IRAQI Academic Scientific Journals
العراقية المجلات الاكاديمية العلمية

University of Kut Journal for Humanitarian Science

ISSN (E): 2707 – 5648 II ISSN (P): 2707 – 563x
www.kutcollegejournal1.alkutcollege.edu.iq
k.u.c.j.hum@alkutcollege.edu.iq

Vol. 6 , Issue 2 , December 2025

The Mistake Magnification Effect in Translation: A Cognitive Analysis of Error Perception and Processing

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Paper Info.
Published: Dec. 2025

Abstract

This study analyzes the Mistake Magnification Effect (MME) on translators' behavior-a cognitive bias in which translators over-amplify their perception on the severity of errors, particularly those that are produced by automatic translation systems. To do so, we conducted an experiment with 20 professional translators and translation students that investigated how translation errors are perceived, processed, and revised; amplified changes between text editing. Based on eye-tracking, think-aloud protocols, and error analysis models, we demonstrated that translators view minor, predictive MT errors as more severe than human errors, which has implications for translation quality assessment and training. The study contributes to TQA by offering empirical evidence on cognitive biases in perception of errors and recommends practical suggestions to improve translation pedagogy and machine translation (MT) post-editing workflows.

Keywords: mistake magnification effect, translation errors, cognitive load, machine translation, post-editing, translation process research

التأثير المتزايد للأخطاء في الترجمة: تحليل معرفي لإدراك ومعالجة الأخطاء

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معلومات البحث
تأريخ النشر : كانون الاول 2025

المستخلص

تحلل هذه الدراسة تأثير تضخيم الأخطاء (MME) على سلوك المترجمين، وهو تحيّز إدراكي يقوم فيه المترجمون بالمبالغة في تقدير شدة الأخطاء، خصوصًا تلك الناتجة عن أنظمة الترجمة الآلية. أُجريت تجربة على 20 مترجمًا محترفًا وطلبة ترجمة للتحقيق في كيفية إدراك الأخطاء الترجمية ومعالجتها وتصحيحها. استنادًا إلى تتبع العين، وبروتوكولات التفكير بصوت عالٍ، ونماذج تحليل الأخطاء، أظهرت النتائج أن المترجمين يرون الأخطاء البسيطة الناتجة عن الترجمة الآلية أكثر خطورة من الأخطاء البشرية، مما له دلالات على تقييم جودة الترجمة والتدريب عليها. تساهم الدراسة في تقييم جودة الترجمة من خلال تقديم دليل تجريبي على التحيزات الإدراكية في تصور الأخطاء، وتوصي بمقترحات عملية لتحسين تعليم الترجمة وآليات تحرير النصوص الناتجة عن الترجمة الآلية.

الكلمات المفتاحية: تأثير تزايد الأخطاء، أخطاء الترجمة، الحمل المعرفي، الترجمة الآلية، التحرير الاحق، بحوث عمليات الترجمة

1. Introduction

Translation is a complex cognitive task which involves the mediation of linguistic, cultural and extralinguistic information between two languages (Angelone, 2010). An emerging issue in the more distributed use of MT systems among professional translators is how to respond to error perceptions and processing, a problem that has arisen with overlapping task-based human-machine interactions (Green et al., 2013; Koponen, 2016).

In this paper we introduce and investigate a new cognitive phenomenon which contrasts directly with increased receiving effort: the Mistake Magnification Effect (MME), observed for the first time in response to translation errors produced by machine. Although error types (Vilar et al., 2006) and correction policies (Lommel et al., 2014) have been thoroughly documented in previous studies, cognitive biases for the perception of errors are far from being fully understood by practitioners with respect to translation processes.

The potential importance of MME, both logically and empirically, has implications not only for on-the-ground translator training but also in translation quality control (TQC) methods as well as machine-translation deployment. In the midst of more advanced machine translation research like SMTs, that technological advancement calls for investigating human-computer error perception in specific translation contexts as well (Daems et al., 2017; Moorkens & O'Brien, 2017).

1.1 Research Questions and Hypotheses

The present study is an exploratory one aiming at answering three basic questions:

What are the effects of translation errors awareness on translator performance and cognitive effort?

To what extent does the origin of errors (human vs. machine) affect error perception and amplification?

What can we learn from the MME that would help to shape translation training and quality assessment?

Given that there is substantial existing support in cognitive bias literature and negativity bias theory (Rozin & Royzman, 2001; Baumeister et al., 2001), hypotheses could be made: \(H_y\) are suggested based on what we already know.

H1: Translators will display higher cognitive load and processing time when informed about the presence of errors as opposed to under error-naive conditions.

