

**PROPOSAL FOR A COGNITIVE THEORY
OF TRANSLATION AND INTERPRETING.
A METHODOLOGY FOR FUTURE EMPIRICAL RESEARCH**

By

Presentación Padilla, Maria Teresa Bajo, Francisca Padilla
Department of Experimental Psychology and Department
of Translation and Interpreting, University of Granada, Spain.

1. Introduction

For over a decade now teachers and practitioners of translation and interpreting have witnessed the appearance of a large number of empirical studies using a cognitive approach in their experiments, virtually since 1982 when Gideon Toury spoke about the mystery of the processes taking place in the "black box" of the language mediator. This cognitive approach has focused primarily on the objective of separating and dissecting the different stages and phases of processing involved in the task of language mediation.

From the point of view of the mediator the task of mediating is far from what we could consider a "normal activity". It cannot be assumed that the cognitive processes of translation and interpreting (either consecutive or simultaneous) are identical to the cognitive processes involved in the tasks of speaking, listening, reading or writing. In fact, although this may seem mere repetition, these processes of language mediation are extremely complex, since they are not only linguistic processes. These processes must also be understood within their social, cultural and above all psychological contexts.

A comprehensive analysis of the tasks of language mediation can distinguish three basic stages:

- 1) The communicative function established between the speaker or writer (the first sender) of the source text or discourse and the mediator as first recipient.
- 2) The mental activity of the mediator processing the message received (either written or spoken).
- 3) The communicative function established between the mediator as second sender of the target text or discourse and the final recipients of the message.

These three stages are understood to be common to both translation and interpreting. The first and the third cover the functional pragmatic aspect of mediating as a communicative social and cultural action, whilst the second covers the mental or cognitive processes. For the communicative function successfully to be fulfilled, an optimum implementation of these cognitive processes is of paramount importance.

Our main objective in presenting this paper is to outline a comprehensive theory of language mediation that fully specifies the component processes of translation and interpretation tasks. This theory combines psychological work on comprehension taking into account the constructive nature of these processes, with research approaches on translation and interpreting that stress the role of attention and memory capacity. The premise is that many mental operations are shared by these tasks, and that a better understanding of them could emerge from a contrastive analysis emphasising, on one hand, those aspects common to them and, on the other, those which differentiate them.

Finally, certain methodological guidelines and research goals are proposed, including the use of empirical methods taken from empirical research used traditionally by cognitive psychology. By studying each of the variables affecting and conditioning these processes, the methods applied may involve procedures and techniques such as dual tasks, analysis of materials, psychophysiological techniques of eye movements and brain activity.

2. The Theoretical Proposal

First of all, the cognitive processes common to both translation and interpreting are to be considered. Within a frame of macroprocesses the following phases are recognised: I) analysis and understanding of the source text or discourse in L1; II) translation or reformulation of the source text or discourse to L2; III) production of the text or discourse in L2 once reformulated.

Our approach attempts to analyse the processes involved in these three phases. We consider that it is not only useful in understanding how professional translators and interpreters perform these processes, but that it also has pedagogical implications. By trying to define which processes require a greater cognitive effort, we emphasise those processes which should receive more intensive training in a teaching programme. In this first stage of our research the third or production phase has not been investigated in greater depth.

2.1. Analysis and Comprehension

A common basic objective which both tasks (translation and interpreting) share is that of causing the same reaction in the final recipients of the translated or interpreted message as that which they would have received if they had understood it in its L1. To achieve this it is essential to understand the original message completely.

From a psycholinguistic point of view this statement implies creating an adequate *mental representation*. Different psycholinguistic theories (Kintsch 1988, 1994; Gernsbacher 1994) distinguish between different levels of

representation which combine to form an adequate representation of the text.

We identify the following levels:

- a) Phonological and orthographic analysis of the input received. Depending on the psycholinguistic theory (Seidenberg and McClelland 1989; Humphreys and Evett 1985) and on the pairs of languages involved, this analysis has greater or lesser relevance. We accept that this analysis is prior to comprehension of the text.
- b) Once the prior analysis is performed, it is necessary to accede to the lexical and semantic representation of the perceived word, so that the recipient recognises it and accedes to all its possible meanings.
- c) It is necessary to segment the text or discourse and analyse the units of meaning or propositions which compose it.
- d) It is necessary to create a propositional structure. In other words, the propositions must connect to form an integrated and coherent representation of the text. According to Kintsch (1988) it is necessary to process the text or discourse via a series of cycles. The text is represented in the form of a network of propositions connected by relations of coherence (microstructures). To construct this microstructure the recipient works with chunks of input that can include an average of 7 propositions. In each cycle linguistic overlapping or coherence is sought between the propositions involved. If there is overlapping in the argument they contain, these propositions are connected. If there is no overlapping the propositions are not connected and a series of microprocesses take place (inferences, searching in the long-term memory, etc.).
- e) A higher level of the representation of the text is constructed which composes the macrostructure of the text. A series of macroprocesses acts to achieve this: relevant previous knowledge stored in long-term memory is recovered, following the "theory of schemata", micropropositions of lesser importance are eliminated, a summary is made of the main part of the text and inferences are made.

