Linguistic and cognitive modelling of concentration and inhibition in simultaneous interpreting quality assessment

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Abstract. The present study examines concentration and inhibitory control as key psycholinguistic mechanisms underpinning the quality of simultaneous interpreting. The present study examines concentration and inhibitory control as key psycholinguistic mechanisms underpinning the quality of simultaneous interpreting. Drawing on research in executive functions and bilingual control, such as the frameworks proposed by Miyake and colleagues (2000), Green (1998), and Dong and Xie (2014), as well as recent advances in Cognitive Translation Studies and situated cognition, including the work of Risku and Rogl (2020), the study introduces a linguistic-cognitive model that connects time-based and structural features of interpreter output with quality assessment scales employed in professional training. Concentration is operationalized via ear-voice span (EVS) and a balance of cognitive load index (BKN), while inhibition is measured using a cognitive economy coefficient (KCE) and an emotional-cognitive equilibrium index (EKE), reflecting interpreters' regulation of affective and analytical responses in real time. These indices are synthesized into a composite Cognitive Integration Index (CII), offering a comprehensive metric for interpreting performance. Empirical data were collected from a longitudinal experiment involving 68 MA interpreting students (English–Ukrainian, B2–C2) enrolled in a six-month "Simultaneous Interpreting Training" course (2 hours daily, 5 days per week, in 15-minute blocks with 5-minute breaks). Pre- and post-training recordings of simultaneous interpreting of political and diplomatic speeches were transcribed and annotated for EVS, pauses, self-repairs, and semantic compression; quality was rated by independent experts using EMT-based scales. Results indicate that concentration and inhibition in interpreting are not merely abstract psychological traits, but measurable and trainable cognitive skills. The study suggests that psycholinguistic monitoring, including EVS tracking and composite indices such as CII, can be integrated into interpreter education. Implications for aligning Ukrainian curricula with EMT standards and for interpreting in crisis and war-related contexts are discussed.

Keywords: simultaneous interpreting, concentration, inhibition, cognitive load, interpreter training, ear-voice span, linguistic and cognitive modelling.

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Скрильник Сергій. Лінгвокогнітивне моделювання концентрації та інгібіції в оцінюванні якості синхронного перекладу.

У цьому дослідженні концентрація та інгібіторний контроль розглядаються як ключові психолінгвістичні механізми, що лежать в основі якості синхронного перекладу. Спираючись на дослідження виконавчих функцій і контролю в білінгвізмі, зокрема на теоретичні моделі, запропоновані Міяке та колегами (2000), Ґріном (1998), а також Донґом і Сє (2014), а також на сучасні напрацювання в межах когнітивних студій перекладу та концепції ситуативної когніції, представлені у працях Ріску і Роґла (2020), у статті запропоновано лінгвокогнітивну модель, що поєднує часові й структурні характеристики продукту синхронного перекладу зі шкалами оцінювання якості, які застосовуються в професійній підготовці перекладачів. Концентрацію операціоналізовано за допомогою показника *ear–voice span* (EVS) та індексу балансу когнітивного навантаження (BKN), тоді як інгібіторний контроль вимірюється за допомогою коефіцієнта когнітивної економії (KCE) та індексу емоційно-когнітивної рівноваги (EKE), що відображають здатність перекладачів у режимі реального часу регулювати афективні й аналітичні реакції. Зазначені показники інтегровано в узагальнений індекс когнітивної інтеграції (Cognitive Integration Index, CII), який пропонується як комплексна метрика якості синхронного перекладу. Емпіричні дані було зібрано в межах лонгітюдного експерименту за участю 68 студентів магістерської програми з усного перекладу (англійська–українська, рівні B2–C2), які протягом шести місяців навчалися на курсі «Синхронний переклад» (2 години щодня, 5 днів на тиждень, у 15-хвилинних блоках із 5-хвилинними перервами). Аудіозаписи синхронного перекладу політичних і дипломатичних промов до та після навчання було транскрибовано й анотовано за параметрами EVS, пауз, самокорекцій і семантичної компресії; якість перекладу оцінювали незалежні експерти із застосуванням шкал, розроблених на основі стандартів EMT. Отримані результати свідчать, що концентрація та інгібіторний контроль у синхронному перекладі є не лише абстрактними психологічними характеристиками, а вимірюваними й тренованими когнітивними навичками. У дослідженні обґрунтовується доцільність упровадження психолінгвістичного моніторингу, зокрема відстеження EVS та використання композитних індексів на кшталт CII, у систему підготовки перекладачів. Окремо обговорюються наслідки для гармонізації українських освітніх програм зі стандартами EMT, а також для практики синхронного перекладу в умовах кризи та війни.

Ключові слова: синхронний переклад; концентрація; інгібіція; когнітивне навантаження, підготовка усних перекладачів, часова затримка, лінгвокогнітивне моделювання.

Introduction

Simultaneous interpreting has long been described as a cognitively saturated activity, but recent psycholinguistic research has shifted the focus from general processing difficulty to the specific architecture of executive functions that enables interpreters to operate under extreme temporal and linguistic constraints. Following the influential model of executive control proposed by Miyake et al. (2000), three components—inhibition, updating, and shifting—form the backbone of complex goal-directed performance. Contemporary

interpreting studies increasingly adopt this framework to explain the moment-to-moment coordination of listening, semantic integration, anticipation, linguistic planning and speech production.

