

## **EFFECTS OF PRESENTATION RATE ON WORKING MEMORY IN SIMULTANEOUS INTERPRETING**

Miriam Shlesinger  
Bar-Ilan University, Ramat-Gan, Israel

### Introduction

The cognitive psychological literature, in general, and studies focusing on working (online) memory (WM), in particular, often include a plea for research based on complex cognitive tasks that "can be characterized as being under cognitive control, involving multiple steps of processing, involving multiple components of the memory system, and requiring fast access to large amounts of information" (Kintsch *et al.* 1999). Simultaneous interpreting (SI), as performed by expert practitioners, is just such a task – one which requires flexible, efficient online allocation of attentional resources in such a way as to approach full and fluent delivery of the target-language (TL) counterpart of a source-language (SL) message. Indeed, studies devoted to the functioning of WM in SI highlight the tension between maintaining a steady speech stream and producing a semantically and pragmatically appropriate TL representation of an SL input.

That some form of temporary storage is involved in SI – and crucially so – seems self-evident. As in other information processing tasks, whenever the processing of language cannot proceed in a strictly linear sequence, and whenever input items must be retained while subsequent ones are being processed, recourse must be made to a memory store, the definition and parameters of which have been the subject of extensive theoretical debate and experimental research. Brown (1958) – and soon afterwards Peterson and Peterson (1959) – demonstrated that material is forgotten within seconds if rehearsal (i.e., some form of mental scanning) is prevented. SI is a task which would seem to defy covert rehearsal, in that it entails an exceptional number of factors likely to impede subvocalization: (1) approximately 70% of the TL output coincides with SL input (Goldman-Eisler 1968; Barik 1975; Gerver 1975), and constitutes a form of articulatory suppression; (2) the cognitive demands of LTM searches and retrieval may supersede covert rehearsal of the source-language items; (3) covert rehearsal of retrieved TL strings awaiting articulation may also supersede rehearsal of new input items; (4) as an indirect addressee who is often deprived of full access to the situational and contextual information, the interpreter may be devoting full attention to compensatory

inferencing<sup>1</sup> (Pöchhacker 1992; cf. Schank 1980; Fincher-Kiefer *et al.* 1988; Chincotta and Underwood 1998). Although Vallar and Baddeley (1982) have shown that some form of rehearsal may be possible even when subvocalization is prevented, it is thus nonetheless quite striking, given all of these factors, that interpreters are able to store stretches of well over 2 seconds (the theoretical limit of working memory whenever no rehearsal is feasible).<sup>2</sup>

While the task of SI is, in many respects, *sui generis*, different in obvious and crucial ways from those generally used to study WM in monolingual settings<sup>3</sup> – and from those used in the study of bilingualism – existing cognitive and psycholinguistic research is nonetheless clearly relevant, especially if one accepts that "a psycholinguistic theory of translation and interpreting should be consistent with a larger framework of information processing in general" (Hamers and Blanc 1989: 254). Most of the models of the SI process have in fact drawn on information processing concepts, but there has been very little reference to the actual processes by which items are lost or discarded from WM or to factors which may contribute to the decay of memory trace in SI. In one of the earliest models, Gerver (1971) incorporates a discard-input module when the buffer is full and a discard-current-item module as part of post-articulatory monitoring.<sup>4</sup> Moser (1976) too includes a discard module, after the point at which a "decision" is made not to restart activation of TL elements residing at the nodes of the conceptual network. Neither of these models, however, nor Gile's Efforts model (1988) nor other, more recent ones (Darò and Fabbro 1994;

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- 1 By analogy, Cowan (1995: 128-129) describes the predicament of a conversationalist who, in order to draw the correct pragmatic inferences, may have to keep several pieces of information in mind while continuing to devote attention to the speaker, rather than rehearsing the critical information.
  - 2 To say that the task may be performed without rehearsal is not to deny that rehearsal may enhance the results. "[...] just because a mechanism is redundant does not mean that it is useless. The STM buffer, for instance, allows for the formation of a more coherent textbase. Propositions maintained in the buffer can be linked with the propositions derived from the next sentence on the basis of purely textual relations, whereas long-term WM links must be based on prior knowledge" (Kintsch 1998: 234-235).
  - 3 Most test materials in (monolingual) serial recall tasks, for example, consist of unrelated items with little or no intra-list predictability; recall is not tested until offset of the final item, often with a further delay or interpolation added; the concurrent task, if any, is relatively undemanding; and the subject is frequently instructed to rehearse the items as they are presented – a strategy which is largely ruled out by the very simultaneity of SI.
  - 4 As in the case of monolingual sovereign speech (Levelt 1989: 466), so too in SI, evidence drawn from repairs (Setton 1999) indicates that the interpreter's own output is available to her before being articulated.