The way in which these levels are presented could indicate that they occur serially. Our approach, shared by other psycholinguists and translation theorists (Langacker 1987; Johnson-Laird 1983; Kintsch and Van Dijk 1978; Kiraly 1995) is that comprehension in translation and interpreting is a constructive, not serial, process, so that the mediator/recipient constructs a mental model of what is being communicated.

For the construction of this model, two types of process are particularly important. Firstly, there is a bottom-up process (from the input to the representation of the meaning of the text). Second, a top-down process going from the conceptual representation to the analysis of the input is equally

important. These processes make use of previous knowledge and of what we shall call the structure of expectations of the "mediator".

We fully subscribe Danks's words (1995) indicating a series of factors that characterise comprehension in translation and interpreting: 1) the way in which the mediator reads/listens and analyses the text is conditioned by his/her previous knowledge of the subject, the type of recipients the translation or interpreting is meant for, the circumstances that give rise to or motivate the text or discourse, etc. (*orienting conditions*); 2) the use that is to be made of the translation or interpreting also determines the manner in which the task of comprehension is approached, since those factors in the text or discourse which are important and relevant are emphasised.

Therefore, comparing the tasks of translation and interpreting leads to the observation that both share the analysis of linguistic input at the levels mentioned. They also share the creation of a mental model; for this to be implemented it is especially relevant to combine information from the text with previous knowledge, to understand the intention of the writer/speaker and communicate it to the reader/listener in an appropriate way.

However, there are different aspects in the tasks of translation and interpreting which make the processes of comprehension and analysis differ:

- a) Temporal parameters: these are more demanding in interpreting than in translation, and in the case of simultaneous even more than in consecutive. This is due not only to the oral form of input in the case of interpreting, which means that the processing has to occur immediately and is marked by the rhythm of speech of the speaker, but also to the actual characteristics of the task to be performed, since the final recipients are waiting for the production of the interpreter and in the case of consecutive interpreting, the speaker may even be waiting for him/her to finish producing in order to continue speaking. It is, therefore, a highly demanding communicative act of here and now.
- b) Conditions of simultaneity: while in the case of translation the processes of comprehension/reformulation/translation occur serially, in the case of interpreting the three phases overlap. However, the condition of simultaneity also differentiates the two techniques of interpreting. In consecutive interpreting there is overlapping between listening (comprehension and analysis), note-taking and the planning processes of the resulting reformulation of the message. In simultaneous interpreting, the simultaneity of the processes occurs on several levels:
 - the speaker's oral production and the interpreter's oral production
 - the interpreter's listening and the speaker's oral production
 - the interpreter's listening, reformulation to a different language and interpreter's oral production

- the interpreter's listening of the speaker's oral production and of his/her own oral production, if the speaker's speech rhythm allows.

However, the level of simultaneity between the content that is listened to and the content that is produced is, in fact, the least simultaneous of all.

- c) The processing unit. The above-mentioned differences mean that the processing units in which the comprehension processes happen are different, as is the way in which the structure of expectations or mental model is created. In translation, the mediator can create a complete mental model of the text and go on to create a macro and micro structure of the text, as in the processes of normal comprehension. In consecutive interpreting, the unit of processing, is conditioned by the positioning of the pauses in the speaker's discourse; the mediator-interpreter has time to create a micro and macro structure of the discourse. The latter processes are especially relevant in consecutive interpreting, as in many cases the interpreter must offer a summarised version of the discourse. In simultaneous interpreting the unit of processing must not go beyond a few propositions, which makes the creation of the macrostructure much more difficult.
- d) The structure of expectations or the mental model that orients comprehension and subsequent translation. In interpreting the structure of expectations must be complete before the task is begun (preparation of the subject, preview of the communicative context, participants, delegates, etc.). On the other hand in translation this structure is created in a more interactive way, so that it is constructed and/or modified while reading takes place and the translation is carried out.
- e) The processes of attention and memory differ. Although we shall deal with this section in greater detail later, it is obvious that there is a considerable difference in the demands of capacity and memory in these three tasks. The case of translation requires the maintenance of a mental model of the text in the memory. However, the capacity of the short-term memory is not required in the same way as in interpreting. In the same way simultaneous interpreting requires great skill to divide the resources of processing between comprehension and production, but this is not the case in consecutive interpreting. These different demands on memory and attention resources imply that the task of comprehension is modified in each one.