From a bilingualism perspective, Green's (1998) Inhibitory Control Model (ICM) provides a further theoretical lens: interpreters must continually suppress competing lexical and conceptual representations while prioritising the target-language channel. Psycholinguistic studies in East Asia have expanded this argument, demonstrating that interpreting experience enhances both conflict monitoring and interference control. Dong and Xie (2014) showed that student interpreters outperform non-interpreting bilinguals on tasks requiring resistance to lexical and semantic distractors, while Eysenck, M. W., et al. (2007) found that anxiety reduces the efficiency of attentional control by consuming executive resources, particularly those involved in inhibition and goal maintenance. These findings situate interpreting expertise within the broader field of bilingual executive adaptation.

Parallel to the psycholinguistic tradition, cognitive translation scholars have increasingly emphasised the situated, embodied and emotionally modulated nature of interpreting. Risku and Rogl (2020) argue that translation processes cannot be reduced to internal computation alone; they involve dynamic interaction with environmental cues, multimodal stimuli, and affective states that support or destabilise cognitive performance. Within Ukraine, scholars have elaborated linguistic-cognitive interpretations of interpreter behaviour, foregrounding such mechanisms as mental modelling, inferencing, semantic compression and the strategic distribution of cognitive resources during high-density discourse.

This integrated perspective helps account for the fluctuating nature of concentration in real-time interpreting. Concentration is not a stable trait but a situationally emergent pattern shaped by memory updating, selective attention and inhibitory suppression. Psycholinguistic studies have repeatedly shown that unstable concentration correlates with longer ear-voice span (EVS), reduced monitoring accuracy and increased self-repair frequency. Conversely, efficient inhibition predicts tighter EVS ranges, more consistent segmentation, and reduced redundancy in output—phenomena that align closely with the interpreter's ability to maintain coherent discourse structure under accelerating cognitive load.

However, inhibition in interpreting is not solely linguistic. High-stakes speeches often carry emotional cues that risk overpowering cognitive focus. Research in affective psycholinguistics (e.g., Barrett, 2017; Kensinger & Schacter, 2008) demonstrates that emotional salience competes with working memory and slows conflict resolution. Given the emotional saturation of contemporary Ukrainian interpreting contexts—war-related briefings,

diplomatic appeals, humanitarian discourse—this interplay becomes especially significant. Interpreters must resist both linguistic and affective interference, maintaining pragmatic sensitivity without allowing emotional contagion to distort output.

Against this background, the present study advances a linguistic-cognitive model that conceptualises concentration and inhibition not as abstract constructs but as measurable psycholinguistic phenomena embedded in interpreter output. Building on the author's doctoral framework, the model operationalises attention and inhibition through four interconnected indices:

- Ear-Voice Span (EVS) as a measure of temporal attention management;
- Balance of Cognitive Load Index (BKN) as an indicator of stabilised processing under fluctuating information density;
- Cognitive Economy Coefficient (KCE) as a measure of inhibitory efficiency expressed through semantic compression;
- Emotional-Cognitive Equilibrium (EKE) as a qualitative descriptor of affective regulation enabling stable linguistic planning in emotionally charged segments.

These indices are integrated into the Cognitive Integration Index (CII), which reflects the tightness of coupling between concentration and inhibition. The model builds on the assumption, supported by prior psycholinguistic research, that interpreting proficiency depends not on maximising one function but on achieving dynamic equilibrium acr*oss functions*. An interpreter with excellent inhibition but unstable attention will still show cognitive breakdowns; likewise, stable EVS without inhibitory control leads to verbosity or overexplicitation. It is the integration—quantified through CII—that predicts quality.

Eastern and Asian scholars have also contributed significantly to this integrative viewpoint. Setton (1999) offered an early cognitive-pragmatic model describing interpreting as a form of constrained mental simulation. Lee (2012) examined EVS variability in Korean–English interpreting and demonstrated how strategic anticipation supports cognitive economy. Dong and Lin (2013) expanded parallel processing in simultaneous interpreting and demonstrated how strategic anticipation supports cognitive economy. Chen (2020) proposed a hybrid model of affective inhibition during high-stress interpreting tasks. In Europe and North America, work by Gile (2009), Moser-Mercer (2010), and (Seeber et al. 2011) similarly highlights the interdependence of attention, cognitive load and processing capacity in interpreting performance.

Recent psycholinguistic research has focused on the significant cognitive and attentional requirements imposed on trainee interpreters. In a comprehensive study of EFL, Moneus, Al-Inbari, and Al-Wasy (2024) demonstrate that

numerous challenges that occur in simultaneous interpreting happen because of attentional overload, constrained processing speed, and inadequate inhibitory control, rather than only from deficiencies in linguistic understanding.

Ukrainian scholarship brings an additional emphasis on interpreting under crisis conditions, where emotional load and ethical responsibility intersect. Studies by Kovalenko (2020), Tymoshchuk (2021) and Krupa (2023) underscore how interpreters navigate heightened stress, rapid shifts in discourse modalities and the cultural-pragmatic pressures of wartime communication. These contexts require interpreters not only to inhibit linguistic interference but also to regulate empathy, distress, or moral shock—dimensions directly reflected in the EKE index proposed here.

