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Translation of Subtitles: Neurolinguistic and Cognitive Aspects

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Abstract: *The present research delves into the intricate neurolinguistic and cognitive dimensions inherent in the translation of subtitles. Recognizing translation as a multifaceted cognitive endeavor, the study explores the interplay between linguistic and extralinguistic factors that significantly impact translation output quality. It underscores the paramount role of cognitive aspects in enhancing the comprehension of the translator's work, delving into the processes governing human cognition during translation. Drawing from an interdisciplinary approach integrating insights from psychology, neuroscience, and linguistics, the research provides a comprehensive understanding of how translators navigate complex tasks such as meaning-making, context adaptation, and linguistic creativity. The study mainly focuses on audiovisual translation, considering film an intricate medium encapsulating diverse linguistic and visual elements. Subtitling, as a confined mode of translation within audiovisual content, emerges as a pivotal domain within translation studies. The research aims to shed light on the cognitive and neurolinguistic challenges translators face, emphasizing the critical role of subtitles in facilitating better viewer comprehension. Furthermore, the research explores stress factors impacting translators during language switching, the structural-semantic gap between languages, and the difficulties in selecting translation equivalents. The former recognizes the even balance between linguistic fidelity and cultural relevance, demanding heightened cognitive efforts from translators. To avoid these challenges, the study advocates for continual experience updating, expansion of background knowledge, and the augmentation of databases of translation equivalents. Stress management strategies, including self-correction and refined language proficiency, are identified as crucial tools for enhancing translation quality. In conclusion, this research contributes to the existing body of knowledge by unravelling the cognitive challenges of subtitle translation, providing valuable insights for practitioners specialized in translation studies.*

Keywords: *neurolinguistic and cognitive dimensions; linguistic and extralinguistic factors; audiovisual translation; subtitling; translation output; cognitive effort.*

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1. Introduction

The emergence of information and communication technologies has fundamentally altered the human experience, ushering in a new era marked by profound transformations. These technologies transcend the mere existence of computers and envelop the individual in a virtual realm, which has evolved into a prevailing aspect of modern existence (Nerubasska, Palshkov, & Maksymchuk, 2020). Moreover, in recent times, there has been a noteworthy surge in demand for multimedia products, fulfilled through the provision of multimedia programmes disseminated by broadcasters and the Internet.

Technology also plays a pivotal role in various facets of audiovisual translation (hereinafter—AVT): during the generation of translations, their dissemination and reception, and the research procedures associated with AVT (Matamala, 2019). Therefore, AVT professionals leverage technology to adapt translations to diverse audiences' cultural implications, linguistic conventions, and preferences, ensuring the content resonates authentically in various global markets.

Within communicative constructs, cinematic productions provide an unparalleled platform for scrutinising the intricate dynamics among language, visual communication, and cultural context. Thus, the former are considered to be multimodal texts. Tuominen, Jiménez Hurtado, & Ketola (2018) maintain that "the translation and the translational inquiry of such texts need to include a careful consideration of both the individual meaning-making resources involved and the way they tie together to form a multimodal entity". This perspective aligns with acknowledging the multifaceted nature of meaning construction in translation. The former emphasises the significance of a comprehensive understanding that encapsulates the nuanced components and their cohesive integration within a multimodal framework.

Technological advances serve as "a main drive" (Guillot, 2019) in the comprehensive examination of facets within the domain of subtitling. Recently, there has been a growing scholarly interest in translating subtitles. The latter is perceived as a cost-effective instrument to mitigate language barriers among audiences with diverse cultural and linguistic backgrounds (Liao, Kruger, & Doherty, 2020).

Suratno and Wijaya (2018) delineated the strategies utilised in the translation of subtitles to ensure adherence to established quality standards. Similarly, Abdelaal (2019) sought to identify subtitling strategies employed in American films, with a specific focus on the translation of culture-bound terms and the evaluation of the translation quality of these culturally specific terms. In contrast, Perego et al. (2010) scrutinised the cognitive processing of a segment of a subtitled film. This investigation employed a methodological framework integrating eye movement data, word, and visual scene recognition.

Regardless of the versatile aspects covered in these scientific works, there are still ample issues to be addressed in further research. Concerning AVT and subtitles in particular, House (2016) appropriately argues for the necessity of a theoretically grounded depiction and elucidation of the cognitive processes that underlie the strategies utilised by translators in tasks related to comprehension, problem-solving, and decision-making regarding the text.