Paradis 1994) dwell on the rapid forgetting that appears to occur – particularly in the case of unrelated, or loosely contextualized items; e.g. names, numbers etc. – in the presence of "online" interlingual transfer.<sup>5</sup>

One of the challenges posed by such strings of unpredictable or loosely contextualized items is that they increase the "density" of the discourse, and place an exceptional burden on the interpreter. Dillinger (1989), Lee (1999) and Tommola and Helevä (1998) cite density as a key determinant of processing capacity, and Gile (1995) notes the heavy load imposed by lists, in particular, which are intrinsically high-density utterances, since "[...] more information must be processed per unit of time. [...] High speech density is probably the most frequent source of interpretation problems. High speech density is associated with [...] information elements put next to each other without grammatical or other low-density word groups in-between" (172-173). Given the likelihood of encountering uncontextualized lists in typical conference discourse, the interpreter's ability to reconstruct strings of names, numbers etc. in the target language is of course relevant to successful performance of the task. The risk of omission is likely to be compounded by any structural or syntactic differences between source and target languages.

In the study reported below, such lists were used as a means of examining the extent of information loss, arguably attributable to the limits of working memory and to the impossibility of rehearsing the items until such time as the target-language syntax allows them to be produced in the output. As discussed below, however, it emerged that more was at stake in the "forgetting" of input items than the limitations of WM as such. The experimental design centered on professional practitioners' capacity to retain long left-branching noun phrases (i.e. a noun preceded by a long string of adjectives) while interpreting into a head-initial language (i.e. one which requires that the noun be produced before its modifiers), and on the role of presentation rate in this process. At the point where the interpreter – possibly cued by prosodic markers of the left-branching structure (the long head-final string) in the SL – becomes aware of the buildup of material which cannot be dealt with in linear sequence, and which requires storage and planning, she is also focusing on anticipation of the yet-to-be-uttered lexemes, particularly the noun, which she must then produce in the TL.

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5 The information-processing model proposed by Massaro (1975), precursor of the Moser (1976) model of SI, includes two memory modules (generated abstract memory and synthesized memory), but no explicit reference to forgetting, per se. The same holds true for SI: "SI theorists are aware of the extralinguistic, implicit and immediate factors in speech but, lacking a reasoned model of their operation, have had to gloss over the intermediate stages of the translation process. IP approaches address SI in terms of the limitations on human computing power, but are vague on what is computed or stored [...]" (Setton 1998: 164).

She must recall and translate the stored modifiers with the requisite morphosyntactic adjustments, while also beginning to process the segment that follows.

#### The experiment

The experiment entailed texts read at two delivery rates – 120 and 140 words per minute – and set out to resolve two seemingly conflicted hypotheses: on the one hand, recall was expected to be better if less time elapsed between the sounding of the SL string and its TL reconstruction; on the other hand, retrieval of TL replacement items from LTM was expected to be poorer when performed at the higher rate.<sup>6</sup> Both rates were within the range often found in conference speakers' presentations. (In fact, 100-120 wpm has been cited as the optimal speed for interpreting (Seleskovitch 1978)).

