from English into Arabic in real time.

Literature Review

Artificial intelligence has recently brought substantial changes in various domains of language services especially in translation and interpreting. In simultaneous interpreting, which is a cognitively demanding process that requires a wide knowledge of linguistic, cultural and contextual competence has seen major advancements in technology with the advent of AI-powered systems (O'Hagan, 2020). Conventionally, SI is not only a real-time linguistic transformation of words but also managing cultural nuances between the SL and the TL, which is a challenging task for machines to be implemented precisely. Various studies have investigated both the possibilities and the constraints of AI in interpreting.

Among the earliest studies in the use of technology in interpreting was a study conducted by Fantinuoli (2018). This study investigates the technological evolution in interpreting practices, highlighting the impact of computer-assisted interpreting (CAI) tools in reshaping the interpreter's workflow. It stressed the impacts of automatic speech recognition (ASR) and machine translation (MT) in improving interpreter performance, especially in conference interpreting. The results of this study showed that these tools are crucial for being a means of supporting interpreters rather than taking their part due to cultural and pragmatic limitations.

In the same line, Defrancq and Fantinuoli (2020) studied the impact of an ASR-based tool, Interpret Bank, in SI tasks with considerable numerical data. The results indicated that interpreters were more accurate and confident, especially with numerical data. Moreover, the study highlighted that ASR tools do not consider nuanced aspects such as figurative language or culture specific expressions.

Saisai and Zhu (2020) investigated the difficulties of AI in dealing with high-context languages. The study showed that machine interpretation systems could not cope with cultural embedded content such as metaphors, idioms, and indirect speech acts. They also found that direct translation does not always convey the intended meaning when interpreting these cultural aspects.

Using comparative framework, Fantinuoli and Prandi (2021) compared AI-generated SI products to human interpreters' output using a communication-oriented approach. The study found that human interpreters are able to provide intelligible and culturally embedded content although AI systems are more informative. This comparison is clearly identified in high-context language combination like English and Arabic, as providing the intended meaning of cultural and rhetorical elements play a key role in the interpreting process.

In a related study, Stadler (2021) investigated how professional interpreters apply AI tools to their work. Her findings reflect that, although many professional interpreters acknowledge the benefit of AI in managing tasks such as retrieving vocabulary and managing repetitive elements, its capacity to manage culturally embedded materials is critically examined. This issue is closely related to interpretation settings as religious references, idiomatic expressions, and politically embedded content are present, which are normally identified in English Arabic interpreting task.

He, Wang, and Ding (2022) evaluated AI interpreting systems in English–Arabic and English-Chinese in cross cultural contexts. The findings revealed that AI-generated interpretations could not preserve cultural differences, which led to ambiguous pragmatic outputs. The study concluded that these AI tools cannot tackle the complex social and cultural dynamics of SI between two linguistically and culturally different languages.

All together, these studies reflect that while AI is useful in real-time interpreting, especially in structured interpreting tasks and low-context framework, it struggles to effectively convey the intended cultural meaning. This is considered an essential part of high-quality performance in SI. The current study builds on these studies by highlighting English–Arabic simultaneous interpreting and evaluating the extent to which AI tools can maintain or fail to preserve the cultural meaning in real-time settings.

AI and Real-Time Interpreting Tools

Artificial intelligence has innovated the field of language service through the introduction of real-time interpreting tools that are able to produce immediate speech translation across different languages. In other words, Neural Machine Translation (NMT) systems, such as Google Translate Live, function using deep learning algorithms to deliver more fluent and contextually precise in comparison to rule-based or phrase-based models (Wu et al., 2016). These tools support communication in multilingual settings by offering real-time translations that are especially effective in less demanding scenarios (Bowker, 2020). However, despite the notable developments, AI-driven interpreting tools face constraints while interpreting contextual and culturally embedded content. Various studies reveal that while NMT systems can provide adequate syntactic and lexical equivalences, they often could not handle idiomatic expressions, pragmatic nuances, and socio-cultural subtleties that are essential in contextual communication (Gaspari et al, 2014; Popović, 2020). This gap is crucial in a demanding task like simultaneous interpreting, as the SL cultural meaning should be preserved in the TL immediately. However, the capability of AI tools to manage such complex linguistic and cultural tasks remains unexplored (Moorkens, 2020). Although AI tools have the potential to support accessibility and speed, their current constraints stress the need for the services of human interpreters in real-time tasks, which include culturally dense content. Furthermore, scholars Studies like Shlesinger (2018),and Gaspari & Toral (2020), Pöchhacker (2022) assert that idiomatic expressions and culturally embedded metaphors are deemed as challenging elements for AI systems, whereas human interpreters apply strategies such as domestication, modulation, and explicitation to maintain the intended meaning.

