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Exploring information processing as a new research orientation beyond cognitive operations and their management in interpreting studies: taking stock and looking forward

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ABSTRACT

This article is a conceptual discussion reflecting on research trends in interpreting studies. It begins with an overview of the long-term focus on cognitive operations and their management in interpreting studies. By revisiting the multiple dimensions and distinctive features of interpreting, it reveals the necessity to go beyond the cognitive approach. Through a stock-taking of relevant literature, it identifies the pivotal role of information processing in interpreting. Proceeding from the distinctive features of interpreting, it proposes a framework on how information processing can be studied, which highlights four lines of research that call for new attention in interpreting studies: (1) how information is processed multimodally as a hyper-discourse in interpreting; (2) how information is processed strategically under the conditions of immediacy and singular presentation in interpreting; (3) how information is processed as meaning-making in interpreting as interpersonal communication and sociocultural interaction; (4) how information processing in interpreting has language-pair specificity.

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1. Introduction

This article is a conceptual discussion reflecting on research perspectives and trends in interpreting studies (ref. Valdeón, 2021). In Section 1, a critical review will be conducted about the long-term focus on cognitive operations and their management in interpreting studies. By revisiting the multiple dimensions and distinctive features of interpreting, the necessity to go beyond the cognitive approach and bring information processing to the fore is highlighted. Section 2 will take stock of pertinent literature to examine the pivotal role of information in interpreting and what has been discussed about information processing. Section 3 will propose a framework on how information processing in interpreting can be studied as a new orientation, in which the main lines of research will be highlighted and main topics along each line of research will be discussed.

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1.1. An overview of the focus on cognitive operations and their management in interpreting studies

As Galvão (2015, p. 173) pointed out, interpreting studies has been long dominated by cognitive processing and a view of (conference) interpreting as a decontextualised, essentially cognitive activity. It has become so dominant that it is considered as a research paradigm in interpreting studies – the CP (cognitive processing) Paradigm (Pöchhacker, 2016, p. 69), in which ‘the science-minded community was guided by the meme of cognitive processing skills, as elaborated by Gerver (1971) and Moser (1978) in their cognitive process models and by Gile (1995) in his Effort Models’ (Pöchhacker, 2016, p. 69).

The cognitive approach has run as a thread through most of the time in the history of interpreting studies, which can be traced to as early as the late 1960s and the 1970s. Among the early studies on interpreting by experimental psychologists, Oléron and Nanpon (1965) explored how simultaneous interpreting (SI) is possible by measuring ear-voice span (EVS) between speakers and interpreters in experiments. Goldman-Eisler (1972) was also curious about the similar question and examined the simultaneity of comprehension and production in SI.

The next generation of interpreting researchers in the 1990s and later focused on how the multiple cognitive operations, such as listening comprehension, short-term memory, note-taking and (re)production are coordinated/managed in the interpreting process, which was represented by Gile (1995, pp. 169–180)’s ‘Effort Models’. Hypothetical models in the form of mathematical equations were proposed on SI and consecutive interpreting (CI), and on operational requirements of the effort modules. Later, Gile (1999) proposed the ‘tightrope hypothesis’, which postulates that ‘for most of the time, interpreters work near saturation level [of their cognitive capacity]’ (Gile, 1999). The Effort Models and the tightrope hypothesis revealed the importance of cognitive management in completing the interpreting process, so they have been widely applied as the theoretical foundation for many empirical studies in the cognitive approach.

From the 1990s to now in psycholinguistics there has continued an interest in SI specifically and in bilingual language processing in general. In this approach the overall cognitive process of interpreting is broken down into cognitive component tasks, which are analysed from the perspective of psycholinguistics on (mono-)language processing. Various cognitive models on the interpreting process have been developed to describe the temporal flow and sequence of component tasks or sub-processes in interpreting (e.g. Dong & Wang, 2013; Macizo & Bajo, 2004). It must be pointed out that in most cases the models seem to be a combination of two models on mono-lingual processing in the source language (SL) and in the target language (TL), which is limited in revealing how information in the SL is comprehended and reconstructed/reformulated in the TL.

With the advancement of research equipment in recent years, such as eye-tracker and fMRI, it has become possible to observe more directly the ‘black box’ of the interpreter’s brain, which helps to reveal the neuro-biological mechanism of the cognitive process in interpreting. A representative study done by Hervais-Adelman et al. (2015) found through neuroimaging with fMRI that SI recruits a broad swathe of brain areas: in addition to structures that are known to be involved in speech perception, comprehension and production, brain activity is also found in the basal ganglia,

which are the structures that form the basis of human ability to select, plan, learn and execute actions. Their findings not only validate that SI involves extremely complex cognitive operations but also can be interpreted as suggesting that interpreting also involves complex information processing, e.g. extremely rapid decision-making, since the speech is paced by the speaker while the interpreter has no control over the speed of the incoming message.

1.2. Going beyond the cognitive approach. Revisiting the multiple dimensions and distinctive features of interpreting

As summarised by Pöchhacker (2016), cognitive processing ‘arguably remains the most widespread meme in interpreting studies to date’ (Pöchhacker, 2016, p. 57). It seems that most research efforts in interpreting studies have been made in the cognitive approach, especially on interpreting as execution of cognitive operations and management of cognitive load/efforts. In spite of all the good efforts devoted to cognitive operations and their management, which have revealed a lot about one important dimension of interpreting, it is time now for us to reflect whether there are other equally important dimensions that need to be explored.