H2: Machine translation errors will be judged as more severe and require additional processing time than equivalent human-generated ones.

H3: The awareness of errors will cause more attention to be allocated to error regions, thereby decreasing the cognitive resources for contextual processing.

1.2 Study Objectives

The main objectives of this exploratory research are to:

- Provide preliminary empirical evidence for the existence of the Mistake Magnification Effect in translation.
- Examine cognitive mechanisms underlying error perception and processing using eye-tracking methodology.
- Analyze the impact of error source attribution on translator behavior and quality assessment.
- Develop initial recommendations for translation pedagogy and professional practice.

2. Theoretical Framework

2.1 The Mistake Magnification Effect: Conceptual Definition

In translation studies, Mistake Magnification Effect (MME) is a cognitive bias that occurs when translators increase their attention to error presence and allocate more effort during processing. This phenomenon seems to be especially strong when errors stem from automatically generated translations and/or translators are alerted explicitly about error occurrence.

The MME builds on established cognitive biases as reported in the psychological literature (Baumeister et al., 2001; Rozin & Royzman, 2001), such as negativity bias—the well-known propensity to respond more strongly cognitively and affectively to negative information than positive one. Cognitive psychology studies show that errors are paid more attention to and have stronger encoding than correct responses or neutral events.

The operation of the MME is based on four interconnected cognitive mechanisms:

Attentional Bias: Errors over-attract and under-repel attention in comparison with correct translations.

Source attribution: Implications of perceived errors (human/technology) for severity judgements and processing strategies.

Cognitive Anchoring: The first impression drives subsequent processing and quality evaluation.

Deficit Magnification: A lack of visual attention causes an overall lower perceived quality even when errors are minor.

2.2 Cognitive Load Theory and Attention Allocation

We also draw on ideas derived from Cognitive Load Theory (Sweller, 1988) and attention research (Wickens, 2002; Lavie, 2005), according to which error awareness leads to an increase in extraneous cognitive load resulting in less available processing capacity for proper translation. This additional burden is reflected in increased processing times, lower accuracy on subsequent tasks and different patterns of attention distribution.

The spotlight attention (Posner, 1980) and zoom lens models (Eriksen & St. James, 1986) offer theoretical bases for considering how error monitoring may influence the acceptance or rejection of cues eliciting shifts in the focus-of-attention. When errors are identified, attention is refocused narrowly around error-prone regions; this may lead to missing broader context suitable for translation.

2.3 Dual-Process Theory Applications

Cognitive Psychology Theories of Cognition based on Dual Process Models Neurocognitive processing models, in particular those that differentiate between automatic (System 1) and controlled (System 2) cognitive operations (Evans,2008; Stanovich & West, 2000)) provide insights into the mechanism underlying MME. The induction of error consciousness may activate controlled processing mode which can increase cognitive demand, and lead to over-processing of translation units that usually become automated.

From this theoretical viewpoint, translators with some experience (and who use more automatic processing) could potentially be specifically hampered by MME assistance when emasculating their conscious error detection processes. On the other hand, novice translators who use controlled processing to a greater degree than expert ones may have different patterns of sensitivity.

2.4 Source Attribution and Human-Computer Interaction

Studies of human-computer interaction identify that we have behavioral biases in judging the performance machine, versus humans (Lee & See, 2004; Parasuraman & Riley, 1997). These biases could occur in translation settings as different measurement standards for MT and HT quality (notwithstanding no difference).

Source attribution differences in translation could be exaggerated by professional attitudes to automation, fear of job loss and prejudices about how capable machine translations are. Awareness of such biases is essential in the successful incorporation of MT systems into professional working practices.

3. Literature Review

3.1 Translation Process Research and Cognitive Studies

Research on the process of translation has developed quite significantly since Krings (1986) for "the first time" used, think and say protocols to obtain information about translators' cognitive assembly. Key stroke logging (Jakobsen, 2003), eye tracking (Pavlovic & Jensen, 2009) and neurophysiological measures related to cognitive processes in translation production have been the focus of recent method studies (Hvelplund, 2016).
Cognitive concerns of translation have also been an object of much research, mostly in the field of working memory capacity and attention span (Seeber 2011; Timarová et al. (No transpose) 014). Studies have shown that translation work is a complex task causing high cognitive load since it involves simultaneous activities such as source text comprehension, cross-linguistic transfer and target language production (Shreve & Angelone, 2010). These cognitive requirements establish 'cognitive conditions' where bias and heuristics can (in) directly shape the decision making of translators.