#### *The subjects*

All sixteen subjects were experienced professionals, with the same directionality:<sup>7</sup> all were working from their B-language (English) into their A-language (Hebrew). The decision to confine the study to professionals (the cutoff point being a minimum of three years' working experience) was based on the differences which are known to exist between novices and experts in skilled performance, including SI. Neubert (1997) notes that the experienced translator and interpreter often use lexical items and grammatical constructions that cannot be predicted on the basis of ready correspondences "suitable to the textual and situational context" (p. 11). In line with this approach, memory for content, coupled with the forgetting of surface structure information, is cited as being crucial to the highly developed semantic memory required in interpreting. Le Ny (1978) suggests that "the forgetting of the non-semantic information of the input text is more rapid in an expert interpreter than in the normal unilingual subject during the phase of comprehension" and that "this rapid decline of the non-semantic information is essential to carry out the task of simultaneous

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6 Studies of WM in tasks involving monolingual recall have indeed yielded conflicting results, attributed in the main to differences in the subjects' use of strategies: a more "active" strategy (involving rehearsal, as well as a grouping of the items to be recalled) produces better results at slower (1 item per second) than at more rapid rates; a more passive strategy (in which all forms of organizing the input are avoided) shows the opposite trend (Hockey 1973).

7 The role of directionality in interpreting is self-evident, with comprehension being more difficult, more error-prone and presumably more time-consuming in interpreting from L2 than from L1 (e.g. Weller 1991; Tommola and Helevä 1998).

interpretation because it facilitates better processing of semantic information" (p. 292).

Skilled performers are able to retain large amounts of information in accessible form while engaging in domain-relevant tasks, an ability that is posited to increase with experience: "[...] expert performance is far more interruptible than would be predicted from the assumption that they have to maintain all of the temporarily stored information in working memory by continued rehearsal" (Ericsson and Delaney 1998: 94). Non-experts, on the other hand, are unable to allocate attention as effectively: "[...] interpreters paused as long as 10 seconds in their SI, apparently as a result of devoting their whole capacity to understanding the incoming message. It turned out that those interpreters were not professional interpreters at all, just good English speakers whose accuracy was far from satisfactory. Their tasks were taken over by professional interpreters after these incidents. These professional interpreters employed the strategy of slowing delivery in order to comprehend dense incoming material" (Lee 1999). Padilla et al. 1995 have demonstrated the gradual extension of WM as a function of task-specific training and experience, and Liu (2001), in a groundbreaking study of domain-specific skills in SI and their role in expertise development, has succeeded in demonstrating that expert performance in SI is not simply a matter of overall better processing skills; rather expertise in SI is confined to performance in this particular task, and is not related to performance on non-domain tasks.

#### *The materials*

In terms of ecological validity, the materials for such a study should ideally be taken from an existing corpus of actual conference presentations. This proved impracticable, however, since the study required clearly delineated, accurately constructed strings, unlikely to figure in naturalistic speech.<sup>8</sup> The materials, therefore, had to be created expressly for the purposes of the study, and engineered so as to include the specific string types. To offset this artificiality, every effort was made to compose complete, coherent texts of the written-to-be-spoken variety often used in conference presentations, requiring no specialized knowledge or prior contextualization.<sup>9</sup> Six such texts were written, comprising

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8 SI research has been very slow to introduce corpus-based analyses (Armstrong 1997; Shlesinger 1998). "The IP [information processing] community has yet to present a corpus in support of its theories" (Setton 1998: 38).

9 Familiarity with the topic of discourse is a key factor in determining the processing effort required. As noted by Doherty (1997): "If we set all other contextual variables at default values and concentrate on the properties that can be read off the linguistic forms of sentences in a text, we can compare the different processing conditions".

approximately 1,700 words each. Embedded within them and serving as the actual target utterances were a total of 180 strings. Sixty of these, each consisting of four attributive modifiers (adjectives) followed by a head (a noun), comprised the materials for the study reported here. To avoid a spillover effect, no two strings followed each other immediately, so that subjects could "recover" from the demands imposed by the one string before encountering the next one (Gile 1997: 200). These target strings are not syntactically or semantically hierarchical; they are essentially series of loosely related items, all of which collocate with the head. As Setton (1999) notes in accounting for approximations and simplifications of propositional structure in SI, "SI is vulnerable as regards numbers and proper names, but we generalise this problem to all items which are difficult to associate into the mental model, predicting difficulty at any sudden influx of new referents" (p. 264). The total duration of the recorded materials (approximately 11,000 words) in which the target strings were embedded was between 79 minutes (at 140 wpm) and 92 minutes (at 120 wpm). The following is an excerpt from the experimental materials:

[...] No less annoying was a stupid, biased, shocking, public account by one of those politicians who always pretend to speak for the people. Their sanctimonious attitude is an insult. Don't they realize that there's nothing intrinsically wrong with TV as such, just as there is nothing intrinsically right with the printed page. Even an illustrious, tempestuous, omnipotent, conservative writer like the editor of our biggest daily seems to have joined the trend.<sup>10</sup>