Human vs. Machine Interpreting

The significant advancements of AI-powered interpreting tools have recently raised questions regarding their effectiveness as compared to professional human interpreters. Although machine interpreting systems, such as Google Translate Live, outperform in providing rapid lexical equivalents and instantly fill language gaps, they usually face difficulties with deeper aspects of meaning, especially in culturally and contextually high discourse (Wu et al., 2016; Gaspari & Toral, 2020). Human interpreters pay great attention to contextual awareness, pragmatic adaptation, and cultural mediation that AI still falls short (O'Brien, 2019; Laviosa, 2014). O'Brien (2019) indicates that human interpreters demonstrate strategic adaptability and rhetorical expertise to tailor to the audience's cultural and contextual expectations, a feature which is unavailable in machine outputs. Laviosa (2014) asserts that

human interpreters often use elaboration and paraphrasing to preserve SL intended meaning, particularly when direct equivalences are not available. However, this is considered challenging for AI systems.

Comparative studies indicate that although machine interpreting outperforms human interpreters in structured, low-context tasks, it fails in high-context situations, where cultural differences, idiomatic expressions, and pragmatic adaptations are critical (Moorkens, 2020). Human interpreters can produce higher cohesion, accuracy, and receptive audience focus on conveying culturally embedded content, particularly in political and sensitive situations (Pöchhacker, 2016; Moorkens, 2020). Moreover, although AI tools may support rapid and efficient access, they still fall short of the essential role of human skill in SI, particularly when cultural meaning is questioned.

Methodology

This study investigates the interpretation of cultural embedded content by AI tool, Google Translate Live and three human professional interpreters in simultaneous interpreting tasks. US former president Barack Obama's 2009 Cairo Speech was used as a corpus of this study as it includes cultural concepts, idiomatic expressions, contextual references, and socio-political sensitivities. The duration of the speech was three minutes, and the speech delivery speed was 120 wpm which was considered suitable for professional interpreters. The human interpreters were professionals who have more than ten years of experience in interpreting and worked at Arabic division at UN headquarters in New York. They conducted the task individually using headphones and their personal computers during June 2025. Their recordings were sent via email. While the second simultaneous interpreting task was conducted during July 2025 using Google Translate Live (via smartphone) for the same speech. The recordings of both tasks were transcribed by the researcher using TurboScribe system. The segments containing culturally loaded content are identified, and qualitatively and quantitatively analyzed using Pöchhacker's (2004) Typology of interpreting strategies, which classifies how each interpreter (AI or human) tackles cultural content in real time. Moreover, Kalina's (2000) was applied to evaluate the outcome of the chosen strategy, which was based on fidelity (to source meaning), functionality (suitability in the context), Listener-orientation(cultural appropriateness) and cohesion (clarity and fluency).

The model adopted

This study adopts Pöchhacker's (2004) typology of interpreting strategies as its analytical model. This scholar proposed a classification of interpreting strategies to help interpreters solve the linguistic, cognitive, and cultural problems during the process of interpreting. These strategies are considered systematic techniques that are intended to preserve accuracy, comprehension, and communicative effectiveness under time limitations. Among the strategies that are relevant to cultural analysis are:

Explicitation and paraphrasing: These strategies can be used when there are no direct TL equivalents for the cultural elements.

Omission and Compression: when interpreters resort to omitting or condensing the target message as cultural expressions cannot be easily interpreted or when interpreters do not have time to explain or add extra information to preserve the meaning.

Addition and Substitution: Interpreters can apply them to solve cultural gaps (e.g., proverbs, explaining metaphors, or culture-specific items).

Adaptation: it can ensure that the cultural meaning—not just the linguistic form—is maintained by interpreters.