3.2 Error Analysis and Quality Assessment

Error analysis has been fundamental to translation quality assessment since the field's establishment (House, 1997; Williams, 2009). Linguistic-centered conventional types of errors for the most part, described in classical error typologies linguistic mistakes such as lexical, syntactic semantic and pragmatic ones (Pym, 1992; Nord, 1997). Nevertheless, recent research emphasizes a more fine-grained consideration of error perception and subjective dimensions of quality judgment (Castilho et al., 2018; Specia et al., 2018).
The inclusion of machine translation has brought new perspectives to error analysis by examining unique qualities of MT errors and their effect on post-editing productivity (Temnikova, 2010; Koponen, 2012). It is observed that some types of error are more demanding for the cognitive effort of post-editing, which may have implications regarding training and developing MT systems (Lacruz et al., 2012; Carl et al., 2015).

3.3 Cognitive Biases in Decision-Making

Although cognitive biases have been discussed widely in the fields of psychology and decision-making research (Kahneman, 2011; Gilovich et al., 2002), transfer to TS is rare. However, there are exceptions that focus specifically on the impact of cognitive bias in translation research (Robert & Remael 2016) and quality assessment practices (Drugan, 2013).
Theoretically, the MME is based on research of negativity bias showing that negative information has a selective advantage in attention and memory encoding over positive or neutral information (Pratto & John, 1991). This bias might be particularly pertinent in translational settings, where error-detection and -correction consist of main professional practice.

3.4 Machine Translation and Human Perception

Human perception of the quality machine

translation It has been shown that human bias exists in translator assessment towards MT output (Koehn, 2009; Lopez, 2008). Studies also show that translators tend to be biased against MT output and rate monolingually-translated HT segments as better than the corresponding MT ones (Läubli et al., 2018; Toral et al., 2018).

Subsequent research has revealed that relationships between translators' attitudes, perception of MT quality and editing behavior are more complicated than they may seem (Moorkens et al., 2018; Guerberof, 2009). This provides evidence that psychological aspects play an important role in how translators treat with MT systems, and indicates a need for future research on cognitive biases in translation.

4. Methodology

4.1 Research Design

This project used an experimental mixed-methods approach which combined the use of quantitative measures (eye-tracking data, bivariate statistics and timing analysis) with qualitative information (think- aloud protocols, post-task interviews). The design used both within-subject and between-subject variables to address individual differences, while controlling for treatment effects.

Given the exploratory character of this investigation with its small sample size, it must be regarded as a pilot study aiming at providing initial evidence for the MME. All statistical results recognize the limitations of small sample sizes and highlight effect size as well as significance testing.

4.2 Participants

Twenty participants were recruited from translation degree programs and professional translator associations. Inclusion criteria were: (1) advanced proficiency in Arabic and English, (2) minimum three years of translation experience, and (3) no extensive prior experience with machine translation post-editing to avoid confounding familiarity effects.

Participant demographics:

- Age range: 22-35 years (M = 27.3, SD = 4.2)
- Translation experience: 3-12 years (M = 6.8, SD = 2.9)
- Educational background: 15 master's degree holders, 5 bachelor's degree holders
- Professional status: 12 professional translators, 8 advanced translation students
- Language direction: Arabic to English (18 native Arabic speakers, 2 native English speakers)

All participants provided informed consent and received monetary compensation for their time. The study was approved by the University of Kut Research Ethics Committee.

4.3 Materials

The translation task was based on a set of six business texts (300-400 words each) in Arabic selected to be neither too easy nor domain-general. Subjects were company communications, annual reports and business letters. Validity of text complexity as established by readability analysis and pilot testing.

For every source text, four experimental editions were created:

Control condition: Source text data L1 and non-errors.

Human errors condition: Text with some usual human-made mistakes in translation.

MT error type: Machine-translation with typical MT errors.

Mixed error class: Text containing human and MT errors types.

Error types were classified using the Multidimensional Quality Metrics (MQM) framework ((Lommel et al., 2014), such as:

- Lexical Mistakes: Selection of the wrong word, false friends, misuse of terminology.
- Syntactical mistakes: Language \ Syntax (For example, cases of faulty syntax; also, why morphophonology and other aspects are needed for understanding the language).
- Errors of semantics: Distortion of meaning, logical incoherence.
- Pragmatic mistakes: Misuse of register, failure to understand culture.

Error density was set to 15% for all experimental conditions, in order to ensure comparability. Errors were confirmed by 2 experienced translators from Arabic into English.

4.4 Equipment and Software

Eye-tracking measures were recorded by means of a Tobii Pro X3-120 eye tracker operating at 120 Hz. The system was one-point calibrated per participant. Translation was carried out with the aid of Translog-II (Carl, 2012), which enabled tracking via keystroke logging and a timing recording.