This paper aims to address the intricacies of translating subtitles through a lens grounded in neuro- and cognitive linguistics.

This research holds promise and relevance on multiple fronts regarding recent global events and prevailing trends in translation studies. Primarily, it scrutinises the impact of film translation processes on the linguistic and cultural meanings inherent in films as they traverse diverse linguistic and cultural landscapes. Secondly, the research reveals the peculiarities of a distinctive process involving generating and disseminating linguistic and multimodal elements in the target language text. Thirdly, it offers viewpoints enhancing the current understanding of the neurolinguistic and cognitive characteristics inherent in the process of AVT. Finally, the study articulates the essence of language transfer and delineates the communication characteristics inherent in interactions among speakers of different languages.

Diverse linguistic methodologies have been employed to attain the established objectives. The research methodology is anchored in the overview of neurolinguistic and cognitive approaches directed toward examining issues related to translating subtitles. The current literature review has facilitated the issues caused while juxtaposing the source language (hereinafter – SL) message with the target language (hereinafter – TL) counterpart, elucidating cognitive difficulties in meaning transmission.

These interdisciplinary insights offer a holistic view of the cognitive demands imposed on translators, enabling a comprehensive understanding of the challenges inherent in the translation process. The methodology draws on established theories from cognitive science, psychology, and linguistics, allowing for an in-depth exploration of the mechanisms that underlie the translation of audiovisual texts. To synthesise these interdisciplinary perspectives, the study critically reviews the existing literature on cognitive processes in translation, with particular emphasis on how cognitive barriers affect the interpretation of audiovisual texts. Moreover, the research explores the cognitive difficulties involved in meaning transmission and the specific challenges subtitlers face in reconciling linguistic differences, such as grammatical structures, pacing, and cultural aspects. The methodology also incorporates an examination of cognitive load theories, neurolinguistic models, and AVT frameworks, with an emphasis on how these theories inform the subtitling process. Furthermore, the study explores the potential drawbacks and cognitive load associated with using modern technologies in translating subtitles, namely machine translation and artificial intelligence tools, relying on insights from computational linguistics.

As a result, this synthesis of theories from multiple disciplines provides a clearer understanding of how subtitlers process and produce translations, balancing linguistic accuracy with the need to maintain clarity and coherence for the audience. The interdisciplinary approach also informs the study of translation strategies and cognitive mechanisms, such as language switching, interlingual interference, and stress factors, which are essential for understanding the intricacies of translating subtitles effectively.

2. Exploring the specificity of audiovisual translation

As a cultural phenomenon, the film wields a transformative influence on its audience. The former serves as a sociolinguistic construct, encapsulating a communicative act centered on a sequence of events that embody national character, stereotypes, and cultural consciousness. Each scene within a film assumes significance as it functions as a conduit for imparting insights into the cultural values embedded in the collective human psyche, shedding light on pressing societal concerns.

Audiovisual texts serve as vehicles for the transmission of translatable information through two concurrent channels of communication. These channels simultaneously convey codified meanings by employing distinct sign systems. The acoustic channel facilitates the transmission and reception of acoustic vibrations, encompassing words, paralinguistic information, the soundtrack, and special effects. In parallel, the visual channel facilitates the transmission and reception of light waves, encompassing images, colours, and movement, as well as posters or captions featuring linguistic signs (Chaume, 2013). The dual modality of audiovisual texts enriches the communicative landscape, allowing for a more precise and comprehensive meaning presentation. The synergy of these two channels enables a multilayered interpretation, catering to diverse cognitive and sensory modalities. Gambier (2023) asserts that meaning arises through the intricate interplay among the visual elements displayed on the screen, the symbiotic relationships among these elements, the diverse stakeholders within the film industry, and the nuanced interactions unfolding between these components and the audience. Moreover, using different semiotic systems enhances the potential for semiotic depth, contributing to a more immersive communicative experience. Thus, the audiovisual text poses a more formidable challenge for a translator than any other form of oral or written discourse.

One of the defining features of AVT is the demand for synchronicity between verbal and non-verbal elements. Achieving this balance requires meticulous attention to timing, pacing, and cultural nuances. Whether in subtitling, dubbing, or voice-over, the translator must navigate the temporal constraints of the medium without compromising linguistic faithfulness or cultural relevance. Neurologically, this process involves language processing, visual perception, and executive functions. The translator must rapidly assess the semantic and syntactic structure of the source language, make informed decisions regarding linguistic equivalence, and synchronise these linguistic choices with the unfolding visual narrative. The challenge lies in linguistic proficiency and the cognitive agility to handle real-time decisions, considering temporal and spatial limitations.