2.1. Translation-reformulation

2.2.1. Vertical translation *versus* horizontal translation.

Although it is difficult to separate the phase of reformulation or translation from that of comprehension, we would like to suggest that the tasks of translation and interpreting involve the recoding of a linguistic structure produced in one

language to another equivalent linguistic structure in a second language. There are two conflicting approaches regarding the importance of these processes of recoding from one code to another and its relevance in translation and interpreting. De Groot (1997) calls these two forms of translation: vertical and horizontal.

Advocates of vertical translation, of whom a clear exponent is Ms Seleskovitch (1978), maintain that in the phase of reformulation the processes of linguistic recoding are minimal. The comprehension of the text or discourse in L1 implies the construction of a meaning and the loss of the specific linguistic form in which it was produced. Therefore once comprehension has taken place, the mediator's task is to produce the message in the second language. Thus the translation/reformulation implies the implementation of the comprehension processes of the message in L1 and the production of it in L2.

On the other hand, horizontal translation implies direct processes of change from one linguistic code to another, in other words, from the lexical representation in L1 to the lexical representation in L2.

From a psychological perspective there is evidence (Sanchez-Casas *et al.* 1992; De Groot 1993) that shows that, at least for bilinguals, the step from comprehension of the meaning in L1 to the form of the word in L2 depends on the characteristics of the word (cognates, degree of familiarity, the value of clarity/abstraction, etc). Therefore depending on the characteristics of the linguistic input the process of translation can vary in verticality (text or discourse with no density in technical terminology) or horizontality (text or discourse with density in technical terminology).

There is little empirical evidence for the principle of "deverbalization" defended by Ms. Seleskovitch. On the other hand, there is some data showing that processes of linguistic recoding do take place. The fact that there are differences in the translation of different linguistic forms suggests that these processes occur (De Groot 1997). Although the answer is not yet clear, it does seem that both types of processes take place depending on the characteristics of the input, the level of expertise of the subject translating and even the task of translation itself. It is necessary to carry out experimental research in which the characteristics of the linguistic input (both words and syntactic, semantic and pragmatic structures of the input) are varied systematically, and in which translators, interpreters and bilinguals are compared.

This dependence on different factors has meant that the process of translation can be considered as one of problem solving where different strategies can be followed (Tijus 1997; Muñoz 1995).

2.2.2. Translation strategies

McDonald and Carpenter (1981) and Muñoz (1995) among others, propose that once the mental model or structure of expectations necessary to guide the translation of the text has been constructed, the translation follows a series of steps:

- a) The segmentation of the text into processing/translation units. These units would be equivalent to the total amount of propositions which are in working memory for comprehension and translation; this number depends on the memory capacity. In this sense, McDonald and Carpenter (1981) have shown that the processes of segmentation and grouping are similar in translation and in the normal processes of reading and comprehension.
- b) The structure of objectives. According to Tijus (1997), the general objective of transmitting the intentions of the speaker (common to the tasks of translation and interpreting, as pointed out earlier), can be broken up into a group of subobjectives that will vary depending on the task to be performed. As examples, we mention the following: finding the structure of the text, beginning to translate as early as possible, not abusing of the time-lag in simultaneous, etc.
- c) Translation strategies. Translation starts by formulating "*personal hypotheses of correspondence*" (Muñoz 1995) between the source text/discourse and its translation. In translation, Muñoz (1995) classifies the strategies according to level of complexity, depending on maintaining the attention load as low as possible. This classification would include:
 - the location of an already existing set phrase which is conventionally equivalent to the unit one wants to translate (*Érase una vez/once upon a time*);
 - if the previous strategy does not work, the translator turns to his/her own formulation of a segment in L2. In this case there would be two possibilities: 1) a linguistic expression can be constructed in L2 expressing the meaning in L1; 2) there is no equivalent in L2 for linguistic or cultural reasons. In the second case the translator must question the relevance of this unit in the general structure. If it is not relevant he/she may decide to omit it; if it is relevant, he/she must find something equivalent, even if this means getting away from the source text.