By adopting Pöchhacker's model, this study focuses particularly on strategies that are relevant to cultural transfer, such as explicitation, paraphrasing, addition, cultural adaptation, and substitution. These strategies can help interpreters overcome the challenges of transferring cultural meaning, idiomatic expressions, and cultural items from English into Arabic. Hence, this model can provide a systematic framework for identifying and analyzing the strategies interpreters use to tackle the cultural elements in simultaneous interpreting.

For the quality assessment, this study adopted Kalina's(2000 a) model which is specific to interpreting. This model focuses on pragmatic and communicative adequacy. It uses the following Key Quality Indicators:

Fidelity: interpreter's output tends to be faithful to the SL meaning.

Functionality: highlights the communicative functions of the context.

Cohesion: focuses on the logical flow of interpreting, which includes cultural adaptation.

Listener-orientedness: examines interpreter's awareness of the cultural expectations of the target audience.

Data analysis

1. "We will extend a hand if you are willing to unclench your fist."

This sample, derived from Obama's 2009 Cairo speech, is considered as reaching out to the Muslim world. In the ST, the word "hand" refers to friendship and peace while the phrase "clenched fist" indicates aggression and hostility. These structures belong to the Anglo-American rhetorical tradition of metaphorical dualism. They are powerful in English due to their simplicity, visuality, and emotional effect. On the other hand, Arabic audiences may comprehend the linguistic meaning but may not capture the implicit metaphorical sense. In Arabic, peace metaphors do not usually refer to physical gestures, but they often reflect religious values such as salaam, reconciliation, and brotherhood. In SI, this example may cause challenges for interpreters as literally rendering sounds odd in the TL as it refers to violence and aggression in contrast to peace and reconciliation. The analysis shows that the AI tool (Google Translate Live) provides literal rendering: نمد يدنا إذا كنت على استعداد لفك قبضتك . This rendering misses the cultural and rhetorical effect when interpreting "Unclench your fist" into "لفك قبضتك" "open your fist", which lacks the cultural or rhetorical force and sounds absurd and threatening. In contrast, the analysis illustrates that professional interpreters (human) provided adequate interpreting with the use of necessary strategies. They provided سنمد يدنا بالسلام إذا كنتم على استعداد للتخلي عن لغة القوة (We will extend a hand of peace if you are willing to abandon the language of force). The strategy of paraphrasing was applied when they substituted the source message with cultural resonance items. Similarly, they employed domestication strategy when they replaced the metaphor with diplomatic language, which is commonly used in Arabic style. Moreover, the interpreters resorted to compensation as they recompensate the metaphor with the intended tone of conciliation against aggression. From the above example, the literal rendering of AI tool may affect the SL intended meaning negatively or even cause unintended attitude(such as posing physical

threat). On the other hand, human interpreters adapted the SL register and metaphor appropriately as they provided a clear political and peaceful language, which is common to Arab audiences.

2. "We were born out of revolution against an empire."

This phrase is drawn from Obama's speech 2009 in Cairo, relating the American's identity to its revolutionary origins. It describes U.S. history as a liberation narrative in terms of revolution against the power of British imperialism. he interpretation of this line conveys two purposes: (a) to remind Arabs that the U.S. itself started as an anti-colonial power, and (b) highlights the shared experiences of resisting tendency. In Western political discourse, the "birth" metaphor often refers to foundational moments (e.g., "birth of a nation"). In Arabic, this also has deep cultural history of resistance against colonialism. However, the effect differs: the Arab world often describes struggle within narratives of anti-imperialism, pan-Arabism, and religious law. The analysis shows that AI tool (Google Translate Live) provided literal interpreting وُلِدنا من ثورة ضد إمبراطورية. Though this interpretation is syntactically correct, it lacks cultural compatibility and poses ironic interpretations because the U.S. is now often seen as an empire. It also sounds awkward because the literal phrasing doesn't align with natural Arabic idiom or rhetorical style.