Both linguistic and extralinguistic factors significantly influence the faithfulness of the translated product in AVT. In cinematic productions, cultural components are inherently tied to national specificity. This cultural layer facilitates an understanding of the characters' cultural and social milieu, crucial for an accurate and faithful interpretation. Given that audiovisual texts are crafted for immediate viewer comprehension, a loan translation of foreign cultural elements, bereft of supplementary explication, fails to enhance clarity and the audience's immersive experience. Moreover, it risks erecting an additional cultural barrier. Thus, AVT necessitates linguistic proficiency and a deep understanding of cultural references, humour, and socio-political contexts. Failure to capture these elements may lead to a loss of meaning, affecting the viewer's overall comprehension and experience.

Exploring culture represents a multifaceted endeavor, intertwining sociological and cultural-science dimensions. Moreover, it takes on the characteristics of a cognitive science undertaking, as it delves into foundational factors influencing human intelligence and capability, in conjunction with collective and communicative endeavors, constituting essential facets of the investigation (Risku, & Windhager, 2015). Thus, the interdisciplinary nature of cultural study and translation, where sociological, cultural science, and cognitive science paradigms converge, can unravel the intricacies of human cognition and cultural dynamics comprehensively.

The process of AVT entails a complex negotiation between linguistic fidelity and cultural relevance, particularly when addressing cultural differences that are intrinsic to various genres. Comedy, for instance, poses unique challenges in subtitling due to its reliance on wordplay, humour rooted in cultural references, and timing synchronised with visual cues. Translating a comedic film often demands creative solutions, such as adapting idiomatic expressions or replacing culturally specific jokes with equivalents that resonate with the target audience. In contrast, drama tends to emphasise more emotional resonance and narrative depth, requiring a subtler approach that preserves the authenticity of the characters' expressions and the sociocultural context in which they are situated. These genre-specific considerations highlight the adaptability required in AVT, where the translator must balance linguistic accuracy with the need to engage viewers meaningfully across cultural boundaries.

Moreover, subtitling practices vary significantly in different linguistic and cultural contexts, particularly between languages with notable structural differences. For example, translating from English to Japanese involves reconciling distinct grammatical structures, varying levels of implicitness in communication, and differences in reading direction. While English subtitles often condense dialogue to fit the temporal constraints of the medium, Japanese subtitling may prioritise maintaining the original tone and nuance, even if this requires additional linguistic reworking. Conversely, translating from Japanese to English can involve unpacking culturally embedded concepts that lack direct equivalents in the TL, necessitating a more explanatory approach to bridge the cultural gap.

A comparison of films with varying degrees of cultural specificity further illustrates the challenges of achieving both linguistic fidelity and cultural relevance. For instance, a historically rooted film like "The Favourite" (2018) requires the translator to handle period-specific language, archaic expressions, and specific cultural references from 18th-century England, which may be unfamiliar to a non-English-speaking audience. The former is also laden with period-specific

expressions, aristocratic jargon, and subtle social cues that are deeply embedded in the British cultural context.

For example, certain terms of address or witty, sarcastic remarks carry connotations that are difficult to directly render into other languages. The subtitler's challenge here is to preserve the humour, social hierarchy, and irony while ensuring the meaning remains clear for a global audience. Translators must navigate the delicate balance between linguistic faithfulness and cultural relevance, as certain expressions, such as "Your Grace", or idiomatic British humour, may not have direct equivalents in languages like Spanish, French, or Italian. The translator must adapt these expressions to maintain the original tone without sacrificing clarity, which often requires creative solutions and cultural mediation.

In contrast, a globally marketed animated film such as "Encanto" (2021) incorporates Colombian cultural elements, including regional music styles, traditional clothing, and familial dynamics. For example, it uses culturally significant terms like "*madrigal*" (a reference to the family name) and expressions tied to family structures and traditions. While these elements are familiar to Colombian audiences, they may require explanation or adaptation for international viewers. In the subtitling of the animated film, the challenge lies in conveying these cultural references without alienating viewers unfamiliar with Colombian culture. In some instances, translators opt for footnotes, explanations, or equivalent cultural references that capture the essence of the term rather than a direct translation. This ensures that the film's emotional depth and cultural significance remain intact. Translators working on such an audiovisual matter must adapt these culturally specific elements to ensure their relevance and appeal to a broad international audience while preserving the unique essence of the source culture.

