Linguistic and psychological indicators of stress in simultaneous interpreting

[Językowe i psychologiczne wskaźniki stresu w tłumaczeniu symultanicznym]
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OŚWIADCZENIE
Ja, niżej podpisany

Paweł Korpal

przedkładam rozprawę doktorską

pt. Linguistic and psychological indicators of stress in simultaneous interpreting
(Językowe i psychologiczne wskaźniki stresu w tłumaczeniu symultanicznym)

na Uniwersytecie im. Adama Mickiewicza w Poznaniu
i oświadczam, że napisałem ją samodzielnie.

Oznacza to, że przy pisaniu pracy, poza niezbędnymi konsultacjami, nie korzystałem z pomocy innych osób, a w szczególności nie zlecałem opracowania rozprawy lub jej istotnych części innym osobom, ani nie odpisywałem tej rozprawy lub jej istotnych części od innych osób.

Jednocześnie przyjmuję do wiadomości, że gdyby powyższe oświadczenie okazało się nieprawdziwe, decyzja o wydaniu mi dyplomu zostanie cofnięta.

(miejscowość, data) (czytelny podpis)
Table of contents

TABLE OF CONTENTS .................................................................................................................. 4

LIST OF TABLES .......................................................................................................................... 8

LIST OF FIGURES .......................................................................................................................... 9

INTRODUCTION ........................................................................................................................... 11

CHAPTER 1: SIMULTANEOUS INTERPRETING AS A COGNITIVE PROCESS ................................................................. 15

1.1. INTRODUCTION .................................................................................................................. 15

1.2. PRODUCT-ORIENTED AND PROCESS-ORIENTED RESEARCH IN INTERPRETING STUDIES ................................................................. 16

1.3. INTERPRETING MODES ................................................................................................... 18

1.4. COGNITIVE EFFORTS IN SIMULTANEOUS INTERPRETING ................................................. 23

1.4.1. The Listening and Analysis Effort ................................................................................... 24

1.4.2. The Short-term Memory Effort ...................................................................................... 25

1.4.3. The Speech Production Effort ....................................................................................... 27

1.4.4. The Coordination Effort ............................................................................................... 27

1.4.5. Efforts combined: Operation of the models and comments ........................................... 28

1.5. SEEBER’S COGNITIVE LOAD MODEL ............................................................................ 30

1.6. BADDELEY’S WORKING MEMORY MODEL ........................................................................... 33

1.7. PROCESSING MODELS OF SIMULTANEOUS INTERPRETING .............................................. 36

1.8. PROCESSING MODELS REVISITED: SUMMARY AND COMMENTS ........................................ 41

1.9. WHEN SIMULTANEOUS INTERPRETING GETS REALLY COMPLICATED: SELECTED LINGUISTIC PROBLEM TRIGGERS ......................................................................................... 43
1.9.1. Numerical data ............................................................................................................. 43
1.9.2. Proper names ............................................................................................................. 45
1.9.3. Enumerations ............................................................................................................. 46
1.9.4. Morphosyntactic features of the source language ...................................................... 47
1.9.5. Strong foreign accent ............................................................................................... 48
1.9.6. Rate of delivery ......................................................................................................... 49
1.10. CONCLUSION .............................................................................................................. 50