In interpreting, Tijus (1997) also proposes a series of strategies. This would begin with the segmentation of the discourse. Taking a segment, the interpreter would try to detect: 1) grammatical difficulties; 2) if there are listening or comprehension difficulties: infer, seek consistency, omit, change the level of segmentation of the message (from proposition to word); 3) errors: correct when they occur if the circumstances allow; 4) if there is temporal pressure, in the

case of simultaneous: not correct irrelevant errors, summarise, not abuse of the time-lag.

Finally Gile (1997) also proposes a series of strategies to reduce the demands of capacity: 1) prior preparation; 2) regulating "*the ear voice span*"; 3) segmentation strategies: reformulating short segments and not waiting for the complete sentence. 4) using symbols and not words in the case of consecutive interpreting, etc.

2.2.3. Phase of evaluation and error correction

Once a segment has been reformulated, the mediator contrasts the result of the segment in L2 with the meaning in L1. He/she also contrasts the reformulation produced with the group of objectives and the mental model guiding the translation. If the objectives are fulfilled and the evaluation is positive the process of translation proceeds to the following section; if errors are detected he/she continues to correct them and to refine the translation. In the case of interpreting, temporal factors impede detailed evaluation and correction; in simultaneous, if the listening conditions (the speech rhythm of the speaker, the redundancy of the opening message etc) permit, the interpreter may correct his/her production.

2.3. Processes of Attention and Memory

Psychological models of comprehension suggest that comprehension requires the use of a series of processing resources residing in short-term or working memory. Its functions are: a) temporary storage of the information that is being used to construct the representation of the text; b) the performance of different cognitive operations necessary to construct this representation. To achieve this double function, this memory has several components: a) a component of phonological storage (the articulatory loop), b) a system of visual/spatial storage and c) a system of attention control (the central executive) (Baddeley 1990). One important characteristic of working memory is that it has limited processing resources, 7 ± 2 units (Miller 1956), and these resources have to be distributed among the different operations necessary for comprehension: a) storage of the linguistic input; b) phonological and semantic analysis; c) the creation of propositions; d) the creation of a relationship between them; e) the creation of a mental model, etc.

In a situation of normal comprehension, there are various factors accentuating the demands on the capacity of the working memory system:

syntactic complexity, lexical ambiguity, allocation of references (resolution of anaphoras), the need to make inferences, etc.

Even more, when the purpose of comprehension is translation or interpreting, these same factors increase the capacity demands of working memory. This is due to two main reasons: a) the fact of working actively with two languages and b) the actual object of the task to be performed. This is especially obvious in the case of interpreting.

The theoretical model of Gile (1985, 1991, 1997) has analysed the tasks of interpreting in terms of "efforts", equivalent to what are here called demands on the capacity of the working memory system. According to Gile, it will only be possible to carry out the task adequately if the demands of capacity of the task involved do not exceed the available capacity of the working memory of the interpreter. Interpreting errors will be produced when the demands required exceed the demands available. Therefore it is important to analyse which factors make these demands more complex.

Even though some factors are common to translation and interpreting, each task has its own specific factors.

1. Translation. Danks (1995) has identified the following factors determining the demands: a) the difficulty of the vocabulary; b) the style of the text; c) the translator's mental model, which will be more difficult to achieve than the writer's mental model; d) conceptual or technical difficulties; e) the need to translate connotative aspects (irony, metaphors, etc); f) the need to acquire and activate previous knowledge.
2. Simultaneous interpreting. The simultaneity of the multiple processes taking place concurrently during the implementation of this task imposes high demands on the capacity of the working memory of the interpreter. Here, differently from the processes of normal comprehension and that of comprehension and translation, working memory, and especially the control component (attention) makes an additional effort, since the task is performed without the help of an important component for comprehension: the phonological component (the articulatory loop), which is occupied in the processes of production (verbalisation, retrieval of lexical and semantic information, etc). Any training in interpretation should have a more efficient usage of the working memory as one of its objectives.

Gile talks of the processing capacity of the interpreter, referring to the capacity of performing his/her task in the optimum way as long as he/she has the available resources. However, there are occasions when the demands exceed the capacity of resources available. These demands are conditioned by a series of factors; we point out: a) the interval produced between the reception of the

message in L1 until the processes of comprehension are completed; b) the interval between the moment when the comprehension of the message to translate finishes and its production is completed; c) external listening difficulties; d) comprehension difficulties which force him/her to maintain more information in memory until he/she has more context to allow the meaning to be extracted: high information density, linguistic reasons (ambiguity, difference in syntactic structures in L1 and L2, vulnerability of the signal, etc.).

