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Mindfulness training for interpreting students

Abstract: In this work we present the results of a study aimed at increasing performance quality in conference interpreting trainees through the development of the attention–regulatory practice of mindfulness. A review of the basic concepts of attention is presented as well as a review of the role of attention in interpreting as an extremely cognitive demanding task. The authors also introduce and review the concept of mindfulness from a theoretical and empirical perspective. Stress in interpreting is also addressed as a factor that may influence performance. An experimental study is presented in which focused attention practices are compared to relaxation practices in relation to performance in interpreting trainees.

Schlagwörter: attention, interpreting, cognitive resources, mindfulness, training, performance

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Introduction

Attention remains a major area of investigation in the cognitive sciences, it has long been a central topic in research on human behavior (Posner & Petersen, 1990) and it constitutes a basic pillar for interpreting. Attention is considered a psychological mechanism that regulates information and cognitive processes (Garcia, 1997; Rosselló, 1998; Ruiz-Vargas & Botella, 1987) therefore affecting performance since it involves the sensory, memory, motor and vegetative systems (Naatanen, 1992; Posner & Dehaene, 1994). Attention is responsible for filtering information through the allocation of resources that enable the internal adaptation to external demands (Reategui & Sattler, 1999). One of the defining features of attention is its capacity to guide the psychological activity towards the selection of information processing content (Kahneman, 1973; Rubinstein & Sattler, 1982; Rossello 1998) and prioritizing it (Eriksen, 1990; Van der Heijden, 1992; Laberge, 1995).

Numerous models of attention have been developed through history. We are going to focus first on Kahneman's capacity model of attention (1973) which is based around the idea of the existence of a limited supply of mental efforts. This model posits a single resource view of attention, meaning that the ability to perform more than one separate concurrent activity depends upon the effective allocation of attention. Interference between tasks depends upon the demands which each separate task impose – when task demands exceed the upper limit of resources, performance will deteriorate. Norman & Bobrow (1975) described how performance may be constrained by the quality of input (data-limited) or by processing resources (resource-limited). Early researchers held the view that the capacity limit may be susceptible to influences such as age, arousal, or mood (Hasher & Zacks, 1979; Humphreys & Revelle, 1984; Kahneman, 1973 *apud* Young & Stanton, 2002). Later evidence, however, questioned the single resource model. Wickens (1984; 1992) described experiments whereby two objectively difficult tasks were performed concurrently without flaws. This proved that the single resource theory was limited since it predicted that difficulty manipulations should eventually lead to altered performance on one or both tasks. Thus, multiple resources theory emerged from studies showing that it is easier to perform two tasks together provided that the required stimuli or response modalities were different (Wickens, 1984; 1992; Wickens & Liu, 1988), that is, when the tasks to be performed are highly dissimilar, both tasks could be performed simultaneously and successfully. This theory posits that there are separate pools of resources referring to processing (Young & Stanton, 2002).

Types of attention

According to (Sohlberg & Mateer, 1989) there are five primary types of attention: Focused attention: it is the ability to respond discretely to specific visual, auditory or tactile stimuli without being distracted by other stimuli. It requires a certain amount of effort to maintain a focused attention.

Selective attention: it refers to a process whereby “the organism selectively attends to some stimuli or aspects of stimuli, in preference to others” (Kahneman, 1973:3). It is a cognitive process that inhibits secondary information and focuses attention on a chosen object. It is an activity that requires a deliberate effort that is greater than the effort required for the ordinary waking state (Kahneman 1973). Concentrating on a particular object becomes more difficult when there are different stimuli to attend, since the volume of information makes it difficult to distribute attention (Celada & Cairo, 1990; Rubinstein, 1982).

Sustained attention: it refers to the ability to maintain the focus on a single object during a given period of time (Celada & Cairo, 1990). Stimuli that hold our attention must be both novel and complex in order to encourage information processing, it must also be motivating (Rubinstein, 1982). It is part of focused attention (Ardila, Lopera, Pineda & Rosselli, 1995).

Alternating attention: the ability to shift focus with ease between two different tasks with different cognitive demands. It takes mental flexibility which is related to the individual's capacity to self-regulate attention processes. It entails decision-making, dividing and sustaining attention (García, 1997) and a hierarchical organization of the information processing system (Roselló, 1998).

Divided attention: it consists of keeping the focus of attention in different stimuli at the same time. It represents the highest level of attention. The more linked the stimuli and the more practice, the greater ease and automation (Celada & Cairo, 1990; Rubinstein, 1982). The distribution of attention, either in the different elements of the attended object or between different objects, is a relevant factor in the ability to respond to stimuli. This is related to the processing capacity requirement.

Divided attention is the factor that can be more directly connected to the concept of finite cognitive resources depending on the quantity of attention required. The greater the attention and distribution capacity, the higher the number of tasks or events that can be processed simultaneously. Spelke, Hirst, & Neisser (1976) showed that, given enough practice, performance in dual tasks could be improved greatly. Therefore, divided attention is a skill that can be learned, and allows for greater information processing capacity; once a skill is highly learned, it gradually requires less conscious attention or little allocation of mental effort¹.

Highly skilled tasks seem to become automated and thereby susceptible to disruption when attention is withdrawn (Lambert, 2004). With sufficient practice, responses can become 'pre-attentive' and are known as 'automatisms' (Lambert 2004) as it is the case for simultaneous listening and speaking.

¹ However, there are signs that show a direct correlation between divided attention capacity and intelligence (Hunt & Lansman, 1982).

Attention in interpreting

Simultaneous Interpreting

Controlled attention or the capacity of distributing attention span or number of tasks that can be performed simultaneously is a decisive element for interpreting (Moser-Mercer, 2005; Lambert, 2004). It is an integral part of the processing capacity or management attention resources and much of the literature in interpreting studies has been devoted to it, although mostly intertwined with studies on memory or working memory.

Simultaneous interpreting is a complex task. The interpreter has to hold new meaning units in his or her working memory, to access the meaning of the words, to connect a new piece of information to information already stored in the long-term memory while concurrently voicing the translation of the previous meaning unit loading and unloading the working memory at a very high speed (Padilla, Bajo, Cañas & Padilla, 1995:62). This process entails cognitive constraints which constitute a critical limiting factor in performance (Gile, 2008). Cognitive shifts are continuous and uninterrupted during the process of simultaneous interpreting (MacWhiney, 1997) suggesting that the central executive, a system responsible for the control and regulation of cognitive processes, manages coordination and control processes (Baddeley & Hitch, 1974).

Early researchers attempted to explain the interpreting cognitive process involving split attention. Goldman-Eisler (1967) studied the interpreter's capacity to perform parallel tasks. This researcher tried to answer the question about how interpreters were capable of performing such complicated operations as monitoring, storing and possibly decoding while engaged in the encoding of previously received sequences into the target language: she suggested that the acts being performed simultaneously would be monitoring and segmenting, which implies decoding on the one hand and recoding and encoding on the other. The supposition was that recoding and encoding are the more automatic ones, and that decoding the input requires most attention, since it involves comprehension. Goldman-Eisler & Cohen (1974:9–10) concluded from an experiment that, strictly speaking, there can be no simultaneous interpreting when interpreting requires cognitive action. While monitoring and segmenting (decoding) may be simultaneous, recoding and encoding must represent a second phase. These researchers also favor the sequential model since they posit that simultaneous interpreting is possible because of the redundant aspect of normal language that permits consecutive and simultaneous interpretation to alternate attention which has been tied exclusively to decoding when monitoring a text with pauses within sentences (i. e., whose information content can

be presumed to be high), can be liberated for recoding (and encoding) at the end of sentences.

Barik (1973; 1975) also focused on pauses suggesting a tendency to make use of pauses to speak to avoid overloading although Gerver (1976) maintained that pauses are too short to be of any real use for the interpreter. Nevertheless, it cannot be fully denied that in order to avoid the strain of continuous processing simultaneous interpreters, even with years of experience, make good use of the brief silences in the source language's input. These views partly oppose the idea of parallel processing.