Thus, addressing cultural gaps in AVT extends beyond linguistic equivalence to encompass a broader understanding of how audiences perceive and interpret audiovisual texts. Translators must consider the sociocultural frameworks that shape audience expectations and reception, leveraging their insights to craft translations that resonate with viewers while respecting the source material's integrity. After analysing subtitling practices across genres, languages, and cultural contexts, it becomes evident that AVT is not merely a technical endeavor but a deeply creative and culturally sensitive process.

Furthermore, the act of translation fundamentally operates within the sphere of language and its cognitive underpinnings (House, 2015). This perspective aligns with the understanding that translation, at its core, engages with linguistic intricacies and the cognitive processes governing language comprehension and expression. AVT stands as a quintessentially interdisciplinary field (Zanotti & Ranzato, 2019) as it involves a convergence of linguistics, cultural studies, and film studies, highlighting the intricate interplay between language and visual elements in this specialised form of translation.

Film subtitles constitute a unique manifestation of cinematic discourse and represent a distinct form of translation (Guillot, 2020). As textual manifestations of source dialogues, which are inherently representations within a single language of naturally transpiring speech, these written counterparts constitute a dual layer of fiction. In this regard, Thawabteh (2011) maintains that bearing sagacious qualities as a translator does not serve as a universal remedy for resolving the persistent array of challenges inherent in subtitling, as these predicaments are multifaceted, encompassing linguistic and cultural dimensions. Hence, the challenges associated with the translation of subtitles extend beyond judicious language and cultural choices. They necessitate a deep comprehension of the audiovisual context, viewer perception, and the intricate interplay between verbal and visual elements, including considerations of "the spatial and temporal specifications" (Díaz Cintas, 2012), neurolinguistic and cognitive constraints. A comprehensive approach to subtitling necessitates transcending linguistic and cultural acumen to address the multifaceted nature of AVT, requiring adaptability and strategic decision-making in response to the diverse complexities presented in this field.

3. Cognitive and neurolinguistic insights into translating subtitles

While the study of translation has been approached from various angles, there is unequivocal recognition of the paramount significance of cognitive skills in the translation process. This practice constitutes a communicative and cognitive endeavor entailing textual operations. In this respect, the term "text" transcends its exclusive association with the written language. However, since interpreters engage in their designated tasks, the articulated content may also be manifested in the spoken form. Hence, a cognitive endeavor consistently endures throughout the entirety of the process, irrespective of the medium, whether oral or written (Erton, 2020).

Cognitive sciences play a pivotal role in enhancing our understanding of the translator's work by delving into the intricate processes that govern human cognition during translation. The cognitive aspects of language comprehension, decision-making, and problem-solving are critical considerations for translators. Xiao and Muñoz Martín (2021) posit that the construction of models in Cognitive Translation and Interpreting Studies is distinguished by its noteworthy characteristic of interdisciplinary inspiration. In this regard, the interdisciplinary approach, drawing from psychology, neuroscience, and linguistics, provides a nuanced comprehension of how translators manage complex tasks such as meaning-making, context adaptation, and linguistic creativity. Furthermore, integrating cognitive sciences enriches the appreciation of the translator's cognitive endeavors and contributes to refining translation theories and practices. Ultimately, Shreve and Diamond (2016) assert that the field of cognitive neuroscience holds greater potential for enhancing our comprehension of translation than solely introducing novel instruments.

As a mode of multimedia communication, the film emerges as an intricate and multifaceted medium, encapsulating diverse elements and incorporating language and visual elements. The use of language within the film is a linguistic phenomenon, given its foundational role in communication processes. In the seminal research on AVT, Sokoli (2009) elucidates distinct characteristics that set the audiovisual text apart from other discourse genres. These distinguishing features include: 1) reception facilitated through both acoustic and visual channels; 2) a substantial prevalence of non-verbal elements; 3) synchronisation between verbal and nonverbal constituents; 4) presentation on screen involving reproducible material; and 5) a predetermined sequence of moving images constituting recorded material. These defining attributes collectively contribute to the distinctive nature of audiovisual texts, presenting a compelling subject for scholarly exploration within translation studies.