CHAPTER 2 : STRESS: PSYCHOLOGICAL AND LINGUISTIC MEASURES 52

2.1. INTRODUCTION .............................................................................................................. 52
2.2. THE SOCIAL READJUSTMENT RATING SCALE (SRRS) .............................................. 53
2.3. HANS SELYE’S STRESS THEORY .................................................................................. 55
2.4. THE TRANSACTIONAL MODEL OF STRESS AND COPING .......................................... 58
  2.4.1. Cognitive appraisal ................................................................................................. 59
  2.4.2. Coping with stress.................................................................................................. 61
2.5. STRESS AND ANXIETY .............................................................................................. 63
2.6. ANXIETY IN THE FOREIGN LANGUAGE CLASSROOM ............................................. 64
  2.6.1. Krashen’s Affective Filter Hypothesis ..................................................................... 64
  2.6.2. The concept of foreign language anxiety ................................................................. 66
2.7. SELECTED PSYCHOMETRIC INSTRUMENTS USED TO MEASURE STRESS, ANXIETY AND
  COPING WITH STRESS...................................................................................................... 68
  2.7.1. STAI – State-Trait Anxiety Inventory ................................................................. 69
  2.7.2. Foreign Language Classroom Anxiety Scale (FLCAS) ........................................... 70
  2.7.3. Coping Inventory For Stressful Situations (CISS) .................................................. 71
  2.7.4. The Coping Orientations to Problems Experienced (COPE) .................................. 72
  2.7.5. Perceived Stress Scale (PSS) .................................................................................. 74
2.8. STRESS INDICATORS IN EXPERIMENTAL RESEARCH ............................................. 76
  2.8.1. Heart rate and blood pressure ................................................................................. 76
  2.8.2. Galvanic skin response ......................................................................................... 79
  2.8.3. Concentration of cortisol ...................................................................................... 81
  2.8.4. Linguistic (acoustic) markers of stress ................................................................. 81
  2.8.5. Markers of stress: Concluding remarks ............................................................... 85
2.9. CONCLUSION ................................................................................................................ 86
CHAPTER 3 : THE PSYCHOLINGUISTIC APPROACH TO INTERPRETING:
CONFERENCE INTERPRETING AND STRESS ........................................ 88

3.1. INTRODUCTION .......................................................................... 88
3.2. INTERPRETER APPTITUDE AND INTERPRETERS’ SUCCESS .......... 89
3.3. COGNITIVE ABILITIES AND INTERPRETING SKILLS ..................... 93
3.4. PSYCHOLOGICAL FACTORS AND INTERPRETING SKILLS ............. 95
3.5. AIIC ON INTERPRETERS’ KEY SKILLS ...................................... 101
3.6. CONFERENCE INTERPRETING AND PSYCHOLOGICAL STRESS: The AIIC WORKLOAD Study ................................................................. 102
3.7. CONFERENCE INTERPRETING AND PSYCHOLOGICAL STRESS: Other Empirical Studies ................................................................. 107
3.8. CONCLUSION ............................................................................ 124

CHAPTER 4 : STRESS IN SIMULTANEOUS INTERPRETING: THE EFFECT OF DELIVERY RATE .............................................................. 126

4.1. INTRODUCTION ........................................................................ 126
4.2. THE AIM OF THE STUDY ......................................................... 126
4.3. STUDY DESIGN ....................................................................... 127
4.4. INDEPENDENT VARIABLES ..................................................... 128
4.5. DEPENDENT VARIABLES ......................................................... 129
4.6. RESEARCH QUESTIONS .......................................................... 131
4.7. HYPOTHESES ....................................................................... 132
4.8. PARTICIPANTS ....................................................................... 135
4.9. MATERIALS .......................................................................... 136
4.10. EXPERIMENTAL PROCEDURE .............................................. 137
4.11. DATA ANALYSIS ................................................................... 139
4.12. RESULTS OF THE EXPERIMENT ............................................ 141
4.13. RESULTS OF THE CISS QUESTIONNAIRE ............................... 152
4.14. RESULTS OF THE INTERVIEW ............................................... 153
4.15. DISCUSSION ........................................................................ 155
  4.15.1. Hypothesis 1 ................................................................. 156
  4.15.2. Hypothesis 2 ................................................................. 158
  4.15.3. Hypothesis 3 ................................................................. 159
4.15.4. Hypothesis 4.............................................................................................................. 160
4.15.5. Hypothesis 5.............................................................................................................. 162
4.15.6. Hypothesis 6.............................................................................................................. 163
4.15.7. The interview............................................................................................................. 164
4.15.8. General discussion.................................................................................................... 164
4.15.9. Limitations of the study and further research......................................................... 166
4.15.10. Didactic considerations ........................................................................................ 170

CONCLUDING REMARKS ................................................................................................. 172

ABSTRACT .......................................................................................................................... 175

STRESZCZENIE .................................................................................................................. 177

REFERENCES .................................................................................................................... 179

APPENDIX A ....................................................................................................................... 206

APPENDIX B ....................................................................................................................... 210

