

## **Descriptive summary**

The aim of the present project was to assess the impact of the level of expertise in three types of subjects — interpreters, bilinguals and novices — in two different languages with respect to the (differential?) processing of these language by the human brain / mind.

For achieving this, a consortium of three laboratories (which have been joined by others during the project) has been formed in order to tackle such a research issue with three different but complementary theoretical approaches:

- a phenomenological and "ecological" approach based on (i) the investigation of various phonetic clues at "low processing levels" which are likely to reveal the nature and the difficulty of the cognitive processing implied in the linguistic manipulation of one or the other language, and (ii) the investigation of the speed (fluidity) and accuracy of their verbal performance.
- a psycholinguistic approach based on the assessment of the (variable?) working memory capacity of the three types of subjects (Baddeley, 1992).
- a neuropsycholinguistic approach that is aimed at identifying with the use of fMRI the neural areas underlying linguistic performance in the different subjects for their different languages in specific tasks.

*Keywords:* Psycholinguistics • Neuropsycholinguistics • Traductology • Level of expertise

*Number of participants:* 9 (2 neuropsycholinguists, 1 psycholinguist and 1 linguist of the Laboratoire Jacques Lordat; 3 linguists (trained in phonetics) of the Institut de Linguistique de Mons, Belgium; 2 neuropsycholinguists at U 455 of INSERM).

This represents a total of 104 man/month, from November 1st 2000 to September 1st 2002.

## **Original aims and outcomes**

The present project is born in the context of a reflection starting in 1995 with the foundation of the Groupe International de Traductologie de l'Interprétation (GITI) by Bernard Harmegnies (Director of Institut de la Communication Parlée, Institut de Linguistique, Université de Mons-Hainaut, Belgium) and Jean-Luc Nespoulous (Université Toulouse-Le Mirail). Its general aim is to investigate, from a three-fold standpoint, the impact of the level of expertise of three groups of participants (novices, bilinguals, expert interpreters) on their performance in each of two selected languages (either French/Spanish or French/English).

1. a phenomenological and "ecological" approach based on (i) the investigation of various phonetic clues at "low processing levels" which are likely to reveal the nature and the difficulty of the cognitive processing implied in the linguistic manipulation of one or the other language, and (ii) the investigation of the speed (fluidity) and accuracy of their verbal performance.
2. a psycholinguistic approach based on the assessment of the (variable?) working memory capacity of the three types of subjects (Baddeley, 1992).
3. a neuropsycholinguistic approach that is aimed at identifying—by the use of fMRI—the neural areas underlying linguistic performance in the different subject for their different languages in specific tasks.

More precisely,

1. the first approach aims at comparing bilinguals who are not interpreters, novice interpreters, and expert interpreters in two cases of simultaneous interpreting: from the non-dominant (French) to the dominant language (Spanish) and from the dominant (Spanish) to the non-dominant language (French). In all cases the form and the content of the texts to be interpreted have been thoroughly controlled for in both the source and the target language.
2. the second approach focuses on an aspect which appears to be crucial considering the specificities of the simultaneous translation situation: it is aimed at evaluating the possible variation in working memory capacity between novice and expert interpreters. In other words: does the magical number  $7 \pm 2$ —born of the historical paper from Miller (1956)—characterise in a stable manner the working memory performance of subjects as different as unilinguals, bilinguals, novice interpreters and expert interpreters?
3. the third approach—based on cerebral imagery data—aims at testing whether the cerebral structures preferentially activated in a specific task remain stable, or, as is hypothesized, vary as a result of the degree of expertise of the subject (i) in each language tested, and (ii) in the different tasks used.

As scheduled in the initial research outline, this programme consists of three steps:

1. The selection of the linguistic material.
2. The development of the experimental tests and the testing of the different experimental populations.
3. The data analysis, giving rise to the publication of the research done by the group.

## Summary of the results

In spite of important delays caused by the AZF explosion in September 2001 in Toulouse (depriving the Laboratoire Lordat of its premises and research tools) the three different approaches have given rise to promising findings which will be presented to the scientific community at the occasion of an Workshop on Cognitive Aspects of Simultaneous Interpreting, to be held in Toulouse in May 2005 (see <http://acoustic31.univ-tlse2.fr/lordat/colloques/JBK/Call-for-papers.htm> ).