Based on Wang (2019)’s comprehensive research framework for interpreting studies, an epistemological model can be proposed to summarise the multiple dimensions of interpreting (Figure 1). In order to capture the full complexity of interpreting, interpreting studies must cover both the micro- and the macro-dimensions, including: (a) in the micro-dimension, interpreting needs to be studied not only as bilingual processing and as cognitive operations and their management but also as information processing; (b) in the macro-dimension, interpreting needs be studied as interpersonal communication and sociocultural interaction.

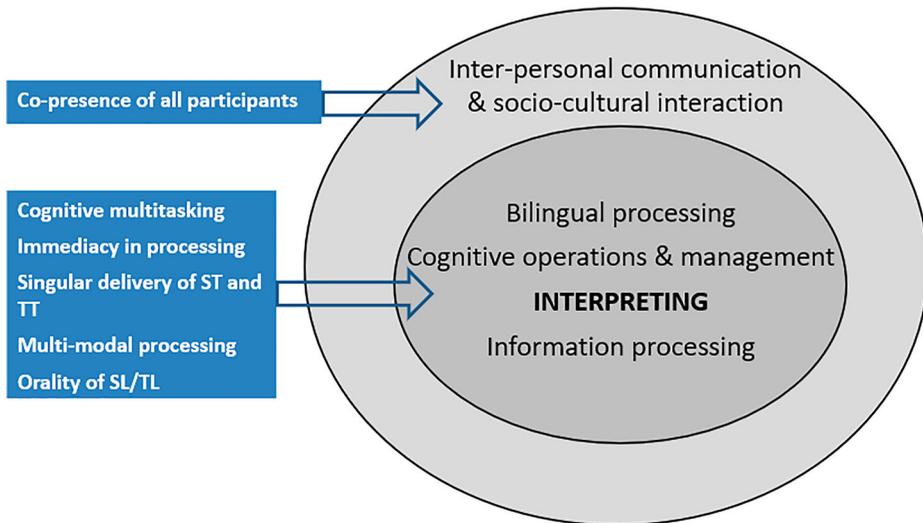


Figure 1. An epistemological model on the multiple dimensions and distinctive features of interpreting.

Also, it is important to capture the distinctive features of interpreting in interpreting studies so that the nature of interpreting can be distinguished from other objects of research (such as written translation and mono-lingual processing). As shown in Figure 1, interpreting has the following six distinctive features:

- (1) cognitive multitasking in interpreting, which means that the interpreter has to complete different multiple cognitive tasks at the same time in interpreting, such as listening, analysis and note-taking in CI, or listening, analysis and speaking simultaneously in SI;
- (2) immediacy of the interpreting process, which means ‘ephemeral presentation [of the speech] and immediate production [of the interpretation]’ (Pöchhacker, 2016, p. 10) that put the whole process of interpreting under extreme time constraint of immediacy;
- (3) singular delivery of the source-text (ST) and the target-text (TT), which means interpreting is ‘the first and final rendition in another language ... of a one-time presentation of an utterance in a source language’ (Pöchhacker, 2016, p. 10);
- (4) multimodal processing of information, which means that the interpreter needs to process in both comprehension and reproduction not only verbal information (the words from the speaker) but also paraverbal information, nonverbal information, situational information about the interpreting settings and the sociocultural information about the ST and TT as well as about the speaker and the listener;
- (5) orality of the SL and TL discourses, which means both the SL and the TL are delivered orally so both the speech and the interpretation bear the features of spoken discourse;
- (6) co-presence of all participants, which means that all participants including the speaker, the interpreter and the listener are all present in interpreting though in remote meetings they are only remotely co-present on the same screen.

Based on the above epistemological framework, we can see that there are other questions lying at the core of interpreting studies that are as important as cognitive operations and their management in interpreting. These pivotal questions that have not been addressed or addressed adequately are: What is actually processed in interpreting? How is information processed under the conditions of immediacy and singular delivery? How is information processed multimodally in interpreting? How is meaning made in interpreting as communicative and sociocultural interaction among all the participants co-present in the setting? It seems that in previous studies so much attention has been drawn to cognitive operations and their management that other dimensions of interpreting, esp. information processing, has not received adequate but equally worthy attention.

A search for ‘information processing’ in the Translation Studies Bibliography (Gambier & van Doorslaer, 2022), which is one of the largest databases with worldwide coverage of journal articles, monographs, (articles from) collected volumes and dissertations in translation and interpreting studies, generates only 82 results of ‘any field matches’ (titles, keywords, abstract, etc.) possibly related to information processing in translation and in interpreting. After manual screening based on their abstracts, only 21 publications remain identified as being relevant to (cognitive) information processing in interpreting. A close reading of the full content of the publications reveals that though

they contain the words ‘cognitive information processing’ or ‘information processing’, most of the publications are actually about cognitive operations and their management.

