

A Cognitive–Multimodal Framework for Audiovisual Translation Training: Rethinking Subtitling Pedagogy

الإطار المعرفي–متعدد الوسائط للتكوين في الترجمة السمعية البصرية: نحو إعادة تصور لتعليم السترجة

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Abstract:

This study proposes a cognitive–multimodal framework for audiovisual translation training, focusing on subtitling as a cognitively demanding multimodal process. Drawing on Cognitive Translation Studies, Multimodality Theory, and Cognitive Load Theory, it conceptualizes subtitling as a staged activity involving multimodal input processing, meaning construction, and subtitle production. The model shifts attention from product quality to cognitive mechanisms such as attention, working memory, integration, and time pressure. It argues that subtitling errors (omission, condensation, synchronization) result mainly from cognitive overload. The framework highlights cognitive load management, multimodal awareness, and explicit strategy teaching, and calls for empirical validation.

Keywords: Audiovisual translation, subtitling, cognitive translation studies, multimodality, cognitive load theory, translation pedagogy.

الملخص:

تقترح هذه الدراسة إطارا معرفيا–متعدد الوسائط للتكوين في مجال الترجمة السمعية البصرية، مع التركيز على السترجة بوصفها عملية معرفية متعددة الوسائط. بالاعتماد على دراسات الترجمة المعرفية، والتعددية السيميائية، ونظرية العبء المعرفي، تعيد الدراسة تصور الترجمة كعملية مرحلية تشمل معالجة المدخلات، وبناء المعنى، وإنتاج الترجمة.

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يركز النموذج على عمليات معرفية مثل الانتباه، والذاكرة العاملة، ودمج الوسائط، واتخاذ القرار تحت ضغط الزمن، ويؤكد أن الأخطاء الشائعة ناتجة أساساً عن ارتفاع العبء المعرفي. كما يبرز أهمية إدارة هذا العبء وتنمية الوعي متعدد الوسائط وتعليم الاستراتيجيات بشكل صريح.

كلمات مفتاحية: التكوين في الترجمة السمعية البصرية، السترجة، دراسات الترجمة المعرفية، التعددية السيميائية، نظرية العبء المعرفي.

1. Introduction

Audiovisual translation (AVT) has become a rapidly evolving field in Translation Studies due to the growth of audiovisual content and streaming platforms, which has increased demand for multilingual access, especially subtitling (Pérez-González, 2014). Subtitling is a multimodal and constrained form of translation requiring simultaneous processing of speech, image, sound, and temporal synchronization, making it a cognitively demanding activity involving attention switching, selection, and condensation under time pressure (Díaz Cintas & Remael, 2021).

The expansion of global media has reinforced the role of audiovisual translation as a means of transcending linguistic and cultural boundaries, making audiovisual content accessible to wider audiences (Benaouda, 2015; Gambier & Gottlieb, 2001).

Despite its growing importance, AVT training remains largely product-oriented, focusing on final output quality while neglecting underlying cognitive processes such as perception, attention allocation, working memory management, and decision-making. This creates a pedagogical gap where learners rely on trial-and-error rather than structured cognitive development.

At a national level, Ghodbane, H., Benaouda, A., & Kellou, Y. (2022) examined the development of audiovisual translation in Algeria and highlighted the growing importance of subtitling and AVT training in response to technological and educational developments.

Cognitive Translation Studies reconceptualizes translation as a cognitive activity involving attention and problem-solving rather than a purely linguistic operation (Hansen-Schirra & Czulo, 2017), supported by empirical methods such as eye-tracking and keystroke logging. Multimodality theory further emphasizes that meaning is distributed across linguistic, visual, and auditory modes (Kress, 2010; Baldry & Thibault, 2006), increasing processing demands. Cognitive Load Theory explains subtitling difficulties through limited working memory and different types of cognitive load, particularly high intrinsic load in multimodal tasks (Sweller, 1988; Sweller et al., 2019).