In Arabic, it may sound provoking a sense of pride or even contradictory when taking about U.S. policies in the Middle East. Literal rendering seems odd in this context وُلِدنا من ثورة as Obama referred to historical event that took place in 1776 which could be difficult for Arab audience to comprehend. In contrast, the human interpreters applied the necessary strategies to provide accurate rendering تأسست أمتنا من ثورة على الاستعمار، تمامًا كما عانت شعوب أخرى من ويلات السيطرة الأجنبية. In other words, they used Adaptation to adjust the TT to make the reference clearer:نشأت أمتنا من ثورة على الاستعمار (Our nation arose from a revolution against colonialism). In the same line, they used Register Alignment as they selected terms that are common to Arabic audience استعمار to comply with their historical memory. It is clear from the interpreters' rendering the use of domestication and contextualization when they used Arab anti- colonial terms.

3. "There is also one rule that lies at the heart of every religion – that we do unto others as we would have them do unto us."

Obama expressed this line as it is rooted in Christian thought — the Golden Rule — and is a moral principle common in all religions. Hence, it is used in this context as a foundation for cross-cultural dialogue. In the same vein, the structure "Do unto others as you would have them do unto you" is commonly used in English-speaking communities, particularly Christian-influenced fields. In contrast, the verbal phrasing and metaphorical effect differ in Arabic, which exists in hadiths and Qur'anic teachings. Interpreting this phrase literally may affect negatively the TL listeners who are not familiar with Christian idiomatic style. Therefore, interpreters have to provide TL cultural and religious familiar expressions. The analysis shows that the AI tool produced a literal rendering افعل للآخرين كما تحب أن يفعلوا لك, which could be understandable, but it might reflect foreign or biblical sense to Arabic-speaking Muslim listeners. This interpreting is grammatically acceptable, but may lack the cultural and religious alignment, which sounds like a foreign proverb. In contrast, human interpreters provided cultural substitution to the SL message when they replaced it with a Qur'anic or religious ethical equivalent: أحب لأخيك ماتحب لنفسك (A prophetic hadith: "Love for your brother what you love for yourself"). This rendering maintains both the SL meaning and resonance, and copes with the TL cultural and religious principles. Furthermore, a human interpreter used Paraphrasing / Explicitation when he provided ينبغي على كل إنسان أن يعامل الآخرين كما يحب أن

يُعامل هو نفسه. (everyone has to treat others in an equivalent way to how he likes others to treat him). This rendering is neutral and general which keeps communication without any religious effect. Human interpreters maintain intertextuality and cultural reference and choose SL equivalences close to Arabic listeners to preserve accuracy and rhetorical influence.

4. "The American Dream belongs to everyone, no matter who you are or where you come from."

The term "The American Dream" is a culture specific expression related to U.S. history and political style. It refers to connotations of freedom, prosperity, and the idea that working hard can lead to success. In Arabic, in contrast, this phrase has no direct cultural and may cause problems for the interpreters during the interpreting process. Despite the possibility of using literal rendering الحلم الأمريكي when interpreting this phrase, it risks keeping the vagueness or misunderstanding unless the audiences are familiar with American political context. Due to its cultural nature, Arab audiences may consider it as a mere dream apart from its socio-political connotations. The analysis shows that AI tool resorted to literal rendering for this cultural phrase; الحلم الأمريكي ينتمي إلى الجميع (The American Dream belongs to everyone). This rendering does not have the explanatory roots and may not align with the intended socio-political resonance to some of Arabic audiences who are not familiar with its connotations. The complete reliance of AI Systems on word-to-word rendering does not convey the cultural aspects of these terms, leading to appropriate but semantically inadequate renderings. On the contrary, human interpreters preserved cultural sensitivity using necessary strategies like explicitation or even contextual adaptation to align with SL intended cultural meaning. In this context, two human interpreters used explicitation when they provided الحلم الأمريكي الذي يعني فرص النجاح والازدهار لكل فرد (the American Dream, meaning opportunities of success and prosperity for every individual). Moreover, Adaptation/Localization was identified in the translation of the third interpreter contextualized the cultural phrase by using local equivalents; فرص العيش الكريم والنجاح للجميع كما يُعَبَّر عنها في الولايات المتحدة بالحلم الأمريكي (the opportunity for a decent life and success for all, expressed in the U.S. as the American Dream).

5. "Violent extremists have exploited these tensions in a small but potent minority of Muslims."