Taken together, these sources provide a basic foundation for the present model. From psycholinguistics, we adopt executive control principles; from cognitive translation studies, situated cognition; from Ukrainian interpreting research, affective-pragmatic regulation. The model synthesises these strands into a unified framework capable of linking cognitive theory with measurable behavioural output. Such alignment not only strengthens the validity of interpreting quality assessment but also opens a path for curriculum reform, where concentration and inhibition are trained as psycholinguistic skills rather than incidental by-products of practice.

Method

Experiment Design

Participants

The study involved 68 MA students in Translation/Interpreting (1st and 2nd year) at the Taras Shevchenko National University of Kyiv translation department. All participants were Ukrainian–English students with B2–C2 proficiency in English and L1 Ukrainian, aged 20–22 years, neurotypical participants with no hearing deficit. Participation in the study was voluntary and formed part of their regular interpreter training.

The core idea was to embed psycholinguistic training into a regular simultaneous interpreting course and to monitor its effects through the indices EVS, BKN, KCE, EKE and the composite CII.

The proposed linguistic-cognitive model integrating concentration- and inhibition-related indices is presented in Figure 1.

Figure 1
The Linguistic-Cognitive Model of Interpreting Performance

Linguistic-Cognitive Model of Interpreting Performance

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┌──────────────┐              ┌──────────────┐              ┌──────────────┐
│     EVS      │              │  Cognitive   │              │     KCE      │
│     BKN      │   ──────▶    │ Integration  │    ◀──────   │     EKE      │
│(Concentration)│              │  Index (CII) │              │ (Inhibition) │
└──────────────┘              └──────────────┘              └──────────────┘
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For the purposes of analysis, the students were divided into two groups:
- an experimental group (n ≈ 34), which followed a cognitive-strategy-based training module integrating empathy, intensification and mitigation strategies within the MBIUP–EKB model;
- a comparison group (n ≈ 34), which followed the standard simultaneous interpreting syllabus without explicit psycholinguistic training in attention and emotion regulation.

Training Context and Design

The experiment was delivered over two academic semesters (approximately six months). Teaching followed this schedule:
- 2 hours per day,
- 5 days per week,
- organised into 15-minute interpreting blocks with 5-minute breaks between blocks.
  The course combined:
- controlled RSI-like setups for simultaneous interpreting;
- corpus-based analysis of authentic political, diplomatic and war-related speeches (UN, OSCE, European Parliament, NATO, national addresses);
- targeted exercises on chunking, semantic mapping, voice mirroring, emotion labelling and affective detachment, designed to strengthen attention control and inhibition of interfering cues.
- The speech corpus comprised 48 English-language public speeches delivered by officials of international organisations and national

governments, including representatives of the UN, EU, and NATO, as well as heads of state, ministers, and institutional spokespersons. Of these, 32 speeches were used during the training phase, and 16 speeches were reserved for pre- and post-test assessment.

The design was pre-test / post-test:

- T1 (pre-test): baseline measurements of all indices (EVS, BKN, KCE, EKE, CII) and expert quality scores.
- Training phase: only the experimental group received explicit psycholinguistic training based on the MBIUP–EKB model; the comparison group practised interpreting with conventional error-focused feedback.
- T2 (post-test): repeated measurements under comparable task conditions (similar speech length, tempo and density).

Materials

The speech corpus combined English-language political, diplomatic and crisis-related addresses delivered between 2014 and 2025, reflecting the communicative conditions of Ukrainian war-time and diplomatic interpreting. Texts were selected to vary systematically in:

- speech rate (approximately 120/140/160 wpm),
- terminological density (low/medium/high),
- genre (plenary speech, press conference, interview, commemorative address),
- emotional load (neutral, moderately affective, high affect).

Audio files were played in class; participants interpreted into Ukrainian in simultaneous mode. For each participant at each time point, two speeches (7–10 minutes each) were analysed in depth.

Data Collection and Annotation

All interpreting performances were audio-recorded and transcribed with time alignment. Using ELAN, annotators marked:

- onset and offset of source and target segments,
- pauses longer than 2 seconds,
- overt self-repairs and false starts.

This allowed us to compute EVS and derive further time-based indices.

Transcripts were segmented into micro-segments (average ≈ 12 words) to facilitate consistent measurement of:

- local speech rate,
- the number of self-repairs,

- reductions and explicitation,
- instances of parallel reformulation.

Two independent experts assessed quality using EMT-inspired scales (semantic accuracy, terminological adequacy, pragmatic equivalence, delivery). Inter-rater agreement, measured by Cohen's κ, reached 0.83, which indicates substantial agreement.

Each student interpreted at least two baseline speeches (T1) and two comparable speeches (T2) under exam-like conditions: no advance access to the full text, only basic topic indication, and no pauses in the source audio.
All statistical analyses were performed using IBM SPSS Statistics (Version 28).

Training Activities in the Experimental Group

While the comparison group practised "classic" simultaneous interpreting with error-based feedback, the experimental group received explicit psycholinguistic training. The core activities included:

1. Attention and EVS-training
   - guided shadowing with gradual acceleration;
   - EVS-awareness exercises (students estimated their lag and then checked against the recording);
   - chunking drills where students were asked to reformulate longer source segments into minimal meaning units.
2. Inhibition and compression training (KCE)
   - "essential vs. decorative" exercises: identifying what can be safely omitted or compressed;
   - deliberate practice of semantic compression (aiming for KCE slightly below 1.0 without loss of meaning);
   - reformulation tasks where students had to condense a dense paragraph into half the number of words in Ukrainian.
3. Cognitive load balancing (BKN)
   - tasks where students deliberately slowed down or accelerated parts of their output to redistribute cognitive load across the speech;
   - reflective analysis of their own pause patterns and repair clusters on transcripts.
4. Emotional-cognitive equilibrium (EKE)
   - exercises in emotion labelling ("this passage is grief/anger/fear...") before interpreting;
   - practising "professional distance" – rendering highly emotional segments with controlled intonation, avoiding uncontrolled vocal tension;

  o short guided discussions about how emotions affected their timing, pauses and word choice.