Although these frameworks advance understanding of AVT, they remain weakly integrated into pedagogy, which still prioritizes linguistic output over cognitive processing. In response, this paper proposes a cognitive–multimodal framework for subtitling training that shifts from product-based evaluation to process-oriented modeling by integrating CTS, multimodality, and cognitive load theory. The aim is to support more cognitively informed AVT pedagogy, enhance multimodal competence, and reduce cognitive overload in subtitling tasks.

2. Audiovisual Translation and Subtitling: A Complex Multimodal Activity

2.1 Audiovisual Translation as a Multimodal Translational Practice

Audiovisual translation (AVT) involves meaning transfer across multimodal environments where verbal, visual, auditory, and kinetic resources interact simultaneously. Meaning is distributed across channels rather than encoded solely in language (Gambier & Gottlieb, 2001; Pérez-González, 2014; Chaume, 2012).

From a multimodal semiotic perspective, audiovisual texts are composite constructs where meaning emerges through the interaction of sign systems, consistent with social semiotic theory (Kress, 2010; van Leeuwen, 2005). AVT is therefore an intersemiotic process (Jakobson, 1959/2000) requiring reinterpretation across modes.

This challenges equivalence-based translation models, as translators must identify and reconfigure meaning across semiotic layers (Taylor, 2013), since audiovisual coherence depends on the interaction of modes (Baldry & Thibault, 2006). Subtitling intensifies this complexity by converting speech into written form while maintaining audiovisual synchronization (Pérez-González, 2014; Díaz Cintas & Remael, 2021).

2.2 Subtitling as a Constrained Translational Mode

Subtitling is constrained by spatial, temporal, technical, and linguistic limits, including character caps, reading speed, and synchronization (Díaz Cintas & Remael, 2021; Pedersen, 2011).

These constraints require condensation strategies such as omission, reformulation, and simplification (Gottlieb, 1992; Pedersen, 2011). Constraints interact: spatial limits affect lexical choice, while temporal limits affect segmentation and pacing. Subtitlers must balance readability, timing, and accuracy (Díaz Cintas & Remael, 2021).

Subtitling also operates under temporal irreversibility, requiring real-time processing and rapid decisions, which increases cognitive load, especially for novices (Kruger & Steyn, 2014).

2.3 Multimodal Complexity and Cognitive Demands

Subtitling involves simultaneous processing of speech, image, sound, and on-screen text, which may reinforce or contradict each other (Baldry & Thibault, 2006; Chaume, 2012).

This creates multimodal density, requiring distributed attention. Meaning is not language-centered but spread across modes (Kress, 2010), demanding constant prioritization.

Eye-tracking studies show dynamic attention shifts between subtitles and visuals (Kruger et al., 2013). Translators must additionally transform input into written output.

CTS research shows subtitling is cognitively demanding, involving working memory, attention control, and decision-making under simultaneity (Hansen-Schirra & Czulo, 2017; Muñoz Martín, 2016).

2.4 Cognitive Challenges in Subtitling Tasks

Subtitling involves four main cognitive challenges:

- First, divided attention across auditory, visual, and textual inputs increases cognitive load (Kruger & Doherty, 2016).
- Second, real-time prioritization under time pressure raises intrinsic load (Sweller et al., 2019).
- Third, condensation requires semantic extraction and inferencing, often relying on visual context (Perego, 2008).
- Fourth, synchronization demands precise temporal and spatial alignment (O'Hagan, 2019).

2.5 Pedagogical Implications of Multimodal Complexity

Due to its complexity, subtitling challenges product-oriented pedagogy focused only on output quality. Such approaches often ignore underlying cognitive processes.

Process-oriented training emphasizes attention management, segmentation, and multimodal awareness (Kruger, 2012; O'Hagan, 2013; Kiraly, 2000). Learners must understand how meaning is distributed across modes.

Scaffolding from simple to complex tasks helps manage cognitive load and develop automation (Sweller et al., 2019). Tools such as eye-tracking, keystroke logging, and think-aloud protocols support process analysis (Hansen-Schirra & Czulo, 2017).

Subtitling should therefore be seen as an integrated cognitive-multimodal competence combining linguistic, technical, and strategic skills (PACTE, 2017).

