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# THE INFLUENCE OF COGNITIVE LOAD ON DECISION-MAKING PROCESSES DURING REAL-TIME TRANSLATION

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**Annotation:** This article investigates the relationship between cognitive load and decision-making processes in real-time translation, with a particular focus on simultaneous interpreting and live subtitling. Drawing from cognitive psychology, translation studies, and neurocognitive linguistics, it explores how translators manage limited working memory resources, time pressure, and linguistic ambiguity while maintaining accuracy and coherence. The study analyzes existing theoretical frameworks such as Gile's Effort Model and Kahneman's Dual-Process Theory, as well as empirical findings from eye-tracking, EEG, and fMRI studies. Practical implications for translator training and cognitive optimization strategies are discussed.

**Keywords:** Cognitive load, decision-making, real-time translation, simultaneous interpreting, working memory, cognitive effort, bilingual processing.

## Introduction

In the age of global communication, real-time translation has become a vital professional activity. From international conferences to live news broadcasts, interpreters and translators serve as the cognitive bridge between languages and cultures. Yet beneath this seemingly fluid performance lies a complex network of cognitive processes that operate under intense time pressure.

**Real-time translation** — particularly *simultaneous interpreting* — requires processing incoming speech in one language while simultaneously producing output in another. Unlike written translation, interpreters have no time for revision, consultation, or rethinking; every second matters. This immediacy turns translation into a cognitive balancing act, where decisions must be made rapidly despite incomplete information.

Cognitive load theory, originally proposed by Sweller (1988), offers a useful framework for understanding the mental strain interpreters experience. It posits that human working memory has limited capacity, and when the demands of a task exceed this capacity, performance declines. In

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real-time translation, interpreters must juggle comprehension, memory, reformulation, and speech production — all at once. This continuous cognitive juggling creates a unique environment for decision-making under pressure.

The aim of this paper is to explore how cognitive load influences the decision-making mechanisms of interpreters in real-time contexts. By integrating findings from cognitive psychology and translation studies, the research highlights both the challenges and adaptive strategies that define professional interpreting.

**Main Part**

**1. Theoretical Background of Cognitive Load in Translation**

Cognitive load theory, initially developed in educational psychology, has been widely applied to interpreting research (Gile, 2009; Seeber, 2011). It posits that human working memory has a limited capacity, and when that limit is exceeded, performance deteriorates. In real-time translation, the **extraneous**, **intrinsic**, and **germane** types of cognitive load interact dynamically.

- **Intrinsic load** arises from the inherent complexity of the source message, including sentence structure, unfamiliar terminology, and idiomatic expressions.
- **Extraneous load** is caused by environmental distractions or poor acoustic conditions.
- **Germane load** relates to the mental effort invested in building long-term cognitive schemas that facilitate faster decision-making in future translations.

Effective interpreters develop mental strategies to minimize extraneous and intrinsic load while maximizing germane load through experience and training.

**2. Working Memory and Attention Control**

Working memory plays a central role in interpreting. According to Baddeley's (1992) model, the **phonological loop** and **central executive** components are heavily engaged during simultaneous translation. The interpreter must hold short segments of speech while processing their meaning and producing an equivalent target-language expression.

This process demands rapid **attention switching** between listening, processing, and speaking tasks. Cognitive studies using eye-tracking and EEG analysis (Seeber & Kerzel, 2012) demonstrate that interpreters allocate attentional resources dynamically—prioritizing either comprehension or production depending on context complexity.

When cognitive load exceeds working memory capacity, interpreters resort to strategies such as chunking**,** anticipation**, and** compression, sacrificing surface-level fidelity for conceptual accuracy.

**3. Decision-Making under Cognitive Pressure**

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Decision-making in real-time translation is characterized by bounded rationality (Simon, 1997). Interpreters make fast, satisficing choices rather than optimal ones due to limited time and information. Decisions include lexical selection, syntactic restructuring, and pragmatic adaptation.

Cognitive overload can lead to omissions**,** semantic shifts**, or** syntactic simplifications**.** According to Gile's Effort Model, decision quality depends on balancing four simultaneous efforts: listening, production, memory, and coordination. When one effort consumes excessive cognitive resources, others suffer.

Moreover, emotional regulation influences decision-making. Under high stress, interpreters experience reduced cognitive flexibility and increased error rates. Neurocognitive evidence suggests that stress-induced cortisol release narrows attention focus, leading to riskier linguistic decisions.

**4. Neurocognitive and Psycholinguistic Perspectives**

Recent advances in **neuroimaging** have enabled researchers to visualize how the brain manages simultaneous interpretation. fMRI and ERP studies (Rinne et al., 2000; Hervais-Adelman et al., 2015) reveal that expert interpreters exhibit enhanced connectivity between the **prefrontal cortex** (decision-making) and **temporo-parietal junction** (language comprehension).

This neural efficiency—often termed **cognitive automatization**—is the result of extensive training and practice. Expert interpreters rely on proceduralized routines for common linguistic patterns, freeing cognitive resources for complex decision-making.

Psycholinguistic models also highlight the importance of **predictive processing**, where interpreters anticipate upcoming phrases using contextual cues, thereby reducing processing load.

