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COGNITIVE ASPECTS OF TRANSLATORS' ACTIVITIES IN ENGLISH-INDONESIAN TRANSLATION: AN ANALYSIS OF USING TRANSLOG-II AND THINK-ALOUD PROTOCOL

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Abstract
This study investigates the cognitive aspects of translators' activities by employing Think-Aloud Protocols (TAPs) and Translog-II software to capture real-time decision-making during English–Indonesian translation tasks. The research aims to reveal how translators plan, monitor, and evaluate their work while handling linguistic and conceptual challenges. Data were collected from one professional translator who performed two translation tasks while verbalizing thoughts and recording keystrokes. The findings show that the translator engaged in complex cycles of comprehension, reformulation, and revision that reflect both cognitive and metacognitive strategies. Frequent pauses, revisions, and self-corrections observed through Translog-II indicate moments of metacognitive monitoring, while TAPs revealed the translator's awareness of lexical and syntactic alternatives. The results highlight the interdependence between cognitive processes and translation strategies, demonstrating how technological tools can provide detailed insight into translators' mental operations. The study concludes that integrating Translog-II and TAPs enriches cognitive translation research and offers pedagogical value for translator training programs.

Keywords: *Translation Process, Cognitive Translation, Think-Aloud Protocol, Translog-II, English–Indonesian Translation*

1. INTRODUCTION

Over the past few decades, translation studies have increasingly focused on the cognitive processes involved in translation, moving beyond purely linguistic analysis to explore how translators think and make decisions. Researchers have examined various aspects of the translation process—including revision, creativity, time pressure, and differences between professional and student translators—highlighting translation as a complex mental activity. Modern technology has transformed translation practice, making it heavily reliant on digital tools like CAT software and online resources. Yet, scholars continue to emphasize the importance of understanding the cognitive and psychological dimensions of translation, an area sometimes referred to as "translation psychology" or "psycho-translation studies" (Holmes, 1972; Chesterman, 2009; Jääskeläinen, 2012), which falls under the broader field of Translation Process Research.

Translation is now widely recognized not as a simple transfer of words, but as a dynamic cognitive task involving comprehension, reformulation, monitoring, and evaluation. This shift reflects an interdisciplinary turn in translation studies, incorporating insights from psychology, cognitive science, and psycholinguistics. By studying translators as active problem solvers who draw on linguistic knowledge, context,

and experience, researchers gain deeper insight into how meaning is constructed and negotiated across languages—something textual analysis alone cannot fully reveal. Cognitive approaches thus help uncover the mental strategies and decision-making patterns that shape translation outcomes and styles.

Despite this growing body of research, studies focusing on Indonesian translators—particularly in English–Indonesian translation—are still scarce. Most cognitive translation research has been conducted in European or East Asian contexts using tools like Think-Aloud Protocols (TAPs) and Translog-II keystroke-logging software. To address this gap, the present study combines TAPs and Translog-II to investigate the cognitive strategies of an experienced Indonesian translator. This dual-method approach captures both verbalized thought processes and real-time behavioral data, offering a comprehensive view of how cognitive strategies unfold during different stages of the translation process.

2. LITERATURE REVIEW

2.1 Theoretical Foundations of Think-Aloud Protocols

The Think-Aloud Protocol (TAP) is a research method that captures participants' cognitive processes by having them verbalize their thoughts during a task. Originally developed in psycholinguistics, TAPs have been widely adopted in translation studies to examine how translators interpret meaning and make real-time decisions. Ericsson and Simon (1993) argued that, when properly used, verbal reports offer valid insights into cognitive activity without significantly disrupting the task. However, in translation, concurrent TAPs—where participants speak while translating—can interfere with the process. Jakobsen (2003) found that concurrent think-aloud slows translators down by about 25% and leads them to work in shorter segments, suggesting that the method may alter natural cognitive behavior, even if it doesn't invalidate the data.