3. Theoretical Framework

3.1 Cognitive Translation Studies: Translation as a Situated Cognitive Activity

Cognitive Translation Studies (CTS) reconceptualizes translation as a dynamic, situated cognitive activity rather than a linear linguistic transfer process. It involves attention, working memory, inferencing, problem-solving, and decision-making under constraints (Hansen-Schirra & Czulo, 2017; Muñoz Martín, 2016). Translation is thus an adaptive process where meaning is continuously constructed and revised in real time (Alves & Gonçalves, 2007; Jakobsen, 2017), shaped by task conditions, technology, expertise, and time pressure (Risku, 2010).

Working memory plays a central role in managing simultaneous comprehension, reformulation, and evaluation (Baddeley, 2012), while attentional control regulates competing cognitive demands (Shreve & Angelone, 2010).

Empirical CTS studies using eye-tracking and keystroke logging show fluctuating cognitive effort during translation, reflected in pauses, fixations, and revisions (Jakobsen, 2002; Dragsted, 2010; Carl et al., 2016). Subtitling intensifies these demands, requiring simultaneous multimodal processing and synchronized output, making it a cognitively extreme translation task (Kruger & Doherty, 2016; Hansen-Schirra & Czulo, 2017).

3.2 Translation as a Multimodal Cognitive System

Multimodality theory views meaning as distributed across linguistic, visual, auditory, and spatial systems (Kress, 2010; van Leeuwen, 2005; Baldry & Thibault, 2006).

In audiovisual texts, meaning emerges through interaction between modes—dialogue, image, sound, gesture, and framing (Chaume, 2012). Translation is therefore a multimodal integration process rather than linear decoding.

This increases cognitive demands, requiring selective multimodal attention and prioritization of relevant semiotic channels (Kruger et al., 2013). Translators must also perform cross-modal inferencing, as meaning is often implicit in visual or auditory cues (Forceville & Urios-Aparisi, 2009).

Meaning construction engages perceptual, linguistic, and conceptual systems, consistent with embodied cognition (Barsalou, 2008). In subtitling, time constraints further increase reliance on rapid, heuristic processing and multimodal literacy.

3.3 Cognitive Load Theory and Translation Constraints

Cognitive Load Theory (CLT) explains performance limits based on working memory constraints (Sweller, 1988; Sweller et al., 2019). It distinguishes intrinsic, extraneous, and germane cognitive load (Paas et al., 2003).

In subtitling, intrinsic load is high due to simultaneous comprehension, reformulation, and synchronization across semiotic modes. Extraneous load arises from poorly designed audiovisual input (Mayer, 2009), while germane load supports strategy development such as segmentation and condensation.

Effective AVT training requires reducing extraneous load while enhancing germane load through reflective and strategic learning (Sweller et al., 2019; Kirschner et al., 2018). Novices are particularly vulnerable to overload due to limited automation of processes.

3.4 Integration of CTS, Multimodality, and CLT

Although originating from different disciplines, CTS, multimodality theory, and CLT offer a unified framework for subtitling.

From CTS, subtitling is a dynamic problem-solving process involving attention and memory (Muñoz Martín, 2016). From multimodality theory, it is a cross-semiotic integration of distributed meaning (Kress, 2010; Chaume, 2012). From CLT, it is a capacity-constrained activity requiring cognitive load management (Sweller et al., 2019).

Together, they show that subtitling challenges are not only linguistic but also cognitive and attentional, shaped by both task complexity and human limitations.

3.5 Toward a Cognitive–Multimodal Pedagogical Perspective

This integrated framework calls for a shift from product-oriented to process-oriented AVT pedagogy, focusing on cognitive and strategic competence rather than only subtitle quality.

Training should develop learners' ability to manage attention across modes, regulate cognitive load, segment information, condense meaning, and synchronize production under time pressure.

This aligns with socio-cognitive and constructivist approaches to translation learning (Király, 2000; Risku, 2010) and competence-based models of translation expertise (PACTE, 2017).