Subtitling as "a confined mode of translation" (Mollanazar & Nasrollahi, 2019) constitutes a pivotal domain within translation studies. Working with the former, the translator is required to condense the translation into a limited number of lines and characters according to the international standards for reading speed and subtitle display on screens. Subtitles should be synchronised with changes in the frame, thereby reducing translation time. In this context, the former encompasses textual elements displayed on the screen synchronously with the characters' dialogues, appearing either in the language concurrent with the audiovisual content (intralingual subtitling) or in an alternative target language (interlingual subtitling). In comparison to other methods of AVT, subtitles introduce minimal distortion to the content of the original translated text. However, Mollanazar and Nasrollahi (2019) assert that subtitling engenders psychological and cognitive demands upon practitioners that diverge significantly from the challenges encountered by textual translators within the confines of its widely acknowledged literal interpretation. Thus, in addition to proficiency in translation, subtitlers are required to possess supplementary specialised skills and operate efficiently the strategies aimed at surmounting prevailing barriers.

In the translation of films, the interpreter is confronted with synchronising it with the original text. Given the differing pace of language and grammatical structures that do not align across languages, there is often a necessity to resort to translation transformations, artificially condensing or expanding the text. Furthermore, as the audiovisual text is designed for immediate perception, it must be maximally informative and comprehensible to the viewer. In this respect, Bogucki (2020) points out that the deficiency of information within subtitles leads the audience to a

state of bewilderment regarding the intended meaning of the respective scene. Consequently, this circumstance imposes an augmented cognitive burden on the viewers.

The scholar emphasises the detrimental impact of insufficient information in subtitles, noting that such inadequacy can lead to audience confusion regarding the intended meaning of a scene. This confusion, in turn, necessitates increased cognitive effort on the part of the audience to make sense of the audiovisual content. Thus, subtitles serve as a crucial component of the interpretive process, not merely as a linguistic aid but as a cognitive scaffold for viewer comprehension.

According to Onyshchak et al. (2021), "cognitive barriers can be easily overcome if the interpreter projects the cognitive environment of the parties to the exchange". In other words, the role of comprehensive subtitling in ensuring content comprehension by the audience is critical. A nuanced understanding of visual narratives without any cognitive challenges arising from the lack of adequate information is possible by facilitating clear and informative subtitle content. Thus, interpreters can facilitate a more seamless and accurate information exchange, thereby contributing to effective cross-linguistic and cross-cultural communication by recognising and addressing the cognitive dimensions of communication.

Regardless of the inherent constancy, formulaic nature, and unassailable quality of the linguistic expressions employed for media-related objectives (Nykytchenko, 2019), it is crucial to recognise that such linguistic characteristics can indeed give rise to significant cognitive challenges during the translation process. The latter is predominantly influenced by specific socio-cultural and historical experiences common among representatives of the culture associated with the target language (Onyshchak et al., 2021). Linguistic nuances embedded in media content, such as fixed expressions and formulaic language, interact dynamically with the socio-cultural and historical dimensions of the target language. Translators must navigate the delicate balance between linguistic faithfulness and cultural relevance, as certain expressions carry socially embedded meanings that resonate within specific cultural frameworks. This intricate interplay demands a heightened cognitive effort as translators grapple with the linguistic intricacies of the source language material and the intricate layers of cultural connotations. The challenge lies in preserving the integrity of both linguistic and cultural dimensions to ensure a faithful and meaningful interpretation of communication in the target language.

The main linguistic challenges that affect a translator's thinking include things like specialized vocabulary, abbreviations, idioms, puns, and other tricky elements in the source text

Setton (1999) suggests that some expressions interpreters use may come across as standardised phrases taken from a kind of mental phrasebook. However, many holistic and idiomatic translations, which align with the traditional idea of "free" translation, pose a challenge to psycholinguistics. The difficulty arises from their resistance to being modeled within the framework of semantic representations and "other knowledge." The scholar highlights the complexity of translation, emphasizing the need to understand how formulaic elements interact with the interpreter's ability to make creative and linguistic choices.

Gillies (2019) says that "hearing what you already know will reduce the effort required to understand what you're listening to; reduce stress levels; and make it easier to remember what you hear during the speeches". To help translators handle this kind of stress, it's important to use specific strategies and keep updating their knowledge of subject-specific terms, broaden their general background knowledge, and build a strong database of common translation equivalents in their long-term memory.