3. Consecutive interpreting. Here the demands of capacity are not determined by the simultaneity of the processes of production and comprehension, even though the delay in production means that both short- and long-term memory play a more significant role. The greatest demand on the capacity of memory is imposed by the fact that the processes of comprehension and note-taking are simultaneous. Thus notes may be considered part of the coding process first to store and then to retrieve information. Therefore the interpreter carries out the following processes: listening phase: 1) comprehension; 2) coding in the long-term memory and creating recovery structures: notes; 3) maintaining information in the working memory in the interval between the moment of reception of the input and the note-taking; production phase: 1) interpreting the notes; 2) recovery of information from the memory; 3) production.

In consecutive the processes of reformulation/translation have already started when the interpreter is taking notes in the listening phase, so there is overlapping between the processes of comprehension and reformulation. According to Gile (1997), in the listening phase the attempt to memorise and the note-taking compete for capacity. The demands on capacity will depend to a great extent on the interpreter's degree of skill at note-taking (abstraction, conceptualisation, structuring). Therefore, unlike simultaneous, consecutive interpreting depends on an additional technical skill.

3. Proposal for a Methodology of Empirical Research

Our approach is that, once a theory accurately formulating the processes involved in the tasks of translating and interpreting has been elaborated, these processes can be studied empirically using the same experimental methodology that Cognitive Psychology has been using for years.

In the field of translation and especially in that of interpreting, much of the empirical research done to date has been criticised for its lack of ecological validity. Gile has made a detailed study of the problems encountered by this type of interdisciplinary research (1995).

Our approach is that, despite the fact that many of the problems pointed out by Gile are valid (they are also valid for many other areas of research: computer programming, medical diagnosis, etc), this does not invalidate the experimental method in translation and interpreting. However, they are factors to bear in mind and try to overcome.

It is precisely the diversity of experimental methods and of the indicators of processes (dependent variables) that makes it possible to study different aspects of tasks as complex as those that we are dealing with. The contrast and convergence of the data obtained with different methodologies is what makes the results valid. To make rigorous and realistic research possible, our proposal considers it necessary to use different methodologies, or even the combination of some of them.

Given the complexity of the tasks and the simultaneity of some of their components, a line of research, important in itself, is to try and isolate each of those components. In order to do this, we shall consider four general parameters: A) the complexity of the task, B) simultaneity, C) performance indicators, D) variations in the mental model.

3.1. The complexity of the task

There are several theoretical models (Gerver 1976; Moser-Mercer 1997; Gile 1997) attempting to dissect and analyse each of the components of the tasks, leaving evidence of the enormous cognitive complexity of the task in itself. Cognitive Psychology has always tried to identify the processes of which complex tasks are composed, but in activities considered as "normal", such as reading or problem solving.

- a) The method of cognitive components. This consists of an analysis and comparison of tasks in which different components of a more complex task are involved. In the case of translation and interpreting the procedure will consist of comparing performance in the task of translation or interpreting with that of other tasks that contain all these components except one.

Example: Several studies (Gerver 1974; Lambert 1992) have already compared simultaneous interpreting with tasks of *shadowing* and paraphrasing. From research done on the task of *shadowing* (Marslen-Wilson 1973) we know that the subjects perform syntactic and semantic analyses as they receive the input (on-line) according to the phonological information they have in working memory. Both the subject performing the task of *shadowing* and the interpreter are concurrently carrying out the processes of production and comprehension. Therefore the task of *shadowing* shares both processes, the critical difference is

that, when performing the task of interpreting, the interpreter is using reformulation processes to translate the input to the other language.

The task of paraphrasing also involves reformulation processes, but within the same language. Therefore interpreting and paraphrasing share the process of reformulation; the difference is that in interpreting the process is interlinguistic and in the task of paraphrasing it is intralinguistic. Thus the comparison between these three tasks is relevant to isolate the processes of reformulation and determine the possible effect of some of their variables.

Proposals: a) a comparison of consecutive interpreting with simultaneous will enable the study of the role of simultaneity of the processes of production and comprehension, on the one hand, and of the processes of coding and retrieval from long-term memory, on the other; b) the study of the role of memory comparing different versions of the implementation of consecutive (consecutive versus semi-consecutive); c) the study of the effect of temporal pressure and of the modality by varying the temporal parameters and the modality of the task to be performed, etc.

