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Autor(en): **Moser-Mercer, Barbara**

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Remote interpreting: The crucial role of presence

Barbara MOSER-MERCER
Université de Genève, École de Traduction et d'Interprétation, 40, boulevard du Pont-d'Arve, CH-1211 Genève 4, Switzerland; barbara.moser@eti.unige.ch

Die audiovisuelle Fernkommunikation per Videokonferenz ist in den vergangenen Jahren für viele Konferenzdolmetscher zur Realität geworden. Doch stellt das Ferndolmetschen in vieler Hinsicht ein System mit vielen Zwängen dar, welches von den Dolmetschern die Entwicklung neuer Kommunikationsstrategien erfordert, um nicht nur den dolmetschinhärenten kognitiven Anforderungen zu entsprechen, sondern darüber hinaus auch auf die Sondersituation einzugehen, in der Bild und Ton oft nur ungenügend synchronisiert und die dem Dolmetscher zur Verfügung gestellte visuelle Information im Vergleich zur Realität im Konferenzsaal häufig nur sehr unzureichend ist. In diesem Artikel wird auf die besondere Rolle der visuellen Kommunikation eingegangen sowie auf die psychischen und physiologischen Anpassungen, die Dolmetscher in der Videokonferenz vornehmen, um die gewohnte Dolmetschqualität zu garantieren. Diese Anpassungen gehen allerdings auf Kosten der zur Verfügung stehenden kognitiven Ressourcen, was dann durch rascheres Ermüden im Sinne eines verfrühten Qualitätsabfalls zum Ausdruck kommt. Besonders betroffen sind die semantischen Aspekte der Informationsübertragung sowie deren Vollständigkeit, während syntaktische, stilistische und andere grammatikalische sowie prosodische Aspekte kaum Abweichungen aufweisen.
Schlagwörter: Ferndolmetschen, Simultandolmetschen, menschliche Faktoren im Dolmetschen, virtuelle Präsenz, Videokonferenz und Dolmetschen.

Introduction[1]

The complexity of simultaneous interpreting was first recognized when the International Labor Organization in the 1930s and the Nuremberg War Crimes Tribunal in the 1940s introduced this new mode of interpretation to replace consecutive interpreting. Many of the most prominent consecutive interpreters of the time refused to adapt to this new mode claiming it was much less precise (Gaiba, 1998).

European enlargement can be seen as another watershed event in that it represents one of the biggest challenges to professional interpreting practice since the introduction of the simultaneous mode. The number of language combinations to be covered, the physical and architectural constraints to house the increased number of booths, forced new ways of thinking on what had become a rather well-established professional practice. There is an immediate temptation to answer the question of how multilingualism can be

1 The author wishes to acknowledge the collaboration of the members of the research team and the technicians: Hanne Laugesen, Marina Korac, Valérie Servant, Alexander Künzli, Jaqui Jouffroy, William Ijeh, Craig Jones, Claude Lagrive; as well as the support of Prof. Hans Zeier, ETH Zürich for analysis of cortisol samples. The valuable comments of three anonymous reviewers are gratefully acknowledged.

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managed efficiently and cost-effectively by suggesting that the number of languages and language combinations have to be reduced. But obviously, not only the constitutional mandate but also democratic legitimacy and decision-making would be in peril. The next best solution is then to analyze real language needs, to proceed on the assumption that active language proficiency is more difficult to achieve than passive comprehension proficiency, and to conclude that all people should be allowed to speak their native tongue while being obligated to listen to discourse in one of their passive languages.

Different interpreting regimes are available to meet immediate and longer-term needs (Seleskovitch, Klein, Lederer, & Moser-Mercer, 2000): the integral regime (all languages interpreted into all languages, one A-language per booth), the bi-directional regime (all languages interpreted into all languages, interpreters work both into their A- and B-language), and mixed regimes with asymmetric language coverage (e.g., all delegates may speak their mother tongue, but are interpreted into only a limited number of languages) and bi-directional booths, as well as remote interpreting featuring any of the preceding regimes. Obviously, all potential solutions *require adjustment on the part of everyone*, recent evidence for this can be found in SCICNEWS No. 78, 2004 (*Booths and channels in Council)*.

Remote interpreting is not an entirely novel idea. Originally designed to facilitate meetings where parties could not physically come together for discussions, the prospect of an enlarged European Union led to the sober realization that retrofitting almost all existing meeting rooms and buildings to accommodate a substantially larger number of interpreting booths (and larger booths to accommodate a larger number of interpreters if a mixed regime was adopted) was next to impossible. In contrast to a live setting where the interpreter is in the same meeting room as the delegates and speakers, remote interpreting separates delegates and speakers from interpreters; the latter are installed in booths away from the meeting room, either in a different part of the building, across town, in another country or on another continent.

The first major remote interpreting experiments were carried out in the 1970s: the Paris-Nairobi ("Symphonie Satellite") experiment by UNESCO in 1976 and the New York-Buenos Aires experiment by the United Nations in 1978. A series of experiments was conducted by the European Commission in 1995 (Studio Beaulieu), and a pilot study on ISDN video telephony for conference interpreters was carried out by the European Telecommunications Standards Institute in 1993. The European Commission launched another test in 1997 (Zaremba, 1997) and yet another in 2000 (European Commission, 2000, http://www.europarl.eu.int/interp/remote_interpreting/scic_janvier2000.pdf).
The European Parliament launched two in 2001 (European Parliament, 2001, http://www.europarl.eu.int/interp/remote_interpreting/ep_report1, http://www.

europarl.eu.int/interp/remote_interpreting/ep_report2). The European Council carried out a test in 2001 (http://www.europarl.eu.int/interp/remote/sg_conseil_avril2001.pdf), and the United Nations explored the issue again in 1999 (United Nations, 1999) and in 2001 (United Nations, 2001). The aforementioned studies covered mostly technical aspects of the remote interpreting situation, some included stress measurements, but none explored the issue of quality.

The interpreting task and cognitive constraints in remote interpreting

As technology improves, so does the technical feasibility of remote interpreting. While cost and effort necessary to ensure high-quality remote interpreting set-ups are certainly still not negligible, they are likely to decrease as equipment becomes less expensive and technical support staff become more experienced. Human factors then emerge as one of the most important issues to be explored in remote interpreting:

- psychological aspects such as coping with the stress of a novel work environment,
- medical aspects such as having to rely on a screen to derive the visual support information necessary for carrying out the interpreting task,
- processing information from multiple sources (multi-modal information processing),
- operating multiple controls (multi-tasking),
- motivation,
- social isolation, and others.

Even in live settings a considerable number of external and internal cognitive constraints operate on interpreters. A task analysis of simultaneous interpreting reveals the involvement of a large number of sub-processes:

- speech perception,
- lexical, syntactic, semantic, and discourse processing,
- problem solving, transfer,
- situational assessment and speech production, etc.,
- attention and memory,

each featuring its own dynamic.

The list of "stressors" in interpreting is impressive and includes among the most important:

- speaker's speed, tempo, accent, vocal characteristics, use of microphone,
- availability of text in advance, speaker reading from text, departures from prepared texts,

- lack of clarity and coherence, unavailability of background material, criticalness of subject matter and meeting,
- novel terminology,
- relay (the floor language is not part of he interpreter's language combination and he or she therefore has to rely on a first interpretation which will then be interpreted a second time into the interpreter's A-language), double and triple relays,
- background noise in meeting room, reactions of audience,
- being monitored,
- temporal factors (number of consecutive meetings interpreted, recovery time, length of meeting, time on task, duration of speaker's utterances),
- environmental and equipment parameters,
- expertise of technicians,
- motivational factors such as feedback from speakers and fellow interpreters as well as delegates,
- intra- and inter-booth relationship and the anonymity of the interpreter.