The source's linguistic system is activated as soon as the first part of the message is perceived, serving as cognitive input for the cross-linguistic processes, where the source language material transforms the target language within the context of a translation or interpreting task (García, 2019). Following the assimilation of incoming information, the linguistic system of the target language is subsequently activated. Throughout the interpretation process, both linguistic systems remain in an active state. At this juncture, a mechanism for language switching becomes

activated, facilitating a continuous scan of both systems to identify correspondences between the target and source language units. Sustaining both systems in an active state necessitates significant cognitive efforts from the interpreter. Thus, the neurolinguistic aspects of translating subtitles encompass the interplay between language centers, memory retrieval, and the cognitive load associated with multitasking. Understanding how the brain navigates these complexities sheds light on the cognitive demands imposed on translators and contributes to refining practices in AVT.

In cognitive mechanisms, interlingual interference is the most stressful factor in language switching. Collados Aís and García Becerra (2015) argue that interpreting can be understood as a service aimed at enabling comprehension of messages expressed in another language. From this perspective, it is reasonable to conclude that this activity is guided by a set of governing principles. Therefore, to mitigate interference, a translator must possess the ability to suppress conflicting correspondences and activate those that best adhere to translation norms. In such instances, the translator frequently employs the strategy of self-correction to fine-tune the linguistic output. This process involves a delicate balance between inhibiting disruptive language elements and reinforcing linguistic correspondences that align most effectively with the established norms of the translation process. Following applying the translation language system, the translator selects the translation variant. At this stage, the anticipated variant is verified to ensure its conformity with the original message's content according to the translation language's norms. This process involves a meticulous examination to ascertain the alignment of the translated output with the linguistic standards governing the act of translation.

The stress factor for the selection mechanism of translation equivalent is the structural-semantic gap between the original and translated languages. In other words, the expression's structure and the sense embedded in the original message do not always align with equivalent constructions in the translated language. This aspect underscores a fundamental challenge in translation, where the intricate interplay between structural elements and cultural meaning demands careful consideration to navigate the complexities of conveying the intended message across linguistic boundaries. A translator who serves as "a cultural mediator" (Katan & Taibi, 2021) will have to cultivate a heightened level of intercultural awareness and sensitivity, and possess the ability to assess the efficacy of translation decisions contingent upon specific cultural contexts. The inherent tension arising from cultural misalignment presents a notable stress factor in the translation process, requiring translators to navigate and mitigate the impact of structural and semantic disparities between the source and target languages.

As a result, the translator's attentional faculties undergo significant degradation. Consequently, there is an intricate connection between psychological aspects and the cognitive abilities essential for producing effective translation. To mitigate the adverse impact of stress, a translator must consistently refine his/her language proficiency, broaden the range of equivalents, and enhance familiarity with the terminology specific to the thematic domain in which they perform translation. It is also very important to actively use self-correction mechanisms as a proactive way to reduce stress. This practice helps translators continuously refine their linguistic skills, making it easier and more precise to handle the complexities of audiovisual translation (AVT).

The process of subtitling has often been seen as a cognitive and linguistic challenge for translators, as it heavily focuses on the mental effort and decision-making required to convey meaning from one language to another. These factors are important for understanding the translation process but they often miss the bigger picture: the main goal of subtitles is to bridge the gap between the audiovisual content and its audience. While the subtitles were initially designed as a bridge between languages, now they have a dual purpose. Firstly, subtitles not only offer linguistic translation but also play a key role in aiding cognitive processes like comprehension, memory retention, and emotional engagement. For viewers, engaging with subtitles is an active process rather than a passive one (Chandler & Munday, 2020). Cognitive research on subtitle processing shows that viewers actively interact with the subtitled content. They use complex mental processes to decode, interpret, and retain information. This involves not only linguistic decoding but also

integrating visual and auditory cues from the film, which demands efficient management of cognitive resources.

increases as they have to navigate between multiple languages, often requiring varying levels of familiarity with both the source language (SL) and the target language (TL).

In multilingual settings, the cognitive load on viewers increases as they have to navigate between multiple languages, often requiring varying levels of familiarity with both the source language (SL) and the target language (TL). Under these circumstances, the viewer's ability to comprehend the subtitled material depends not only on their proficiency in the TL but also on their capacity to handle the additional cognitive load of language switching, especially when subtitles are translated from a third language (Liao, Kruger, & Doherty, 2020). However, these considerations necessitate further investigation into how multilingual audiences process subtitles and how the subtitling strategies employed can either facilitate or hinder comprehension. In particular, the effect of subtitles on viewers' cognitive engagement is critical in understanding how information is retained and integrated throughout the viewing experience.