This phrase is an example of euphemistic political context. In the Western political domain, controversial and sensitive matters are presented in an indirect way to reduce the offense and preserve the diplomatic tone. In this example, the phrase "small but potent minority of Muslims" does not accuse Islam as a religion, while still relating extremism with Muslims. Interpreters should preserve the cultural content in the TL via balancing the diplomatic nature of the concept with clarity without affecting the image of Muslims in the TL context.

The analysis of AI tool reflects the use of literal rendering with interpreting this phrase as it provides لقد استغل المتطرفون العنيفون هذه التوترات لدى أقلية صغيرة لكنها قوية من المسلمين. This rendering may unintentionally cause cultural misunderstanding as it seems awkward and sound offensive with direct Muslims' stigmatism. In contrast, human interpreters applied various strategies to convey the same cultural effect in the TL context. In other words, human interpreters applied softening / mitigation to convey the blame of extremism indirectly without generalizing:لقد استغل المتطرفون هذه التوترات بين فئة محدودة من المسلمين . This, though leaves 'potent' untranslated, preserves the nuance of group limitation while preventing overemphasizing on the potency. Similarly, the strategy of Neutralization was also applied as interpreters removed the cultural euphemistic expression and applied more neutral TL expression to avoid the explicit mentioning of "Muslims": لقد استغل المتطرفون هذه التوترات في أوساط بعض الأفراد . Another human interpreter

applied explicitation: لقد استغل المتطرفون هذه التوترات عند أقلية ضئيلة لاتمثل عموم المسلمين. This clarifies the intended meaning by focusing on the smallness and exclusion. Moreover, it adds a clear disclaimer to keep neutrality. The analysis explains how euphemistic political rhetoric in English needs careful adaptation in Arabic. AI tool cannot grasp the SL pragmatic intention, which leads to literal translation. In contrast, human interpreters balanced accuracy, diplomacy intent, and cultural sensitivity when they applied the strategies of mitigation and explicitation.

6. "We are proud of our pioneering spirit at the frontier of science and innovation."

The metaphorical term "frontier" is deeply rooted in American cultural and historical style, indicating the imagery of westward expansion and the pioneering ethos. For English listener, this aligns with national identity and progress. However, in Arabic, it does not have similar historical or cultural connotations. The analysis explains that AI-assisted tools, such as Google Translate Live typically rendered this phrase into: في الحدود الأمامية للعلوم والابتكار. This word for word rendering sounds awkward and confusing, for the simple reason that الحدود الأمامية refers to physical borders but not symbolic progress. This rendering does not include cultural sensitivity to modify the interpreting dynamically. On the contrary, human interpreters often use the strategies of cultural substitution and explicitation to avoid literal interpretation for the cultural term. Hence, they provided "في طليعة العلوم والابتكار" "at the forefront of science and innovation", which preserves the SL intended meaning without losing rhetorical impact. This adaptation keeps both the clarity and cultural alignment for Arabic listeners. This example reveals that human interpreters, unlike AI system which resorts to literal rendering, can identify culturally embedded content and restructure them adequately in order to avoid misinterpretation.

7. "For centuries, Black people in America suffered the lash of the whip as slaves and the humiliation of segregation."

This phrase deeply rooted to American history of slavery and racial segregation. Structures like "lash of the whip" are considered metaphorical representations but belongs to US concrete cultural memory. Therefore, Arabic listeners have a general background about slavery which may not fully understand the real resonance of segregation as tied to struggles of civil rights in the U.S.A. The analysis shows that AI tool provided literal rendering: لقد عانى السود في أمريكا لقرون من سوط الجلد كعبيد ومنإذلا لا لفصل العنصري. In English, this interpretation is linguistically correct, but it is deemed literal in Arabic, as it lacks the rhetorical solemnity of the SL intended meaning. Moreover, the interpretation of الفصل العنصري is appropriate for segregation, but it aligns more with South African discrimination rather than the racial history of U.S.A, which is potentially confusing TL audiences. In contrast, analyzing human interpreters' rendering indicates their adjustment ability to focus on human dignity and moral injustice as they provided: لقد عانى الأمريكيون من ذوي البشرة السوداء على مدى قرون من ويلات العبودية ومن مهانة التمييز العنصري. This preserves solemnity, prevents literal rendering, and adapts the reference for Arabic listeners. Although the AI rendering is linguistically correct, it is inadequate to capture the rhetorical and emotional depth of the original message. It seems literal and implies harsh lexical terms that sound disturbing and unnatural to Arabic audiences. Human interpreters, on the other hand, can adjust fidelity with cultural sensitivity, to make it resonate with TL audiences and with deep sincerity.