Process-oriented tools such as eye-tracking, keystroke logging, and screen recording can enhance metacognitive awareness by revealing cognitive processes (Angelone, 2010; Hansen-Schirra & Czulo, 2017).

Ultimately, subtitling competence is best understood as a cognitively grounded multimodal expertise involving the coordinated management of linguistic, perceptual, and strategic processes.

4. Cognitive–Multimodal Framework and Pedagogical Implications for Subtitling Training

4.1 Overview of the Framework

The cognitive–multimodal framework conceptualizes subtitling as a dynamic, staged cognitive activity shaped by multimodal input, cognitive constraints, and pedagogical conditions. It integrates Cognitive Translation Studies (CTS), Multimodality Theory, and Cognitive Load Theory (CLT) to explain how meaning is processed and produced under temporal and technical constraints (Hansen-Schirra & Czulo, 2017; Muñoz Martín, 2016; Risku, 2010; Kress, 2010; Sweller et al., 2019).

Subtitling is structured into three recursive stages: (1) multimodal input processing, (2) cognitive meaning construction, and (3) subtitle production and synchronization. These stages interact dynamically rather than linearly, reflecting translation as a self-regulated, problem-solving activity (Shreve & Angelone, 2010; Alves & Gonçalves, 2007).

4.2 Multimodal Input Processing and Attentional Control

This stage involves perception and attentional allocation across speech, image, sound, and written on-screen elements. Learners must filter relevant cues, integrate simultaneous inputs, and maintain coherence across modes.

It is characterized by high perceptual and intrinsic cognitive load due to competing semiotic channels (Sweller et al., 2019). Meaning is distributed across modes rather than linguistically centralized (Kress, 2010; Baldry & Thibault, 2006), increasing processing complexity.

CTS identifies this phase as early situation-model construction requiring attentional control and rapid orientation (Muñoz Martín, 2016). Eye-tracking studies confirm dynamic shifts of attention across modalities (Kruger et al., 2013).

From a pedagogical perspective, reducing input complexity and training learners to identify multimodal cues enhances attentional efficiency and reduces overload (Mayer, 2009).

4.3 Cognitive Processing and Meaning Construction

The second stage constitutes core cognitive activity, where multimodal input is integrated into coherent meaning representations through decoding, inferencing, selection, and condensation.

This process imposes heavy working memory demands (Baddeley, 2012) and high intrinsic cognitive load due to element interactivity (Sweller et al., 2019). Meaning is often implicit and distributed across semiotic modes, requiring cross-modal inferencing (Forceville & Urios-Aparisi, 2009; Chaume, 2012) and context-based interpretation (Gutt, 2000).

CTS studies show that increased cognitive effort correlates with pauses and revisions during complex segments, reflecting problem-solving activity (Jakobsen, 2002; Dragsted, 2010; Carl et al., 2016).

Pedagogically, scaffolding segmentation, inferencing, and condensation strategies supports schema construction and reduces cognitive overload (Kirschner et al., 2018).

4.4 Subtitle Production, Synchronization, and Strategy Use

The final stage involves externalizing meaning into subtitles while respecting spatial, temporal, and linguistic constraints. Learners must segment speech, reformulate concisely, synchronize timing, and comply with technical limitations such as character counts and reading speed (Díaz Cintas & Remael, 2021).

This stage introduces combined production and coordination load. With practice, some processes become proceduralized, reducing cognitive effort (Anderson, 1982; Shreve, 2002). However, novices often experience high cognitive demand due to limited automation.

CTS research highlights recursive processing, where production constraints trigger reinterpretation and revision of earlier decisions (Angelone, 2010).

Strategically, subtitling relies on adaptive techniques such as condensation, prioritization, simplification, and segmentation, which are central to expert performance (Gottlieb, 1992; PACTE, 2017).

4.5 Multimodal Competence and Cognitive Load Management

Multimodal competence refers to the ability to integrate meaning across linguistic, visual, and auditory channels (Kress, 2010; Baldry & Thibault, 2006). Novices often over-rely on verbal input, underutilizing other semiotic resources (Perego, 2008; Chaume, 2012).