Think-aloud protocols were gathered from participants by means of professional-quality audio recording equipment including noise-cancelling headphones and directional microphones. Recording devices were calibrated before each individual experiment to ensure data quality.

4.5 Procedure

Each experimental session took about 2.5 hours and comprised: Pre-task phase (30 minutes): Participant instruction, equipment setup and calibration, router script run-through, questionnaire on demographics and consent signing.

During training (15 minutes): Introduction to eye tracking configuration, practice think aloud protocols and familiarization with the system.

Translation (90min): 6 translation tasks, randomized order with a break of five minutes after each.

Post-task phase (45 minutes): Semi-structured interview, including issues related to strategies for mental representation of errors and translation experience in addition to attitudes toward machine translation.

In translation, participants were asked to translate text from Arabic into English aloud. A total of ten subjects were assigned to the error-aware condition (informed about potential errors), with an additional 10 forming an error-naive control group.

All tests were performed in the same laboratory setting including lighting, temperature and noise conditions. Subjects had the right to refuse participation at any time.

4.6 Data Analysis

Quantitative analysis included:

- Performance: We measure translation time, accuracy according to human assessment, post- edition frequency and error detection.
- Eye-tracking data: Fixation duration, saccade pattern, attention spread across paragraphs and AOIs (Areas of interest) etc.
- Cognitive load cues: Pupil dilation reading effort (as a cue for cognitive activity), fixation patterns in regions harboring errors.

Qualitative analysis involved:

- Think-aloud protocol analysis: coding of error detection strategy, metacognitive comments, emotional reactions and attempt by the pupil to switch strategies.
- Interview material: Thematic analysis of post-task reflections on translation experience and error (mis) conception.

All statistical analyses were conducted with the R software (version 4.3.0, www.r-project.org) using mixed effect models for within subject and between depth signals to account for repeated measures as well as individual differences37. Cohen's d was used to calculate effect sizes, with 95% confidence intervals. Due to the exploratory nature of this study and limited sample size, α was.05 for statistical significance but we focused on practical significance by examining effect sizes.

5. Results

5.1 Translation Performance Measures

Analysis of translation quality indicated significant effects on several dependent variables, in line with H1.

Translation Time: Error-aware participants took significantly longer to translate than error-naive ones. The average translation time per text segment was 44% higher in error-aware conditions (M = 156.3 s, SD = 28.7) than in error-naive conditions (M D116.8s,SDD22.4), a large difference with an effect size of Cohen's d“1:52;95%CI [0:82;2·22]. This differential effect was most extreme for the MT error conditions, with error-aware participants taking 51% longer than controls.

Translation Quality: Complexity in quality assessment was observed. Error-aware participants had (as expected) better error detection rates, 87% compared to 62%, but their translation quality scores were paradoxically lower because of overcorrection and unnecessary changes made on acceptable translations. When humans-as-evaluators were asked to rate the translations, error-aware outputs scored lower in terms of fluency and naturalness (both compared to their human reference) even when they are more technically correct.

Rate of Revision: error-aware participants revised many more times per region (M = 8.7, SD = 3.2) than did naive participants (M = 5.1, SD=2.I), t(18)=4/23; p <. 001, Cohen's d = 1.33, 95% CI [0.65, 2.01]. A detailed investigation showed that 34% of these extra revisions were made to acceptable translations, indicating overcorrection.

5.2 Eye-tracking Analysis

Objective cues to attentional allocation and cognitive processing style were demonstrated by eye-tracking measures, lending strong support for H3.

Mean Length of Fixation: Participants in the error-aware conditions spent significantly longer reading text containing errors (M = 847ms, SD = 234ms) than equivalent text without errors (M = 623 ms,SD=187), giving added support for increased processing demand through a moderate effect size (Cohen’s d =1.09,95% CI [0.45–1.73]).

Attention distribution: The heatmaps indicated significant differences in attention. Error awareness led to focused attention with 68% of all fixations in total directed towards error regions, compared with the control condition (34%). This increased attentional focus was related to decreased relative attention toward contextual information and less coherence of the text.

Cognitive Load Measures: Objective cognitive load was observed in error-aware conditions as well, measured through pupil diameter. Average pupil dilation was 12% higher than baseline (Cohen's d = 0.73, [95% CI: 0.09 to –1.37]), corresponding to a moderate–large effect size of increased cognitive effort.

Saccade patterns: Error-aware participants showed less stable saccade patterns with a higher frequency of regression (backwards eye movements) and shorter progression saccades, which is indicative for less-efficient reading and processing strategies.