8. "America and Islam are not exclusive and need not be in competition."

In this sample, the use of cultural content refers to **liberal Western believe of coexistence and inclusivity**, in contrast with Arabic-Islamic historical and political sensitivities. In English, "exclusive" means separation and contradiction while it refers to "opposition" in Arabic, which better preserves the meaning. Moreover, the phrase "Need not be in competition" indicates Western liberal discourse of coexistence and cooperation. The analysis shows that the AI tool provided أمريكا والإسلام ليسا حصريين، وليس من الضروري أن يكونا في منافسة. The literal rendering of "exclusive" ليسا حصريين is vague and confusing in Arabic, as it does not include the intended meaning of non-opposition. Moreover, rendering "Need not be in competition" as ليس بالضرورة أن يكونا في منافسة, is a literal rendering which may sound formal and less persuasive. In contrast, the three human interpreters produced: أمريكا والإسلام ليسا متعارضين، ولا ينبغي أن يكونا في حالة تنافس. This rendering shows the use of strategies like modulation/ semantic adaptation as in "ولا ينبغي أن يكونا في حالة تنافس" → "need not be in competition", "متعارضين", → "exclusive" and cultural adaptation, which maintains the diplomatic tone to fit Arab political style. This analysis reflects human interpreters' ability to adapt cultural meaning through manipulating words and tone to be suitable for Arab listeners, whereas AI rendering risks loss of persuasive impact and misinterpretation, particularly with cultural and political expressions.

9. "So long as our relationship is defined by our differences, we will empower those who sow hatred rather than peace."

The phrase "defined by our differences" is related to Western political style that often focuses on identity politics, variety, and social division. The phrase "sow hatred" derived from English culture where "sowing" refers to planting seeds — indicating that hatred grows and spreads if supported. It has a moral and cultural effect in English, encouraging people to "plant peace" instead. On the other hand, Arabic rhetoric typically applies direct ethical and Quranic references of peace rather than abstract metaphors. The analysis reveals that AI tool provides word for word rendering: طالما أن علاقتنا تُعرّف باختلافاتنا،فسوف نُمكّن سوف نمكّن الذين يزرعون الكراهية بدلا من السلام (those who sow hatred) is أولئك الذين يزرعون الكراهية. The phrase understandable, but the agricultural metaphor may not sound common or does not have the rhetorical influence in Arabic political speech. Moreover, the phrase تعرّف باختلافاتنا sounds rigid and awkward in Arabic. Similarly, the AI tool presents "يزرعون الكراهية"for "sow hatred," which is available in Arabic, but it can sound strange in a political discourse, missing the rhetorical impact. The AI rendering seems strange or vague for Arab audiences expectations because it does not differentiate between the binary framing of hatred and. Peace. In contrast, human interpreters applied strategies to provide adequate rendering as they provided مادمنا نُعرّف علاقتنا من خلال خلافاتنا، فإننا نمنح الفرصة لمن يغذّون الكراهية بدلا من أن ينشرواالسلام. The interpreters applied the strategy of adaptation / adjustment and paraphrasing when interpreting this example. In this regard, they produced; مادمنا instead of طالما أن, which is smoother, and expresses rhetorical Arabic style, من خلال خلافاتنا instead of باختلافاتنا,which is more natural collocation, يُثيرون الفتنة or يغذّون الكراهية instead of the literal rendering يزرعون الكراهية, which is considered a resonance cultural equivalence. The human rendering preserves the binary opposition; however, they adapt the rendering into diplomatic tone which is accepted in political discourse.

10. "Our daughters can contribute just as much to society as our sons."