After each task, students received targeted feedback not only on errors but also on EVS, pauses, KCE and overall EKE, so that the indices became part of their everyday metacognitive vocabulary.

  The pre-test (T1) and post-test (T2) were organised as follows:
1. Students entered the booth one by one or in small groups.
2. They were briefly informed about the general topic of the speech (e.g., EU enlargement, humanitarian crisis, security).
3. The 7–10-minute English speech was played without interruption.
4. Students performed simultaneous interpreting into Ukrainian.
5. All outputs were audio-recorded and later transcribed.

Neither group received any additional help, visual support or glossaries during testing. The goal was to assess spontaneous performance under realistic conditions.

  For each recorded performance, the following steps were undertaken:
1. Transcription and time-alignment
   - o Source and target texts were transcribed;
   - o segment boundaries and time-stamps were marked in transcription software (e.g., ELAN).
2. Annotation of pauses and repairs
   - o Pauses > 2 seconds in the target speech were labelled;
   - o Overt self-repairs and false starts were marked.
3. Calculation of indices
   - o EVS was measured as the time lag between the onset of each source segment and the onset of its corresponding target segment; mean EVS and its standard deviation were computed.
   - o BKN integrated EVS, pauses and repairs relative to speech rate and information density, producing a normalised indicator of cognitive load balance.
   - o KCE was calculated as the ratio of target to source word counts, indicating compression or expansion.
   - o EKE was coded per segment as optimal / under-activated / over-activated based on intonation stability, pause behaviour and expert judgement in emotionally charged passages.
   - o CII was computed as a composite, combining KCE, EVS and BKN into a single integration score.
4. Expert quality assessment
   - o Two independent experts rated each T1 and T2 performance on semantic accuracy, terminological adequacy, pragmatic equivalence and delivery;

    ○   disagreements were discussed or resolved via averaging; inter-rater reliability was checked.

A key practical element was the feedback loop. After T1 and periodically during training, students in the experimental group received individual "profiles" with:

- their mean EVS and dispersion,
- BKN and KCE values,
- typical EKE patterns,
- expert comments on how these parameters linked to specific errors or strengths.

This feedback made the otherwise "invisible" psycholinguistic mechanisms visible and discussable, turning EVS, KCE, BKN, EKE and CII into concrete learning targets rather than abstract theory. By T2, most students could interpret their own graphs and tables and use them to plan further self-training.

- It operationalises abstract cognitive constructs (attention, inhibition, affective regulation) using measurable behavioural indicators from interpreter output.
- It validates a new linguistic-cognitive model that incorporates both time-based and discourse-level parameters.
- It demonstrates empirically that cognitive integration, not isolated functioning, best predicts interpreting quality—an insight with relevance for both research and pedagogy.

The results extend previous findings from American, Asian and European theories and add a distinctively Ukrainian perspective by incorporating emotional-cognitive dynamics characteristic of interpreting during periods of war, political instability and humanitarian crisis.

Psycholinguistic and Linguistic-Cognitive Indices of Concentration and Inhibition

EVS as attentional focus is defined as the time lag (in seconds) between the onset of a source segment and the onset of its corresponding target segment. Psycholinguistically, EVS reflects how the interpreter manages online attention and working-memory updating: excessively long EVS signals potential overload, while extremely short EVS may indicate shallow processing and a risk of omissions.

    For each performance we computed:

- mean EVS,
- standard deviation of EVS (stability),
- proportion of "critical" EVS values above 3.0 s.

Balance of Cognitive Load Index (BKN)

The BKN index integrates EVS, pausing and self-repair behaviour into a single parameter of cognitive stability. In its time-based form, it is calculated as:

$$BKN = \frac{(EVS + P + R)}{SR \times ID} \tag{1}$$

where:
- EVS is mean ear-voice span (in seconds),
- P is the cumulative duration of pauses > 2 seconds,
- R is the number (or duration) of overt self-repairs,
- SR is speech rate (words per minute),
- ID is information density (proxied by content-word / function-word ratio).

Lower BKN values correspond to more even distribution of cognitive load across the speech, with fewer breakdowns. In the experiment, average BKN decreased from 1.9 to 1.4 after training, indicating improved cognitive balance.

Cognitive Economy Coefficient (KCE / KKE) – Inhibitory Efficiency

The KCE, corresponding to the KKE, quantifies how economically interpreters use linguistic resources:

$$KCE = N\_target / N\_source \tag{2}$$

Values below 1.0 reflect semantic compression and inhibition of redundant material; values significantly above 1.0 indicate over-explicitation and potential loss of focus.

From a psycholinguistic perspective, higher-quality interpreters are expected to display controlled compression (KCE slightly below 1.0) rather than uncontrolled expansion. After training, participants in the experimental group typically moved closer to KCE ≈ .95–1.00, which aligns with more efficient inhibitory control over irrelevant details.