In recent years, for example, substantially faster processing speeds (up to 180 words per minute) have put increased strain on working memory capacity. Most theoretical models of the interpreting process (Gerver,1976; Moser, 1978; Setton, 1999) feature component processes and break down the interpreting activity into macro and/or micro sub-skills. Such an approach is useful if we are to pinpoint the source or sources of problems in a novel work environment, such as remote interpreting.

The interpreter as individual – impact on test-situations

Just and Carpenter (1992) and Salthouse (1996) have argued convincingly that differences in rates of processing and working memory capacity are likely the result of individuals' differences in one or the other cognitive ability, such as reasoning or one of the linguistic sub-skills (rate of discourse comprehension, rate of discourse production, etc.). This view is borne out by extensive experience in the training of conference interpreters at the post-graduate level: we have yet to see two trainee interpreters with exactly the same combination of cognitive strengths and weaknesses. Interpreting novices thus have to develop interpreting strategies that maximize their individual strengths and minimize their weaknesses (Moser-Mercer, 2005). Adopting a within-subject design is therefore of paramount importance if we are to capture the real differences between a live and a remote interpreting setting for a given population.

Attention

Difficulty or inability to concentrate has been identified in most previous remote interpreting experiments as one of the consequences of prolonged exposure to remote interpreting. However, no direct correlation was experimentally established between attentional difficulties and fatigue and/or quality of performance. The Code for the use of new technologies in conference interpretation (AIIC, 2002) accounts for this and recommends shorter working hours. Long-term studies on interpreting skill development in novice interpreters (Moser-Mercer, 2005) have also identified sustained concentration as one of the most intractable challenges in acquiring expertise in interpreting. Neurological changes result in reduced attentional resources and in cognitive slowing, which in turn leads to reduced cognitive control and to poorer memory performance. Thus, in order to maintain a high level of quality, interpreters' performance becomes more effortful and thus also more tiring.

Expertise and individual adaptability

Demanding cognitive and complex linguistic processes such as simultaneous interpreting already draw on substantial cognitive resources. Expert interpreters have learned to circumvent resource constraints by automating certain parts of the interpreting process through long-term practice and experience, by preparing for meetings to develop a solid knowledge base, and by taking regular turns so as not to exhaust resources through excessive time on task. There is a solid body of research (Ericsson, 1996) to substantiate the notion that expert performance relies heavily on more automated (economical in terms of resource use) rather than on consciously controlled processing (resource intensive). A skill that is clearly specified, such as simultaneous interpreting for an expert interpreter, offers ample opportunity for automation. However, interpreters have not yet been trained to work in remote settings and are thus still having to rely largely on consciously controlled processing. In order to maintain smooth expert performance in a remote environment, experienced interpreters work to some extent like novices learning a new task or skill. Experts do not always adapt easily to modifications in the task environment they have become so used to (see also Braun for a relevant discussion on video-conferencing and interpreting: Braun, 2004). Such routine expertise may even become more of a hindrance than help in accommodating new task variables; these interpreters are thus forced to draw on resources deployed traditionally to other cognitive tasks in the interpreting process (comprehension, production, etc.) with these sub-processes then becoming vulnerable to error. The ultimate consequence is a faster onset of fatigue and a drop in performance quality if normal turn times are maintained. Thus, interpreters who "know" how to interpret by virtue of many years of professional practice may be less likely to adapt to a new working environment (Kimball & Holyoak,

2000) than less experienced colleagues who may exhibit a greater degree of adaptive expertise.

Salient factors identified in past remote interpretation tests

Not all job characteristics are likely to be important for performance, or feelings of satisfaction and well-being. Some of those characteristics that have been associated with occupational stress are lack of variety, absence of discretion and control, lack of contact with other people, and physical working conditions (e.g., ergonomically designed equipment) (Chmiel, 1998). One of the prerequisites to job design and redesign is a good task analysis which identifies what people are required to do and the constraints that are placed on them. Modern-day task analysis incorporates psychological factors and uses models of how people handle and process mental information; it considers factors such as memory, learning, attention, mental effort, and decision-making (Cassidy, 1999). With modern technology having increased the emphasis on mental, rather than physical work, and with complex technologies obliging operators to handle considerable amounts of information, it is only fitting that the most recent innovation in interpreting, remote interpreting, be subjected to careful analysis as regards its impact on the physical and psychological well-being of the interpreter and on his or her performance.

The remote interpreting situation appears to represent not only a novel environment for interpreters in which they need to invoke more effortful problem-solving strategies, but seems to cause more than the usual physiological and psychological strain in that the coordination of image and sound, the piecing together of a reality far away and the concomitant feeling of lack of control all draw on mental resources already overcommitted in this highly complex skill.

Feeling of control

The ITU/ETI/Swisscom study's lead author has argued elsewhere that inference generation and the construction of situation models are crucial to discourse comprehension (Moser-Mercer, 2002); we might conclude theoretically that the reason interpreters feel the need to be in control of the situation (see Annex II of the above study at http://www.aiic.net/community/attachment/ViewAttachment.cfm) reflects their need to decide freely and quickly as to which contextual and extra-linguistic information is needed for successful comprehension to occur at high speed. This argument is entirely consistent with the results reported in virtually all preceding remote interpreting tests. Interpreters seem to perform well under normal working conditions, but any change in these conditions has immediate repercussions on the efficiency and delicate balance of comprehension and production processes in short-term and long-term working memory (Ericsson & Kintsch, 1995) and ultimately compromises quality (Moser-Mercer, Künzli, & Korac, 1998).

We must assume that remote interpreting as it is currently set up, and irrespective of technical parameters such as sound and picture quality, prevents interpreters from building up the requisite situation models in working memory that normally allow them to perform at a high level of quality throughout a regular 30-minute turn.

Feeling of "being there"

There are a number of factors that contribute to a sense of presence, such as degree of control, immediacy of control, anticipation of events, mode of control and the modifiability of physical environments. These factors are often compromised in a remote setting. Visual information strongly influences the feeling of presence, but needs to be rich in order to stimulate the senses sufficiently. Multi-modality is another major contributing factor to the feeling of "being there": all the senses that are normally stimulated in interpreting ought to be stimulated in a remote setting as well. The information received in a remote setting also needs to be consistent with the real world, i.e., the live meeting room. Presence, or the lack thereof which is usually termed alienation by the interpreters who have participated in remote interpreting experiments over the last six years (for a review see Moser-Mercer, in press; Moser-Mercer, 2003) is a subjective sensation that is not easily amenable to objective physiological definition and measurement. Subjective reports provide the essential basic measurement (Sheridan, 1992, p. 121). The strength of presence experienced in a virtual environment varies both as a function of individual differences and the characteristics of that virtual environment. Individual differences, traits, and abilities may enhance or detract from the presence experienced. Hence, presence measures need to address individual differences as well as characteristics of the virtual environment that may affect presence.