This sample reflects Western liberal-democratic impact focusing on gender equality and women's empowerment. This phrase assumes that the listeners are familiar with discussions of feminism, equality, and human rights. The role of gender is socially and culturally different in Arabic, which is impacted by religion, rituals, and social standards. The analysis shows that AI tool interprets this phrase into يمكن لبناتنا

المساهمة بنفس القدر مثل أبنائنا في المجتمع. It is grammatically correct and lexically adequate. However, it lacks difference in tone, which consequently feels meaningless and assertive. On the contrary, human interpreters provided cultural adequate rendering as they used the strategy of cultural adaptation; بناتنا قادرات على تقديم مساهمة مساوية لمساهمات أبنائنا في المجتمع. This translation is more forceful than AI's since is a noun, and the noun, unlike the verb, conveys continuity and permanence. In other words, human interpreters adapted this rendering to look formal, clear, and inclusive. Furthermore, it preserves both semantic and cultural alternatives. They produced قادرة على تقديم مساهمة مساوية to focus on equality without leading to cultural dissonance. This example shows how Western gender equality style requires strategic adaptation in Arabic. Hence, Human interpreters adapt the tone and phrasing to align the semantic faithfulness with cultural compatibility, whereas AI tools tend to provide literal equivalents, lacking implicit sociocultural implications.

Findings

1. It is clearly noted that human interpreters consistently expressed a higher ability to maintain cultural differences, historical references, and metaphorical connotations. In contrast, AI systems (Google Live Translate) show accuracy on lexical choices, aim at simplifying and neutralizing cultural expressions (such as "the lash of the whip" interpreted literally, which loses its historical connotation in Arabic).

2. The study shows that human interpreters applied a range of strategies (paraphrasing, explication, cultural adaptation) which are already proposed by some scholars in the field of translation to help TL audiences comprehend culturally embedded expressions accurately. On the contrary, AI tools, depended mostly on word for word or near-literal rendering without using the necessary strategies, often lose the idiomatic and cultural connotations.

3. Human interpreters can adapt tone and register to indicate the political and cultural nuances of an Arab/Muslim listeners (such as religious wars and Islamic references). On the other hand, AI tools could not understand the pragmatic impact of such expressions, providing mechanically adequate but culturally inaccurate equivalences.

4. In all samples of this study, human interpreters provided a consistent use of culturally mediated strategies. However, AI renderings showed inconsistency, even when they provided adequate renderings with some examples, but with the majority of examples AI tool produced vague and culturally inaccurate interpretations.

5. Human interpreters clearly provided more appropriate renderings than AI in managing historical, religious, metaphorical, and cultural references. In contrast, AI tools coped well with the processing speed of source speech but missed the cultural adaptation, reflecting that human mediation continues to be crucial in a high task like political interpreting.

Conclusions

This study sheds light on the essential difference between AI-driven interpreting tools (Google Live Translate) and human interpreters when dealing with culturally embedded content such as Obama's Cairo speech. In contrast, AI tools are progressing in accuracy and speed levels, they show inadequacy in managing cultural expressions, metaphors, and political structures. Moreover, human interpreters applied professional strategies and cultural knowledge, which assisted them to overcome cultural challenges, providing linguistically accurate equivalences and appropriate pragmatic choices.

The findings reflect that cultural mediation is not only linguistic choices but also context based and interpretive management, requiring human decision-making acts that AI cannot yet do. Despite that fact that, AI tools can help in low-risk tasks, but in sensitive contexts such as political and cultural contents, human interpreters are indispensable.