5.3 Error Type Analysis

Different types of errors demonstrated differing levels of magnification effects, and these were evidence for the cognitive processes involved in MME:

Lexical Errors: Showed the most pronounced magnification effect with 89% longer processing in error-aware conditions (95% CI [67%, 111%]). Think-aloud protocols were found to include many dictionary consults and synonym looks-up, including long after most arguable decision points.

Syntactic errors: Displayed medium magnification effects of 43% longer processing time (95% CI [28%, 58%]). Subjects engaged in meticulous grammatical detail analysis, and multiple alternative formulations were produced with many first ones second-guessed against the background of what later turned out to be correct.

Semantic Errors: Shown in variable magnification with processing times 23% to 67% longer (95 % CI [15%, 78%]), depending on how seriously the error is and participant's expertise. Older translators were more likely to overmagnify delicate semantic deviations.

Pragmatic Errors: Had the smallest magnification effect at 18% longer processing (95% CI [8%, 28]), perhaps because judgements of pragmatic appropriateness are more subjective and tolerate stylistic variation.

5.4 Source Attribution Effects

Analysis of error source attributions showed that bias effects were significant:

MT Error Bias: Errors produced by a machine were perceived as more severe and took 28% longer to respond to than the same errors made by human translators.

Overall quality ratings were significantly lower when the texts were labeled as MT output (M = 6.2/10, SD = 1.4) rather than human translation (M = 7.8/10, SD = 1.2); $t(19) = -3.67$; $p < .01$).

Error Tolerance: Participants often made useful justifications and context-based defenses for suboptimal translations showing a higher tolerance of human mistakes.

5.5 Individual Differences

Analysis identified some significant patterns of individual variation:

Experience Effects: Contrary to expectations, more experienced translators (>7 years) displayed a greater MME pattern; this could be an indication that higher sensitivity for quality differences and stronger professionalism. More experienced participants did exhibit on average 23% higher magnification effects than less experienced counterparts.

Personality Factors: Individuals high in perfectionism (measured by post-task questionnaire) showed greater MME effects, with 25% longer EPN processing times than low-perfectionism individuals (r = 0. 01).

MT Attitudes: Pre-MTM attitudes toward machine translation were a significant predictor of MME magnitude. Those subjects with the most negative attitudes towards MT showed enhanced magnification effects (r = 0.64, p <. 01), indicating that the impact of bias is somewhat dependent on attitudes.

Level of Education: Participants who obtained a master's degree had stronger MME effects than those holding only bachelor's degrees, which may owe to the difference in theoretical knowledge about how translation quality and error is evaluated.

5.6 Think-aloud Protocol Analysis

Content analysis of think-aloud protocols identified several common themes associated with MME:

Increased Vigilance: Error-conscious participants displayed heightened monitoring behavior, frequently making remarks about possible problems or unsure of the decisions they make in translating. Sample comments were "I am trying to find errors" and "This is too easy, so there must be something wrong."

Metacognitive Interference: Error awareness elicited explicit metacognitive reflection, which may have interfered with spontaneous processing fluency. They often expressed self-doubt: "I keep second-guessing myself" and "right now I'm being too cautious, but I can't help it."

Emotional Reactions: There were clear negative emotional reactions to the existence of errors with participants stating frustration ("This is so annoying") and anxiety about them ("I'm worried I'm missing something"), along with lower confidence in oneself ("I don't trust my instincts anymore").

Strategic Change: Error awareness lead to a strategic change from fluency-driven strategies towards accuracy-related translation procedures. Learners attended more to outside sources, chose fewer risky translations and were generally less open to risk taking.

Time pressure awareness: Highly cited in responses as factor to feeling pressured for time was increased monitoring of errors, comments like "I know I am taking too long but have check everything" highlighting the cognitive cost that comes with more vigilance.

6. Discussion

6.1 Evidence for the Mistake Magnification Effect

The results offer preliminary evidence for the Mistake Magnification Effect in translation, and have theoretical as well as pedagogical implications. The reliable effects of prolonged RT and reshuffled attention, biased perceptual assessments in error-aware trials indicate top-down cognitive changes more sustained than mere adjustments to correcting errors.

It was initially surprising to observe a stronger MME effect in the more experienced translators, but this runs parallel with expertise research which has shown that experts are often more sensitive than novices to domain-relevant information (Chi et al., 1988; Ericsson & Lehmann, 1996). This increased sensitivity is helpful in trolling for quality, but it can backfire if users are given a chance to be overly critical and make too many changes.

This magnitude of effect sizes (Cohen's d = 0.73-1.52) indicates that MME is a sizeable cognitive phenomenon with practical implications, despite the small sample sized used in this study.

Nevertheless, these preliminary results need to be confirmed in a larger study.