A large number of technical problems had an impact on interpreters' performance in previous remote interpreting tests (EP, 2001; European Council, 2001; ITU/ETI/Swisscom, 1999; UN, 1999, 2001). Some of these have been resolved through technological advances, while others remain, such as successful echo cancellation and deficient synchronization of audio and video streams. Interpreters participating in these tests criticized mostly their inability to obtain specific visual information precisely when needed, being offered images at a time when they were not useful (source of distraction), the feeling of not being "there", eye strain, dizziness, headache, and lack of motivation. Those who appear to have a more positive view of the quality of visual and sound input seem to have been less bothered by remote interpreting (UN, 2001).

The ITU/ETI/Swisscom remote interpreting project

ETI (École de traduction et d'interprétation, University of Geneva) was the first to introduce the within-subject design into remote interpreting research. In collaboration with ITU (International Telecommunication Union), ETI designed the first *controlled* experiment to evaluate human factors and technical arrangements in remote interpreting. The research team's null hypothesis was that there would be no difference in terms of perceived psychological and physiological stress, nor in terms of fatigue as evidenced in a drop in performance quality between live and remote interpreting. A large number of technical parameters were sampled in order to obtain as comprehensive a picture as possible of the issues involved in remote interpreting.

The meeting used for this research project was a live meeting of a general nature held from April 7 to April 9, 1999 at ITU headquarters in Geneva. The working languages were English, French and Spanish. A standard team composition was used in the conference room: each booth was staffed with three interpreters, two working at the same time with the third interpreter off. The study design included the duplication of one (French) booth at the remote site (ETI).

Interpreters in the conference room and at the remote site were given the same documents at the same time in advance in order to prepare the meeting. Separate phone, fax and e-mail numbers at the remote site were available for in-session document transmission and technical coordination during the meeting.

On the ETI site two interpretation booths were prepared for the test, equipped with a videoconference system, which would enable the interpreters to follow the conference live. One booth was used as the remote French booth, the second was designed as a back-up in case of technical difficulties. The picture on the interpreter's monitor showed an overall view of the conference room at ITU with an image of the speaker (delegate or chairperson) as picture-in-picture (PiP) in the upper left-hand or lower right-hand corner of the screen.

The videoconference system used was a PictureTel video modem, series 4500, version 6.12, equipped with a Promptus IMX-1B Inverse-Multiplexer connected via ISDN links to the Swisscom switched digital network. The picture monitor in the booth was a 15" computer monitor, in which the video signal had been converted for computer display.

On the ITU site a different infrastructure was installed in order to provide the most faithful coverage of the conference environment. For this purpose, it was necessary to install three studio cameras and video facilities for processing the image. The audio signal from the conference room's interpretation equipment used other routes and interfaces. The two signals were then fed into a videoconference system similar in every way to the one used at ETI.

An identical videoconference system was used at ITU. The only difference was in the connections to the network: Bus SO (Hicom series 300) internal connections to the PABX were used. The audio and video equipment used in ITU included 2 Sony DXC 325 professional video cameras; 1 Sony BVWV 507 professional video camera; 3 video monitors; 1 digital video control unit; 1 audio mixer; and 1 CODEC.

Throughout the experiment, all the installations were under permanent load. For the videoconference, this meant a continuous link from 0845 hours to 1800 hours without interruption. H.320 standard connections were used with a bit rate of 384 kb/s and a coding algorithm H.261 for video and G.722 (48 kb) for audio, with a rate of 30 frames per second.

To cover the meeting room visually, three video cameras were used. These three cameras were operated by cameramen and all three were connected to a digital video control unit operated by an editor, who mixed the three signals and produced a composite image: almost the whole of the room as a background and an insert of the speaker (PiP) with his place-card. The floor sound from the room was picked up with a clam shell socket. The composite image and the sound were sent to the CODEC. The CODEC, connected to the remote site (ETI) by four ISDN lines, transmitted the sound and the picture with good qualities. The French sound was received back from the ETI (the floor interpreted), and fed into an interpretation channel in the meeting room, using a mixer to adapt the impedance and the power level. Delegates had a choice between two French booths, one working live, the other remotely.

Methods

Interpreters

Interpreters in the conference room constituted the control group, interpreters at the remote site the experimental group. The study used a within-subject design to eliminate excessive variation in human factors measurements and in output quality. Within-subject designs are ideally suited for studies with small numbers of subjects, and experiments in conference interpreting almost always fall in that category. Thus, each of the six interpreters working in the French booth was his or her own control, working according to a prescribed rotation schedule both in the conference room and at the remote site. In addition, the 6 interpreters working in the English and Spanish booths at the conference site were included in part of the sampling (personality inventory, physiological and psychological stress measurements). There were four male and eight female subjects.

Quality as a dependent variable

Interpreters' output from both French booths was recorded at both sites (dual track, original and interpretation) for the duration of the entire 3-day meeting. Interpreter output from both French booths was sampled at regular intervals (every 12 minutes), transcribed, evaluated according to a scale developed by ETI for comparable research projects (Moser-Mercer, Künzli, & Korac, 1998) and compared. The interpreters' anonymity was ensured by assigning codes to each tape. Previous research on fatigue in interpreting (Moser-Mercer, Künzli, & Korac, 1998) has revealed that quality of performance can serve as an informative dependant variable for studying fatigue and that it complements other physiological measurements. It has also been shown there that a drop in performance is mostly the result of an increase in the number of meaning errors committed by the interpreter, while other parameters of production such as grammar, style, syntax and prosody do not appear to be significantly affected by increased load. It was nevertheless decided for this experiment to analyze transcripts for the full scale of errors and to weight these errors in a task-appropriate manner. Meaning errors (subdivided from most to least serious into contre-sens, faux-sens, nonsense, nuance, omission) were given the most weight, while other grammatical parameters (grammar, syntax), style, and prosodic features (intonation, hesitation, pauses) were given less weight.

Human factors

Many studies on occupational stress have investigated the effects of stress on various components of the immune system and have found immuno-suppression (see Zeier, 1994, for a relevant discussion). However, there are data on cellular and humoral (hormonal) immune markers showing that psychological stressors can also have stimulating effects on the immune system, such as increasing the number of natural killer cells or increasing the number of T-cells, the concentration of IgM and the complement component C3. Cortisol, one of the stress glucocorticoids, inhibits immune functions, especially the cellular immune response, but probably has no significant short-term effects on humoral immunity. Nevertheless, repeated and increased secretion of cortisol is assumed to have a negative long-term effect on humoral immunity. Prolonged stress floods the system with cortisol, which then suppresses the immune system and increases vulnerability to illnesses.

Baseline stress measurements (stress hormones, sIgA – Salivettes, Sarstedt, Germany) were taken before the experiment (at the latest one day prior to the selected meeting), immediately before the selected meeting began, and at regular intervals during the experiment.

Questionnaires

The following standardized questionnaires were administered to interpreters before and after the experiment:

- Eysenck Personality Questionnaire (Eysenck & Eysenck, 1975) (administered before experiment to both experimental and control groups, as well as to other interpreters in English and Spanish booths).
- State-Trait Anxiety Inventory (STAI) (Spielberger, 1983) (general questionnaire administered before experiment to both experimental and control group and English and Spanish booths, situational questionnaire administered at the beginning of each meeting and at regular intervals throughout the experiment and to coincide with physiological stress measurements).
- Technical questionnaire relating to technical aspects of the remote interpreting situation. Experimental and control groups in French booth filled in all parts, English and Spanish booths filled in the general part only.