Emotional-Cognitive Equilibrium Index (EKE)

The broader MBIUP–EKB model assumes that performance quality depends on a balance between affective arousal and analytical processing.
In the article we refer to this as the EKE index, which is derived from:
- expert ratings of intonational stability and pragmatic adequacy,
- the absence of "emotional pauses" and uncontrolled prosodic spikes in high-affect segments,

- maintenance of EVS and BKN within a functional range under emotional load.

While EKE is not a single scalar in the current implementation, we coded segments as:
- EKE-optimal,
- EKE-under-activated (flat, overly detached delivery), or
- EKE-over-activated (excess emotional involvement and instability).

These labels were used as categorical variables in regression models predicting quality scores.

Cognitive Integration Index (CII / IKI)

To integrate the above parameters, we adapted into an English-language CII, using the following normalised formula:

$$CII = ((KCE \times 100) - (EVS \times 10) + (3 - BKN) \times 15) / 100 \qquad (3)$$

This formula weights:
- KCE positively (rewarding efficient inhibition and compression),
- EVS negatively (penalising excessive delay),
- BKN inversely (rewarding a more balanced cognitive load).

CII ranges approximately between 0 and 1. Higher values correspond to more integrated, stable performance where concentration and inhibition co-operate. In the experimental group, CII systematically increased after the MBIUP–EKB training and was strongly associated with expert quality scores.

Statistical Analysis

All indices (EVS, BKN, KCE, CII) and expert quality scores were averaged per participant for T1 and T2. The main analyses included:
- paired-samples t-tests within groups (T1 vs. T2),
- ANCOVA with T2 scores as outcomes, group (experimental/comparison) as factor and T1 scores as covariates,
- Pearson correlations between indices (EVS, BKN, KCE, EKE labels, CII) and expert quality ratings.

Results

The analysis focused on how the four psycholinguistic indices—EVS, BKN, KCE, and EKE—and the composite Cognitive Integration Index (CII) changed

after six months of cognitive-strategy-based training. Because the study aimed to capture the interaction of concentration and inhibition, descriptive and inferential statistics were interpreted jointly, rather than treating each variable in isolation.

Changes in Temporal Attention (EVS)

Across all participants, ear–voice span decreased significantly from pre-test (M = 3.02 s, SD = .41) to post-test (M = 2.54 s, SD = .36). The reduction was larger in the experimental group, which received explicit training in attentional control and affective regulation. In the comparison group, EVS decreased only marginally (Δ = −.21 s), suggesting a modest improvement attributable to routine interpreting practice.

The experimental group exhibited not only lower mean EVS but also greater EVS stability, reflected in a narrower standard deviation range and a 27% reduction in "critical" EVS cases above 3.0 seconds. This stabilisation is consistent with psycholinguistic predictions: as selective attention becomes more efficient, interpreters rely less on extended buffering and can maintain a tighter processing loop even under high-density input.

Fig. 2 illustrates the reduction in ear–voice span as a result of the training programme.

Figure 2
Reduction in Ear-Voice Span After Training
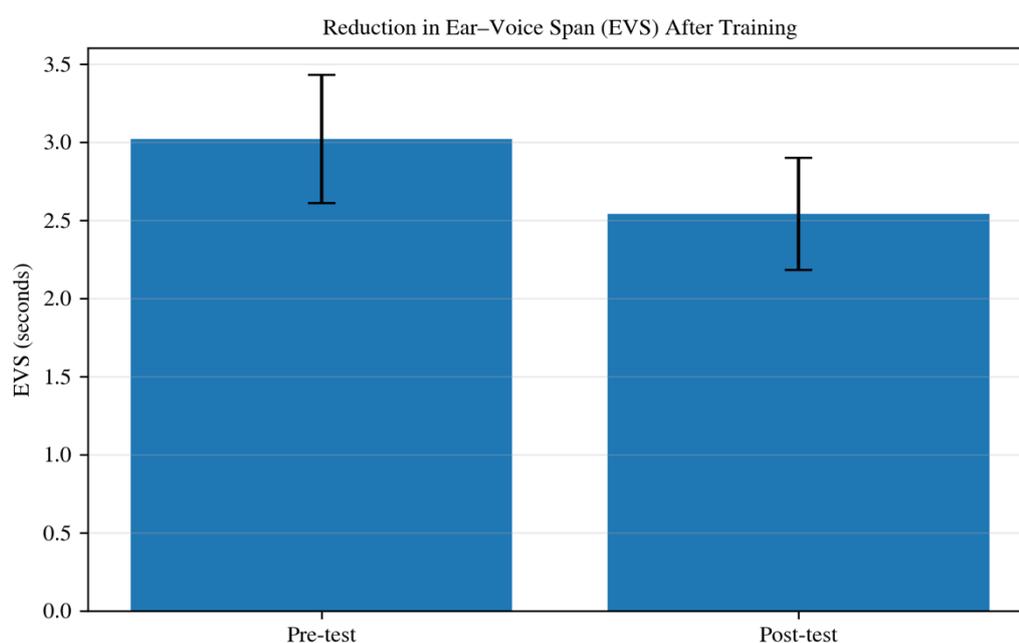
Balance of Cognitive Load

The BKN index exhibited a notable shift following training. In the experimental group, BKN dropped from a pre-test mean of 1.92 to 1.38, indicating fewer disruptive pauses, smoother segmentation and improved control over speech-rate fluctuations. The decline in BKN was statistically significant ($p < .01$), while the comparison group demonstrated a smaller, non-significant improvement ($\Delta = -.19$). Qualitative examination of transcripts supports this trend: participants in the experimental group displayed more uniform distribution of pauses, with fewer long hesitation gaps and a reduction in repair clusters around terminologically dense segments. In psycholinguistic terms, BKN improvement reflects more efficient allocation of processing resources and less oscillation between overload and compensatory slowing.