Both Gerver (1976) and Gile (1997) assumed that attention resources are limited and shared between the various components. Gile's well-known effort model (Gile, 2009:160) revolves around the concept of limited processing capacity that requires one coordination effort superimposed on the other efforts: the Listening and Analysis Effort, the Production Effort, and a short-term Memory Effort. The coordination effort manages attention allocation and shifts between the other three in a proposal comparable to Baddeley and Hitch's (*supra*) central executive. Gile (2008:62) points out that "interpreters often work close to saturation in at least one Effort and lose information or quality in speech production when attention management is suboptimal". In summary, Gile (1995:179) holds that the *total requirement of the mental energy* (TR) must be less than the total capacity available (TA).

Padilla & Bajo's (1998) main point is that attention can be distributed among multiple tasks and this distribution is a matter of degree and remains under the control of the individual's temporary intentions and permanent dispositions. They suggest the existence of two attentional levels during the interpreting process. On the one hand, a process that requires a greater attentional capacity or more controlled processes (e. g. during the reception or comprehension phase) and, on the other hand, a level that requires a lesser attentional capacity (the linguistic rephrasing phase devoted to the semiautomatic processes of delivering the message).

Cowan (2000) addresses the fact that the attentional capacity during the comprehension and production stages is regulated during the interpreting process. Between the listening and production phases there are highly effective and rapid controlled attentional changes.

Lambert (2004:298) argues that the ability to have one's attention divided between different synchronous tasks can be explained by several hypotheses: 1. The extra effort hypothesis referring to the enlarged quantity of resources necessary to perform concurrent tasks requires a superior effort on the part of the subject. Controlled processing requires active attention; thus, the number of features that can be controlled at a given time is limited under the risk of

interference. 2. The alternation of attention hypothesis means that the different tasks are not carried away in a rigorously concurrent way; instead, individuals learn how to shift back and forth rapidly from the processing of one task to the processing of another. 3. The automatic mental activities hypothesis that explains how after acquiring the ability to accomplish a task involving divided attention, there is no longer the need to monitor every single mental activity through a central processing system, since some of these activities can be carried out automatically. That is, she argues that automatic processing takes place without active control or attention.

According to McLaughlin (1987) automatic processes are learned following the earlier use of controlled processes. Spelke *et al* (1976) suggested from their experimental findings that that controlled tasks can be automatized so that they consume fewer attentional resources. Interestingly enough, when professional interpreters are asked to consciously focus their attention either to the input or to the output they revert back to behavior expected of beginners, that is, their performance deteriorates significantly (Lamber, Darò & Fabbro, 1995).

Darò, Lambert and Fabbro (1996) report on findings from an experiment to test different modes of conscious monitoring of attention. The authors admit it is a difficult task. For Darò (1989) the good execution of simultaneous interpretation depends on the ability of the interpreter to control, diversify and distribute attention on different parallel tasks (listening, analysis, synthesis and production) following a shared attention model (Shallice, 1988) a capability that is partly unconscious and partly voluntary (Darò, 1989).

Gran and Fabbro 1995, *apud* Lambert (2004) found that for verbal tasks requiring divided attention, and in particular during simultaneous interpretation, untrained subjects tended to alternate their attention by focusing it mainly either on the incoming message or on their own output, at the same time as they increased their voice level, both detrimental to an interpreter's performance.

Timarová (2008) presents the control-of-attention extension model of working memory by Conway & Engle (1994), developed in cognitive psychology. This researcher examines its application to interpreting studies and suggests that the crucial role of working memory lies on the central or control executive to the extent that it becomes almost synonymous with controlled attention (responsible for maintaining goals, protection of task execution against interference, effortful processes, etc.). Research suggests that controlled attention is more important (is a better correlate) for higher-cognition activities than the storage component of working memory although she regrets that executive functions have rarely been taken into consideration for research purposes, with no empirical testing of the role of the central executive.

Finally, Yudes-Gómez (2010) shows how interpreters seem to have developed control processes to manage comprehension and production and to deal with the cognitive load associated to the overlapping of these two processes. Another empirical finding was that interpreters seem to coordinate comprehension and production tasks by distributing and balancing cognitive load associated to articulation and by changing objectives in a flexible manner according to task demands. Here again the central executive seems to play a major role.

Consecutive interpreting

The studies presented so far refer to simultaneous interpreting. However, consecutive interpreting also imposes a cognitive overload whereby the interpreter's memory operations and attention allocation play a major role (Jin, 2011) although this mode has been studied to a much lesser degree, probably because cognitive operations have a lot in common in both modes. Consecutive interpreting is a typical task-oriented cognitive process which requires both divided attention for the completion of listening to the speech and delivering the interpreted text, but which is also challenged by the requirements of selective attention, as inadequate note-taking and note-reading could distract interpreters' attention from their comprehension and reproduction (ibid). In order to perform these multiple tasks successfully it is vital to allocate the interpreter's attention to balance his or her competing efforts involved in the comprehension and reproduction stages. In Gile's Effort Model for consecutive interpretation (1995:162) the tasks involved in the process are listed as following: 1) a listening and analysis component; 2) a speech production component and 3) a short-term memory component. He adds three more additional efforts: 4) the note-related effort – including note-taking, note-reading; 5) a coordination effort and 6) a remembering effort long term memory (1995:179). All these efforts belong to the first phase of the process (listening and note-taking) and he represents them in a mathematical form: $I = L + N + M + C$ (whereby initials stand for *interpreting*, *listening*, *note-taking*, *memory* and *coordination*). Coordination again plays the leading role. In the second phase of the process, according to Gile's Effort Model, remembering, note-taking reading and production are the final tasks that do not require so much attention allocation. The correct order of attention distribution should be: listening and analysis the first, memory the second, note-taking the third. Although in real practice the three components take place almost simultaneous, correct order should be born in mind to guide the training and practice (Zhang, 2012).

Darò (1997 *apud* Jin 2011) states that “it is understandable that concurrent listening and writing of notes might well interfere”. This means that the divided attention for listening and note-taking should be distributed in a balanced way to diminish cognitive overload.

Jin (2010) prioritizes the cognitive ability of attention focused on recognizing conceptual linkages as opposed to a large body of literature that deals with this interpreting mode from other perspectives (note-taking, directionality and language-related interpreting skills). Arumi & Esteve (2006) list attention and concentration as a consecutive interpreting skill in a study about metacognitive learning without dwelling into it. Zhang (2012) proposes that rather than competing efforts one should speak about cooperating efforts following the principle of “understanding first, memorizing better” with coordination.

All in all, it has become clear that attention constitutes the central focus of the interpreting process in whatever form. The simultaneity of listening and speaking imposes a severe strain on the attentional resources of the human channel capacity, which may explain in part why professional interpreters normally work for 20–30 minute periods only (AIIC). When people attempt to perform two overlapping speeded tasks, the responses for one or both tasks – speaking or listening- are almost always slower or poorer during the first stages of learning. It is believed that only training and experience can improve interpreting tasks (Gerver, 1974; Jääskeläinen & Tirkkonen-Condit, 1991; Lambert, Daró & Fabbro, 1995; Cowan, 2000; Chmiel, 2007) provided some previous requirements are met like having a high competence in the working languages and some permanent dispositions.

Yet, we believe that interpreting performance may be improved, especially at the initial learning stages, by enhancing attention given the crucial role attention seems to play to conduct interpreting tasks. Baer (2003) and Bishop, Lau, Shapiro, Carlson, Anderson, Carmody, Segal, Abbey, Speca, Velting & Devins (2004) assert that the improvement of attention monitoring processes (self-regulation of attention) enhances the capacity for sustained, alternating and divided attention, while, at the same time, it allows for the inhibition of elaborative processing (rumination) thereby increasing control over thought content and actions.