These tests provided information on interpreters' basic personality profile and coping mechanisms and specific coping behavior on the job. The technical questionnaire was designed to capture specific (technical and other) problems interpreters in the experimental group may have experienced due to the novel technical arrangements.

Results

Questionnaire on technical arrangements

Overall, interpreters seemed to be accepting remote interpreting. While certain dimensions of the technical arrangements (sound quality, image, screens) still needed to be improved, none of these emerged as a major factor in determining whether a participant would accept remote interpreting or not. The single most important factor appeared to be the physical and perceived distance from the conference hall, the inability to be more closely involved with what is going on in the conference hall, which produced a feeling of "not being in control". Only fifty per cent of the respondents felt they were in the same hall as the speaker (Fig. 1) and eighty-three per cent believed that the action outside their scope of vision (outside of what was visible on the screen) was important (Fig. 2).

While the technical arrangements were such that in case of technical difficulties it was probably easier and quicker to phone, fax or e-mail from the remote site to the conference site than for an interpreter working live to go down into the conference hall to try and fix the problem, that did not change interpreters' perception of being "remote". Sixty-six per cent of those working remote, and the same percentage of those working on site, felt that it is important to be able to speak to the chairman. It seems that the lack of proximity to clients and staff produces a feeling of alienation that ultimately results in lack of motivation and increased fatigue as evidenced by a decrease in interpreting quality (see below).

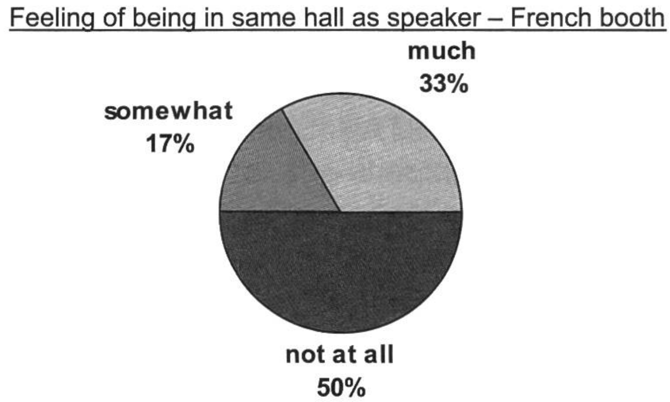

Fig. 1: French interpreters' (n=6) feeling of being in the same hall as speaker

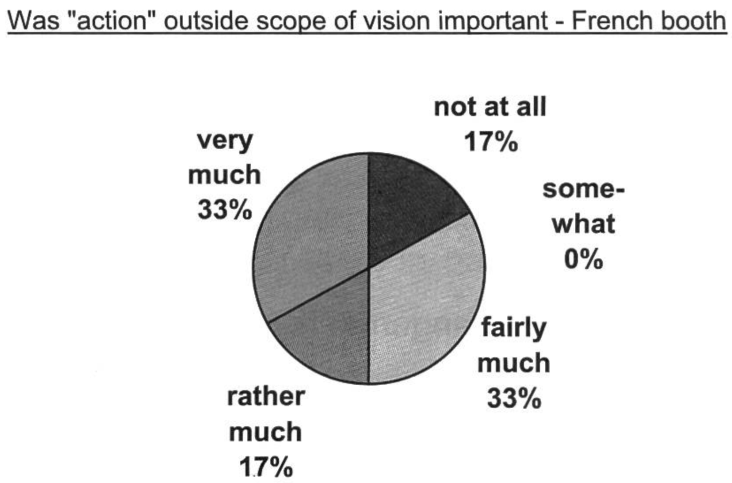

Fig. 2: Importance of action outside of scope of vision on screen for French booth (n=6)

It is obvious that some of the technical arrangements, such as for example an image that would allow the interpreter to clearly make out lip movements, facial expressions, etc., are being judged much more harshly under remote interpreting conditions than under normal conference conditions. The fact that fifty per cent of the respondents in the remote condition could make out facial expressions compares well with fifty per cent of them considering that aspect to be important. In other words, those who felt that these expressions were important, were able to make them out on the screen, others were not or did not try to. Answers were similar for gestures and body movements: Those who felt gestures were important, were able to make them out on the screen, others were not.

While participants in the French booth, who rotated between the conference hall and the remote location, were divided in their acceptance of remote interpreting (Fig. 3; fifty per cent seemed favorably disposed, fifty per cent much less so), no correlation could be established between their attitude towards remote interpreting and their general attitude towards new technologies, nor between their attitude towards remote interpreting and their desire to travel (questions to that effect had been included as control questions in the Technical Questionnaire). Sixty-six per cent of interpreters questioned enjoy travel, which obviously includes those who were also accepting of remote interpreting. All agreed to some degree, however, that there were certain aspects of new technologies that worried them. It appears that the feeling of not being in control of the situation, because one was physically remote from it, is reflected in these replies.

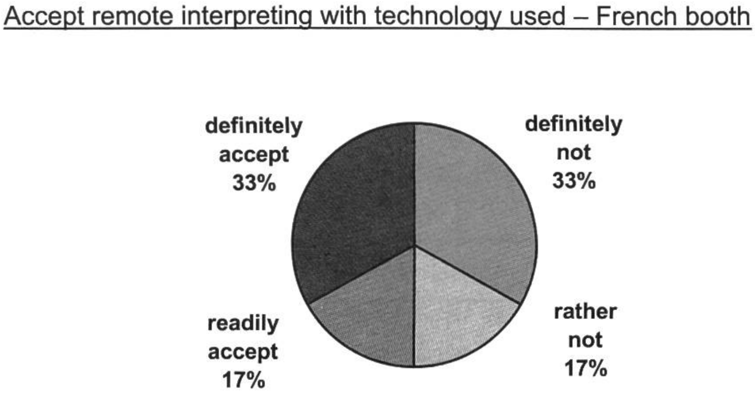

Fig. 3: Acceptance of remote interpreting by French booth (n=6)

Standardized questionnaires

In order to obtain a comprehensive picture of interpreters participating in the experiment, the design included the administration of the *Eysenck Personality Questionnaire - EPQ-R* as well as the administration of the *State-Trait-Anxiety Questionnaire* whose results are correlated with the physiological stress measurements (immunoglobulin A – IgA, cortisol).

Eysenck Personality questionnaire – EPQ-R

The Eysenck Personality Scales embody the results of forty years of development, and many hundreds, if not thousands, of psychometric and experimental studies, carried out in many different countries. The Scales are designed to measure the major dimensions of personality as they have emerged from self-ratings, ratings by friends or acquaintances, observational studies, experimental investigations, psychophysiological experiments and biochemical analyses. The major factors of personality here measured – *Psychoticism* (P), *Extraversion* (E), *Neuroticism* (N), *and Social desirability* (L) – have achieved the widest consensus in this field and more is known about their psychological meaning and their importance in educational, clinical, industrial and other applied fields than could be said about any other personality factors.

Table 1: Means of P, E, N and L for male participants

	N	Reference values Mean	Reference values SD	Experimental values
Psychoticism	4	5.72	3.21	8.75
Extraversion	4	14.90	4.74	13.5
Neuroticism	4	10.55	5.49	8.75
Social desirability	4	6.22	3.79	7.5

Table 2: Means of P, E, N and L for female participants

	N	Reference values Mean	Reference values SD	Experimental values
Psychoticism	7[2]	4.61	2.97	9
Extraversion	7	14.44	4.90	16.43
Neuroticism	7	13.66	5.49	10.72
Social desirability	7	7.62	3.90	9.43

Although the small number of participants does not enable us to make definitive statements regarding the population of interpreters as a whole, some clear indications emerge nevertheless. These add an additional dimension to the results obtained in this study and perhaps shed some light on whether interpreters might be capable of adapting to the new task demands of remote interpreting in future.