It is of course useful to have a close look at the publications in the search results that include the term ‘information processing’ in their titles. In Lambert (1988)’s article titled ‘Information processing among conference interpreters. A test of the depth-of-processing’, she compared listening and shadowing with interpreting in controlled experimental tasks, combined with lexical, semantic and syntactic recognition tests, which was actually an examination of whether the interpreting task would require greater cognitive processing depth than listening and shadowing. Gerver (1971)’s doctoral dissertation titled ‘Aspects of simultaneous interpretation and human information processing’ is another piece of literature that mentioned information processing explicitly. The main body of the study explored the effects of several input variables on the performance of simultaneous interpreters, including SL presentation rate (Chapter 2), minimising supra-segmental and pausal cues (Chapter 3) and noise (Chapter 4). It examined through memory capacity tests the effect of language of recall and recall strategy upon free call of word lists (Chapter 5) as well as the effects of presentation rate, message structure and message length on auditory short-term memory (Chapter 6). Therefore, as seen from the main content, the focus of this study is on cognitive processing (esp. memory) and how input variables affect the result of cognitive processing. Though the ‘flow chart model of simultaneous interpretation’ (Gerver, 1971, p. 160) proposed in Chapter 7 has been cited as a classical reference on the interpreting process, it must be pointed out that the model is based on the input-output or decoding-encoding hypothesis, which is limited in accounting for how information is processed in interpreting. Also, most previous research on cognitive information processing was done in the experimental approach, which used decontextualised tasks simulating the sub-processes of interpreting with strict control of variables, while the contextual, situational and socio-cultural factors that are part and parcel of information processing in interpreting have hardly been taken into consideration. Gerver himself had also acknowledged later that it is necessary to take account of factors beyond the cognitive mechanics: ‘Furthermore, linguistic, motivational, situational, and a host of other factors cannot be ignored’ (Gerver, 1976, p. 167).

In summary, while research on cognitive operations and their management has revealed a lot about the interpreting process and has contributed a substantial volume of literature in interpreting studies, it is necessary to pay more attention to information processing to capture the full complexity of interpreting in interpreting studies.

2. Taking stock of relevant literature: the pivotal role of information and its processing in interpreting

2.1. On what information is in interpreting

A stock-taking of relevant literature in interpreting studies identifies ‘information’ as an important concept that has been used primarily in interpreting quality assessment. In studies about interpreting quality, which is an ‘overarching theme which relates to many of the topics’ (Pöchhacker, 2016, p. 173) in interpreting studies, information or content is often referred as a pivotal aspect that carries most weighting in quality

assessment. In interpreting quality assessment, ‘there is widespread agreement that performance must be assessed for both content (i.e. source–target correspondence) and target-language presentation (i.e. expression and delivery)’ (Pöchhacker, 2016, p. 203). The marking criteria used in interpreter training always put information accuracy and completeness in the first place. In the interpreting profession, according to the survey study about interpreting quality criteria by Chiaro and Nocella (2004) among 286 interpreters worldwide, which replicated Bühler (1986)’s pioneering survey study, sense consistency with the original message is the top-ranking criterion of quality, and information completeness is ranked second. In another major international survey commissioned by AIIC about interpreting user expectations in 84 different meetings, Moser (1996) also reported completeness in content, faithfulness in meaning and accuracy in terminology, which are all aspects of information, as most important criteria in interpreting quality assessment.

It must be noted that in interpreting studies the term ‘information’ is used interchangeably with ‘sense’, ‘idea’, ‘meaning’ or ‘message’ (Ouyang, 2018). For example, in the representative theory about interpreting, *theorie du sens*, as proposed by the Paris School (Seleskovitch & Lederer, 1984), the content or information processed in interpreting is referred to as ‘sense’. According to the theory, interpreting is not transcoding from the SL to the TL but ‘interpreting sense’, which means to extract ‘nonverbal sense’ from what the speaker has expressed in the SL and then re-express it to the listener in the TL (Seleskovitch & Lederer, 1984, p. 168). According to Lederer (1978), sense units or ‘units of meaning’ are ‘the synthesis of a number of words present in short-term memory associating with previous cognitive experiences or recollections’ (Lederer, 1978, p. 330). Therefore, based on this classical theory, information in interpreting is not linguistic meaning of the words that can be transcribed through verbal transfer but the result of comprehension through deverbalisation, i.e. ‘reducing words to nonverbal sense’ (Seleskovitch & Lederer, 1984, p. 168), in which cognitive complement with extra-linguistic knowledge (e.g. contextual and situational) knowledge is indispensable.

It must be clarified that ‘information’ discussed here is different from that in the traditional concept of information processing used in computer science, which compares human brain processing to decoding and encoding by the computer. In interpreter training and interpreting studies, ‘information’ is a broad term referring to the content that the interpreter processes in comprehending the SL speech and in reconstructing the TL interpretation. Therefore, ‘information processing’ here refers to how the content is processed in interpreting. In contrast, for the cognitive processing approach ‘the dominant research issues have included the processing capacity ... , the possibility of dividing attention over various tasks (multi-tasking), and the structure and function of its memory component(s)’ (Pöchhacker, 2016, p. 60).