Cognitive Load Theory explains performance constraints through intrinsic, extraneous, and germane load (Sweller et al., 2019; Paas et al., 2003). Subtitling inherently involves high intrinsic load, while extraneous load can be reduced through instructional design.

Effective training should therefore:

- Reduce extraneous load (simplified input, segmentation, controlled speed)
- Enhance germane load (strategy development, reflection)
- Support schema formation through progressive complexity (Kirschner et al., 2018)

4.6 Pedagogical Implications: From Product to Process

The framework supports a shift from product-oriented to process-oriented AVT pedagogy. Traditional evaluation of subtitle quality is insufficient without attention to underlying cognitive processes.

CTS emphasizes translation competence as attention control, inferencing, and decision-making under constraints (Hansen-Schirra & Czulo, 2017; Muñoz Martín, 2016). Learning occurs through situated practice and gradual automation of processes (Kiraly, 2000; Shreve, 2002).

AVT training should therefore include:

- Multimodal analysis and cue recognition
- Think-aloud protocols and reflective tasks (Angelone, 2010)
- Progressive task sequencing and scaffolding
- Repeated practice with subtitling software
- Comparison of alternative subtitle solutions

Process-oriented assessment should complement product evaluation by focusing on strategies, decision-making, and cognitive effort (Jakobsen, 2017).

4.7 Curriculum Design and Progressive Skill Development

A cognitively informed AVT curriculum should follow a gradual progression from controlled to authentic tasks:

- **Introductory stage:** simplified audiovisual input, basic segmentation
- **Intermediate stage:** multimodal integration and strategy use
- **Advanced stage:** authentic materials, real-time constraints, full subtitling tasks

This progression reflects skill acquisition models moving from controlled processing to automatization (Anderson, 1982) and aligns with competence-based translation pedagogy (PACTE, 2017). Technology integration further supports authenticity and technical skill development.

4.8 Integrated Summary

The cognitive–multimodal framework conceptualizes subtitling as a recursive system combining multimodal meaning construction, attentional control, and cognitive load management. It shows that subtitling competence is not purely linguistic but fundamentally cognitive, strategic, and perceptual.

By integrating CTS, multimodality theory, and CLT, the framework provides a unified theoretical and pedagogical model for AVT training, emphasizing that effective subtitling instruction must address both cognitive constraints and multimodal complexity.

5. Discussion

The cognitive–multimodal framework offers a theoretical and pedagogical reorientation of audiovisual translation (AVT), particularly subtitling training, by conceptualizing subtitling as a staged cognitive process involving multimodal input processing, meaning construction, and subtitle production. This moves beyond product-oriented approaches and aligns with process-based views of translation as dynamic and situated activity (Alves & Gonçalves, 2007; Risku, 2010).

A key contribution of the study is the integration of Cognitive Translation Studies (CTS), Multimodality Theory, and Cognitive Load Theory (CLT), which have rarely been combined in AVT pedagogy (Hansen-Schirra & Czulo, 2017; Kress, 2010; Sweller et al., 2019). Together, these frameworks explain subtitling as both a cognitive and multimodal activity.

From a CTS perspective, translation is a problem-solving activity involving attention, working memory, and decision-making under constraints (Hansen-Schirra & Czulo, 2017; Muñoz Martín, 2016; Shreve & Angelone, 2010), with fluctuating cognitive effort depending on task complexity (Jakobsen, 2002; Dragsted, 2010). However, CTS alone does not fully capture multimodal meaning construction. Multimodality theory addresses this by emphasizing that meaning is distributed across semiotic systems and must be reconstructed by the translator (Kress, 2010; Baldry & Thibault, 2006; Chaume, 2012).

CLT further explains learner difficulty in subtitling through cognitive load constraints. Simultaneous processing of multimodal input generates high intrinsic load, while poor instructional design increases extraneous load (Sweller et al., 2019; Mayer, 2009). The framework extends CLT by applying it directly to AVT training contexts, where cognitive overload affects both performance and learning.