Research on the psychological effects of subtitles has shown that viewers process subtitled content differently based on factors such as familiarity with the language, reading speed, and prior knowledge of the content. The study on the retention of information from subtitled material indicates that comprehension is strongly linked to the viewer's ability to quickly decode the written text while simultaneously processing the audiovisual stimuli (Perego et al., 2010). In this regard, the viewer's prior knowledge of the content, including cultural references, themes, and narrative structure, plays a key role in shaping their cognitive engagement. Consequently, in multilingual settings, the complexity of this cognitive task undeniably increases as viewers must switch between languages or rely on their second or third language skills to make sense of the subtitled material.

However, it is not only the text itself that impacts the viewer's comprehension. The broader context of the subtitling process must also be considered. The cultural and linguistic choices made by subtitlers influence how viewers interpret and connect with the content. Moreover, the use of culturally adapted subtitles can either enhance or hinder viewer understanding, depending on the level of familiarity the audience has with the cultural context.

4. The role of technology in AVT

The intersection of technology and translation has become an increasingly prominent area of research, especially in the realm of AVT, where subtitles play a crucial role in mediating meaning across languages and cultures. While technological advancements, particularly in machine translation and artificial intelligence (hereinafter – AI) have significantly impacted translation practices, their influence on subtitling has not been explored in sufficient depth.

Machine translation, defined as the use of computer programs to translate texts from one language to another, has long been used in translation studies. The integration of these tools into the subtitling process has opened new frontiers in terms of speed and accessibility, particularly when dealing with large volumes of content. However, while machine-generated translations can produce quick results, their adequacy in conveying meaning accurately and fluidly remains a contentious issue. This is especially relevant in AVT, where visual, auditory, and linguistic elements must be harmonised to create a coherent and culturally appropriate translation.

The subtitling process involves the transformation of speech into concise, readable text, which not only requires linguistic accuracy but also adherence to various constraints, such as time limits, reading speed, and synchronisation with audiovisual content. These constraints present challenges that machine translation tools often struggle to address. For example, they can face difficulty in rendering idiomatic expressions, slang, or culturally specific references that require deeper understanding and creative adaptation. While neural machine translation models, such as Google Translate or DeepL, have shown improvement in producing fluent translations, they still face difficulties with the contextual subtleties that AVT demands. The former, which utilises large data sets to generate translations, often provides literal translations that fail to capture the meaning

and tone intended by the original dialogue (Bahdanau, Cho, & Bengio, 2015). This is particularly true in film subtitling, where humour, colloquial expressions, and tone play a critical role in conveying the essence of the narrative.

In a study by Martín-Mor & Sánchez-Gijón (2016), the authors explored the integration of machine translation tools in AVT, finding that while they can help speed up the initial translation process, human intervention is still necessary to refine and adapt the material for the specific linguistic, cultural, and cognitive demands of the audience. Likewise, the research conducted by Arnáiz-Uzquiza & Igareda González (2023) emphasised the growing role of post-editing in machine translation-based subtitling, where human translators must revise machine-generated subtitles to ensure accuracy, fluency, and contextual appropriateness. This combination of machine translation and human expertise represents a hybrid model that maximises efficiency while retaining the necessary human touch in subtitling.

AI, particularly in the form of natural language processing, has seen tremendous growth in recent years, with applications ranging from speech recognition to machine translation and automated subtitling. AI-based subtitling tools, such as automatic speech recognition systems, have become indispensable in audiovisual translation, especially for real-time subtitling and live events (Tamayo & Ros Abaurrea, 2024). These systems are capable of converting spoken language into text with varying degrees of accuracy, facilitating the rapid creation of subtitles for audiovisual content.

Despite their promising potential, AI-driven systems face significant limitations when it comes to subtitling. One of the primary concerns is speech recognition accuracy, especially in noisy environments or with non-standard accents and dialects. Artificial speech recognition systems often struggle to transcribe speech accurately when dealing with homophones, slang, or multiple speakers, which are common in film dialogues (Fathallah, Bhole, & Staab, 2024). The subtitling process also requires synchronising the generated text with the on-screen visuals, which adds another layer of complexity. AI tools have yet to master the subtitling nuances that require cultural adaptation, emotional tone, and timing precision.