#### *The procedure*

The subjects interpreted the same set of pre-recorded texts individually in a language lab in two sessions, scheduled three weeks apart, to minimize the chances of their remembering their own solutions to particular segments: texts 1, 3, 5 were delivered (on tape) at 120 wpm and texts 2, 4, 6 at 140 wpm at one of the sessions (with short breaks between texts); texts 1, 3, 5 were delivered (on tape) at 140 wpm and texts 2, 4, 6 at 120 wpm at the other session. The order of presentation was counterbalanced across subjects.

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10 The fact that the first string comprises entirely of two-syllable modifiers and the second comprises four-syllable ones is a variable which figured in a separate analysis of the word-length effect in SI. The study, in fact, included 120 additional strings, designed to test additional aspects of processing, but these will not concern us here.

### Results

The study began with the seemingly counterintuitive hypothesis that performance would be better at a higher rate of presentation. While the slower presentation rate affords the interpreter more for retrieval of TL replacements from long-term memory (LTM), it also entails the risk of greater trace decay. It was predicted that the latter factor would predominate and that TL string integrity would be weaker at 120 wpm than at 140 wpm one. Since all of the materials were processed by each of 16 subjects at each of two rates, the total number of strings comprising the data was: 60 target strings x 16 subjects x 2 rates = 1920 target strings. (Six strings were later discarded for various reasons, leaving a total of 1,914.)

In the case of 325 (34.7%) out of 936 strings presented at 120 wpm, and 305 (31.2%) out of 978 strings presented at 140 wpm<sup>11</sup> – i.e. for slightly fewer than **one third of all strings** – the output included not a single modifier; all that remained of the 5-word string in the TL output was the noun. In the cases of approximately **one third of all strings** – 302 (32.3%) of the strings at 120 wpm and in 349 (35.7%) of the strings at 140 wpm – only one modifier remained. Two modifiers were produced in 254 (27.1%) of the 120 wpm and 276 (28.2%) of the 140 wpm strings. Three were produced in 51 (5.4%) of the 120 wpm and 47 (4.8%) of the 140 wpm strings. In only 4 (.4%) of the 120 wpm and 1 (.1%) of the 140 wpm strings were all four modifiers retained. Thus, the 140 wpm strings showed an advantage over the 120 wpm ones with respect to the number of modifiers retained, as predicted (means = 1.07 and 1.05, respectively) – approaching, but not reaching significance. (See Figure 1).

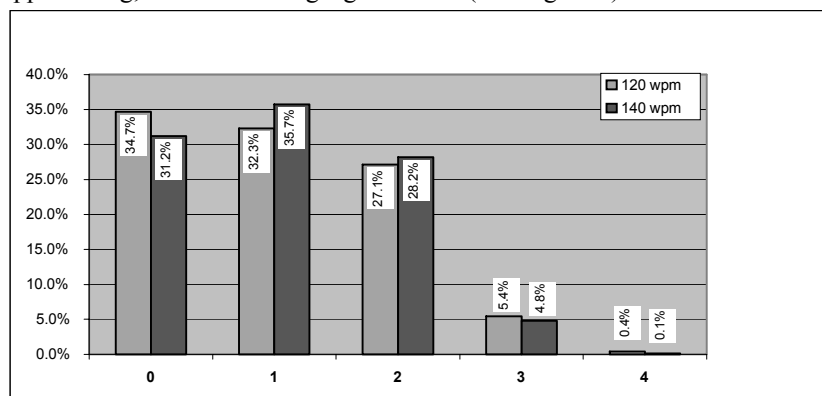


Figure 1 – Modifiers retained (by presentation rate)

11 Due to human error, part of one text – including the first 21 strings – was inadvertently played twice at 140 rather than 120 wpm in the case of one of the subjects.