**5. Technological Support and Artificial Intelligence**

Modern translation technologies, such as **Computer-Assisted Interpreting (CAI)** tools and **AI-based speech recognition systems**, aim to reduce interpreters' cognitive burden. These systems provide real-time glossaries, predictive text, and automatic speech segmentation. However, over-reliance on technology can shift cognitive load from language processing to interface management.

Hybrid human-AI collaboration models show promise in distributing cognitive load more evenly, allowing human interpreters to focus on high-level semantic and cultural nuances while machines handle repetitive lexical tasks.

**6. Pedagogical Implications**

Training programs for interpreters increasingly incorporate cognitive load management strategies, such as stress inoculation, memory enhancement exercises, and dual-task training.

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Simulated interpreting labs with real-time feedback help students recognize signs of overload and develop resilience under pressure.

Moreover, teaching metacognitive awareness—the ability to monitor and regulate one's cognitive state—enables interpreters to make adaptive decisions when cognitive resources are stretched.

**7. The Role of Experience and Expertise**

One of the most decisive variables in how translators manage cognitive load is professional experience. Expert interpreters demonstrate greater automaticity in lexical retrieval, syntactic reformulation, and message anticipation. These processes reduce reliance on conscious control and thus lighten cognitive strain. Research by Liu et al. (2018) indicates that expert interpreters activate different neural pathways compared to novices — relying more on subcortical automatic processes and less on the prefrontal regions responsible for deliberate reasoning.

Moreover, experienced interpreters employ strategic decision-making heuristics such as selective omission, paraphrasing, and reformulation to maintain semantic coherence. These choices are not signs of failure but of expertise — the ability to maintain communicative equivalence while optimizing mental workload. In cognitive translation theory, this is seen as an adaptive equilibrium between *fidelity* and *feasibility*.

Another crucial factor is domain familiarity. When interpreters work within specialized fields (medicine, law, diplomacy), background knowledge significantly reduces intrinsic load. Knowing the subject matter allows them to predict terminology, anticipate sentence structures, and handle complex discourse with less mental effort.

**8. Emotional Regulation and Stress Management**

Real-time translation often occurs in high-stress environments where interpreters must perform under observation, with immediate consequences for mistakes. Stress can amplify cognitive load by impairing working memory and narrowing attentional focus.

Professional interpreters cultivate emotional self-regulation through experience and deliberate training. Techniques such as deep breathing, cognitive reframing, and controlled pacing of speech help maintain composure. A study by Timarová and Salaets (2011) found that interpreters who applied stress-management techniques performed with higher consistency in lexical choices and lower omission rates during simultaneous interpreting sessions.

Cognitive resilience is therefore not only a mental but also an emotional competence. The translator's ability to make sound linguistic decisions under stress determines the reliability of real-time communication.

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**9. Ethical and Pragmatic Decision-Making**

Decision-making in translation is not purely linguistic; it also involves ethical and pragmatic judgments. Under high cognitive load, interpreters must still ensure neutrality, confidentiality, and accuracy. Ethical decision-making becomes more complex when cultural sensitivities or politically charged content are involved.

Research by Chesterman (2001) on translator ethics highlights the cognitive tension between fidelity to the source text and responsibility to the target audience. In real-time translation, interpreters often prioritize clarity and communicative intent over literal accuracy, invoking the ethical principle of *translator responsibility*.

Pragmatic decisions — such as whether to omit redundant information, adjust tone, or reframe metaphors — require rapid contextual assessment. These micro-decisions shape audience understanding and cross-cultural rapport, illustrating that decision-making under cognitive load is not merely mechanical but deeply interpretative.

**10. Implications for Future Research**

Despite extensive studies on cognitive load theory, many aspects of real-time translation remain underexplored. The emergence of neuroadaptive systems, capable of detecting cognitive stress via physiological indicators (e.g., EEG or heart rate variability), opens new possibilities for dynamic support systems that adjust task difficulty in real time.

Future research could also integrate AI-driven analysis of interpreters' performance data, combining linguistic accuracy, latency, and emotional markers to model optimal decision-making patterns. Such interdisciplinary approaches would link linguistics, psychology, neuroscience, and computer science, expanding the boundaries of cognitive translation studies.

**Conclusion**

The intricate relationship between cognitive load and decision-making in real-time translation underscores the complexity of human cognition under time pressure. Translators and interpreters operate at the frontier of linguistic performance, where mental effort, emotional regulation, and ethical awareness converge.

Cognitive load affects every stage of translation — from perception and comprehension to memory retention, reformulation, and verbal output. Excessive load can impair performance, but with experience, training, and strategic adaptation, interpreters learn to redistribute their mental resources effectively.

Decision-making, therefore, is not a single act but a continuous cognitive negotiation between competing demands — accuracy versus fluency, faithfulness versus communicability,

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speed versus quality. The ability to navigate these tensions distinguishes expert interpreters from novices.

As translation technologies and artificial intelligence evolve, human interpreters must increasingly collaborate with machines. The future of real-time translation will likely depend on **hybrid systems** where human cognitive intuition and machine precision complement each other. Understanding cognitive load mechanisms will be essential for designing training programs, ergonomic tools, and adaptive systems that enhance interpreter performance while preserving the human essence of meaning-making.

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