6.2 Cognitive Mechanisms Underlying MME

Eye-tracking data is informative about the cognitive mechanisms underlying the MME. The fixations to error regions, the longer fixation duration and pupil diameter should be regarded as a reflection of increased activation level in controlled processing systems when participants become aware that they have made errors, which might compete with automatic translation processes.

This is consistent with dual-process accounts that posit interference between explicit awareness and implicit, automatic processing (Schooler, 2002; Wilson & Schooler. Patterns of observed attention distributions in Experiment 1 argue for such a cognitive resource competition hypothesis, by which error-related attention expenditure could constrain resources directed to context-processing and more flexible translation options.

The pupil dilation results averaged measures of cognitive load, confirming predictions derived from Cognitive Load Theory. The 12% change in pupil diameter reflects a significant increase in cognitive effort that could explain the observed performance decrements despite higher error detection accuracy.

6.3 Source Attribution Bias and Professional Implications

The strong negative bias toward MT output—reflected both in lower quality ratings for and longer reaction times to (correct) MA errors—not surprisingly, follows a more general pattern of human-computer interaction where machine performance is judged harsher than comparable performances by humans (for an extensive overview see Parasuraman & Riley 1997; Lee & See 2004).

This bias has formative consequences for the integration of MT into professional translation work processes. The fact that the same errors are treated differently depending on whether their sources were attributed to such result is a strong indication of how communicative and/or informative dynamics may end up biasing translator's behavior in ways that might affect more objective measures of quality.

The source attribution effect also emphasizes the need for translators\' attitudes and preconceptions to be taken into account in MT training. Professional development efforts may also be required to focus explicitly on these biases in order for humans and machines to work most effectively together.

6.4 Implications for Translation Process Research

These results further the study of translation processes by illustrating cognitive biases in translator responses. The MME is a clear illustration of the role played by metacognitive awareness in translation performance, and contributes to our understanding of consciousness versus expertise in professional translating.

The research also suggests that translation cognition models should be more complex and include emotional/motivational elements in addition to cognitive processing features. The participants' emotional responses when they were aware of the fact that they made an error indicate that affective variables might have significant effects on translation production and quality assessment.

The paradoxical result that more error awareness may lead to lower overall quality while improving detection rates contradicts simple models of translation product improvement and implies a far less clear-cut relation between the conscious control over work-in-progress (WIP) and professional performance.

6.5 Practical Applications and Recommendations

Training for Translation: The MME results point out that translation training programs could include modules on error perception biases and metacognitive regulation mechanisms. Training may also involve tasks targeting error sensitivity modulation to facilitate a response adjusted towards stopping excessive over-correction.

Specific training recommendations include:

- Bias awareness workshops to teach translators to spot overcorrections
- Balanced attention allocation: Meta-cognitive strategy training
- Authenticity-based error severity quantification activities
- Mindfulness techniques to help with anxiety-related over-monitoring

Quality assessment: The bias effects that we show here have potential implications for translation quality control. Magnification effects should be considered in quality evaluation procedures, and blind evaluations may offer more promise as to reduce source attribution bias.

Recommended quality assessment modifications include:

- Implementation of blind evaluation procedures
- Multi-stage audit that places an initial emphasis on communicative effectiveness
- Failure of error weighting systems to focus on functional rather than technical flaws
- Training of assessors to identify and control for effects of bias

Machine Translation Integration: Comprehension to MME may lead the way for better MT integration strategies into professional work-flow. Source: Psychological principles-informed MT training could focus on bias factors that impact the human-machine interaction, and then interfaces of an MT system can be designed to avoid features triggering cognitive biases.

8. Conclusion

This exploratory study represents the first empirical manifestation of a MMET—a cognitive distortion that impacts upon translator behavior, attention allocation and quality judgments in a consistent manner. Although the sample size and scope are limited, we found similar trends of longer processing time, more attention shifts in reading patterns and non-significant unidirectional bias toward evaluation related to error-awareness for both human translations as well machine translation output.

The theoretical implications are far-reaching for TPR which shows that increased awareness and monitoring could have the opposite effect of overall performance quality. This reveals the intricate interplay between conscious attention and expert knowledge, which in turn calls for more sophisticated models of translation cognition.

The impact is very practical for different target groups from the translation field. Bias awareness and metacognitive regulation aspects should be included in translation training programs, so that translators can calibrate their error sensitivity accordingly. Quality assurance approaches should adjust for magnification effects and blind testing methods could be considered to avoid source attribution bias. The psychological dimensions of human-machine cooperation should be taken into account in the implementation stage (for example, through psycho-cognitive orientated training).