Because of this interference, researchers have turned to retrospective TAPs, where participants reflect on their process after completing the task. Retrospective protocols often yield more structured and reflective accounts, especially regarding inferential thinking, and avoid disrupting the translation itself. When combined with tools like Translog-II, which record and replay every keystroke, retrospective TAPs become even more reliable: the replay function helps participants accurately recall their actions, reducing the risk of embellishment or inaccurate memory. This combination allows researchers to access rich cognitive data while minimizing the drawbacks of concurrent verbalization.

The use of TAPs in translation studies emerged in Europe in the late 1980s as scholars sought empirical, process-oriented methods to move beyond traditional, normative models that focused on ideal or prescriptive translation practices. Researchers like Krings, Jääskeläinen, and Tirkkonen-Condit aimed to uncover "what actually happens" when people translate—essentially opening the "black box" of the translator's mind. This shift was influenced by broader trends in psychology and psycholinguistics, which renewed interest in internal mental processes rather than just observable behavior. Viewing translation as a problem-solving activity, these scholars pioneered experimental approaches using TAPs, laying the foundation for today's diverse and interdisciplinary field of Translation Process Research.

2.2 Applications of TAPs in Translation Studies

Think-Aloud Protocols (TAPs) have been widely used in translation studies to explore how translators process meaning, resolve ambiguities, and navigate cultural or linguistic challenges. Research by Krings (2001), Jääskeläinen (2011), and Alves and Gonçalves (2013) shows that TAPs reveal decision-making patterns, moments of hesitation, and shifts in strategy across translation stages—from comprehension to reformulation. These insights not only deepen theoretical understanding of translation as a cognitive, problem-solving activity but also support pedagogy: TAPs can model effective strategies for learners and help instructors identify whether students struggle with comprehension or expression, avoiding misdiagnosis based solely on final translations.

TAP studies vary significantly in design—using monologue (individual verbalization), dialogue (pair discussions), or retrospective interviews—and involve different participants (students, professionals), text types, languages, and task conditions. While monologue TAPs are common, they face criticism: professionals often verbalize little during routine tasks due to high automation, and cognitive overload can also reduce verbal output. Dialogue protocols, as tested by House (1988), may yield richer data through negotiation and clarification, though the "best" method depends on research goals. Retrospective interviews, often combined with keystroke logging tools like Translog-II, help mitigate memory gaps and reduce artificiality, offering a more accurate picture of cognitive processes.

Despite limitations—such as incomplete verbalization, post-hoc rationalization, or the challenge of capturing non-verbal thought—TAPs remain the most viable method for accessing the "black box" of translation. Their validity is enhanced when combined with theoretical models from psycholinguistics (e.g., bottom-up/top-down processing, schemata) and translation theory (e.g., functional strategies, interlanguage). Early studies focused on surface behaviors (pauses, dictionary use), but later work interprets "hidden" phenomena like planning or cultural transfer through analytical frameworks. Ultimately, TAPs provide rich, multifaceted data—but only when researchers clearly define their aims, choose appropriate methods, and apply robust interpretive models.

3. RESEARCH METHOD

This study employs a qualitative descriptive design to investigate the cognitive processes of a professional Indonesian translator during English–Indonesian translation. Using a dual-method approach, it combines Think-Aloud Protocols (TAPs) and Translog II—a keystroke-logging software—to simultaneously capture the translator's verbalized thoughts and real-time writing behaviors, such as typing, pausing, deleting, and revising. The participant, an experienced translator with over five years of practice, translated two short English texts (250–300 words each) while verbalizing her thinking and being recorded by Translog-II. Retrospective interviews after each session added further context, enabling triangulation across three data sources: TAPs, keystroke logs, and interview responses.