For psychoticism, a measure that according to Eysenck reflects personal disillusionment, bitterness, cynicism, idiosyncrasy and a disregard for convention, values both for male and female participating interpreters are clearly above the norm. Perhaps the fact that interpreters, particularly free-lance interpreters, need to fit in with a particular team only for the duration of a contract and then move on to another social grouping once the next contract begins, is responsible for interpreters being solitary beings, who are at times troublesome and do not fit in. Remarks regarding interpreters' elitist attitude are often heard outside the profession – the above results would lend some credence to

2 One female participant was ill at the time baseline values were taken and did not fill in Personality questionnaires.

that assessment insofar as the meaning of elitist includes being solitary and at times troublesome and aggressive.

For extraversion, values of male participating interpreters are somewhat below the norm, those for female interpreters somewhat above the norm. Thus interpreters appear to be neither particularly impulsive, nor prone to taking too many risks, nor particularly introverted and overly pedantic. The relatively balanced scores appear to fit in well with the profile of an interpreter: he or she must be ready to take risks, but not excessively so, and he or she must be able to plan ahead (anticipate).

For neuroticism, values both for male and female participating interpreters are below the norm. Thus interpreters do not appear to be anxious, worrying, moody or frequently depressed, nor do they react too strongly to all sorts of stimuli. Could one perhaps conclude from this that they are fairly well equipped for remote interpreting?

For social desirability, values both for male and female participating interpreters are above the norm. Interpreters might want to look good and conform, and/or many years of conference interpreting and adapting to a large variety of speakers and situations have left their mark.

It is interesting to note in this context the answers to questions 2, 3 and 4 of the *Technical questionnaire – Part: General aspects* (see Annex II at http://www.aiic.net/community/attachment/ViewAttachment.cfm). When asked whether they would accept remote interpreting with the technology used in the experiment, fifty per cent of the respondents said they would accept. When asked whether they believe other interpreters would accept remote interpreting with the technology just used, seventy per cent said they would. However, when asked whether the profession as a whole should accept remote interpreting, only thirty-three per cent said it should. It appears that respondents had an inkling that most of their colleagues were leaning towards accepting this new technology and that it was therefore socially desirable to join them, whereas they still harbored strong reservations about the technology: the profession (this abstract entity) should not accept it.

State-Trait Anxiety Questionnaires (STAI 1 & 2) (Spielberger,1983)

Anxiety states are characterized by subjective feelings of tension, apprehension, nervousness, and worry and by activation or arousal of the autonomous nervous system. Scores increase in response to physical danger and psychological stress.

STAI (State-Trait Anxiety Inventory) is a self-report scale, based on 3300 studies carried out in more than 30 languages. It reflects a person's subjective feeling of anxiety. The STAI-Y-2 is designed to capture a person's trait anxiety, i.e., a general level of anxiety independent of any particular anxietyprovoking event. The STAI-Y-1 is designed to capture a person's state anxiety, the level of anxiety experienced in a particular situation.

Spielberger (1966) believes there is a basic difference between trait anxiety and state anxiety. Trait anxiety tends to be relatively stable across time and place. For the high trait-anxious person, it takes relatively less external stress to trigger a stress reaction. In contrast to trait anxiety, state anxiety is specific to a situation, such as a driving test, a job interview, a novel job situation, etc. A person high in trait anxiety faced with such an event might be overwhelmed or panic. On the other hand, someone with low trait anxiety might manage with no difficulty as long as state anxiety in any particular situation does not become extreme.

For the purposes of this study, one STAI-Y-2 was filled in by each participating interpreter several days before the beginning of the experiment (together with the Eysenck Personality Questionnaire). Three STAI-Y-1 questionnaires were filled in by each interpreter during each morning and afternoon session, yielding six completed questionnaires per interpreter for each complete day in the booth. Frequent sampling was chosen in order to capture any variation in an interpreter's state anxiety in the course of a workday.

A comparison of state anxiety adjusted for age and gender of all interpreters at the start of their first turn the first day showed no significant difference between interpreters working under live conditions and those working remote (Fig. 4).

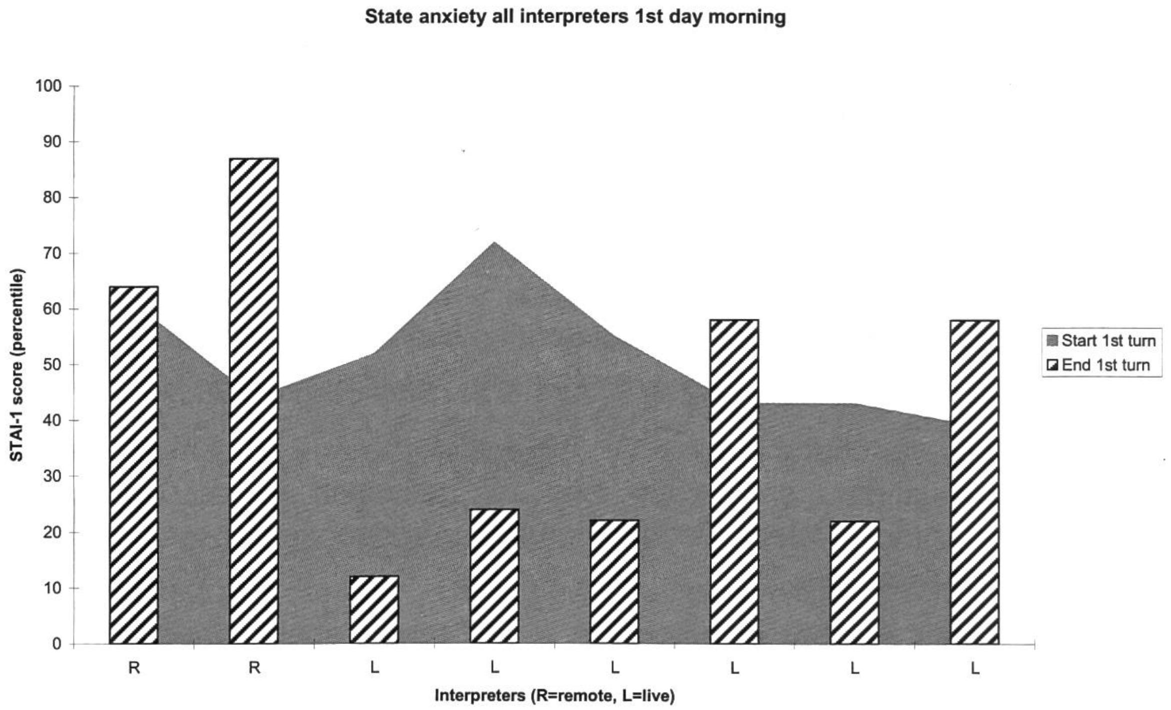

Fig. 4: State anxiety all interpreters first day (n=8)

Towards the end of the first turn a somewhat different picture emerges. Interpreters in the French booth experience more state anxiety when working at the remote site as compared to working under live conditions. This difference is noticeable, but did not reach statistical significance. Interpreters in the Spanish booth consistently had higher state anxiety values.