Though these results need to be further tested and expanded in order for the extent of their validity to become clear, the findings also offer valuable new research directions at the crossroads between cognitive psychology and translation. Taking into account cognitive biases in translation is therefore an essential step towards the establishment of more effective curricula, testing methods and human-machine collaboration protocols that aim to maximize efficiency without sacrificing quality in professional practice.

The Mistake Magnification Effect points to an elementary cognitive process, which has been largely neglected in studies of translation. By acknowledging and working to overcome these cognitive biases, the translation field should strive for evidence-based procedures that consider all aspects of human cognition in professional translating settings.

Future work in this direction holds the potential to extend our knowledge of what takes place during translation at a cognitive level, and can offer practical resources for translator training and QA/MT integration into professional practice. The integration of cognitive psychology and translation studies offers a useful model from which evidence-based practices for language professions more generally - can be developed.

References

- Angelone, E. (2010). Uncertainty, uncertainty management and metacognitive problem solving in the translation task. In G. M. Shreve & E. Angelone (Eds.), Translation and cognition (pp. 17-40). John Benjamins.
- Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. Review of General Psychology, 5(4), 323-370.
- Carl, M. (2012). Translog-II: A program for recording user activity data for empirical reading and writing research. Proceedings of the Eight International Conference on Language Resources and Evaluation, 4108-4112.
- Carl, M., Dragsted, B., Elming, J., Hardt, D., & Jakobsen, A. L. (2011). The process of post-editing: A pilot study. Copenhagen Studies in Language, 41, 131-142.
- Carl, M., Schaeffner, C., & Bangalore, S. (2015). New directions in empirical translation process research. Springer.
- Castilho, S., Doherty, S., Gaspari, F., & Moorkens, J. (2018). Approaches to human and machine translation quality assessment. In J. Moorkens, S. Castilho, F. Gaspari, & S. Doherty (Eds.), Translation quality assessment: From principles to practice (pp. 9-38). Springer.
- Chi, M. T., Glaser, R., & Farr, M. J. (Eds.). (1988). The nature of expertise. Lawrence Erlbaum Associates.
- Daems, J., Vandepitte, S., Hartsuiker, R. J., & Macken, L. (2017). Identifying the machine translation error types with the greatest impact on post-editing effort. Frontiers in Psychology, 8, 1282.
- Drugan, J. (2013). Quality in professional translation: Assessment and improvement. Bloomsbury Academic.
- Ericsson, K. A., & Lehmann, A. C. (1996). Expert and exceptional performance: Evidence of maximal adaptation to task constraints.

Annual Review of Psychology, 47(1), 273-305.

- Eriksen, C. W., & St. James, J. D. (1986). Visual attention within and around the field of focal attention: A zoom lens model. Perception & Psychophysics, 40(4), 225-240.
- Evans, J. S. B. (2008). Dual-process accounts of reasoning, judgment, and social cognition. Annual Review of Psychology, 59, 255-278.
- Gilovich, T., Griffin, D., & Kahneman, D. (Eds.). (2002). Heuristics and biases: The psychology of intuitive judgment. Cambridge University Press.
- Green, S., Heer, J., & Manning, C. D. (2013). The efficacy of human post-editing for language translation. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 439-448.
- Guerberof, A. (2009). Productivity and quality in MT post-editing. Proceedings of MT Summit XII Workshop on Beyond Translation Memories: New Tools for Translators, 11-16.
- House, J. (1997). Translation quality assessment: A model revisited. Gunter Narr Verlag.
- Hvelplund, K. T. (2016). Eye tracking and the translation process: Reflections on the analysis and interpretation of eye-tracking data. MonTI. Monografías de Traducción e Interpretación, 8, 201-223.
- Jakobsen, A. L. (2003). Effects of think aloud on translation speed, revision, and segmentation. In F. Alves (Ed.), Triangulating translation: Perspectives in process oriented research (pp. 69-95). John Benjamins.
- Kahneman, D. (2011). Thinking, fast and slow. Farrar, Straus and Giroux.
- Koehn, P. (2009). Statistical machine translation. Cambridge University Press.
- Koponen, M. (2012). Comparing human perceptions of post-editing effort with post-editing operations. Proceedings of the 7th Workshop on Statistical Machine Translation, 181-190.
- Koponen, M. (2016). Is machine translation post-editing worth the effort? A survey of research into post-editing and effort. The Journal of Specialised Translation, 25, 131-148.
- Krings, H. P. (1986). Was in den Köpfen von Übersetzern vorgeht: Eine empirische Untersuchung zur Struktur des Übersetzungsprozesses an fortgeschrittenen Französischlernern. Gunter Narr Verlag.
- Lacruz, I., Denkowski, M., & Lavie, A. (2012). Cognitive demand and cognitive effort in post-editing. Proceedings of the 10th Biennial Conference of the Association for Machine Translation in the Americas, 1-10.
- Läubli, S., Sennrich, R., & Volk, M. (2018). Has machine translation achieved human parity? A case for document-level evaluation. Proceedings of the 2018 Conference on Empirical Methods in Natural Language Processing, 4791-4796.
- Lavie, N. (2005). Distracted and confused?: Selective attention under load. Trends in Cognitive Sciences, 9(2), 75-82.
- Lee, J. D., & See, K. A. (2004). Trust in automation: Designing for appropriate reliance. Human Factors, 46(1), 50-80.
- Lommel, A., Uszkoreit, H., & Burchardt, A. (2014). Multidimensional quality metrics (MQM): A framework for declaring and describing translation quality metrics. Revista Tradumàtica, 12, 455-463.