References

1. Almahasees, Z., & Qassem, M. (2020). The impact of machine translation on the performance of English-major students in translating English idioms into Arabic. *Translation and Interpreting Studies, 15*(2), 245–268. https://doi.org/10.1080/08963568.2020.1794739
2. Baker, M. (1992). *In other words: A coursebook on translation*. Routledge.
3. Bowker, L. (2020). Machine translation literacy: Training perspectives and the impact on professional practice. In *Machine Translation and Global Research* (pp. 1–14). Emerald Publishing.
4. Christoffels, K. (2004). *Cognitive studies in simultaneous interpreting*. Ipskamp/Enschede: PrintPartners.
5. Defrancq, B., & Fantinuoli, C. (2020). Automatic speech recognition in the booth: Assessment of system performance, interpreters' performances and interactions in the context of numbers. *Target: International Journal of Translation Studies, 33*(1), 73–102. https://doi.org/10.1075/target.19166.def
6. Deng, H., Ding, L., Liu, X., Zhang, M., Tao, D., & Zhang, M. (2022). Improving simultaneous machine translation with monolingual data. *arXiv*.
7. Fantinuoli, C. (Ed.). (2018). *Interpreting and technology* (Translation and Multilingual Natural Language Processing, Vol. 11). Language Science Press.
8. Fantinuoli, C., & Prandi, B. (2021). Towards the evaluation of automatic simultaneous speech translation from a communicative perspective. *Proceedings of the 18th International Conference on Spoken Language Translation (IWSLT 2021)*, 245–254. https://doi.org/10.18653/v1/2021.iwslt-1.29
9. Gaspari, F., & Toral, A. (2020). A set of recommendations for assessing human–machine parity in language translation. *Journal of Artificial Intelligence Research, 68*, 343–384. https://doi.org/10.1613/jair.1.11566
10. Gaspari, F., Almaghout, H., & Doherty, S. (2014). A survey of machine translation competences: Insights for translation technology educators and practitioners. *Translation & Interpreting Studies, 9*(2), 1–21.
11. Gile, D. (1995). *Basic concepts and models for interpreter and translator training*. John Benjamins.
12. Halimah. (2018). Comparison of human translation with Google translation of imperative sentences in procedures text. *Journal of English Language Teaching and Linguistics, 3*(2), 141–152. https://doi.org/10.21462/jeltl.v3i2.129
13. Hutchins, W. J., & Somers, H. L. (1992). *An introduction to machine translation*. Academic Press.
14. Kalina, S. (2000). Interpreting competences as a basis and a goal for teaching. *The Interpreters' Newsletter, 10*, 3–32
15. Koehn, P. (2010). *Statistical machine translation*. Cambridge University Press.

16. Laviosa, S. (2014). *Translation and language education: Pedagogic approaches explored*. Routledge.

17. Maier, E., Clarke, A., & Stadler, H.-U. (2001). Evaluation of machine translation systems at CLS Corporate Language Services AG. In B. Maegaard (Ed.), *Proceedings of the 8th Machine Translation Summit* (pp. 223–228). Santiago de Compostela, Spain. https://aclanthology.org/2001.mtsummit-papers.41/

18. Moorkens, J. (2020). "A tiny cog in a large machine": Digital Taylorism in the translation industry. *Translation Spaces, 9*(1), 12–34.

19. O'Brien, S. (2019). More than tweets: A critical reflection on developing and testing crisis machine translation technology. *Translation Spaces, 8*(2), 300–333.

20. O'Hagan, M. (Ed.). (2020). *The Routledge handbook of translation and technology*. Routledge.

21. Paranjape, A., Bhattacharyya, P., & Joshi, A. (2020). *Machine translation and natural language processing*. Springer.

22. Pöchhacker, F. (2004). *Introducing interpreting studies*. Routledge.

23. Pöchhacker, F. (2022). *Introducing interpreting studies* (3rd ed.). Routledge. https://www.routledge.com/Introducing-Interpreting-Studies-Third-Edition/Pochhacker/p/book/9780367433083

24. Popović, M. (2020). Informative manual evaluation of machine translation output. *Proceedings of the 28th International Conference on Computational Linguistics (COLING 2020)*, 5059–5069. https://doi.org/10.18653/v1/2020.coling-main.444

25. Shlesinger, M. (2018). Simultaneous interpreting. In S. Chan (Ed.), *An Encyclopedia of Practical Translation and Interpreting* (pp. 531–561). The Chinese University Press.

26. Somers, H. (2003). Machine translation: Latest developments. In H. Somers (Ed.), *Computers and translation: A translator's guide* (pp. 165–184). John Benjamins.

27. Wu, Y., Schuster, M., Chen, Z., et al. (2016). Google's Neural Machine Translation System: Bridging the gap between human and machine translation. *arXiv*. https://doi.org/10.48550/arXiv.1609.08144

28. Zheng, S., & Zhu, S. (2021). A study of college English translation teaching in the age of artificial intelligence. *Proceedings of the 2021 7th Annual International Conference on Network and Information Systems for Computers (ICNISC)*, 1–5. https://doi.org/10.1109/ICNISC54316.2021.00188