2.2. On how information is processed in interpreting

In previous literature some researchers have explored how information is comprehended by the interpreter. Lederer (1978) postulated based on her observation about SI that there is much more language transposition or transcoding at the beginning than later on; as the speech goes on when interpreters probe more and more deeply into the intended meaning of speakers and as this stored knowledge builds up, their interpretation

departs from the linguistic meaning of the SL and consequently their rendition becomes more natural (Lederer, 1978, p. 324). To her, information processing in interpreting is not simply 'language transposition' but 'understanding sense' by 'adding a cognitive element to language meaning' (Lederer, 1978, p. 327). Bacigalupe (2010) also found through an experiment of English-Spanish SI that three complementary and overlapping systems interplay concurrently in interpreting: literalness, automatic responses and meaning construction, which largely concur with Lederer's hypothesis. Alexieva (1983) pointed out that deciphering information in SI depends on whether semantic constructs of propositional nature are detected. According to her, target-language utterance is possible only if the simultaneous interpreter is 'in the position to detect the semantic constructs of propositional nature in the segment he is handling at the moment, for otherwise he will utter only disconnected words, mostly nouns, the way beginners do' (Alexieva, 1983: 196). According to Bühler (1989), as the spontaneous speech has a rhythmic character with periods of hesitancy alternating with periods of fluency, following psycholinguistic cycles of planning the speech and producing the speech, simultaneous interpreters can take advantage of this rhythmic character as they can go along with the speaker and discern sense units that may serve as translation units. In addition to verbal cues, interpreters also make use of non-verbal signals (the prosodic features of intonation and stress) and non-vocal (visual) signals (e.g. facial expression, hand and finger movements, head movements, direction of gaze, and general appearance) in their understanding of the spoken discourse (Bühler, 1989, pp. 133–134).

How information processing is possible within the short time frame of SI is what Chernov (2004, p. 91) expounded through his 'probability anticipation model' on SI, which hypothesised that simultaneous interpreters employ the inference mechanism of 'probability anticipation' in comprehending the SL message and 'anticipatory synthesis' in reproducing information in the TL (Chernov, 2004, p. 5). According to him, with the human ability to make inferences, interpreters are able to extract the meaning of a message after receiving only part of it in SI by making linguistic, cognitive, situational and pragmatic inferences (Chernov, 2004, p. 59). For this to be possible under the extreme time constraint in SI, interpreters need to take advantage of redundancy in the theme part of the information, on which syllabic, syntactic and semantic compression can be made (Chernov, 2004, pp. 113–120), and devote their attention to the rheme part, which always contains new and main information (Chernov, 2004, pp. 121–126).

Hatim and Mason (1997)'s discussion on interpreting from the text linguistic perspective can also be interpreted as being relevant to information processing. In their perception, information and meaning in a text comprises three constituents: (text) texture, structure and context. Texture refers to 'the various devices used in establishing continuity of sense and thus making a sequence of sentences operational (i.e. both cohesive and coherent)' (Hatim & Mason, 1997, p. 30). Structure provides the outline for the composition of the text while texture fleshes out the details (Hatim & Mason, 1997, p. 31). Contextual factors include the rhetorical purpose that the text serves, the attitudinal meanings that the text relays and the communicative intentions that the text realises (Hatim & Mason, 1997, pp. 32–34). Accordingly, they proposed the following hypotheses on the mechanism of SI, CI and liaison interpreting: (1) The simultaneous interpreter has to settle for a partial view of both context and text structure and has therefore to rely more on the emerging texture in order to make and maintain sense. In the case of SI,

context and structure are revealed only piecemeal and the speech can thus be accessed more effectively via texture, i.e. the words as they are spoken. (2) The consecutive interpreter, whose output is produced after the ST has been delivered, tends to focus on information relevant to text structure as this outweighs that yielded by context or texture in what is noted down and used as a basis for delivery. In the case of CI, texture and context are retained only in a most short-lived manner and the speech can thus be stored more effectively via structure. (3) The liaison interpreter has access only to a partial view of texture and structure, both of which would be unfolding piecemeal in the two-way exchange. In this case, context would seem to be the main resource which the interpreter draws on in the task of maintaining the continuity of the exchange (Hatim & Mason, 1997, p. 35).