When looking at the start of the last turn and again comparing French interpreters working under live and remote conditions, we observed an increase in state anxiety for those working under remote conditions (Fig. 5). The increase was statistically not significant. Again, interpreters working in the Spanish booth consistently revealed higher levels of state anxiety.

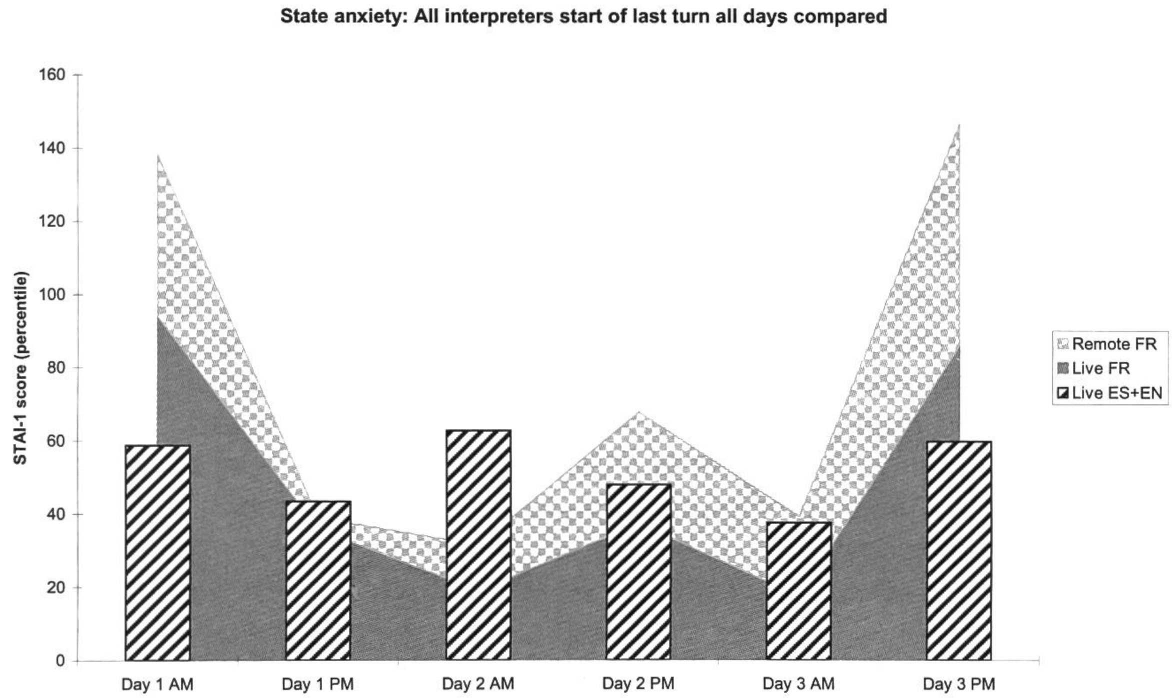

Fig. 5: State anxiety all interpreters start of last turns all days compared (n=8)

On the whole, repeated psychological self-assessment by interpreters during the experiment indicated that they found working under remote conditions more stressful, although these results did not reach statistical significance.

Objective stress measurements – The measurement of cortisol and IgM levels

Cortisol secretion was measured by collecting saliva samples at regular intervals. Test tubes (Salivettes, Sarstedt, Germany) marked with the personal code-number of each subject and containing a small sterile cotton roll were provided before each test. Completed test tubes were immediately shipped to the École Polytechnique Fédérale in Zürich (ETH, Department of Behavioral Sciences) in order to be frozen until all laboratory analyses could be performed. Instructions for taking the saliva samples were handed out in written form before the experiment. The subjects were instructed not to eat, and to rinse their mouths well with water 10 minutes before the first saliva collection. Drinks, sweets and chewing gum were allowed, smoking was not. The laboratory recorded the volume of saliva in each vial; thirteen test tubes (8.3%) out of a total of 144 samples taken over the three days of the test contained insufficient saliva volumes to be processed. Concentrations of free cortisol were determined using the RIA kit Cortisol Coat-A-Count from Diagnostic Products and a gamma counter from Canberra-Packard using the RIA-CALC and 4PL programs (Zeier, 1994).

Contrary to interpreters' self-assessment, stress hormone values did not show much variation for French interpreters between their working under live and remote conditions. Again, interpreters in the Spanish booth revealed the highest levels of stress hormones; this correlates well with their self-reported stress on the STAI. Fig. 6 plots both stress hormone (cortisol) levels and state anxiety levels (expressed in percentile) for six different measure points distributed over the six half-days of the experiment for live (bold) and remote interpreting conditions.

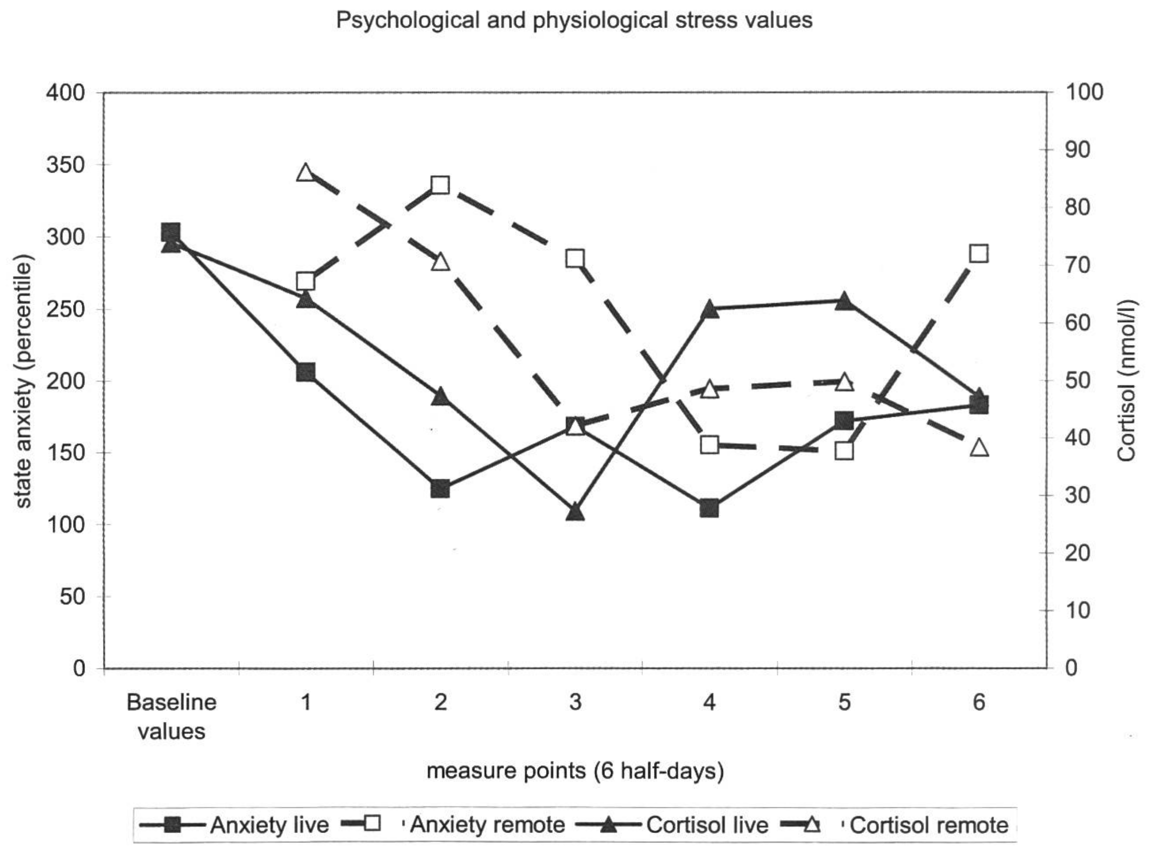

Fig. 6: Psychological (STAI-T) and physiological (cortisol) stress values (n=8)

In reading the graph from left to right to obtain an idea of the evolution of anxiety over time we note that values tend to be higher at the beginning of the experiment and then settle into a slightly lower pattern, with some variation.