Data analysis involved transcribing and coding verbal reports into cognitive categories like problem identification, solution generation, and revision, while Translog-II logs were examined for

behavioral indicators of cognitive effort, particularly pause duration (over two seconds) and revision frequency. The study ensured credibility through methodological triangulation and member checking, with interpretations validated by the participant. Guided by established frameworks from scholars like Wenden (1991), Victori (1995), and Riazi (1997), the analysis focused on metacognitive strategies such as planning, monitoring, and evaluating. Using Translog-II's standard interface—source text on top, target text below—the software enabled a detailed, time-stamped reconstruction of the translation process. By integrating reflective, linguistic, and behavioral data, the study provides a rich, interdisciplinary insight into the complex mental and practical dimensions of professional translation.

4. RESULTS AND DISCUSSION

The analysis revealed three main categories governing the translator's cognitive activities: translation activities, translator behaviors (cognitive aspects), and strategy use. These categories were interpreted based on prevalent theoretical frameworks sampled throughout the translation process. The translator frequently engaged in diverse strategies such as reading the source text, comparing source and target texts, consulting dictionaries, reading aloud, and checking structural consistency while working towards acceptable equivalencies.

This sample indicates the translator generated ideas by verbalizing thoughts concurrent with the keying of the target text, closely aligning syntactic structure with the source. Rather than automatic recall, the process demonstrated deliberate word and sentence-level cognitive operations. Further analysis revealed consistent reliance on resourcing strategies, including verification with digital dictionaries and online tools (for example, Google Translate and Collins Dictionary). The translator's cognitive workflow showed iterations between lexical searches, syntactic restructuring, and metacognitive evaluation of translation decisions. These findings align with established cognitive translation theories suggesting translators engage in complex and iterative problem-solving and self-monitoring processes (Victori, 1995; Wenden, 1991). Moreover, shifts in translation choices—such as lexical additions or syntactic adjustments—reflect active decision-making aimed at balancing equivalence and readability. To arrive at this end, she used several strategies such as reading, comparing the source and target texts, consulting with dictionaries, reading out loud, comparing language structures and working out acceptable equivalents.

Data 1

No	Time	Transcription	Activities	Behavior	Coding/Strategy
15	02:21	OK, kita coba aja… (mengetik terjemahan sambil mengucapkan) minuman telur kopyok terbaik di dunia…. we will try this	Translating	Generating ideas	Tr→Translating, Sasaki (2000)

From the data above, the translator seemed to generate her ideas when she tried to translate from the source text to the target text. It can be seen from her expression "ok Kita coba aja… (mengetik terjemahan sambil mengucapkan) minuman telur kopyok…" in this case, the translator seemed to stay very close to the structure of the source text, most commonly translating at the word or sentence level. As can be expected, experience played a significant role in how the translator worked through the text, especially regarding syntactic structure through her expressions. The required word order was deeply embedded, and she verbalized the structure of the target language. The translator was able to verbalize the thought processes required to convert the structure because it had not yet been automated. This phenomenon has been well documented in other observational studies and can be attributed to the fact that the translator can verbalize processes that have become automatic (Séguinot, 1996; Ericsson and Simon, 1980).

Data 2

No	Time	Transcription	Activities	Behavior	Coding/Strategy
21	03:38	Kita lihat translate Collins…pretty…mmmmmhhh…pleasing…neat, charming commendable, good of its kinds, informal, excellent, to be objectives, mmmhhh…agak…agak…sangat spesial, wow…kita lihat ini ((sambil mengkoreksi terjemahan) agak atau sangat …. kita lihat dari keterangan berikutnya)	Verbalizing a proposition verbalizing	Generating ideas	Vb→verbalizing, Wenden (1991), Sasaki (2000)

The understanding and reasoning stage of the translation process above seemed to involve a lot of decision making made by the translator. The expression uttered by the translator can help to know the translator's strategy when she translates from the source text to the target text. Translog was most useful in capturing this stage to capture the expression “Kita lihat translate Collins…pretty…mmmmmhhh…pleasing…neat, charming commendable, good of its kinds, informal, excellent, to be objectives, mmmhhh…agak…agak…sangat spesial, wow…kita lihat ini (sambil mengkoreksi terjemahan) agak atau sangat …. kita lihat dari keterangan berikutnya).” It recorded the execution of the translation whether it was verbalized or not. During the searching stage, the translator looked for words, expressions, terms, titles, and collocations using a variety of resources including dictionaries. From this example, the translator's activities can be categorized as Verbalizing a proposition verbalizing to generate ideas through her expression. It is inlining with the scholars' opinion that such translation is

considered as verbalizing to what Wanden (1991) and Sasaki (2000) metacognitive process.