Furthermore, while AI-driven tools can help automate certain aspects of subtitling, they are often limited by their inability to fully understand the source material's context. For example, in translating idiomatic phrases or culturally loaded references, AI tools may produce translations that are accurate in a literal sense but fail to convey the intended cultural meaning. According to O'Hagan and Ashworth (2002), AI's current capabilities in subtitling are largely limited to technical aspects such as speech-to-text conversion and simple linguistic structures. This limitation has led to calls for a more nuanced understanding of the cognitive demands of subtitling, suggesting that AI tools should be designed to complement human creativity rather than replace it entirely.

One of the most significant opportunities AI presents in subtitling is the ability to analyse vast amounts of audiovisual data quickly, making it possible to generate initial drafts of subtitles that can later be refined by human translators. The use of machine learning algorithms allows AI tools to learn from large datasets, continuously improving their accuracy and fluency (Fonkam & Vajjhala, 2024). This iterative learning process could lead to more efficient subtitling workflows, especially for non-specialised content such as user-generated videos or educational material. However, the effectiveness of AI tools depends on the quality of the data they are trained on. Inadequate training data, particularly for less commonly spoken languages or dialects, can lead to inaccurate translations that undermine the quality of the final subtitles.

The role of technology in audiovisual translation, particularly in subtitling, is multifaceted, offering both opportunities and challenges. While machine translation and AI tools offer substantial benefits in terms of efficiency and scalability, they also present significant limitations that must be addressed through human intervention. The hybrid model, which combines AI-generated outputs with human expertise, represents the most promising approach for the future of subtitling.

5. Conclusion

The research emphasises the significance of cognitive skills in the translation process, emphasising its communicative and cognitive nature across various mediums, even if it is written or spoken. The interdisciplinary nature of translation activity is instrumental in enriching the understanding of translators' cognitive endeavors, integrating insights from psychology, neuroscience, and linguistics. As a multifaceted medium, the film offers a distinctive platform for scholarly exploration within translation studies, necessitating diverse approaches in AVT. Subtitling, a confined translation mode, demands specialised skills and presents cognitive challenges for subtitlers, emphasising their critical role in viewer comprehension.

The interaction between language, cognition, and audiovisual elements poses challenges that demand a comprehensive approach, considering individual meaning-making resources and their combination into a multimodal form. The study identified the cognitive challenges which the translators encounter, shaped by linguistic, cultural, and historical factors. Linguistic stressors, such as specialised terminology, idiomatic expressions, and language features unique to media content, significantly add to the translator's cognitive load. Language switching, an aspect of interpretation, presents challenges, particularly in managing interference across languages. The structural and semantic differences between languages create stress when choosing translation equivalents, requiring strong cultural mediation skills.

Studying AVT looks at how it connects to psychology and language. Translators face extra mental pressure because they have to make quick decisions, especially during real-time translations. Understanding how the human brain handles language and visuals in this context is the key to improving methodologies. To make the cognitive challenges easier, translators need to keep learning, broaden their knowledge, and build up databases of common translation equivalents. Stress management strategies, like self-correction and refined language proficiency, help boost the quality of the translation.

Besides being a tool for translate the language, subtitles also actively influence how audiences process, understand, and remember information. In multilingual contexts, viewers face an increased cognitive load as they navigate between multiple languages. This highlights the need for well-designed subtitling strategies that consider the different cognitive processes involved. The study concludes by highlighting the deep connection between neurolinguistic and psychological factors and the cognitive skills required for effective translation. It stresses the importance of ongoing skill development to handle the complexities of audiovisual translation (AVT).

While technology has undeniably revolutionised the field of AVT, particularly in the realm of subtitling, it remains clear that the integration of machine translation and AI tools come with both advantages and challenges. These tools have the potential to greatly enhance efficiency, especially when handling large volumes of content, and assist in tasks such as speech recognition and generating initial subtitle drafts. However, the complexity of subtitling, especially the need for cultural awareness, emotional tone, and contextual accuracy, highlights the limitations of current AI-driven systems. Despite their impressive capabilities, these technologies often fail to capture the subtleties of language that are crucial for high-quality translations. As such, the hybrid model that combines machine-generated outputs with human post-editing and creative adaptation is likely the most effective approach moving forward.

As the research probes into the cognitive challenges and demands that surface during subtitling, it provides a foundation for further exploration in this dynamic field. Ultimately, this study contributes to the evolving landscape of AVT, paving the way for continued inquiry into the intricate interconnections between language, cognition, and audiovisual elements.

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