Inhibitory Efficiency and Cognitive Economy

The KCE as an indirect measure of inhibitory control also shifted in a direction consistent with enhanced performance. At pre-test, many students produced target texts with inflated word counts (KCE > 1.05), suggesting a tendency to over-explicate or compensate for uncertainty. After training, the experimental group converged around KCE ≈ .95–1.00, indicating more disciplined filtering of redundant details and more controlled semantic compression. Notably, improvement in KCE correlated moderately with reductions in EVS ($r = -.42$), supporting the view that inhibition and attention interact dynamically: shorter, more stable EVS windows encourage interpreters to prioritise essential meaning, while more efficient inhibition prevents lexical "spill-over" that might otherwise prolong EVS.

Fig. 3 illustrates the parallel reduction in BKN and improvement in KCE after the training programme.

Emotional-Cognitive Equilibrium

Segment-based coding revealed clear differences between groups in the EKE patterns. Before training, both groups showed a high proportion of EKE-over-activated segments in emotionally charged passages (e.g., war-related appeals, humanitarian crises). These were characterised by unstable prosody, elongated hesitation pauses, and a spike in repairs—markers typically associated with affective interference. After training, the experimental group shifted substantially toward the EKE-optimal zone, maintaining steady intonation, controlled timing and pragmatic alignment even in high-affect contexts. Meanwhile, the comparison group exhibited minimal EKE change. This finding

supports theories that link emotional regulation to working-memory stability: when affective cues are labelled and strategically inhibited, they cease to interfere with linguistic planning. EKE improvements also paralleled increases in quality assessment scores for delivery and pragmatic equivalence.

Figure 3

Changes in Cognitive Load Balance and Cognitive Economy After Training

Changes in Cognitive Load Balance (BKN)
and Cognitive Economy (KCE) After Training
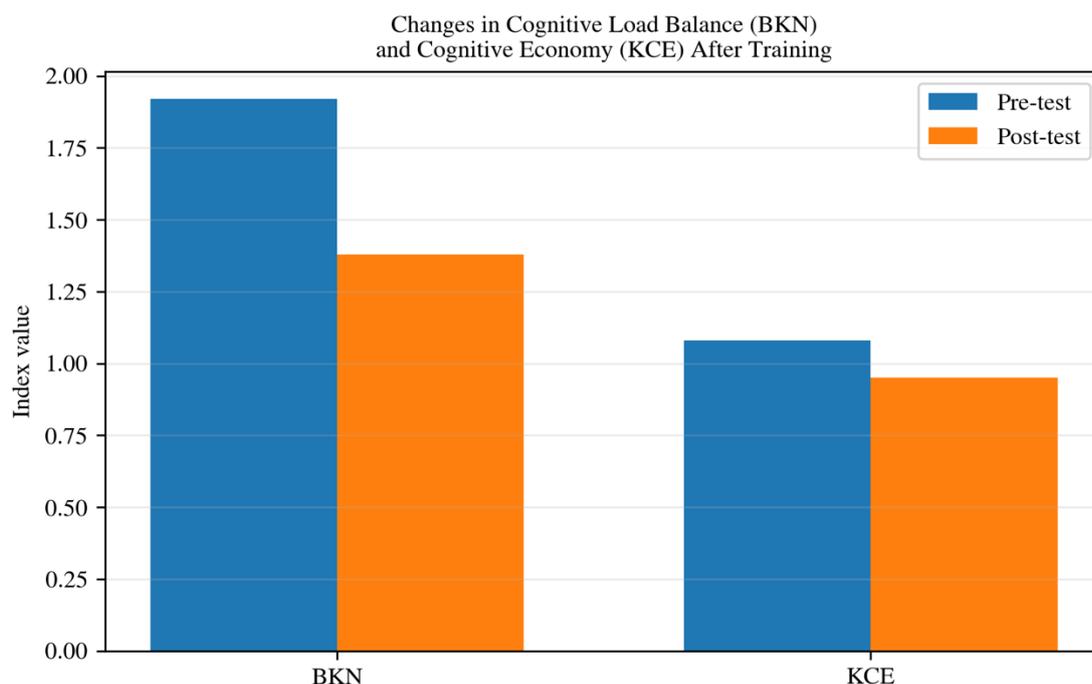
Cognitive Integration Index

Because interpreting quality is best explained by the interaction—not the sum—of cognitive variables, the CII provides the most illustrative measure of skill development. The CII increased from .47 to .63 in the experimental group ($p < .001$), while the comparison group showed only a modest rise from .46 to .52. Regression modelling confirmed that CII was the strongest predictor of overall expert quality scores ($\beta = .71$), outperforming individual indices such as EVS or KCE.

As illustrated in Figure 4, the experimental group achieved substantially higher ANCOVA-adjusted post-test CII scores compared to the control group.

This result validates the theoretical assumption behind the model: effective interpreting emerges from the *alignment* of concentration and inhibition mechanisms rather than from isolated strengths in one domain.