In order to enhance the attentional resource allocation capacity, so vital for the interpreting process as has been shown above, and speed up the automatization process the authors of this paper turned to new practices to maximize attentional resources and cost-effectiveness in interpreting training.

The concept of mindfulness

Along the development of studies on emotion and its relationship with attention, information and decision-making processes, a new avenue of researching attention has opened up within the framework of the cognitive sciences: the study of mindfulness. Thus, mindfulness constitutes a psychological construct that has received a great deal of attention over the last couple of decades. It can be defined as an attentional state of mind by which cognitive processes interact with emotional processes to receive, perceive and manage information. It is a psychological state characterized by an open mind to present events. Kabat-Zinn (2003:145) described it as paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment. Two aspects stand out: 1. The state of mindfulness is characterized by an awareness of the internal and external sensory and cognitive experience of the present moment. 2. This awareness leads to simply acknowledge and examine, without any judgment, elaboration, or reaction whatever arises. It thus incorporates elements of both attention-regulation (central executive function) and orientation to experience characterized by openness, acceptance, and non-judgmentalism (Bishop *et al.*, 2004; Brown & Ryan, 2004; Hayes & Shenk, 2004; Bishop, 2002).

The state of mindfulness directly affects the cognitive process of attention, which entails changes in the information processing modes. These changes affect alertness, expanding the attention span and increasing attentional sensitivity to detail. The person is emotionally not distracted by new items involving emotional memories. According to Bishop *et al* (2004) mindfulness skills are related to three areas of attention: selective, sustained and divided attention. The development of mindfulness therefore, increases the ability to enhance attentional monitoring systems.

Means to achieve mindfulness

Mindfulness is a mental state or result that can be achieved through the adequate practice by means of the continued use of tools that develop the capacity to maintain attention towards the present moment. There is, however, a great deal of variability in individual levels of mindfulness. The tool that has proven to be most effective for the development of mindfulness is meditation. Manna, Raffone, Gianni-Perruci, Nardo, Ferretti, Londei, Del Gratta, Olivetti-Belardinelli & Romani (2010) describe meditation as a set of complex emotional and attentional regulatory practices which can be classified into two main styles: 1) Concentrative or focused attention (FA) (Brown, 1977; Delmonte, 1987; Pfeiffer, 1966; Semple, 1999;

Speeth, 1982; Valentine & Sweet, 1999). Here, attention is restricted to a specific focus. 2) Receptive attention or open monitoring (OM) (Lutz, Slagter, Dunne, & Davidson, 2008b). This method involves no object of attention and the goal is simply to keep attention focused in the present moment of experience without orienting, directing, or limiting it in any way. That is, attention is receptive to the whole field of experience and awareness and remains in an open state. These two styles involve different attentional, cognitive monitoring and awareness processes and both are linked with brain systems involved in conflict monitoring, selective and sustained attention (Manna *et al.* 2010)

Kabat-Zinn (2005:268) compares meditation to “scaffolding” used to develop the state, or skill, of mindfulness. Numerous writings suggest that the mindfulness state enhances the two disparate forms of attention aforementioned (FA and OM). Jha, Krompinger & Baime (2007) explain that many mindfulness training protocols recommend that concentrative or focused attention should be mastered before receptive attention is cultivated. According to these authors this recommendation is motivated by subjective reports from trainees that attention becomes lost in thought, mental images, or emotions without the power of concentrative attention to keep it anchored to present experience. Jha *et al.* (2007) point to the fact that meditation texts postulate that novices develop concentrative but not receptive attention skills early in the course of their training whereas more experienced meditators develop receptive attention as a consequence of continued concentrative training. Some traditions further suggest that receptive attention cannot be explicitly trained but will emerge naturally after extensive experience with concentrative attention (Trungpa, 1975 *apud* Jha *et al.* (*ibid*). Schneider & Shiffrin (1977) indicate that cognitive processing capacity can be extended when it is released from elaborative thinking allowing the optimal allocation of processing resources for the current experience, thus increasing access to information that otherwise would remain outside awareness (Bishop *et al.*, 2004) or that would require an effort exceeding the individual’s capacities. Rather than observing experience through the filter of beliefs, assumptions, expectations and desires, mindfulness involves a direct observation of various objects as if for the first time, a quality often referred to as “beginner’s mind” (Bishop *et al.* 2004). Contrary to what it may seem, this does not imply forgetting the meaning and connotations of the object or related objects but rather a mental openness to new possibilities for the benefit of creativity. The development of mindfulness would likely be associated with a greater capacity to address objects or internal and external processes without prejudices or expectations.

There are numerous practices of meditation used to achieve mindfulness (Raffone, Tagini & Srinivasan, 2010) the most widespread being the so-called ‘breath meditation’ where the spotlight focuses single-pointedly on the breath, a

type of FA meditation style. When attention is diverted, one becomes aware of this and self-regulates attention redirecting it back to the initial focus that is breathing. The return to the spotlight occurs naturally and without frustration. This is a cycle that is repeated constantly and is part of the training. Most meditation techniques originate from Eastern spiritual practices. Western contemporary psychology and medicine have introduced these practices in a non-religious context for improving mental and physical health.

Brief review of empirical research in mindfulness

Attention

There is a tendency to believe that meditation and relaxation are one and the same but there are differences (Kushner & Marnocha 2008; Lynn, Srya-Das, Hallquist & Williams, 2006; Cherevaty 2011). Meditation is a useful tool to achieve mindfulness and a mindful mind is an alert mind. A number of empirical studies have shown that attention increases significantly after going through a period of guided meditation practice compared to the same period of relaxation practices or compared to control groups (Kratte & Hogan, 1983; Cranson, Orme-Johnson, Gackenbach, Dillbeck, Jones & Alexander, 1991; Tang, Ma, Wang, Fan, Feng, Lu, Yu, Sui, Rothbart, Fan & Posner, 2007; Barragan, Lewis & Palacio, 2007; Rangan, Nagendra & Bhatt, 2009; MacLean, Ferrer, Aichele, Bridwell, Zanesco, Jacobs, King, Rosenberg, Sahdra, Shaver, Wallace, Mangun & Sharon, 2010). Furthermore, attention measures have proven to be significantly higher in meditation experts compared to non-meditators or novices (Davidson, Goleman & Schwartz, 1976; Sabel, 1980; Brown, Forte & Dysart, 1984; Rani & Rao, 1996; 2000; Valentine & Sweet, 1999; Moore & Malinowski, 2009). Secular meditation training is believed to modify the subsystems of attention, in the sense of expanding them; in particularly systems of alert, orientation and control of conflict leading to an enhancement of attention-related behavioral responses (Jha *et al.* 2007). In addition, individuals report an optimized memory recall after training in mindfulness (Atwood & Maltin, 1991 *apud* Delmonte, 2000).

To conclude, neuroscientific studies have also shown certain functional and anatomical changes that occur in the brain related to self-regulation of attention through focused attention practices (Aftanas & Golocheikine, 2001; Lutz *et al.* 2004; Lazar, Kerr, Wasserman, Gray, Greve, Treadway, McGarvey, Quinn, Dusek, Benson, Rauch, Moore & Fischl, 2005; Pagnoni & Cekic, 2007; Lutz *et al.* 2008a; Baijal & Gupta, 2008; Baerentsen, Stødkilde-Jørgensen, Sommerlund, Hartmann, Damsgaard-Madsen, Fosnæs, & Green, 2009; Cahn, Delorme & Polich 2010;

Manna *et al.*, 2010; Brefczynski-Lewis *et al.* 2010; Chiesa & Serretti, 2010 *apud* Cherevaty, 2011).