Nevertheless, values for remote are generally above values for live interpretation, without reaching significance, though. A larger sample of interpreters would most likely help establish a clearer difference in anxiety between the two conditions.

Fatigue

Fatigue on task can be assessed only indirectly (see our earlier discussion on quality as a dependent variable to establish fatigue levels). In order to study the effects of fatigue under live and remote conditions (French booth) interpreters' performance was audio-recorded, sampled at regular intervals, transcribed and assessed, using an error matrix (see above for a more detailed description) specifically developed for calculating the effects of an experimental condition (independent variable) on quality as a dependent variable (Moser-Mercer, Künzli & Korac, 1998). Interpreters' output was sampled three times during each half-day, once in the beginning, once in the middle and once towards the end of a turn. It is important to use conference interpreters as jurors as only they can assess information loss correctly knowing that during simultaneous interpreting a variety of compression strategies are applied by the interpreter which do not necessarily lead to meaning/information loss, but might produce an "overt" deviation from the original for listeners/readers/jurors unfamiliar with interpreting. Given the quantity of discourse sampled over three days, the authors decided against coding the transcribed data for propositional analysis (Tommola & Lindholm, 1995). Two judges with the same language combination (French mother tongue, English as a passive language) and the same number of years of professional experience as conference interpreters (five years) scored each sample independently. Inter-judge agreement was computed for the values returned by the two jurors for each sample; it was on average $P_r = 0.89$ ($p < 0.05$) for all samples.

When comparing the effects of fatigue on performance for the same interpreters working either live or in a remote condition, we find significant differences ($t = 2.77$, two-tailed, $p < 0.05$). The same interpreter will be less tired, and hence work at a higher level of quality, in live conference conditions as opposed to remote conditions. This significant difference holds for all but one of the sampled interpreters in the French booth.

As to the onset of fatigue, hence the onset of decline in performance, we observed the same interpreter will tire faster (error rates increase) between the middle and the end of a turn in the remote condition as compared to the live condition, where error rate increases are known to occur past the normal end of turn time (past the 30 minute mark on average; see Moser-Mercer, Künzli & Korac, 1998). The onset of fatigue under remote conditions, as evidenced by a decrease in performance, appears to occur fairly soon after "half-time", i.e., somewhere between 15 and 18 minutes into a 30-minute turn.

Quality of performance then declines consistently irrespective of time of day. Under live conditions, variations in quality follow a very similar pattern throughout an interpreter's turn, which confirms that a 30-minute turn corresponds largely to an interpreter's normal work span.

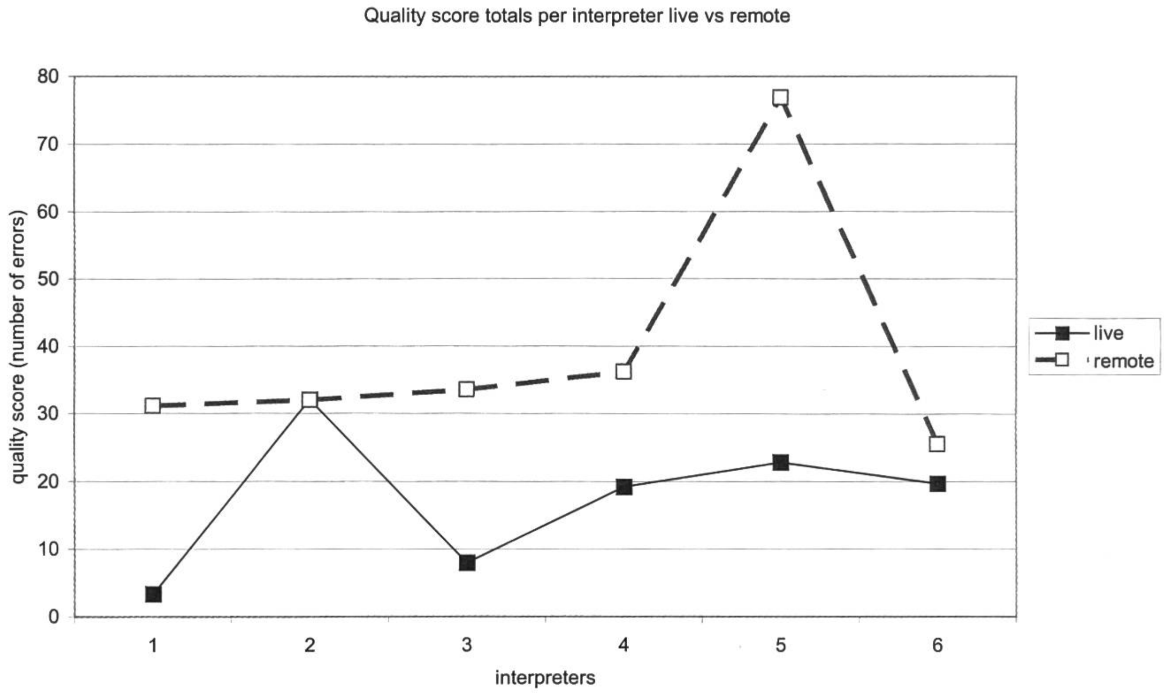

Fig. 7: Quality score totals per interpreter, live versus remote interpreting
(n=6; t=2.77, two-tailed, p< 0.05)

We therefore need to conclude that remote interpretation increases an interpreter's mental workload and leads to fatigue as evidenced by a decline in performance that occurs faster than during live interpretation. These results have been obtained by controlling individual performance differences that are normal across the interpreting population through the application of a within-subject design and by comparing the performance of the same interpreters working in two conditions, live and remote, at the same conference, hence on the same technical subject material and often for the same speakers. Therefore, any difference in fatigue as measured via performance must be attributed to the condition the interpreter worked in and the effect it had on his or her output.