## Discussion

Studies of list-based recall in monolingual tasks or in straightforward word-translation tasks rarely report results as poor as the ones obtained here – particularly in the case of expert practitioners.<sup>12</sup> Granted, the requirement to store such high-density strings comprising four successive SL modifiers (or their TL replacements) in anticipation of the noun imposes a heavy cognitive load, and one may expect a dramatic loss of information since the articulation of a TL output in the case of SI largely or completely suppresses the rehearsal of incoming materials, and yet, the explanation apparently goes beyond the sheer difficulty of SI as a task which epitomizes the constant interplay of context-driven, top-down and data-driven, bottom-up information under highly constrained circumstances.<sup>13</sup> Precisely because of the inherent difficulties, the interpreter's efficiency in prioritizing the incoming information and "deciding" what to retain and what to discard is crucial to adequate performance of the task. Without discounting this difficulty as a factor in the subjects' overall poor recall, it stands to reason that the explanation lies (primarily) elsewhere: strategies – whether norm-driven or idiosyncratic, conscious or automatized, universal or language-specific – may play an important role in the subjects' "decision" to assign low priority to the integrity of the target strings, even when cognitive resources are not being used to capacity and would allow for the retention of a greater number of modifiers. In fact, the strategy of cutting slack for a more demanding yet-to-come segment, or of conserving energy by focusing on the "important" components has often been cited as accounting for the proceduralization of the process, even among those with no experience at translation (Tourey 1995: 99), and is reminiscent of the Minimax Principle (Levy 1967).<sup>14</sup>

Manipulation of instructions has also been shown to motivate strategies which, in turn, affect working memory. Thus, Gregg et al. (1989) have shown the effects of strategic control of the articulatory loop: subjects who were encouraged to rehearse the first half of the list had a higher recall rate than those

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12 This retention rate is even lower than would be expected in the case of items which must be retained after being perceived in one "take": Cowan (1999) cites various studies of immediate recall which lead to the conclusion that up to 4 unconnected items can be kept in mind at one time, and suggests that "only about four items can be drawn from sensory memory to the focus of awareness on a particular trial".

13 "The harder the task intervening between presentation and recall the worse the recall" (Crowder 1976: 195).

14 As people become more proficient in performing a cognitively demanding task, they also become more proficient in selecting the best strategy for any particular instance of task performance (Reder 1987).



who were not. While the instructions in the present study were non-specific and, as such, did not motivate the implementation of intentional strategies, the findings may nonetheless point to the presence of strategic factors – presumably generated by norms and expectations based on the subjects' training and professional experience – which appear to account for some of the across-the-board findings of the study. The effect of presentation rate then was in the predicted direction: performance at the higher rate (which allows less time for unrehearsed items to decay) was consistently (though not significantly) better than at the slower rate.

### Conclusion

While the articulation of a TL output in the case of SI largely or completely suppresses the rehearsal of incoming materials and may be expected to entail a dramatic loss of information, there may also be more deliberate, possibly conscious factors involved in the functional online juxtaposition of the interpreter's two or more languages. This possibility raised methodological complications, which called into question the results of the present study as well: certain norm-driven strategies appeared to be playing a greater role than was previously suspected, and were difficult to distinguish from the operation of WM in SI *per se*. Thus, the dramatic loss of information (i.e. the omission of most of the items in the strings comprising the experimental materials) may be accounted for both as a by-product of WM limitations and as the result of the subjects' strategic "decisions".

It remains to be seen whether the findings generated by this study will be reflected in more natural settings. Towards this end, a corpus-based study, using existing corpora of interpreted texts (for which an SL version is available), may prove enlightening. With a sufficiently large number of examples of left-branching structures or of other constructions known to rely on the effectiveness of the central executive component of WM, one can infer about the constraints which affect the use of WM in SI in natural settings – and test the validity of the experimental results reported above.

### References

- Armstrong S. (1997): "Corpus-based Equivalents for NLP and Translation Studies", *Interpreting: International journal of research and practice in interpreting*, 2 (1/2), pp. 141-162.
- Barik H. (1975): "Simultaneous Interpretation: Qualitative and Linguistic Data", *Language and Speech*, 18 (2), pp. 272-298.