Academic and sport performance

Significant enhancement in academic performance has been appreciated in experimental groups submitted to training in meditation with respect to control groups showing no significant improvement (Beauchemin, Hutchins & Patterson, 2006; Shao & Skarlicki 2009). Other correlational studies compared individual mindfulness baseline with academic performance and found a direct correlation between mindfulness attention and academic success (Martín, Leon & Vicente, 2007). The relationship between mindfulness and task performance is currently being tested in a large number of studies and results tend to confirm the hypothesis that mindfulness training enhances performance, particularly in sports (Cranston *et al.*, 1991; Sugiura, 2003; Oyan, 2006; Moore & Malinowski, 2009; Shao & Skarlicki, 2009).

Health

There are numerous clinical studies that point to the effectiveness of a medical practice known as Mindfulness-based Stress Reduction (MBSR), a medical program based on the practice of meditation for eight weeks (Kabat-Zinn 1990; Kabat-Zinn, Lipworth & Burney, 1985). Johanson (2009) compiles almost one thousand medical studies showing the recovery of health within a wide range of diseases and conditions. This technique was first applied to patients suffering chronic pain, then emotional conditions such as anxiety, anger, depression, insomnia, phobias, addictions, and finally dealt with almost all kinds of clinical conditions especially those known to get worse with anxiety: psoriasis, diseases of the skin, hypertension, obesity, allergies, asthma, heart disease, etc. It should be noted that it is not only used for the treatment of pathologies but as a preventive to improve health and enhance the quality of life (Grossman, Niemann, Schmidt & Walach, 2004).

Empathy

It can be defined as the ability to understand, perceive and feel another person's feelings (Decety & Jackson, 2004). There are many definitions of empa-

thy in psychology but for many researchers empathy implies at least three different processes according to Decety & Jackson (2004:73) empathy means “feeling what another person is feeling, knowing what another person is feeling, and having the intention to respond compassionately to another person’s distress”. But whatever terminology according to Decety & Jackson (*ibid*), there is broad agreement on three primary components: affective, cognitive and a regulatory mechanism that keep track of the origins of self and other-feelings. Thus, empathy requires both the ability to share the emotional experience of the other person (affective component) and an understanding of the other person’s experience (cognitive component). It is the last field of research within the mindfulness paradigm and it has been mainly addressed at medical staff and welfare providers (Schuster, 1979; Aiken, 2006; Siegel, 2007; Krasner, Epstein & Beckman, 2009; Lutz *et al.* 2008a) with positive results. This ability may have an impact in the field of translation and interpretation since it could be identified with the ability to truly understand what is read or listened, *i. e.*, to be able to put oneself in the writer or speaker’s shoes -which is not tantamount to get emotionally involved. Empathy can become an essential ability to thoroughly understand the speaker’s words or intentions, in Seleskovitch and Lederer’s (1986:256) words *le vouloir dire*. In this regard, it would be interesting to address studies on empathy and the ability to translate or interpret, and, consequently, about the benefits of mindfulness training to enhance both the listening and understanding phase of the language transfer process and the appropriate production of the target text.

Brain imaging techniques

The first evidence of modification of attention was obtained through observation in performing experimental tasks (Brown, 1977; Delmonte, 1987; Cranson *et al.* 1991; Henderson, Weeks & Hollingworth, 1999; Valentine & Sweet, 1999) but in recent years more objective measures are being used such as brain imaging. Observable changes in behavior are seen in the structure of the brain both in expert meditators and individuals that have undergone a several week training period. Changes are related to the amount of grey or white brain matter density and can be located in areas responsible for self-regulation and sensory processing among others (Lutz *et al.* 2004; Lazar *et al.*, 2005; Holzel 2008, Baerentsen *et al.* 2009; Cahn *et al.*, 2010; Vestergaard-Poulsen, 2009; Tang, Lu, Geng, Stein, Yang & Posner, 2010; Luders, Clark, Narr & Toga, 2011; Hölzel, B. K.; Carmody, J.; Vangel, M.; Congleton, C.; Yerramsetti, S. M.; Gard, T.; & Lazar, S. W. 2011).

Relaxation versus mindfulness

As it has been stated above mindfulness is not tantamount to relaxation. Relaxation techniques used to manage stress differ notably to mindfulness training techniques. There is an intentional focus to relax during the practice in the former. Through relaxation bodily tension is released leading to a psychophysiological state of decreased arousal that opposes that of the stress response and is experienced as a calming state (Jain, Shapiro, Swanick, Roesch, Mills, Bell, Schwartz, 2007). Mindfulness training also leads to an initial physiological relaxation response in the short term (Delmonte, 1987) which is why it is used in therapy especially for medical conditions that tend to deteriorate with anxiety (*supra*). Mindfulness meditation is associated with faster wave activity than relaxation (Dunn, Hartigan, & Mikulas, 1999) although a tangible consequence of mindfulness is a calmer state of mind. These authors concluded after an experimental study comparing relaxation techniques with mindfulness techniques that the latter is a potential unique mechanism to decrease both rumination and distraction perhaps thereby decreasing psychological anxiety and distress (Jain *et al.* 2007:19).

The capacity to control stress has traditionally been considered one of the requisites for interpreting (Cooper, Davies, & Tung, 1982; Moser-Mercer, 1985; Longley, 1989; Klonowicz, 1994; Gile, 1997; Moser-Mercer, Künzli & Korac, 1998; Riccardi, A.; Marinuzzi, G. & Zecchin, S., 1998) and a predictor for interpreting competence (Moser-Mercer, 1985, 1994; Alexieva, 1997). Other authors highlight the importance of coping with stress (Iliescu, 2001; Kurz, 2003; Gillies, 2004) and suggest methods to overcome it like the Alexander Technique (Taylor-Bouladon, 2007:199; Renau Michavilla, 2008). In two experimental studies, however, the authors of the present paper found no correlation between anxiety and performance in interpreting trainees (Jiménez Ivars & Pinazo Calatayud, 2001; 2002). Nevertheless, these results do not imply that coping with stress is not necessary but may not be enough, on its own, to increase performance in interpreting.

Therefore, we believe that the development of mindfulness through focused attention can have more positive effects on interpreting performance in trainees than relaxation because it can calm the mind while keeping it alert. However, the interpreters' cognitive processing capacity management determines quality performance.

Method

A study in mindfulness training was carried out with students at the University Jaume I from 2007 to 2011 with the hypothesis that students who practiced focused attention just before the final interpreting test would perform better than those who practiced relaxation.

Sample

A total of 371 Translation and Interpretation last year undergraduate students who took interpreting tests in the simultaneous and consecutive mode. 327 were female and 44 male; the vast majority of them were under 25 years old. They had all received the same training in interpreting, that is, 80 contact hours for each interpreting mode (consecutive and simultaneous), and were also familiar with both focused attention and relaxation practices since the two techniques had been practiced during class sessions almost on a daily basis (some days it was meditation, other days it was relaxation, and occasionally there were not any such practices).

Variables

Independent variables: focused attention practice (breath meditation) and relaxation practice. Dependent variable: interpreting performance.

Materials

One audio recording of guided breath meditation and one audio recording of guided body based relaxation. Non-specialized speeches in English ranging from 4 (for the consecutive mode) to up to 15 minutes (for the simultaneous mode) were played for the students to interpret. The level of difficulty was intermediate according to the number of lessons students had taken.