1. The first approach has given rise to a Doctoral Dissertation, defended in September 2004 by Myriam Piccaluga at the University of Mons-Hainaut. The aim of this exploratory study was to identify linguistic phenomena relevant to the study of simultaneous interpreting and to set up methodological means for further studies. This aim has largely been achieved by an in-depth study of subjects belonging to 4 different populations: bilinguals, interpreting students, novice interpreters, expert interpreters (within the langue combination “French/English”. Two main groups of linguistic variables were investigated in the two interpreting conditions mentioned above: a) an analysis of “high level” processes through the semantic correspondence of lexical items (detailed analysis of deviances and dysfluencies), b) an analysis of “low level” processes acoustic analysis of the speech signal produced by the subjects while performing their interpretative task under conditions of noise and/or speech acceleration). Furthermore, a detailed questionnaire investigating the linguistic background of the subjects has been developed.
2. The second approach has led to the first large scale study of working memory capacity in simultaneous interpreters. The study involves a total of 79 subjects: 18 novice

interpreters (interpreting students), 21 expert interpreters (professionals) and two control groups: 20 students and 20 bilinguals matched in age and education level with the expert interpreters. These subjects have been tested in a battery of memory tasks allowing for the contrasting of phonological and semantic aspects of working memory. It consists of different span tasks (involving digits, words, pseudo-words, semantically related words, and phonologically close words), free recall with and without articulatory suppression, a rhyme and a category probe task, a listening span and a unilingual and a bilingual Stroop test. All tests were conducted in French, the A-language of all participants. The results show that working memory capacity is not generally enhanced in interpreters: only the more complex working memory tasks allowing for the use of semantic strategies (free recall with articulatory suppression, category probe task, listening span) give rise to significant group effects. Interestingly, the most performant group is not the expert interpreters' but the novice interpreters' group. This gives rise to a more differentiated view of the role of working memory in simultaneous interpreting which is, obviously, not only to store phonological forms until they can be processed, even if this might nevertheless be the case in novice interpreters as far as specific subcomponents of short term working memory are concerned. In expert interpreters, however, the cognitive skills involved are more likely to be highly specialised schemes (Sweller, 2003) or routines subserved by long term memory (Ericsson & Kintsch, 1995). Two papers are currently being written up in order to report on these results and further analyses.

3. The third, neurolinguistic, approach has given rise to a Doctoral Dissertation, defended in December 2004 by Charlotte Momaur at the University of Toulouse-Le Mirail. This investigation implies behavioural and cerebral imaging measures in two tasks (translation and word generation) focussing on lexical access in several conditions: intra- or interlanguages in a mixed or unilingual list condition. The participants are 10 professional interpreters and 10 bilingual control subjects. The underlying rationale was that cerebral activations would be more circumscribed in the professional interpreters due to higher automatization of lexical retrieval procedures. Whereas behavioural measures show no differences between the two groups (maybe due to the fact that the tasks used were not “ecological” tasks of interpretation!), the fMRI measures suggest higher activations of subcortical structures—namely bilateral activations of the thalamus—in the professional interpreters. This finding—similarly to the initial hypothesis predicting a greater circumscription of the cerebral zones involved— (would) suggest a higher degree of automatization of the linguistic processes involved, based on subcortical structures, and this despite the fact that expert interpreters were not performing their usual professional task.

## **Perspectives**

The research perspectives with respect to such a scarcely explored subject are definitely huge. The association of three approaches in the present project has allowed to provide the consortium with a range of methodological tools that are easily adaptable for further studies. One specific project—stemming from the second (psycholinguistic) approach— is currently in the process of elaboration. In this investigation the general survey of different working memory tasks will be supplemented by some more specific measures with special interest in the context of simultaneous interpreting. Special attention will be paid to production measures

which are more likely to automatise in the context of interpreting than comprehension skills, which nevertheless are more frequently investigated in recent research.

Such research program is currently being developed within the context of the “Réseau Thématique Européen (RT2) that was organized following the ACI Cognitive. It involves the University of Mons-Hainaut (Belgium), the Autonomous University of Barcelona (Spain) and the University of Toulouse-Le Mirail (France) under the leadership of the “Groupe International de Traductologie de l’Interprétation”.