Two previous articles have tried to explain the reconstruction of information in interpreting by applying Kintsch and van Dijk (1978)'s text linguistic model on discourse comprehension and production, according to which the surface structure of a discourse can be represented as a set of micro-propositions and the global meaning of a discourse can be represented by semantic macrostructures. In information processing micro-propositions are processed into macrostructures through application of three macro-rules (Kintsch & van Dijk, 1978): (1) Deletion Rule: Each proposition that is neither a direct nor an indirect interpretation condition of a subsequent proposition may be deleted; (2) Generalisation Rule: Each sequence of propositions may be substituted by the general proposition denoting an immediate superset; (3) Construction Rule: Each sequence of propositions may be substituted by a proposition denoting a global fact of which the facts denoted by the microstructure propositions are normal conditions, components, or consequences. Applying this model to the interpreting process, Mackintosh (1985) contended that consecutive interpreters' schematic note-taking in the listening stage is the application of the macro-rules to generate macro-propositions from the micro-propositions of the original speech and that in the (re)production stage the interpreters apply the macro-rules again but in the inverse direction to derive micro-propositions. She also points out that in SI macrostructural processing is not directly observable as most of the micro-propositions of the original speech are present in the interpretation. Also informed by Kintsch and van Dijk (1978)'s model, Wu and Wang (2009) tried to explain the condensing strategy employed by consecutive interpreters in covering the gap between the limited capacity of short-term memory and the actual demand for processing extraordinarily long segments in CI. They hypothesised that CI follows three rules in discourse processing: (1) when both the themes and the rhemes overlap in two or more clauses, only one clause is left and the rest is to be deleted according to the Deletion Rule; redundancy, repetition and hesitation, which characterise spontaneous speech, are also deleted accordingly. (2) when themes and/or rhemes in two or more clauses can be subsumed under one superordinate class, the clauses can be generalised according to the Generalisation Rule. (3) when themes and rhemes in two or more clauses belong to a common schema, the clauses can be (re)constructed according to the Construction Rule. In addition, they postulate that a discourse in CI undergoes several rounds of 'discourse transformation' when the Deletion Rule, the Construction Rule and the Generalisation Rule are applied in sequence.

Yang (2010) also accounted for reconstruction of information in interpreting based on a descriptive categorisation about the functions of information, including two types: (1)

introducing components (引介成份), which usually appear at the beginning of a sentence (in SI) or of a paragraph (in CI) to introduce the information, such as when, where, about what; (2) event structures (事件结构), which appear as the main clause or the main paragraph in the form of propositions, such as the theme, the event, the action, the relation (Yang, 2010, p. 144). It is worth noting that the term of ‘introducing components’ seems similar to what Torsello (1996) mentioned about the role of theme in the theme-rheme structure, which is used by the speaker as the starting point for new messages as they build up the text, so they can serve the interpreter/hearer as a signpost to the direction that the discourse is taking. According to Yang (2010, p. 142), in CI information is processed in the unit of a paragraph where a complete discourse unit or a thematic event structure is reconstructed through structure configuration (结构布局) and projection rules (投射规律). Through batch processing, the information focus is identified and the information structure is configured. With the focus and the structure as the base, the information content of the original speech is projected to the interpretation. In contrast, in SI information is processed by following the linear presentation of the source speech, i.e. maintaining parallel between the SL and the TL, in order to minimise the loss of information. Therefore, in order to maintain the flow and accuracy of the interpreted information, the interpreter must interpret a small portion of the ST in its original order first and then reproduce the second segment through a series of techniques such as repetition, generalisation, stalling and word or phrase adjustments (Yang, 2010, p. 142).

In summary, based on the above stock-taking of relevant previous literature, ‘information’ in interpreting can be defined as a broad term referring to the content that the interpreter processes in comprehension and reconstruction, which is used interchangeably with ‘sense’, ‘idea’ or ‘meaning’. The stock-taking shows the pivotal role of information processing in interpreting and that most previous studies were about processing of verbal information, which points to not only the necessity of new research attention but also the need for a more comprehensive research framework.

3. Looking forward: a framework for research into interpreting as information processing

In order to approach information processing in interpreting systematically, this section proposes a conceptual framework to outline the main aspects that call for new attention in interpreting studies. As summarised in Figure 2, proceeding from the distinctive features of interpreting, the framework covers four main aspects of information processing in interpreting, including: (1) how information is processed multimodally as a hyper-discourse in interpreting; (2) how information is processed strategically under the conditions of immediacy and singular presentation in interpreting; (3) how information is processed as meaning-making in interpreting as interpersonal communication and sociocultural interaction; (4) how information processing in interpreting can be language-pair specific. The main research topics along these lines are discussed in the following sub-sections.

3.1. Information is processed multimodally as a hyper-discourse in interpreting

Interpreting can be easily misperceived as involving only listening to the verbal speech in the SL and re-expressing the verbal content in the TL, i.e. interpreting is only about

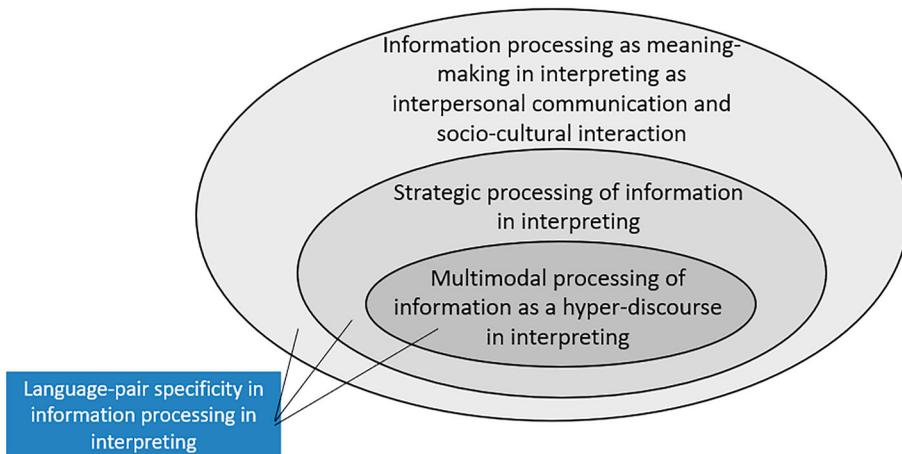


Figure 2. A framework for research into interpreting as information processing.

translating orally the words only. In fact, what the interpreter needs to process include not only the verbal information presented orally (i.e. what the speaker says), but also the paraverbal information (i.e. information expressed by the speaker's pauses, stress and intonation), the nonverbal information (i.e. information expressed by the speaker's facial expressions, gestures and body language), as well as the meaning embedded in the situational context and the sociocultural context of the SL and TL. Therefore, what the interpreter actually processes is a hyper-discourse integrating different layers of information, which is expressed by the speaker multimodally and re-expressed by the interpreter multimodally. In this sense, multimodality is the primary feature of information processing in interpreting.