- b) The method of cognitive correlations. This consists of a selection of subjects that differ in their skill in the process or task under study and of the comparison of their performance in a series of simple tasks which are presumed to be involved in that skill. In translation and interpreting the method will consist of comparing the performance of different levels of skill between translators or interpreters, other professionals, students, bilinguals, etc., in the performance of different tasks that involve subprocesses of the same (e.g. comprehension, memory). The superiority of the highly-skilled subjects in one of the simpler tasks indicates that the process involved, is also involved in the performance of the more complex task.

Example: Dillinger (1994) uses this method to discover whether the high skill superiority that expert (interpreters) show compared to bilinguals is due to their linguistic skills or to the development of other skills. The comparison of the two involves comparing the performance of two groups of subjects with high linguistic skills, so that if their performance is the same or depends on the same factors, we have an indication that the quality of interpreting depends much more on this linguistic skill than on factors like memory or attention. If, on the other hand, the interpreters are superior to the bilinguals, this indicates that linguistic skills are not the determining factor of good performance.

Both, the cognitive correlates and cognitive component methods, permit the isolation and breakdown of highly complex tasks such as translation and interpreting.

3.2. Simultaneity. As Gile (1995) points out, the isolated study of each of the components can be deceptive as when they are produced simultaneously they may interact and be modified. For this reason in psychology the use of the methodology of dual tasks makes it possible to study the impact of joint performance and therefore identify possible interactions and modifications.

Example: If one of the components of simultaneous interpreting is to place a series of elements in memory whilst simultaneously performing processes of linguistic articulation, using the logic of dual tasks we would compare a task of memorising when it is in isolated form, with the same task when we force the subject simultaneously to verbalise a linguistic sequence.

The study of different variables in different tasks carried out either simply or dually can provide a vision of the consequences of simultaneity. It would also enable measurement of the attention span of different components.

Although these conclusions may seem simplistic, the logic can be applied in a more sophisticated way and thereby provide an indication of the capacity dedicated to different processes.

A) Performance indicators. It is true that each of the dependent variables used in psychology which can serve as process indicators in translation and interpreting have their limitations. However, each one contributes with different and complementary information. The joint use of several of them and the convergence and consideration of the results obtained converts them into useful and reliable measurements of the underlying processes of performance. Cognitive psychology has successfully used the following variables in the study of comprehension and production.

1. Process indicators:

- Reading time: enables the measurement of the demands of the process of comprehension during mediation.
- Reaction time: it is an indicator of the speed at which certain processes are carried out.
- Production time: the speed at which we are able to access the world and lexical knowledge stored.
- Accuracy measures, % count: especially relevant in certain modalities of mediation in which high demands on memory and attention are exerted.

2. Measures of global performance:

- Think-aloud protocols and questionnaires: they provide evidence about the order the mediator follows to implement his/her task, about his/her

strategy in case of difficulty, about the way in which he/she evaluates, or even anticipates, the results of the strategies implemented.

- Error classification: a combination of the analysis of the errors in the three tasks of mediation (translation, consecutive and simultaneous interpretation), with an analysis of think-aloud protocols in translators can provide evidence about the differences between these tasks regarding global processes such as comprehension, need for using previous knowledge or for storing information in memory during longer or shorter time, etc.

3. Psychophysiological measures:

- Eye movements: it shows which parts of the stimulus are being processed at a given time. It registers where the eyes of the subject performing the task are oriented, and for how long this situation is maintained.
- Evoked potential, PET and other measures of brain activity: they show the brain activity while a certain task is being performed. These measures show which brain areas are activated and for how long.

B) Variations in the mental model. The importance of contextual and cultural variables (recipient type, text type, etc) in the strategies of translation and interpreting that can determine the structure of expectations or mental model with which the mediator undertakes the process have already been indicated. The systematic manipulation of these variables can be in itself an object of study.

The subject's prior knowledge, the situation in which comprehension occurs, etc. can lead to variations in the mental model which the recipient constructs for himself/herself and thus determine the representation that he/she makes of the text or discourse in L2 (Glenberg *et al.* 1994; Garham and Oakhill 1989). We propose two kinds of methodologies enabling an assessment of the influence of the mental model on comprehension and the inferring of these models from the subject's implementation. There are two types of measurements:

- Direct measurements: direct observation by the investigator of the subject and the expectations with which the subject faces the task. In this way the subject's verbalisations can be observed during the performance of the task, or precise questionnaires can be built on the characteristics of the subject's mental model. This methodology presents problems of quantification and interpreting, but it is useful when the experimenter has no previous hypothesis about the nature of the mental model.