Procedure

Data were collected along over a period of four years. There were nine groups taking the final test immediately after a guided focused attention practice,

nine groups which sat the final test immediately after a relaxation practice, and nine control groups who sat the test without any previous exercise. Tests consisted of consecutive and simultaneous interpretations from English into Spanish. There were always three groups in each session due to the limited capacity of the interpreting laboratory. The first two groups interpreted the same texts since there was no time break between them; the third group interpreted always a different speech of the same type and level. Students randomly signed up for the turn that suited them best completely unaware of what kind of practice, if any, would take place prior to the test. They were not surprised either by it since there had always been some kind of exercise before the interpreting renderings in each class session (either focused attention or relaxation). So, once they were seated in their respective booths the two experimental groups listened to a randomly assigned eight minute guided practice through earphones as it happened in many ordinary class sessions, the control group just sat the test. Conditions were assigned aleatorily, that is, there was no established order for each experimental group and it varied in every exam session. Due to the large number of students *per* class (around 100) consecutive tests were also taken in booths as it is usual in the undergraduate programme at the University Jaume I. Each interpreting rendering was digitally recorded to be reviewed. A technical assistant converted student audio file names into codes and the three groups were mixed for reviewing so that the reviewer could not know the students' identity or what group they belonged to. Each interpretation rendering was assessed on a 10-point grading scale according to the Spanish official assessment system. Assessment criteria included, among other factors, presentation skills (fluency, pronunciation, intonation, volume, pauses, voice pleasantness, self-confidence, etc.), appropriateness of target language expression (complete sentences, vocabulary, grammar, coherence and cohesion), content (in relation to the source text) and general plausibility. At the end of the four year research process audio codes, names and experimental conditions were cross-matched and only then data started to be processed.

Analysis and results

An ANOVA was conducted to determine if there was any performance variation under the experimental conditions (Table 1). Results reveal significant differences between the three conditions.

Tabelle 1: ANOVA of interpreting performance

	<i>N</i>	<i>Performance M (s.d.)</i>	<i>F</i>	<i>p</i>
Focused attention	121	6.00 (2.28)	3.153	.044
Relaxation	121	5.33 (2.29)		
Control	129	5.45 (2.28)		

A t-test was conducted, comparing participants' total difference performance grades across the three conditions to determine significant differences that can explain performance variability. Results indicate that the groups that practiced focused attention immediately before the interpreting test significantly outperformed both the relaxation and control groups (Table 2).

Tabelle 2: T-test of independent samples

	<i>Performance M (s.d.)</i>	<i>t</i>	<i>df</i>	<i>p</i>
Focused attention	6.00 (2.28)		240	.022
Relaxation	5.33 (2.29)	2.30		
Focused attention	6.00 (2.28)		248	.048
Control	5.45 (2.28)	1.99		
Relaxation/	5.33 (2.29)		248	.680
Control	5.45 (2.28)	.41		

Conclusions

In the light of these results we strongly believe that the development of focused attention through meditation techniques is highly beneficial to enhance interpreting trainees' performance, especially given that the number of training hours is always limited. These results are in line with most studies conducted on focused attention and task performance (*supra*) and especially with Rani & Rao (2000) who studied the sustained effect of meditation and found that its effects on attention tasks are better felt soon after meditating. From the present study it can be inferred that effects on a highly demanding cognitive task, such as interpreting, can be perceived even after a short practice in novel meditators, therefore providing them with a cognitive tool that can be used in classroom settings.

Results also suggest that anxiety management techniques, such as induced relaxation, do not prove very useful to increase interpreting performance in trainees. In fact, scores were even lower than the control groups' though not in a statistically significant way. These results confirm previous studies mentioned earlier that did not find correlation between anxiety and students' interpreting performance (Jiménez Ivars & Pinazo Calatayud, 2001; 2002). Thus, it can be inferred that relaxation practices during the training and testing period are not so relevant to achieve optimal results.

There are several limitations that need to be acknowledged and addressed regarding the present study. The first limitation refers to the fact that no interpreting skills or requirements -like second language competence- were measured, although the research design and the number of subjects may lead to conclude that possible variability could be distributed randomly. The second limitation is that no questionnaires were taken and there is no empirical evidence to know if there were any expert meditators in the sample (although this is highly unlikely). A final limitation of this study is that women outnumber men (88.14% vs. 11.86%); however it is representative to a certain extent of most Translation and Interpreting programmes and also the interpreting career (AIIC).

Thus, as no other variables were taken into account further studies should look into them by pre-tests of second and native language competence, translation competence and/or other cognitive skills such as short-term memory, auditory attention, recall capacity under articulatory suppression conditions², latency time, standard IQ tests or levels of baseline mindfulness³. The only dependent variable measured was task performance in summative assessments but the practice of focused attention could have positive effects on other aspects related to interpreting training or professional interpreting such as stress decrease and mental or physical fatigue, empathy enhancement (more necessary perhaps in face-to-face interpreting within the community setting), expanded awareness of interpreting users' needs, the possibility of improving managing interaction or dealing with conflicting objectives of dialogue interpreting participants. It is a line of research that is worth further pursuing both in teaching and professional practice.

² Articulatory suppression is the process of inhibiting memory performance by speaking while being presented with an item to remember.

³ Baseline mindfulness can be measured with validated tests like the one proposed by Baer, R. A.; Smith, G.T.; Hopkins, J.; Krietemeyer, J. & Toney, L. (2006).

Bibliography

- Alexieva, B. (1997). A typology of interpreter-mediated events. *The Translator: Studies in Intercultural communication*, 3(2):153–174.
- Aftanas L. I. & Golocheikine S. A. (2001). Human anterior and frontal midline theta and lower alpha reflect emotionally positive state and internalized attention: High-resolution EEG investigation of meditation. *Neuroscience Letters*, 310(1), 57–60.
- AIIC (International Association of Conference Interpreters) (2013). <http://aiic.net/page/2887/a-statistical-portrait-of-aiic-2005-06/lang/1>. Accessed 4 April 2013.
- Aiken, G. A. (2006). *The potential effect of mindfulness meditation on the cultivation of empathy in psychotherapy: A qualitative inquiry*. Unpublished Doctor of Philosophy dissertation, Saybrook Graduate School and Research Center: San Francisco, California, USA.
- Ardila, A.; Lopera, F.; Pineda, D., & Rosselli, M. (1995). Neurología comportamental y neuropsicología. *Acta Neurológica Colombiana*, 11:83–86.
- Arumi, M. & Esteve, O. (2006) Using instruments aimed at self-regulation in the consecutive interpreting1 classroom: Two case studies. *Electronic Journal of Foreign Language Teaching* 3(2):158–189.
- Atwood, J. D. & Maltin, L. (1991) Putting Eastern philosophies into Western psychotherapies. *American Journal of Psychotherapy*, XLV:368–382.
- Baddeley, D. & G. Hitch (1974) Working Memory. In Bower, G. A. (ed). *The Psychology of Learning and Motivation*, 8:47–89. New York: Academic Press.
- Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical Psychology: Science and Practice*, 10(2):125–143.
- Baer, R. A.; Smith, G. T.; Hopkins, J.; Krietemeyer, J. & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment*, 13(1):27–45.
- Bærentsen, K. B.; Stødtkilde-Jørgensen, H.; Sommerlund, B.; Hartmann, T.; Damsgaard-Madsen, J.; Fosnæs, M. & Green, A. C. (2010). An investigation of brain processes supporting meditation. *Cognitive Processing*, 11(1):57–84.
- Baijal, S. & Gupta, R. (2008). Meditation-based training: A possible intervention for attention deficit hyperactivity disorder. *Psychiatry*, 5(4):48–55.
- Barik H. C. (1973). Simultaneous interpretation: Temporal and quantitative data. *Language and Speech* 16/3:237–270.
- Barik H. C. (1975). Simultaneous interpretation: Qualitative and linguistic data. *Language and Speech* 18/3:272–297.
- Barragan, R.; Lewis, S. & Palacio, J. (2007). *Autopercepción de cambios en los déficits atencionales intermedios de estudiantes universitarios de Barranquilla sometidos al Método de Autocontrol de la Atención (Mindfulness)*. Salud, Uninorte, 3(2):184–192.
- Beauchemin, J.; Hutchins, T. L. & Patterson, F. (2006). *Mindfulness meditation may lessen anxiety, promote social skills, and improve academic performance among adolescents with learning disabilities*. *Health Practice Review*, 13:34–45.
- Bishop, S. R. (2002). What do we really know about mindfulness-based stress reduction?. *Psychosomatic Medicine*, 64:71–84.
- Bishop, S. R.; Lau, M.; Shapiro, S.; Carlson, L.; Anderson, N. D.; Carmody, J.; Segal, Z. V.; Abbey, S.; Specia, M.; Velting, D. & Devins, G. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice*, 11(3):230–241.