In order to illustrate on this, I am proposing the model of multimodal information processing in CI (Figure 3) and the model of multimodal information processing in SI (Figure 4), which cover the two fundamental working modes of interpreting.

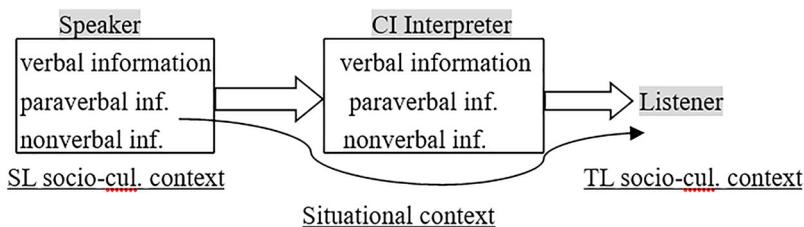


Figure 3. A model of multimodal information processing in CI.

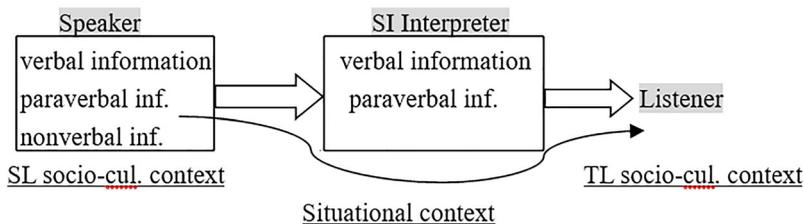


Figure 4. A model of multimodal information processing in SI.

As shown by [Figure 3](#), in CI the interpreter integrates the verbal information, paraverbal information and nonverbal information from the speaker with the situational context in the setting and the SL sociocultural context at the comprehension stage of information processing; and employs the verbal means in combination with paraverbal and nonverbal means at the reproduction/re-expression stage. The information is conveyed to the listener in the form of a hyper-discourse, which comprises not only the verbal, paraverbal and nonverbal information from the interpreter but also of the paraverbal and nonverbal information from the speaker. Also, as the listener has direct access to the paraverbal information and nonverbal information from the speaker in CI, these are also integrated into their understanding of the message conveyed by the interpreter.

As shown by [Figure 4](#), in SI the interpreter comprehends the information from the speaker by integrating the verbal information, paraverbal information and nonverbal information from the speaker with the situational context in the setting and the SL socio-cultural context; and at the same time reproduces/re-expresses the information in the TL through the verbal means in combination with the paraverbal means. The information is conveyed to the listener in the form of a hyper-discourse, which comprises the verbal and paraverbal information from the interpreter and the paraverbal and nonverbal information from the speaker. The SI process is different from CI because as the professional norm the simultaneous interpreter works in the booth, from which their nonverbal language is not accessible to the audience, though listeners have access to the paraverbal information and nonverbal information from the speaker directly, which are integrated into their understanding of the message conveyed by the interpreter.

3.2. Information is processed strategically under the conditions of immediacy and singular presentation in interpreting

As conditioned by the two distinctive features of interpreting, i.e. immediacy (time constraints) of processing and singular presentation of the ST and the TT, the interpreter has to process information strategically in a highly efficient manner. Therefore, how information is processed strategically in interpreting is another core issue worth systematic exploration.

As observational evidence, the following strategic behaviours can always be observed from the interpreting performance of professional interpreters:

- (1) In CI, interpreters have to identify the structure of information and decide on relative importance of information points in order to retain them strategically through

short-term memory and note-taking and reconstruct them clearly in interpretation. The following procedures are identified as typical for information processing in CI: (a) to identify the global message; (b) to distinguish major information points from minor details and prioritise grasping the main information points; (c) to identify logic links among and structure of the information points; (d) to extract indispensable supporting details.

- (2) In SI, interpreters process information by adopting the techniques of linear processing, segmentation and anticipation in order to make simultaneous listening in the SL and speaking in the TL possible and manageable as the interpreter can only get a partial view of the ST in the process.
- (3) In reconstructing the target discourse in interpreting, interpreters often use the interpreting strategies of reformulation, summarising, simplification, approximation and even omission (of redundancy and minor details).