Figure 4
ANCOVA-Adjusted Post-Test Cognitive Integration Index

ANCOVA-adjusted Post-test Cognitive Integration Index (CII)
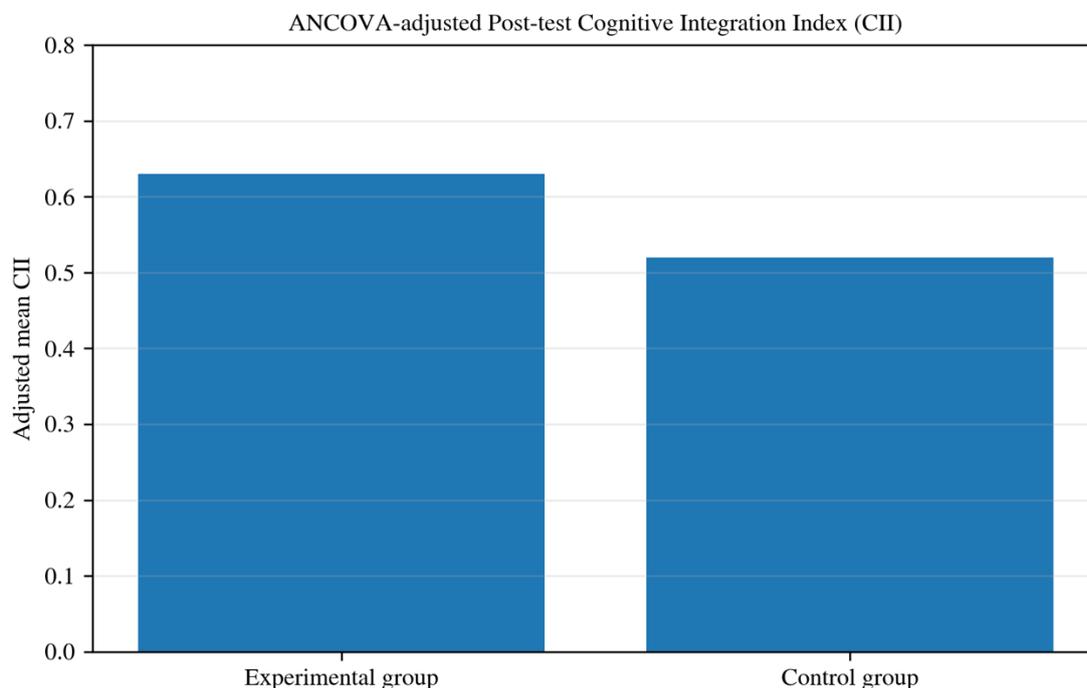
Expert Quality Assessment

Independent evaluators rated target texts along four EMT-aligned dimensions: semantic accuracy, terminological adequacy, pragmatic equivalence, and delivery. The experimental group demonstrated statistically significant gains across all dimensions, with the most pronounced improvements in semantic accuracy (+14%), precision (+12%), and delivery (+11%). These values reinforce the predictive validity of the indices. Expert comments provide qualitative depth: evaluators noted that post-training interpretations sounded "more concise," "less reactive to emotional pressure," and "more structurally coherent despite high-density content." Such observations mirror the quantitative improvements in KCE, EKE and CII.

Descriptive statistics for the main psycholinguistic indices are summarised in Table 1 to show improvements from pre- to post-test across all measures.

Table 1
Improvements from Pre- to Post-Test Across All Measures

Index	Stage	Mean (M)	Standard Deviation (SD)
EVS (seconds)	Pre-test	3.02	.41
	Post-test	2.54	.36

Index	Stage	Mean (M)	Standard Deviation (SD)
BKN	Pre-test	1.92	.38
	Post-test	1.38	.31
KCE	Pre-test	1.08	.14
	Post-test	.95	.10
CII	Pre-test	.47	.12
	Post-test	.63	.15

As shown in Table 2, the largest change was observed in the CII, indicating a significant improvement in the interaction between concentration and inhibition following the training.

Table 2
Results of the Training

Index	Mean Change	Direction of Change	Interpretation
EVS	–.48 s	Decrease	More efficient attentional control
BKN	–.54	Decrease	Improved balance of cognitive load
KCE	–.13	Shift toward 1.0	More controlled semantic compression
CII	+.16	Increase	Stronger integration of cognitive mechanisms

Discussion

The findings of this study demonstrate that concentration and inhibition—two core executive functions—are not merely background conditions for simultaneous interpreting but active, trainable mechanisms that shape the stability, accuracy and pragmatic adequacy of interpreter output. Framing these mechanisms through the four indices (EVS, BKN, KCE and EKE) and their integration in CII provides a coherent way to link psycholinguistic processes with behavioural manifestations that trainers and researchers can measure objectively.

Concentration as dynamic attentional control. The substantial reduction and stabilisation of EVS support earlier psycholinguistic work by Miyake et al. (2000) and bilingual-control research by Dong and Xie (2014), which highlight

how targeted training enhances selective attention and working-memory updating. Interpreting requires continuous balancing of input monitoring, conceptual integration and output planning. As EVS shortens within a functional range, interpreters rely less on buffering strategies and more on rapid conceptual chunking, which is consistent with Setton's (1999) model of constrained mental simulation.

Additional psycholinguistic evidence for the importance of executive control in interpreting comes from Yudes et al. (2011), who demonstrate that interpreting expertise is associated with enhanced non-verbal executive functioning, particularly in the domains of inhibition and attentional control, even beyond strictly linguistic tasks.