- Brefczynski-Lewis JA; Lutz, A.; Schaefer, H. S.; Levinson, D. B. & Davidson, R. J. (2007). Neural correlates of attentional expertise in long-term meditation practitioners. *Proceedings of National Academy of Sciences*, 104(27):11483–11488.
- Brown, D. P. (1977). A model for the levels of concentrative meditation. *International Journal of Clinical & Experimental Hypnosis*, 25:236–273.
- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological wellbeing. *Journal of Personality and Social Psychology*, 84:822–848.
- Brown, D.; Forte, M. & Dysarte, M. (1984). Visual sensitivity and mindfulness meditation. *Perceptual and Motor Skills*, 58:775–784.
- Cahn, B. R.; Delorme, A. & Polich, J. (2010). Occipital gamma activation during Vipassana meditation. *Cognitive Processing*, 11(1):39–56.
- Carlson, J.; Carlson, K.; Gil, K. & Baucom, D. H. (2004). Mindfulness-based relationship enhancement. *Behavior Therapy*, 35(3):471–494.
- Celada, J. & Cairo, E. (1990). *Actividad psíquica y cerebro 3*. Lima: Centro de Neuropsicología y Rehabilitación.
- Cherevaty, E. (2011). IHP ihpmagazine.com . <http://ebookbrowse.com/dr-elizabeth-cherevaty-meditation-attention-neuroplasticity-23-pdf-d354892587>. Accessed April 12th 2013
- Chiesa, A. & Serretti, A. A 2010. A systematic review of neurobiological and clinical features of mindfulness meditations. *Psychological Medicine*, 40:1239–1252.
- Chmiel, A. (2007). Interpreting studies and psycholinguistics. A possible synergic effect. In D. Gile, G. Hansen, & N. Pokorn (Eds.), *Why Translation Studies Matter*, 223–236. Amsterdam/Philadelphia: John Benjamins.
- Conway, A. R. A. & Engle, R. W. (1994). Working memory and retrieval: A resource-dependent inhibition model. *Journal of Experimental Psychology: General*, 123:354–373.
- Cooper C. L., Davies R. & Tung R. L. (1982). Interpreting stress: Sources of job stress among conference interpreters. *Multilingua* 1(2):641–653.
- Cowan, N. (2000). Processing limits of selective attention and selective memory. Potential implication for interpreting. *Interpreting*, 5(2):117–146.
- Cranson, R. W.; Orme-Johnson, D. W.; Gackenbach, J.; Dillbeck, M. C.; Jones, C. H. & Alexander, C. N. (1991). Transcendental meditation and improved performance on intelligence-related measures: A longitudinal study. *Personality and Individual Differences*, 12:1105–1116.
- Darò, V. (1989). The role of memory and attention in simultaneous interpretation: A neurolinguistic approach. *The Interpreters' Newsletter*, 2:50–56.
- Darò, V.; Lambert, S., & Fabbro, F. (1996). English conscious monitoring of attention during simultaneous interpretation. *Interpreting*, 1(1):101–124.
- Davidson, R. J.; Goleman, D. J. & Schwartz, G. E. (1976). Attentional and affective concomitants of meditation: A cross sectional study. *Journal of Abnormal Psychology*, 85:2358.
- Decety, J. & Jackson, P. L. (2004). The functional architecture of human empathy. *Behavioral and Cognitive Neuroscience Reviews*, 3(2):71–100.
- Delmonte, M. M. (1987). Meditation: Contemporary theoretical approaches. In M. A. West (Ed.), *The psychology of meditation*, 39–58. Oxford: Oxford University Press, Clarendon Press.
- Dunn, B. R.; Hartigan, J. A.; & Mikulas, W. L. (1999). Concentration and mindfulness meditations: Unique forms of consciousness?. *Applied Psychophysiology and Biofeedback*, 24(3):147–165.

- Eriksen, J. J. (1990). Transcendental meditation and improved performance on intelligence-related measures: A longitudinal study. *Personality and Individual Differences*, 10:105–116.
- García, J. (1997). *Psicología de la atención*. Síntesis: Madrid
- Gerver, D. (1974). Simultaneous listening and speaking and retention of prose. *Quarterly Journal of Experimental Psychology*, 26:337–342.
- Gerver, D. (1976). Empirical studies of simultaneous interpretation: A review and a model. In R. W. Brislin (ed.). *Translation Application and Research*, 165–207. Nueva York: Gardner
- Gerver, D.; Sinaiko, H. W. (eds.) (1978). *Language, Interpretation and Communication*. Nueva York y Londres: Plenum Press
- Gile, D. (1995). *Basic concepts and models for interpreter and translator training*. Amsterdam and Philadelphia: John Benjamins.
- Gile, D. (1997). Conference interpreting as a cognitive management problem. In J. E. Danks, G. M. Shreve, S. B. Funtain, and M. K. McBeath (Eds.), *Cognitive Processes in Translation and Interpreting*, 196–214. Thousand Oaks, London and New Delhi, Sage Publications.
- Gile, D. (2008). Local cognitive load in simultaneous interpreting and its implications for empirical research. *Forum*, 6:(2), 59–77.
- Gile, D. (2009). *Basic concepts and models of interpreter and translator training*. Second Edition. Benjamins: Amsterdam, Philadelphia.
- Gillies, A. (2004). *Conference interpreting. A new students' companion*. Cracow Tertium Society for the Promotion of Language Studies.
- Goldman-Eisler, F. (1967). Sequential temporal patterns and cognitive processes in speech. *Language and Speech*, 10(2):122–132.
- Goldman-Eisler, F. & Cohen, G. (1974). An experimental study of interference between receptive and productive processes relating to simultaneous translation. *Language and Speech*, 17:1–10.
- Grossman, P.; Niemann, L.; Schmidt, S. & Walach, H. D. (2004). Mindfulness-based stress reduction and health benefits. A meta-analysis. *Journal of Psychosomatic Research*, 57:35–43.
- Hasher, L. & Zacks, R. (1979). Automatic and effort full, processes in memory. *Journal of Experimental Psychology: General*, 108:356–388.
- Hayes, S. C. & Shenk, C. (2004). Operationalizing mindfulness without unnecessary attachments. *Clinical Psychology: Science and Practice*, 11:249–254.
- Henderson, J. M.; Weeks, P. A. & Hollingworth, A. (1999). The effects of semantic consistency on eye movements during complex scene viewing. *Journal of Experimental Psychology: Human Perception and Performance*, 25(1):210–228.
- Hölzel, B. K.; Carmody, J.; Vangel, M.; Congleton, C.; Yerramsetti, S. M.; Gard, T.; & Lazar, S. W. (2011). Mindfulness practice leads to increases in regional brain gray matter density. *Psychiatry Research: Neuroimaging*, 191(1), 36–43.
- Humphreys, M. S. & Revelle, W. (1984). Personality, motivation and performance: A theory of the relationship between individual differences and information processing. *Psychological Review*, 91(2):153–184.
- Hunt, E. B. & Lansman, M. (1982). Individual differences in attention. In R. Sternberg (Ed.), *Advances in the Psychology of Human Intelligence*, 207–254. Hillsdale: L. Erlbaum Associates.
- Iliescu, C. (2001). *Introducción a la interpretación: la modalidad consecutiva*. Sant Vicent del Raspeig, Universidad de Alicante.