It is evident from interpreting practice that the interpreter is not a translation machine that only interprets it and interprets it all when dealing with the information from the speaker. Some interpreting scholars have postulated principles and even laws related to this. When interpreters are overwhelmed by dense information (e.g. complex numbers) or a fast speech, 'they make spontaneous decisions which seem to be governed by two principles: (a) preserve the essential and (b) be logical' (Bertone, 2006, p. 113). According to Gile (2009), interpreters follow several 'laws' in making tactical and strategic decisions during information processing: (1) maximising information recovery, which means that 'interpreters generally consider it their duty to attempt to reformulate *all* of the speaker's Message in the target language (the Message being the intended information, as opposed to Secondary Information)' (Gile, 2009, p. 211); (2) minimising interference in information recovery, which means that 'interpreters seek to recover as much information as possible on each segment without jeopardizing the recovery of other segments. On this basis, they favour tactics that require little time and processing capacity' (Gile, 2009, p. 212); (3) maximising communication impact of the speech, which means that interpreting as an act of communication has a purpose that needs to be realised by the interpreter, and that 'the communication impact of a statement or utterance depends not only on its information content, but also on its packaging' (Gile, 2009, p. 213). As identified by Wang (2013: p. 106) through a descriptive study based on a relative large corpus of on-site interpreting, interpreters follow several norms of SL-TL relations in processing information: (1) Interpreters tend to adhere to the norm of adequacy, according to which they pursue the consistency and completeness of information; (2) Interpreters tend to adhere to the norm of explicitation of logic relations; (3) Interpreters tend to adhere to the norm of specifying information content; (4) Interpreters tend to adhere to the norm of explicit expression of discursual meaning.

3.3. Information in interpreting is processed as meaning-making in interpersonal communication and sociocultural interaction

As being different from translating where the translator is normally separated from the SL writer and the TL readers, 'co-presence of all participants' is another distinctive feature of interpreting. This feature has three implications for interpreting as information

processing: (a) all the participants (including the speaker, the listeners and the interpreter) are present in the communicative event so they all contribute to meaning-making in interpreting; (b) the interpreter plays a mediating role in the interpersonal communication and sociocultural interaction among them; (c) the communicative situation and the sociocultural contexts of both the SL and the TL constitute meaning in interpreting. In this sense, information in interpreting is processed as meaning-making in interpersonal communicative and sociocultural interaction.

Meaning-making in interpreting can be analysed from the perspective of Systemic-Functional Linguistics (SFL) in three categories: (1) ideational meaning, which is a representation of the world or an event (Munday, 2016, p. 144) with the interpreted discourse; (2) interpersonal meaning, which enacts social relationships (Munday, 2016, p. 144) through the interpreted discourse; (3) textual meaning, which originates from the way the texts are structured (Munday, 2016, p. 144) in the interpreted discourse. As a relevant example, Ouyang (2018) applied the SFL concepts to operationalise different aspects of information in interpreting quality assessment: ideational meaning can be used to operationalise the criterion of information accuracy by examining consistency between the speech and the interpreting; interpersonal meaning can be used to operationalise the criterion of information appropriateness by examining ‘whether the interpreted text duly reflects the interpersonal relationship between the participants in the communicative event and the speaker’s role and attitude’ (Ouyang, 2018); textual meaning can be used to operationalise the criterion of information coherence by examining ‘whether the interpreted text is arranged in an orderly and consistent manner and whether the different parts of the oral rendering are well integrated into a whole’ (Ouyang, 2018).

It is worth noting that interpersonal meaning is a particularly nuanced aspect of information in interpreting as interpersonal communication and sociocultural interaction. In this sense, the interpreter’s mediation of the interpersonal meaning, esp. attitudes, values and ideologies, is a complex issue in information processing that will be meaningful to explore. The interpretation of attitudinal meaning, which is shaped by values and ideologies in particular communicative situations and sociocultural contexts, is considered as important ‘critical points’ (Chernov, 2004, p. 129; Munday, 2012, p. 40) in interpreting. Because all participants are present in the interpreted event, the situational context plays an important role in meaning-making in communicative interaction in interpreting, so do the sociocultural contexts of the SL and the TL, which contribute to meaning-making in the cross-social and cross-cultural interaction between the speaker and the listener as mediated by the interpreter.

3.4. Information processing in interpreting can be language-pair specific

The fourth feature about information processing in interpreting is that language-pair specificity can play a role in interpreting, esp. for language pairs that contrast linguistically and culturally. Although some interpreting scholars working within European languages believe that language-pair specificity is not an issue in interpreting and posited that the interpreter’s output ‘is, in principle, independent of the source language’ (Seleskovitch, 1978, p. 98), those who work between non-European languages and European languages (e.g. between Chinese or Japanese and English) found that language-pair

specificity is an issue that cannot be overlooked in interpreting studies. As Robin Setton, a representative conference interpreter, trainer and researcher with Chinese in his language combination, pointed out:

... however universal the workings of a competent interpreter's brain might be in processing information, local conditions at both ends of the process significantly alter the overall picture: on the input side, there are significant differences in the nature of discourse; in some 'extra- Indo-European' interpreting situations, certainly involving Chinese, probably Japanese, cultural, social and even linguistic factors are of an order such that they cannot be as easily dismissed as in the intra- Indo-European sphere. (Setton, 1993)