- Brown J. (1958): "Some Tests of the Decay Theory of Immediate Memory", *Quarterly Journal of Experimental Psychology*, 10, pp. 12-21.
- Chincotta D. and Underwood G. (1998): "Simultaneous interpreters and the effect of concurrent articulation on immediate memory", *Interpreting: International journal of research and practice in interpreting*, 3 (1), pp. 1-20.
- Cowan N. (1995): *Attention and Memory: An Integrated Framework*, New York/Oxford, Oxford University Press/Clarendon Press.
- Cowan N. (1999): "An Embedded-Processes Model of Working Memory", in *Models of Working Memory: Mechanisms of Active Maintenance and Executive Control*. Ed. by P. Shah, & M. Akira, Cambridge, UK, Cambridge University Press, pp. 62-101.
- Crowder R.G.(1976): *Principles of Learning and Memory*, Hillsdale, NJ, Lawrence Erlbaum Associates (Chapter 3: "Echoic Memory", pp. 45-66; Chapter 7: "Forgetting in Short-Term Memory", pp. 175-216).
- Darò V. and Fabbro F. (1994): "Verbal Memory During Simultaneous Interpretation: Effects of Phonological Interference", *Applied Linguistics*, 15 (4), pp. 365-381.
- Dillinger M.L. (1989): *Component Processes of Simultaneous Interpreting*, Unpublished PhD Thesis, Montreal, McGill University.
- Doherty M. (1997): "Textual Garden Paths – Parametrized Obstacles to Target Language Adequate Translations", in *Machine Translation and Translation Theory*. Ed. by C. Hauenschild and S. Heizmann, Berlin-New York: Mouton de Gruyter, pp. 69-89.
- Ericsson K.A. and Delaney P.F. (1998): "Working Memory and Expert Performance", in *Working Memory and Thinking*. Ed. by R.H. Logie and K.J. Gilhooly, Hove, UK, Psychology Press, pp. 93-114.
- Fincher-Kiefer R., Post T.A., Greene T.R. and Voss J.F. (1988): "On the Role of Prior Knowledge and Task Demands in the Processing of Text", *Journal of Memory and Language*, 27, pp. 416-428.
- Gerver D. (1971): *Simultaneous Interpretation and Human Information Processing*, Unpublished PhD Thesis, Oxford University.
- Gerver D. (1975): "A Psychological Approach to Simultaneous Interpretation", *Meta*, 20 (2), pp. 119-128.
- Gile D. (1988): "Le partage de l'attention et le modèle d'efforts en interprétation simultanée", *The Interpreters' Newsletter*, 1, pp. 27-33.
- Gile D. (1995): *Basic Concepts and Models for Interpreter and Translator Training*, Amsterdam-Philadelphia, John Benjamins.

- Gile D. (1997): "Conference Interpreting as a Cognitive Management Problem", in *Cognitive Processes in Translation and Interpreting*. Ed. by J.H. Danks, G.M. Shreve, S.B. Fountain and M.K. McBeath, Thousand Oaks-London-New Delhi, Sage, pp. 196-214.
- Goldman-Eisler F. (1968): *Psycholinguistics: Experiments in Spontaneous Speech*, London-New York, Academic Press.
- Gregg V.H., Freedman C.M. and Smith D.K. (1989): "Word Frequency, Articulatory Suppression and Memory Span", *British Journal of Psychology*, 80, pp. 363-374.
- Hamers J.F. and Blanc M.H.A. (1989): *Bilinguality and Bilingualism*, Cambridge, UK, Cambridge University Press.
- Hockey G.R.J. (1973): "Rate of Presentation in Running Memory and Direct Manipulation of Input Processing Strategies", *Quarterly Journal of Experimental Psychology*, 25, pp. 104-111.
- Kintsch W., Healy A.F., Hegarty M., Pennington B.F. and Salthouse T.A. (1999): "Models of Working Memory: Eight Questions and Some General Issues", in *Models of Working Memory: Mechanisms of Active Maintenance and Executive Control*. Ed. by P. Shah and M. Akira, Cambridge, UK, Cambridge University Press, pp. 412-441.
- Kintsch W. (1998): *Comprehension: A paradigm for cognition*, Cambridge, UK, Cambridge University Press.
- Lee Tae-Hyung (1999): "Speech Proportion and Accuracy in Simultaneous Interpretation from English into Korean", *Meta*, 44, 2, pp. 260-267.
- Le Ny J.F. (1978): "Psychosemantics and Simultaneous Interpretation", in *Language Interpretation and Communication*. Ed. by D. Gerver and H.W. Sinaiko, New York, Plenum Press, pp. 289-298.
- Levelt W.J.M. (1989): *Speaking: From Intention to Articulation*, Cambridge, Massachusetts, MIT Press.
- Levý J. (1967): "Translation as a Decision Process", in *To Honor Roman Jakobson*, The Hague, Mouton, pp. 1171-1182.
- Liu M. (2001): *Expertise in Simultaneous Interpreting: A Working Memory Analysis*, Unpublished Ph.D. Dissertation, The University of Texas at Austin.
- Lonsdale D. (1997): "Modeling cognition in SI: Methodological issues", *Interpreting: International journal of research and practice in interpreting*, 2 (1/2), pp. 91-117.
- Massaro D. (1975): *Experimental Psychology and Information Processing*, Chicago: Rand McNally College Publishing (Chapter 27: "Generated Abstract Memory", pp. 540-559).