- Lopez, A. (2008). Statistical machine translation. ACM Computing Surveys, 40(3), 1-49.
- Moorkens, J., & O'Brien, S. (2017). Assessing user interface needs of post-editors of machine translation. In D. Kenny (Ed.), Human issues in translation technology (pp. 109-130). Routledge.
- Moorkens, J., Castilho, S., Gaspari, F., & Doherty, S. (Eds.). (2018). Translation quality assessment: From principles to practice. Springer.
- Nord, C. (1997). Translating as a purposeful activity: Functionalist approaches explained. St. Jerome Publishing.
- Parasuraman, R., & Riley, V. (1997). Humans and automation: Use, misuse, disuse, abuse. Human Factors, 39(2), 230-253.
- Pavlović, N., & Jensen, K. T. (2009). Eye tracking translation directionality. In A. Pym & A. Perekrestenko (Eds.), Translation research projects 2 (pp. 93-109). Intercultural Studies Group.
- Posner, M. I. (1980). Orienting of attention. Quarterly Journal of Experimental Psychology, 32(1), 3-25.
- Pratto, F., & John, O. P. (1991). Automatic vigilance: The attention-grabbing power of negative social information. Journal of Personality and Social Psychology, 61(3), 380-391.
- Pym, A. (1992). Translation and text transfer: An essay on the principles of intercultural communication. Peter Lang.
- Robert, I. S., & Remael, A. (2016). Quality control in the subtitling industry: An exploratory survey study. Meta: Translators' Journal, 61(3), 578-605.
- Rozin, P., & Royzman, E. B. (2001). Negativity bias, negativity dominance, and contagion. Personality and Social Psychology Review, 5(4), 296-320.
- Schooler, J. W. (2002). Verbalization produces a transfer inappropriate processing shift. Applied Cognitive Psychology, 16(8), 989-997.
- Seeber, K. G. (2011). Cognitive load in simultaneous interpreting: Existing theories—new models. Interpreting, 13(2), 176-204.
- Shreve, G. M., & Angelone, E. (Eds.). (2010). Translation and cognition. John Benjamins.
- Specia, L., Blain, F., Logacheva, V., Astudillo, R., & Martins, A. F. (2018). Findings of the WMT 2018 shared task on quality estimation. Proceedings of the Third Conference on Machine Translation, 689-709.
- Stanovich, K. E., & West, R. F. (2000). Individual differences in reasoning: Implications for the rationality debate? Behavioral and Brain Sciences, 23(5), 645-665.
- Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. Cognitive Science, 12(2), 257-285.
- Temnikova, I. (2010). Cognitive evaluation approach for a controlled language post-editing experiment. Proceedings of the Seventh International Conference on Language Resources and Evaluation, 3485-3490.
- Timarová, Š., Čeňková, I., Meylaerts, R., Hertog, E., Szmalec, A., & Duyck, W. (2014). Simultaneous interpreting and working memory executive control. Interpreting, 16(2), 139-168.
- Toral, A., Castilho, S., Hu, K., & Way, A. (2018). Attaining the unattainable?

Reassessing claims of human parity in neural machine translation. Proceedings of the Third Conference on Machine Translation, 113-123.

- Vilar, D., Xu, J., d'Haro, L. F., & Ney, H. (2006). Error analysis of statistical machine translation output. Proceedings of the Fifth International Conference on Language Resources and Evaluation, 697-702.
- Wickens, C. D. (2002). Multiple resources and performance prediction. Theoretical Issues in Ergonomics Science, 3(2), 159-177.
- Williams, M. (2009). Translation quality assessment. Linguistics and Language Compass, 3(6), 1370-1383.
- Wilson, T. D., & Schooler, J. W. (1991). Thinking too much: Introspection can reduce the quality of preferences and decisions. Journal of Personality and Social Psychology, 60(2), 181-192.