Actually some empirical studies have identified language-pair specificity as a problem trigger in interpreting, such as Dawrant (1996) on Chinese-English interpreting, Gile (2011) on English and Japanese, French and German interpreting and Wang and Gu (2016) on English and Chinese interpreting. It is also noteworthy that Daniel Gile's revised and updated version of his classical book on interpreting devotes a whole section to 'language-specificity related problems' (Gile, 2009, p. 194), which are categorised according to different processing stages in interpreting (comprehension, production or both). They are: (1) possible language-specific differences in speech perception, including (a) differences in the perception of words, (b) different degree of grammatical redundancies, (c) syntactic structural contrast, and (d) sociolinguistic differences; (2) possible language-specific differences in speech production, including (a) whether the variety of lexical choices is more restricted and whether the linguistic rules are less flexible in the TL than the SL, (b) similarity or lack thereof between the SL and the TL in lexical, syntactic and general informational terms, and (c) whether the order of presentation of information is different in the two languages; (3) culture-specific difficulties, which impact both speech perception and production in interpreting. For example, ambiguity is acceptable and even favoured in some cultures but not in other cultures, and interpreting users may expect interpreters to provide 'clear' statements (Gile, 2009, pp. 194–198).

On language-pair specificity in information processing in interpreting, meaningful topics can evolve from the following contrasts/differences between the language pair: contrasts in grammatical structures, differences in discourse structures, differences in pragmatic and communicative conventions as well as in sociocultural norms.

The contrasts in grammatical structures between the two working languages, esp. syntactic or structural asymmetry, is a typical problem trigger in interpreting. For example, front-loading as a typical syntactic feature for the Chinese language contrasts with the syntactic structure of English, which is typically back-loaded. This constitutes a particular difficulty for linear processing in SI from Chinese to English because in the SL the head word appears only at the end of the long sentence after a long string of modifiers. Similar difficulties also occur with interpreting involving the languages of German and Japanese, in which the negation word does not come right after the verb or as part of the predicate but only appear at the end of the sentence (Davidson, 1992). Among the few empirical studies, Dawrant (1996) found that English interpretation of Chinese structures requiring a significant reordering of information is associated with the use of specific processing-capacity-saving strategies in SI. After an analysis into the errors, omissions and infelicities in a case study of broadcast interpreting between English and Japanese,

French and German, Gile concluded that ‘language-pair-specific differences can indeed have an impact on the difficulty of interpreting’ (Gile, 2011, p. 213). And Wang and Gu (2016)’s observational analysis into three professional interpreters’ on-site simultaneous interpretations of the same speech revealed that structural asymmetry between English and Chinese functions as a variable impacting English-Chinese interpreting performances.

Differences in discourse structures, which refer to the different ways that discourse is organised in different working languages, is another problem trigger in interpreting. For example, Chinese speakers often use a lot of words to prepare the background (作铺垫) before presenting the intended core message or the main idea while English speakers tend to be more straightforward in putting the topic sentence at the beginning of their speeches. Though this type of issue has not been studied empirically in interpreting research, it constitutes a frequent problem for Chinese to English interpreters, who always find themselves either have to manipulate the discourse structure or have to face the possible consequence that the English audience would get a strange impression about the speech style of the Chinese speaker.

Differences in pragmatic and communicative conventions and sociocultural norms between the two working languages also induce problems in interpreting. For example, it is typical for Chinese speakers to end their speeches with such remarks: 由于本人学识浅薄, 加之准备不充分, 所讲之处肯定多有疏漏和不妥, 请大家多多包涵 (Literal gloss: Due to my limited knowledge and insufficient preparation, there must be quite some oversight and errors in my speech. Everyone, please tolerate me a lot.) In Chinese, this is a formulaic communicative gesture expressing modesty, which is regarded positively as a virtue in the Chinese culture. However, if this is interpreted literally, the English audience from the Anglophone culture might wonder why the speaker should make the speech if their knowledge on the topic is limited and if they have not even prepared for the speech sufficiently. Therefore, experienced Chinese interpreters always have to manipulate the information and render the sentence into ‘Thank you very much for your attention. I look forward to your comments on my speech’.

4. Conclusion

Proceeding from a critical overview of the long-term focus on cognitive operations and their management in interpreting studies and a stock-taking of relevant literature pointing to the pivotal role of information processing in interpreting, this article reveals the necessity for a new research orientation to information processing in interpreting studies. It proposes a framework for research into information processing in interpreting, which outline four lines of research that merit new attention, including: (1) how information is processed multimodally as a hyper-discourse in interpreting; (2) how information is processed strategically under the conditions of immediacy and singular presentation in interpreting; (3) how information is processed as meaning-making in interpreting as interpersonal communication and sociocultural interaction; (4) how information processing in interpreting has language-pair specificity.

Although due to the page limit this article cannot present empirical studies in addition to the conceptual discussion about information processing in interpreting studies, the

proposed framework and the main topics discussed under the four lines of research can serve as conceptual foundation for hypothesis testing in empirical studies. Going beyond the current focus on cognitive operations and their management, the new research orientation on information processing can also open up new venues for interpreting studies, which may not only shed new light on the nature and mechanism of interpreting but also have implications for the interpreting profession when it is more imperative now to debunk various AI-related myths that tend to view interpreting as a decontextualised conduit process (ref. Clifford, 2004).

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