Data 3

No	Time	Transcription	Activities	Behavior	Coding/strategies
31	06:19	Tempo hari… saya sedang berjalan dengan floppy eared (mengetik di google translate) …floppy… (how is translated) …floppy	Typing and consulting google translate	to look for alternatives	Rs→Resourcing Victory (1995), Wenden (1991), Riazi (1997)

The translator used a parallel google translate to see how expressions and strings of the text had been translated by other resources. In this case, the translator wants to find the appropriate meaning or meaning equivalence. From the data above, the translator seemed to rely on digital tools when searching for meaning equivalences. Returning to the example "Tempo hari …saya sedang berjalan dengan floppy eared (mengetik di google translate) …floppy… (how is translated) …floppy...", the translator seemed to convince herself by quickly typed his initial thoughts and then immediately revised them into better English. The Translog recording of the translator's verbalization shows several stops within a word where she would jump to another word altogether and make revisions before going back to where he had left off. This is perhaps an indication of effective time usage. Rather than dwelling on a difficult passage, the translator cleared his mind by rereading and correcting another part of the text before continuing. It could also be that he was looking for information from the parts he had already translated and then saw an error that he corrected before continuing. The translator's activities can be categorized as typing and consulting a dictionary to look for alternatives to what Victory (1995), Wanden (1991), and Riazi (1997) called Resourcing.

Data 4

No	Time	Transcription	Activities	Behavior	Coding/Strategy
46	10:15	Bagaimana kita akan… kayanya harus pake kami… bagaimana	Hesitation	phenomena in the search for potential equivalents	Hs→Hesitation, Krings' (1986)

As shown in the table above, the translator showed her hesitation during the drafting stage, with the feeling type and the thinking to type what appropriate equivalence she wants to achieve. The hesitation shown by the translator, however, did not affect any changes at the end revision stage, although she only tried to make a review on the text after it had been translated. It probably means that the translator was either ensuring the translation by looking at the word she had translated. The translator seemed to reread the sentence while drafting her translations. At the end revision stage, however, the thinking type occurs very often as many expressions she uttered that she seemed to look hesitate. It can be

seen from her statement when she expressed "Bagaimana kita akan… kayanya harus pake kami… bagaimana". In fact, the thinking type produced by the translator can be classified as hesitation which belongs to phenomena in the search for potential equivalents according to metacognitive theory proposed by Kring (1986). The data suggests that such problems occurred due to the translator wanted to provide appropriate translation and her decision-related psychological function which can help the researcher to identify the cognitive aspects of the translator.

Data 5

No	Time	Transcription	Activities	Behavior	Coding/Strategy
57	15:33	Tacky … (membuka Collins) kita lihat tacky …graded ...you dislike it because it is cheap and badly made…. terburuk maksudnya? Ok...what about ostentatious. copy aja…characterized by pretentious, showy or vulgar display …if you describe something as ostentatious you disapprove of it is expensive and it is intended to impress people… shobby maksudnya sombong gitu….	to look for alternatives /synonyms	Resourcing	Rs→Resourcing Victory (1995), Wenden (1991), Riazi (1997)