In our data, EVS also interacted with BKN, illustrating that attention is not a stand-alone resource but part of a multi-component system. When the distribution of pauses becomes more even, and repair clusters decrease, attention becomes more resilient to momentary overload. This resonates with Seeber et al. (2011) parallel processing model, which argues that interpreters constantly reallocate cognitive resources in response to fluctuating demands.

Inhibition as a linguistic and emotional filter. The shift in KCE toward controlled compression indicates that inhibition improves not only in the domain of competing lexical activations (as described in Green, 1998, Inhibitory Control Model) but also in higher-level discourse planning. Students learned to suppress irrelevant details, avoid overexplicitation and focus on core semantic relations. This supports findings by Lee (2012) and Imbir et al. (2020), who show that interpreters with stronger inhibitory control produce more concise, information-dense output without compromising accuracy.

Importantly, inhibition was not limited to linguistic form. Improvements in EKE demonstrate how affective regulation stabilises performance in emotionally charged segments. Psycholinguistic research shows that emotional salience consumes working-memory resources and interferes with conflict resolution (Kensinger & Schacter, 2008; Barrett, 2017). The present results confirm that explicit training in emotion labelling, mitigation and strategic distancing allows interpreters to maintain prosodic stability, retain pragmatic nuance and avoid reactive hesitations. This is especially relevant in the Ukrainian context, where interpreters regularly work with war-related discourse requiring both empathy and restraint.

Integration of cognitive mechanisms. Perhaps the most meaningful finding is the predictive power of the Cognitive Integration Index (CII). As the composite measure most sensitive to changes in both concentration and inhibition, CII best explains why certain students experience dramatic growth in quality—even when individual indices improve only modestly. This supports the notion that interpreting competence is *synergistic*: performance arises not

from strengthening a single cognitive function but from optimising the interaction between them.

This interpretation aligns with contemporary work in situated cognition (Risku & Rogl, 2020), which conceptualises interpreting as an adaptive system where cognitive, emotional and environmental factors co-regulate performance. By quantifying these interactions, CII provides an empirical pathway for bridging psycholinguistic theory with applied interpreting pedagogy.

Implications for interpreter training. The results have direct implications for curriculum design in interpreter education, particularly in Ukraine, where educational programmes are increasingly aligned with EMT standards. Three implications stand out:

(1) Psycholinguistic skills must be explicitly trained, not assumed.

Attention management, inhibition, segmentation and emotional regulation can be systematically developed through targeted exercises, as shown in the experimental group's gains.

(2) Quality assessment should integrate cognitive indicators.

Traditional error-based evaluation overlooks early signs of breakdown (e.g., expanding EVS, increasing pause asymmetry, rising repair frequency). Integrating indices such as CII or even basic EVS-tracking can allow trainers to detect developing issues before they materialise as overt errors.

(3) Interpreting in crisis contexts requires training in affective inhibition.

Ukrainian interpreters frequently encounter emotionally saturated speeches. The EKE component demonstrates that emotion regulation is not peripheral but central to maintaining performance quality in such contexts.

This study contributes to the emerging intersection of psycholinguistics, bilingual cognition and Translation Studies in several ways: It operationalises abstract cognitive constructs (attention, inhibition, affective regulation) using measurable behavioural indicators from interpreter output. It validates a new linguistic-cognitive model that incorporates both time-based and discourse-level parameters. It demonstrates empirically that cognitive integration, not isolated functioning, best predicts interpreting quality—an insight with relevance for both research and pedagogy.

Conclusion

This study set out to examine concentration and inhibition as core psycholinguistic determinants of simultaneous interpreting quality and to articulate how these mechanisms can be modelled, measured, and deliberately strengthened in interpreter training. By operationalising attention and inhibitory control through a set of complementary indices, such as EVS, BKN,

KCE and EKE, and integrating them into the Cognitive Integration Index, the research provides a coherent and empirically grounded framework for interpreting performance analysis.

The six-month experiment with MA students in the English–Ukrainian language pair demonstrated that targeted cognitive and affective training can yield substantial improvements in both behavioural indicators and expert-rated quality. Reductions in EVS and BKN reflected more efficient temporal management and balanced cognitive load, while optimisation of KCE signalled improved linguistic inhibition and semantic economy. Stabilisation within the EKE-optimal zone underscored the importance of emotional regulation in high-pressure and crisis-related interpreting contexts that are increasingly typical for Ukrainian interpreters. The strong growth in the composite CII score confirmed that effective interpreting arises not from isolated cognitive strengths but from the alignment and integration of attention, inhibition and affective equilibrium.

Beyond empirical verification, the study contributes to a broader reconceptualisation of interpreter competence. It suggests that psycholinguistic mechanisms that are traditionally treated as opaque or incidental can become explicit components of training design, diagnostic assessment and feedback. For interpreter education programmes aligned with EMT standards, especially in Ukraine's current communicative landscape, the proposed model offers a concrete, measurable pathway for preparing interpreters to operate under high cognitive and emotional load.

Future work may extend this framework to professional interpreters, explore neural or physiological correlates of the indices, or examine how cognitive integration interacts with pragmatic decision-making and cultural mediation. Nevertheless, the present study confirms that linguistic-cognitive modelling provides a robust foundation for understanding how interpreters manage the competing demands of language, emotion and time—and for helping them do so more effectively.

Disclosure Statement

The author reported no potential conflicts of interest.

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