- Jääskeläinen, R. & Tirkkonen-Condit, S. (1991). Automatised processes in professional vs. non-professional translation: A think-aloud protocol study. In S. Tirkkonen-Condit (ed.). *Empirical research in translation and intercultural studies*, 89–109. Tübingen: Gunter Narr.
- Jain, S.; Shapiro, S. L.; Swanick, S.; Roesch, S. C.; Mills, P. J.; Bell, I. & Schwartz, G. E. (2007). A randomized controlled trial of mindfulness meditation versus relaxation training: effects on distress, positive states of mind, rumination, and distraction. *Annals of Behavioral Medicine*, 33(1):11–21.
- Jha, A. P.; Krompinger, J. & Baime, M. J. (2007). Mindfulness training modifies subsystems of attention. *Cognitive, Affective and Behavioral Science*, 7(2):109–119.
- Jimenez-Ivars, A. y Pinazo, D. (2001). I failed because I got very nervous. Anxiety and performance in interpreter trainees: An empirical study. *The Interpreters' Newsletter*, 11:105–118.
- Johanson, G. (2009). Selected bibliography on mindfulness and therapy. <http://www.hakomiinstitute.com/Resources/Biography-Mindfulness.pdf>. Accessed May 6 2011
- Kabat-Zinn, J. (1990). *Full catastrophe living. Using the wisdom of your body and mind to face stress, pain, and illness*. Delta Book Publishing. New York.
- Kabat-Zinn, J. (2003). Mindfulness: The heart of rehabilitation. In E. Leskowitz, (Ed.), *Complementary and Alternative Medicine in Rehabilitation*, xi–xv. Saint Louis: Churchill Livingstone.
- Kabat-Zinn, J. (2005). *Coming to our senses*. New York: Hyperion.
- Kabat-Zinn, J.; Lipworth, L. & Burney, R. (1985). The clinical use of mindfulness meditation for the self-regulation of chronic pain. *Journal of Behavioural Medicine*, 8:163–190.
- Kahneman, D. (1973). *Attention and effort*. Prentice-Hall. Englewood Cliffs: New Jersey.
- Klonowicz, T. (1994). Putting one's heart into simultaneous interpretation. In S. Lambert (Ed.), *Bridging the Gap: Empirical Research in Simultaneous Interpretation*, 213–224. Benjamins.
- Krasner, M. S.; Epstein, R. M. & Beckman, H. (2009). Association of an educational program in mindful communication with burnout, empathy, and attitudes among primary care physicians. *The Journal of American Medical Association*, 302(12):1284–1293.
- Kratter, J. & Hogan, J. D. (1983). The use of meditation in the treatment of attention deficit disorder with hyperactivity. Dissertation Abstracts International, 44. at: <http://www.livingwisdomschool.org/howtoapply/qs-pars-ask/research/Meditation%20in%20>. Accessed August 15 2011.
- Kushner, K. & Marnocha, M. (2008). Meditation and relaxation. In W. T. O'Donohue & N. A. Cummings (Eds.) *Evidence-based adjunctive treatments*. Academic Press Adjunctive Treatments. Burlington. MA. Academic Press.
- Kurz, I. (2003). Physiological stress during simultaneous interpreting: A comparison of experts and novices. *The Interpreters' Newsletter*, 12:51–68.
- Laberge, D. (1995). *Attentional processing*. Harvard University Press.
- Lambert, S.; Daro, V. & Fabbro, F. (1995). English focalized attention on input vs. output during simultaneous interpretation: Possibly a waste of effort. *Meta*, 38(2):319–329.
- Lambert, S. (2004). Shared attention during sight translation, sight interpretation and simultaneous interpretation. *Meta: Journal des traducteurs/ Meta: Translators' Journal*, 49(2):294–306.
- Lazar, S. W.; Kerr, C.; Wasserman, R. H.; Gray, J. R.; Greve, D.; Treadway, M. T.; McGarvey, M.; Quinn, B. T.; Dusek, J. A.; Benson, H.; Rauch, S. L.; Moore, C. I. & Fischl, B. (2005). Meditation experience is associated with increased cortical thickness. *NeuroReport*, 16:1893–1897.

- Longley P. (1989). Aptitude testing of applicants for a conference interpretation course. In L. Gran and J. Dodds (Eds.), *The Theoretical and Practical Aspects of Teaching Conference Interpretation*, 241–243. Udine: Campanotto.
- Luders, E., Clark, K., Narr, K. L., & Toga, A. W. (2011). Enhanced brain connectivity in long-term meditation practitioners. *NeuroImage*, 57:1308–1316.
- Lutz, A.; Greischar, L. L.; Rawlings, N. B.; Ricard, M. & Davidson, R. J. (2004). Long-term meditators self-induce high-amplitude gamma synchrony during mental practice. *Proceedings of the National Academy of Sciences*, 101(46):16369–16373.
- Lutz, A.; Brefczynski-Lewis, J.; Johnstone, T. & Davidson, R. J. (2008a). Regulation of the neural circuitry of emotion by compassion meditation: Effects of meditative expertise. *PLoS ONE* 3 (3): e1897.
- Lutz, A.; Slagter, H. A.; Dunne, J. D. & Davidson, R. J. (2008b). Attention regulation and monitoring in meditation. *Trends in Cognitive Science*. 12(4):163–169.
- Lynn, S. J., Surya-Das, L., Hallquist, M. N., & Williams, J. C. (2006). Mindfulness, acceptance, and hypnosis: Cognitive and clinical perspectives. *International Journal of Clinical and Experimental Hypnosis*, 54, 143–166.
- MacLean, K. A.; Ferrer, E.; Aichele, S. R.; Bridwell, D. A.; Zanesco, A. P.; Jacobs, T. L.; King, B. G.; Rosenberg, E. L.; Sahdra, B. K.; Shaver, P. R.; Wallace, B. A.; Mangun, G. R. & Saron, C. D. (2010). Intensive meditation training improves perceptual discrimination and sustained attention. *Psychological Science*, 21(6):829–839.
- MacWhiney, B. (1997). Simultaneous interpreting and the competition model. In J. H. Danks, G. M. Shreve, S. B. Fountain and M. K. McBeath (Eds.), *The Cognitive Processes in Translation and Interpreting (Applied Psychology: Individual, Social & Community Issues)*, 215–232. Sage: Thousand Oaks, CA
- Manna, A.; Raffone, A.; Gianni-Perucci, M. Nardo, D.; Ferretti, A.; Tartaro, A.; Londei, A.; Del Gratta, C.; Olivetti-Belardinelli, M & Romani, G. L. (2010). Neural correlates of focused attention and cognitive monitoring in meditation. *Follow Brain Research Bulletin*, 82(1):45–56.
- Martín, E.; León, B. & Vicente, F. (2007). Mejora de las aptitudes musicales mediante una intervención en atención auditiva e interior. *Revista Galego-Portuguesa de Psicoloxía e Educación: Revista de Estudos e Investigación en Psicología y Educación*, 14:95–106.
- McLaughlin, B. (1987). *Theories of second language learning*. London: Edward Arnold.
- Moore, A. & Malinowski, P. (2009). Meditation, mindfulness and cognitive flexibility. *Consciousness and Cognition*, 18(1):176–186.
- Moser-Mercer, B. (1985). Screening potential Interpreters. *Meta* 30(1):97–101
- Moser-Mercer, B. (1994). Aptitude testing for conference interpreting: Why, when and how. *Bridging the gap: Empirical research in simultaneous interpretation*, 57–67.
- Moser-Mercer, B.; Künzli, A. & Korac, M. (1998). Prolonged turns in interpreting. Effects on quality, physiological and psychological stress (pilot study). *Interpreting: International Journal of Research and Practice Interpreting*, 3(1):47–64.
- Moser-Mercer, B. (2005). Simultaneous interpreting and cognitive limitations. The acquisition of expertise as a process of circumventing constraints. Keynote delivered at the Workshop on “Cognitive aspects of simultaneous interpreting”, May, 19–20, 2005, Université de Toulouse-Le Mirail.
- Naatnen, R. (1992). *Attention and brain function*. Hillsdale, NJ; Erlbaum Associates.
- Norman, D. & Bobrow, D. G. (1975). On data-limited and resource-limited processes. *Cognitive Psychology*, 7:44–64.