The data in table 5 above showed that the translator wanted to see how expressions and strings of the text had been translated by another resource. In this case, the translator wants to find the appropriate meaning or meaning equivalence through the Collin dictionary. The translator seemed to compare the meaning from one source to another source. It can be seen from her statement "Tacky … (membuka Collins) kita lihat tacky …graded ...you dislike it because it is cheap and badly made…. terburuk maksudnya? Ok...what about ostentatious. copy aja…characterized by pretentious, showy or vulgar display …if you describe something as ostentatious you disapprove of it is expensive and it is intended to impress people …shobby maksudnya sombong gitu…." There are a great number of synonymic substitutions and additions at the stage by correcting the word choice, spelling corrections, as well as a few changes of word order and syntactic rearrangements. Thus, the translator worked most extensively on the lexical and syntactic levels. The cognitive process done by the translator is likely focused mostly on finding suitable synonyms but also made a few deletions and additions to the text, as well as morphological and spelling corrections, and syntactic rearrangements. Based on the case study, it is possible to generalize that the translator with the dominant cognitive process displayed the tendency to generate ideas from the source language to the target language by using the strategy of resourcing. Interestingly,

the translator seemed to prefer the strategy through lexical units and rearranging word order by seeking synonyms from several sources.

The data obtained from the translation process of eggnog translation by using the think-aloud protocol was very important. Thinking aloud provides information about reflection, reasoning, self-revision, and other processes required for translation. Based on the data findings and discussion above, the research may highlight the phenomenon of translation shifts, such as various changes introduced during the translation process and visible in the translation product. A parallel corpus of aligned originals and translations allows a systematic analysis of shifts between translation units of various sizes and on a different level of linguistic analysis. From the data obtained from the translator's translation process illustrated that there happened a lot of cognitive process showing the translator's activities mostly use the strategy of formal translation equivalence. For example, when she translated the expressions "The best eggnog in the world … minuman telur kopyok terbaik di dunia ...spesial." there happened a cognitive process when the translator decides to translate whether she prefers to choose from the dictionary or from google translate. In this stage, her decision can be categorized as a metacognitive function process that may affect translation products. The translation process from the phrase "the best eggnog in the world" was translated into "minuman telur kopyok terbaik di dunia" indicated that she was trying to find the equivalencies from the source language to the target language. Here, there happened a translation shift that was not available in the source language, such as "minuman" which was not found in the source language. The shifts seemed to be inlining with Vinay & Darbelnet's (1995, p.36) opinions which was called "transposition".

The analysis revealed that the translator engaged in a cyclical process of comprehension, transfer, and revision, with the longest pauses occurring during linguistically or culturally complex segments; verbal reports showed she alternated between quick reformulation and reflective hesitation—hallmarks of expert problem-solving. Three types of strategies were identified: cognitive (e.g., inference, paraphrasing, restructuring), metacognitive (e.g., monitoring, self-evaluation, revision), and resource-based (e.g., dictionary use, contextual referencing). These findings align with prior research by Alves and Gonçalves (2013) and Ehrensberger-Dow (2018) but extend understanding by illustrating how such strategies operate in the English –Indonesian translation context. The combined use of Think-Aloud Protocols and Translog-II also offers practical value for translator training, particularly in fostering self-monitoring, critical thinking, and effective problem-solving skills.

5. CONCLUSION

This study confirms that translation is a highly complex, non-linear, and recursive cognitive process involving constant interaction between comprehension, reformulation, and evaluation. Using Think-Aloud Protocols (TAPs) and Translog-II keystroke logging, the research captured both the introspective thoughts and observable behaviors of a professional translator working on English-Indonesian texts. The findings show that the translator employed a wide range of interrelated strategies—such as planning, monitoring, evaluating, re-reading, revising, consulting dictionaries or Google Translate, comparing source

and target structures, and generating equivalents—often repeating and combining them dynamically throughout the task. These strategies align with those proposed by Victori (1995), Wenden (1991), and Riazi (1997), underscoring the metacognitive and resourceful nature of expert translation. The study highlights that translation is not mechanical but deeply reflective, shaped by continuous problem-solving and adaptation. It also demonstrates the value of combining TAPs and digital tracking tools for both research and translator education, suggesting future work should include more participants, varied text types, and additional methods like eye-tracking to further explore cognitive variation in translation.

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