- Moser B. (1976): *Simultaneous Translation: Linguistic, Psycholinguistic and Human Information Processing Aspects*, Unpublished doctoral dissertation, Innsbruck University.
- Neubert A. (1997): "Postulates for a Theory of *Translatio*", in *Cognitive Processes in Translation and Interpreting*. Ed. by J.H. Danks, G.M. Shreve, S.B. Fountain and M.K. McBeath, Thousand Oaks-London-New Delhi, Sage, pp. 1-24.
- Padilla P., Bajo M.T., Cañas J.J. and Padilla F. (1995): "Cognitive Processes of Memory in Simultaneous Interpretation", in *Topics in Interpreting Research*. Ed. by J. Tammola, Turku, University of Turku Press, pp. 61-71.
- Paradis M. (1994): "Neurolinguistic Aspects of Implicit and Explicit Memory: Implications for Bilingualism and SLA", in *Implicit and Explicit Language Learning*. Ed. by N. Ellis, London, Academic Press, pp. 393-419.
- Peterson L. and Peterson M.J. (1959): "Short-Term Retention of Individual Verbal Items", *Journal of Experimental Psychology*, 58 (3), pp. 193-198.
- Pöschhacker F. (1992): "The Role of Theory in Simultaneous Interpreting", in *Teaching Translation and Interpreting: Training, Talent and Experience*. Ed. by C. Dollerup and A. Loddegaard, Amsterdam-Philadelphia, John Benjamins, pp. 211-220.
- Reder L.M. (1987): "Strategy Selection in Question Answering", *Cognitive Psychology*, 19, pp. 90-138.
- Schank R.C. (1980): "Language and Memory", *Cognitive Science*, 4, pp. 243-284.
- Seleskovitch D. (1978): "Language and Cognition", in *Language Interpretation and Communication*. Ed. by D. Gerver and H.W. Sinaiko, New York, Plenum Press, pp. 333-341.
- Setton R. (1998): "Meaning assembly in simultaneous interpretation", *Interpreting: International journal of research and practice in interpreting*, 3 (2), pp. 163-199.
- Setton R. (1999): *Simultaneous Interpretation: A cognitive-pragmatic analysis*, Amsterdam-Philadelphia, John Benjamins.
- Shlesinger M. (1998): "Corpus-based Interpreting Studies as an Offshoot of Corpus-based Translation Studies", *Meta*, 43 (4), pp. 486-493.
- Tammola J. and Helevä M. (1998): "Language Direction and Source Text Complexity: Effects on Trainee Performance in Simultaneous Interpreting", in *Unity in Diversity? Current Trends in Translation Studies*. Ed. by L. Bowker, M. Cronin, D. Kenny and J. Pearson, Manchester, St. Jerome Publishing, pp. 177-186.

- Toury G. (1995): *Descriptive Translation Studies and beyond*, Amsterdam-Philadelphia, John Benjamins.
- Vallar G. and Baddeley A.D. (1982): "Short-Term Forgetting and the Articulatory Loop", *The Quarterly Journal of Experimental Psychology*, 34A, pp. 53-60.
- Weller G. (1991): "The Influence of Comprehensible Input on Simultaneous Interpreters' Output", in *Proceedings of the Twelfth World Congress of the International Federation of Translators 1990*. Ed. by M. Jovanovic, Beograd, Prevodilac, pp. 391-401.