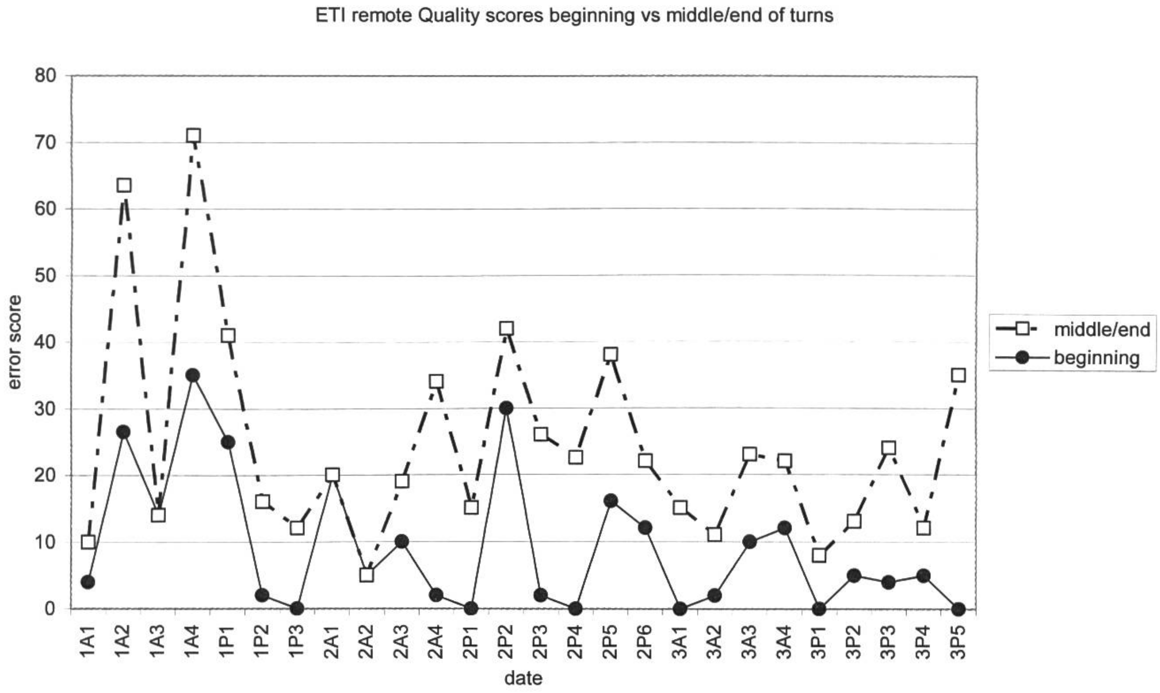

Fig. 8: Quality scores for beginning versus middle/end of turns in the remote condition (ETI), n=6

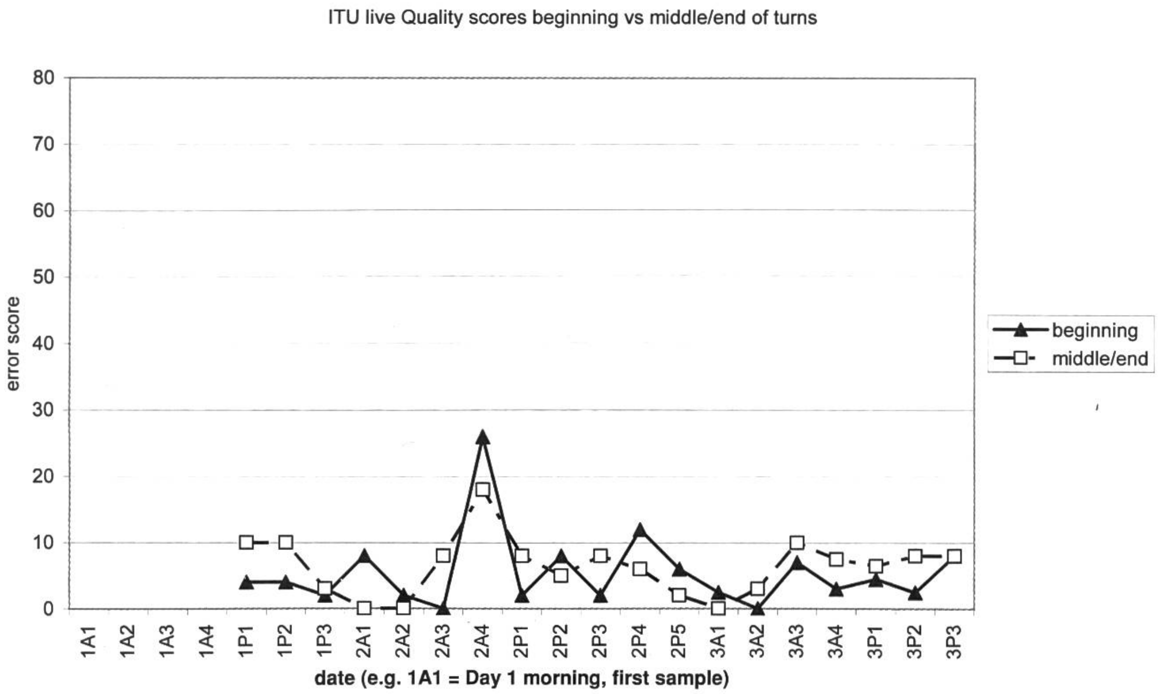

Fig. 9: Quality scores for beginning versus middle/end of turns in the live condition (ITU)[3]*, n=6*

[3] Due to a technical error no recordings were available for the live condition on the morning of day 1.

Conclusions

The first *controlled* experiment to evaluate human factors and technical arrangements in remote interpreting has demonstrated that for the same group of interpreters, working live in a conference room is psychologically less stressful (according to interpreters' self reports), less tiring as evaluated via performance indicators and conducive to better performance overall. The remote interpreting situation appears to represent not only a novel environment for interpreters in which they need to invoke more effortful problem-solving strategies, but seems to cause more than the usual physiological and psychological strain in that the coordination of image and sound, the piecing together of a reality far away (virtual presence) and the concomitant feeling of lack of control (self-reported in the Technical Questionnaire) all draw on mental resources already over-committed in this highly complex skill.

The author has argued elsewhere (Moser-Mercer, 2002) that inference generation and the construction of situation models were crucial to discourse comprehension; we might conclude theoretically that the reason interpreters feel the need to be in control of the situation reflects their need to decide freely and quickly as to which contextual and extra-linguistic information is needed for successful comprehension to occur at high speed. Interpreters seem to perform well under normal working conditions, but any change in these conditions has immediate repercussions on the efficiency and delicate balance of comprehension and production processes in short-term and long-term working memory (Ericsson & Kintsch, 1995). We must assume that remote interpreting as it is currently set up, and irrespective of technical parameters such as sound and picture quality, prevents interpreters from building up the requisite situation models in working memory that normally allow them to perform at a high level of quality throughout a regular 30-minute turn.

Although the above results are based on a small sample, they nevertheless allow us to corroborate more directly the many self-reports of fatigue during earlier remote interpreting experiments, which did not use quality of performance as a dependent variable to study the development of fatigue in remote interpreting, but relied exclusively on self-reports. Based on the results obtained in this study and in order to guarantee commensurate interpreting quality in remote settings, we would need to recommend not only shorter turn times for interpreters, but also a thorough analysis of interpreters' visual needs during time on task to ensure an improved sense of presence. This could be accomplished via sophisticated eye-tracking studies, for example, comparing different conference room seating arrangements. Such findings could provide important input for technical support staff (camera men, sound and image engineers) as to what images or what image selection to send on to interpreters working remotely. In addition, it appears that although the present study could establish only trends, interpreters seem to be under increased psychological stress when working away from the conference room, mostly because they experience a lack of control of the situation (see Mouzourakis, 2003, for a comprehensive discussion of the role of presence in simultaneous interpreting). Studying the impact of a variety of presence factors will certainly provide us with the information necessary to alleviate the feeling of alienation reported by a majority of interpreters taking part in remote interpreting experiments over the years. Establishing and guaranteeing correct working conditions for interpreters working remotely is vital to their maintaining the high level of performance they are expected to provide without suffering from undue psychological stress. Thus, no effort should be spared to continue to investigate human factors in remote interpreting in carefully controlled settings.

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