A key implication is that subtitling errors (e.g., omission, segmentation issues, or synchronization problems) should not be viewed solely as linguistic weaknesses but as manifestations of cognitive overload and inefficient multimodal processing (Kruger & Doherty, 2016; Díaz Cintas & Remael, 2021). This shifts error analysis toward cognitive diagnosis and more targeted pedagogy.

The study also reconceptualizes subtitling competence as a multidimensional cognitive skill involving attention control, multimodal integration, information selection, and temporal coordination. This aligns with translation competence models that emphasize integrated cognitive, strategic, and procedural knowledge (PACTE, 2017; Shreve, 2002) and expertise research highlighting automatised and adaptive problem-solving (Ericsson, 2000).

Furthermore, the framework supports a shift from product-oriented to process-oriented pedagogy, emphasizing cognitive and strategic processes rather than only final output quality (Király, 2000; Király, 2016). It advocates making cognitive processes visible and teachable in AVT training (Angelone, 2010; Hansen-Schirra & Czulo, 2017).

However, the model remains conceptual and has not yet been empirically validated through methods such as eye-tracking or keystroke logging. Empirical testing is therefore necessary to confirm its explanatory power (Jakobsen, 2017; Carl et al., 2016).

Future research should investigate attentional distribution in subtitling using process-tracing tools (Kruger et al., 2013), test pedagogical interventions experimentally, and explore cross-linguistic variation in cognitive load and multimodal processing (Pérez-González, 2014).

Despite these limitations, the framework provides a bridge between cognitive theory and AVT pedagogy, framing subtitling as both a linguistic and cognitively constrained multimodal process (O'Hagan, 2019; Pérez-González, 2014). Ultimately, it supports a shift toward more theoretically grounded and cognitively informed AVT training practices.

6. Conclusion

This paper has proposed a cognitive–multimodal framework for audiovisual translation (AVT) training, focusing on subtitling as a cognitively demanding multimodal activity. By integrating Cognitive Translation Studies (CTS), Multimodality Theory, and Cognitive Load Theory (CLT), subtitling is reconceptualized as a staged cognitive process involving multimodal input processing, meaning construction, and subtitle production (Kress, 2010; Hansen-Schirra & Czulo, 2017; Sweller et al., 2019).

The main contribution of the study is the shift from a product-oriented to a process-oriented model of AVT pedagogy. Instead of focusing only on final subtitle quality (e.g., accuracy, segmentation, formatting), the framework emphasizes underlying cognitive mechanisms such as attention control, working memory, multimodal integration, and decision-making under constraints (Kiraly, 2016; Muñoz Martín, 2016; Shreve & Angelone, 2010; Baddeley, 2012).

By framing subtitling as a staged cognitive activity, the model explains common learner difficulties—such as omission, segmentation errors, and synchronization problems—as effects of cognitive overload and inefficient resource allocation rather than purely linguistic failure (Kruger & Doherty, 2016; Díaz Cintas & Remael, 2021).

Pedagogically, the study highlights the need to design AVT training according to cognitive principles. This includes managing cognitive load through structured sequencing, reducing complexity in early stages, and progressively increasing multimodal demands (Sweller et al., 2019; Mayer, 2009). It also stresses the development of multimodal awareness and strategic competence in condensation, selection, and reformulation (PACTE, 2017; Chaume, 2012). Overall, translation competence is understood as cognitive, strategic, and procedural rather than purely linguistic (Shreve, 2002; PACTE, 2017).

Although theoretically grounded, the framework remains conceptual and requires empirical validation. Future research should apply methods such as eye-tracking, keystroke logging, and screen recording to examine cognitive processing in subtitling tasks (Jakobsen, 2017; Carl et al., 2016; Kruger et al., 2013). Experimental and cross-linguistic studies could further test the model and explore variations in cognitive load across languages and audiovisual genres (Pérez-González, 2014; O'Hagan, 2019).

In conclusion, this study contributes to AVT research by bridging cognitive theory and pedagogy, positioning subtitling as a cognitively complex multimodal process. It encourages a shift from static product evaluation toward cognitively informed, process-oriented training in higher education (Risku, 2010; Kress, 2010; Kiraly, 2016).

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