- Indirect measurements: inferring the subject's mental model. For example, in the study of comprehension processes, the importance and nature of the subject's mental model can be inferred by observing the inferences the subject performs on the text after reading or listening to it (Glenberg *et al.* 1994), before the presentation of a series of phrases that, although they are not included in the text, are consistent with the information offered. From the way subjects recognise this information, albeit implicitly, evidence of the properties of this mental model may be obtained.

The paper's final conclusion is that whatever the method of measurement chosen, what must be taken into account is not only the variables that can construct the mental model of the translator/interpreter, but also that the influence of these variables must and can itself be the object of a study.

4. Summary and Conclusions

The work presented here is a piece of interdisciplinary research endeavouring to bring together developments and experiences both in the field of cognitive psychology and in the field of translation and interpreting. Its main objective is to contribute to a better understanding of the cognitive processes implied in translating and interpreting. We have proposed, so far, an outline of a comprehensive theory of language mediation combining psychological work on comprehension with research approaches on translation and interpreting that stress the role of attention and memory capacity.

Once a theory formulating the processes involved has been elaborated, including the different variables which affect each one of these processes, we propose a methodology of empirical research using the same methods that Cognitive Psychology has been using.

We believe that, despite so much criticism of the lack of ecological validity in this kind of methodology, it is precisely the diversity of experimental methods and the indicators of processes (dependent variables) that makes it possible to study different aspects of these complex cognitive tasks objectively and rigorously. The validity of the results come from the contrast and convergence of the data obtained with different methodologies.

Our line of empirical research, started some years ago, is based on this general approach. Undoubtedly the immediate implications of our results must be their application to a more efficient training of future interpreters.

References

- Baddeley A.D. (1990): *Human Memory: Theory and Practice*, Hove, Lawrence Erlbaum Associates.
- Brislin R.W. (1976) (ed.): *Translation, Application and Research*, New York, Gardner Press.
- Danks J. (1995): "The psycholinguistics of reading and translation", in *Basic Issues in Translation Studies*. Ed. by A. Neubert, G. Shreve, & K. Gommlich, Kent, OH: Institute for Applied Linguistics, pp. 101-112.
- Danks J., Shreve G., Fountain S. & McBeath M. (1997) (eds): *Cognitive Processes in Translation and Interpreting*, Thousand Oaks, SAGE Publications.
- de Groot A.M.B. (1993): "Word-type effects in biligual processing tasks: Support for a mixed representational system", in *The Bilingual Lexicon*. Ed. by R. Schreuder & B. Weltens, Amsterdam, John Benjamins, pp. 27-51.
- de Groot A.M.B. (1997): "The cognitive study of translation and interpretation: three approaches", in *Cognitive Processes in Translation and Interpreting*. Ed. by J. Danks, G. Shreve, S. Fountain & M. McBeath, Thousand Oaks, SAGE Publications, pp. 25-26.
- Dillinger M. (1994): "Comprehension during interpreting: What do interpreters know that bilinguals don't?", in *Bridging The Gap: Empirical Research in Simultaneous Interpretation*. Ed. by S. Lambert & B. Moser-Mercer,. Amsterdam, John Benjamins, pp. 155-189.
- Gambier Y., Gile D. & Taylor Ch.. (1997) (eds): *Conference Interpreting: Current Trends in Research*, Amsterdam-Philadelphia, John Benjamins.
- Garham A. & Oakhill J.V. (1989): "The everyday use of anaphoric expressions: implications for the mental models theory of text comprehension", in *Models of Cognition: A Review of Cognitive Science*. Ed. by N.E. Sharkey, Norwood, N.J., Ablex, pp. 78-112.
- Gernsbacher M.A. (1994): *Handbook of Pscholinguistics*, San Diego, Academic Press.
- Gerver D. (1974): "Simultaneous listening and speaking and retention of prose", *Quarterly Journal of Experimental Psychology*, 26 (3), pp. 337-342.
- Gerver D. (1976): "Empirical studies of simultaneous interpretation: a review and a model", in *Translation, Application and Research*. Ed. by R.W. Brislin, New York, Gardner Press, pp. 165-207.