- Oyan, S. (2006). *Mindfulness meditation: Creative musical performance through awareness*. Louisiana State University And Agricultural and Mechanical College
- Padilla, P.; Bajo, M. T.; Cañas, J. J. & Padilla, F. (1995). Cognitive processes of memory in simultaneous interpretation. In J. Tommola (ed.), *Topics in Interpreting Research*, 61–71. Turku: University of Turku Press.
- Padilla, P. & Bajo, M. T. (1998). Hacia un modelo de memoria y atención en interpretación simultánea. *Quaderns: Revista de Traducció*, 2:107–117.
- Pagnoni, G. & Cekic, M. (2007). Age effects on gray matter volume and attentional performance in Zen meditation. *Neurobiological Aging*, 28(10):1623–1627.
- Pfeiffer, W. M. (1966). Konzentrierte Selbstentspannung durch Übungen, die sich aus der buddhistischen Atemmeditation und aus der Atemtherapie herleiten [Concentrative self-relaxation by exercises derived from Buddhistic respiration-meditation and from respiration therapy]. *Zeitschrift für Psychotherapie & Medizinische Psychologie*, 16:172–181.
- Posner, M. I., & Petersen, S. E. (1990). The attention system of the human brain. *Annual Review of Neuroscience*, 13:25–42.
- Posner, M. I. & Dehaene, S. (1994). Attentional networks. *Trends in Neuroscience*, 17(2):75–79.
- Raffone, A; Tagini, A. & Srinivasan, N. (2010). Mindfulness and the cognitive neuroscience of attention and awareness. *Zygon*, 45(3):627–646.
- Rangan, R.; Nagendra, H. R. & Ramachandra-Bhat, G. (2009). Effect of yogic education system and modern education system on memory. *International Journal of Yoga*, 2(2):55–61.
- Rani, N. J.; & Rao, P. V. (1996). Meditation and attention regulation. *Journal of Indian Psychology*, 14(1–2):26–30.
- Rani, N. J.; & Rao, P. V. (2000). Effects of meditation on attention processes. *Journal of Indian Psychology*, 18:52–60.
- Reategui, N. & Sattler, C. (1999). *Metacognición. Estrategias para la construcción del conocimiento*. Lima: CEDUM.
- Renau, M. (2008). Del discurso al cuerpo: La Técnica Alexander en interpretación. *Translation Journal*, 12(2).
- Rosselló, J. (1998). *Psicología de la Atención*. Madrid: Pirámide.
- Rubinstein, R. (1982). *Principios de Psicología General*. La Habana: Ediciones R.
- Ruiz-Vargas, J. M. & Botella, J. (1987). Atención. In J. M. Ruiz-Vargas (Dir.) *Esquizofrenia: Un Enfoque Cognitivo*, 93–125. Madrid. Alianza.
- Sabel, B. A. (1980). Transcendental meditation and concentration ability. *Perceptual and Motor Skills*, 50:799–802.
- Schneider, W. & Shiffrin, R. M. (1977). Controlled and automatic human information processing: I. Detection, search, and attention. *Psychological Review*, 84(1):1–66.
- Schuster, R. (1979). Empathy and mindfulness. *Humanistic Psychology*, 19(1):71–77.
- Seleskovitch, D. & Lederer, M. (1986). *Interprete pour traduire*. Paris: Didier Erudition.
- Shallice, T. (1988). *From neuropsychology to mental structures*. Cambridge: Cambridge University Press.
- Shao, R. & Skarlicki, D. P. (2009). The role of mindfulness in predicting individual performance. *Canadian Journal of Behavioural Science/Revue Canadienne des Sciences du Comportement*, 41(4):195–201.
- Semple, R. J. (1999). *Enhancing the quality of attention: A comparative assessment of concentrative meditation and progressive relaxation*. Unpublished Master's thesis, University of Auckland, New Zealand.

- Siegel, D. J. (2007). *The mindful brain: Reflection and attunement in the cultivation of well-being*. Norton and Company
- Sohlberg, M. M.; Mateer, C. A. (1989). *Introduction to cognitive rehabilitation*. New York: Guilford.
- Speeth, K. R. (1982). On psychotherapeutic attention. *Journal of Transpersonal Psychology* 14:141–160.
- Spelke, E. S.; Hirst, W. C. & Neisser, U. (1976). Skills of divided attention. *Cognition*, 4:215–230.
- Sugiura, Y. (2003). Detached mindfulness and worry: A meta-cognitive analysis. *Personality and Individual Differences*, 37(1):169–179.
- Tang, Y. & Lu, Q.; Geng, X.; Stein, E. A.; Yang, Y. & Posner, M. I. (2010). Short-term meditation induces white matter changes in the anterior cingulate. *Proceedings of the National Academy of Sciences*, 107(35):15649–15652.
- Tang, Y. Y.; Ma, Y.; Wang, J.; Fan, Y.; Feng, S.; Lu, Q.; Yu, Q.; Sui, D.; Rothbart, M. K.; Fan, M. & Posner, M. I. (2007). Short-term meditation training improves attention and self-regulation. *Proceedings of the National Academy of Sciences*, 104:17152–17156.
- Taylor-Bouladon, V. (2007). *Conference interpreting. Principles and practice*. Charleston: S. C., BookSurge.
- Timarová, S. (2008). Working memory and simultaneous interpreting. In P. Boulogne (ed.). *Translation and Its Others. Selected Papers of the CETRA Research Seminar in Translation Studies*. <http://www.kuleuven.be/cetra/papers/papers.html>. Accessed 7 May 2012.
- Trungpa, C. (1975). *The myth of freedom and the way of meditation*. Boston: Shambhala.
- Valentine, E. R. & Sweet, P. L. G. (1999). Meditation and attention: A comparison of the effects of concentrative and mindfulness meditation on sustained attention. *Mental Health, Religion and Culture*. 2(1):59–70.
- Van der Heijden, A. H. C. (1992). *Selective attention in vision*. London: Routledge.
- Vestergaard-Poulsen P.; van Beek M.; Skewes, M.; Bjarkamb, C. R.; Stubberup, M.; Berstlsedn, J. & Roepstorff, A. (2009). Long-term meditation is associated with increased gray matter density in the brain stem. *NeuroReport*, 20:170–174.
- Ying, J. (2010) The conceptual mapping model in consecutive interpreting teaching. *T21N Translation in transition* 2010/07. www.t21n.com/homepage/.../T21N-2010-07-Jin.pdf. Accessed May 03 2013.
- Ying, J. (2011) *Cognitive Processing Capacity Management in the Teaching of Consecutive Interpreting – Proposal for a Conceptual Mapping Model*. Ph. D. Dissertation. <https://researchspace.auckland.ac.nz/bitstream/handle/2292/.../01front.pdf>. Accessed May 03 2013
- Young, M. S. & Stanton, N. A. (2002). Malleable attentional resources theory: A new explanation for the effects of mental underload on performance. *Human Factors*, 44(3):365–375.
- Yudes-Gómez, C. (2010). *Procesos cognitivos en intérpretes simultáneos: comprensión, memoria de trabajo y funciones ejecutivas*. Unpublished doctoral dissertation supervised by M. T. Bajo & P. Macizo. Granada. digibug.ugr.es/bitstream/10481/15396/1/1955445x.pdf Accessed 31 January 2013.
- Wickens, C. D. (1984). Processing resources in attention. In R. Parasuraman & D. R. Davies (Eds.), *Varieties of attention*, 63–102. New York: Academic Press.
- Wickens, C. D. (1992). *Engineering psychology and human performance*. Harper Collins Publisher.
- Zahng, M. (2012) The Study of Note-taking and Memory in Consecutive Interpretation. International Conference on Education Technology and Management Engineering *Lecture Notes in Information Technology*, Vols.16–17