- Gerver D. & Sinaiko H.W. (1978) (eds): *Language, Interpretation and Communication*, New York, London, Plenum Press.
- Gile D. (1985): "Le modèle d'effort et l'équilibre d'interprétation en interprétation simultanée", *Meta*, 30, 1, pp. 44-48.
- Gile D. (1991): "The processing capacity issue in conference interpretation", *Babel*, 37, 1, pp. 15-27.
- Gile D. (1997): "Conference interpreting as a cognitive management problem", in *Cognitive Processes in Translation and Interpreting*. Ed. by J. Danks, G. Shreve, S. Fountain & M. McBeath, Thousand Oaks, SAGE Publications, pp. 196-214.
- Glenberg A.M., Kruley P. & Langston W.E. (1994): "Analogical processes in comprehension", in *Handbook of Psycholinguistics*. Ed. by M.A. Gernsbacher, San Diego, Academic Press, pp. 609-639.
- Humphreys G.W. & Evett L.J. (1985): "Are there independent lexical and non-lexical routes in word processing?", *Behavioral and Brain Sciences*, 8, pp. 689-740.
- Johnson-Laird P.N. (1983): *Mental Models: Towards a Cognitive Science of Language, Inference and Consciousness*, Cambridge, MA, Harvard University Press.
- Kintsch W. & Van Dijk T.A. (1978): "Toward a model of text comprehension and production", *Psychological Review*, 85, pp. 363-394.
- Kintsch W. (1988): "The use of knowledge in discourse processing: a construction-integration model", *Psychological Review*, 95, pp. 163-182.
- Kintsch W. (1994): "The psychology of discourse processing", in *Handbook of Psycholinguistics*. Ed. by M.A. Gernsbacher, San Diego, Academic Press, pp. 721-736.
- Kiraly D.C. (1995): *Pathways to Translation: Process and Pedagogy*, Kent, OH, Kent State University Press.
- Lambert S. (1992): "Shadowing", *Meta* 37/2, pp. 263-273.
- Lambert S. & Moser-Mercer B. (1994) (eds): *Bridging The Gap: Empirical Research in Simultaneous Interpretation*, Amsterdam, John Benjamins.
- Langacker R. (1987): *Foundations of Cognitive Grammar*, Stanford, CA, Stanford University Press.
- Marslen-Wilson W. (1973): "Linguistic structure and speech shadowing at very short latencies", *Nature*, 244, pp. 522-523.
- McDonald J.L. & Carpenter P.A. (1981): "Simultaneous translation: idiom interpretation and parsing heuristics", *Journal of Verbal Learning and Verbal Behavior*, 20, pp. 231-247.

- Miller G.A. (1956): "The magical number seven, plus minus two: some limits on our capacity for processing information", *Psychological Review*, 6,3, pp. 81-97.
- Moser-Mercer B. (1997): "Beyond curiosity: can interpreting research meet the challenge", in *Cognitive Processes in Translation and Interpreting*. Ed. by J. Danks, G. Shreve, S. Fountain & M. McBeath, Thousand Oaks, SAGE Publications, pp. 176-195.
- Muñoz R. (1995): *Lingüística para Traducir*, Barcelona, Teide.
- Neubert A., Shreve G. & Gommlich K. (1995) (eds): *Basic Issues in Translation Studies*, Kent, OH, Institute for Applied Linguistics.
- Sanchez-Casas R., Davis C.W. & García-Albea J.E. (1992): "Bilingual lexical processing: exploring the cognate/non-cognate distinction", *European Journal of Cognitive Psychology*, 4, pp. 293-310.
- Schreuder R. & Weltens B. (1993) (eds): *The Bilingual Lexicon*, Amsterdam, John Benjamins.
- Seidenberg M. & McClelland J. (1989): "A distributed developmental model of word recognition", *Psychological Review*, 96, pp. 523-568.
- Seleskovitch D. (1978): "Language and cognition", in *Language, Interpretation and Communication*. Ed. by D.Gerver & H.W. Sinaiko, New York, London, Plenum Press, pp. 333-341.
- Sharkey N.E. (1989) (ed.): *Models of Cognition: A Review of Cognitive Science*, Norwood, N.J., Ablex.
- Tijus Ch. (1997): "Understanding for interpreting, interpreting for understanding", in *Conference Interpreting: Current Trends in Research*. ed. by Y. Gambier, D.Gile & Ch.Taylor, Amsterdam-Philadelphia, John Benjamins, pp. 29-48.
- Toury G. (1982): "A rationale for descriptive translation studies", *Dispositio*, 7, pp. 23-39.