APPENDIX C ....................................................................................................................... 214

APPENDIX D ....................................................................................................................... 216

APPENDIX E ....................................................................................................................... 218
List of tables

Table 1. The 15 Scales of the COPE Inventory (after Litman 2006: 275). .................... 74
Table 2. Summary of empirical studies on psychological and physiological stress in
conference interpreting.......................................................... 120
Table 3. The length (in sec) and speed (in words/min) of each recording. .................... 136
Table 4. The counterbalancing scheme........................................................................ 137
Table 5. Mean heart rate in interpreting trainees (TR) and professional interpreters (PR)
(in beats per minute) (with standard deviations = $SD$)...................................... 141
Table 6. Mean STAI X-1 scores in interpreting trainees (TR) and professional
interpreters (PR) (with standard deviations = $SD$)........................................ 143
Table 7. Mean hesitation number in interpreting trainees (TR) and professional
interpreters (PR) (with standard deviations = $SD$)........................................ 144
Table 8. Mean F0 values in interpreting trainees (TR) and professional interpreters (PR)
(with standard deviations = $SD$)...................................................................... 145
Table 9. Mean accuracy scores in interpreting trainees (TR) and professional
interpreters (PR) (with standard deviations = $SD$)........................................ 147
Table 10. Stress vs. accuracy: Correlation matrix (Pearson).................................. 149
Table 11. The results of the CISS questionnaire: interpreting trainees (TR) and
professional interpreters (PR) (with standard deviations = $SD$)...................... 152
Table 12. Stress coping strategies: Qualitative data from the interview. ................. 154
List of figures

Fig. 1. Structure of the memory system (Atkinson and Shiffrin 1968: 93). ....................... 25
Fig. 2. Conflict matrix of simultaneous interpreting by Seeber (2011: 188). ..................... 31
Fig. 3. The initial model of working memory (Baddeley and Hitch 1974). ..................... 34
Fig. 4. The model of working memory (Baddeley 2000). ........................................... 35
Fig. 5. Model of simultaneous interpreting by Gerver (1975), adapted by Moser-Mercer (2002: 151). ................................................................. 37
Fig. 6. A processing model of simultaneous interpreting by Moser-Mercer (1978). ...... 39
Fig. 7. Model of simultaneous interpreting by Darô and Fabbro (1994). ..................... 40
Fig. 8. The Social Readjustment Rating Scale (Holmes and Rahe 1967: 216). .......... 54
Fig. 9. Diagram of the General Adaptation Syndrome (GAS) Model (taken from Rice 2011: 24). ................................................................. 56
Fig. 10. Operation of the “affective filter” (Krashen 1982: 32). ............................... 65
Fig. 11. Two subdivisions of autonomic system: Sympathetic and parasympathetic (taken from http://www.austincc.edu/rfofi/NursingRvw/PhysText/PNSefferent.html). ............... 77
Fig. 12. Four GSR startle responses (taken from Kurniawan et al. 2013: 211). ........... 80
Fig. 13. Determinants of human performance and their interaction (Moser-Mercer 2008: 3, adapted from Blumberg and Pringle 1982: 565). ........................................... 91
Fig. 14. Aptitude model for simultaneous interpreting (Chabasse 2009, in Chabasse and Kader 2014: 21). ................................................................. 100
Fig. 15. Experimental design (IV – independent variable, DV – dependent variable). 134
Fig. 16.: Heart rate – line chart. ................................................................. 142
Fig. 17. STAI X-1 – line chart. ................................................................. 144
Fig. 18. Fundamental frequency – line chart. ................................................................. 146
Fig. 19. Individual accuracy scores (trainees). ................................................................. 147
Fig. 20. Individual accuracy scores (professionals). ......................................................... 148
Fig. 21. Accuracy – line chart ........................................................................................... 149
Introduction

Interpreting is commonly believed to be one of the most cognitively demanding language tasks (Gile 1995; Christoffels and de Groot 2005; Seeber 2011). Simultaneous interpreting (SI) involves processes and skills such as: self-monitoring, memory skills, verbal fluency and concurrent listening and production. In order to provide a high-quality interpretation, the interpreter needs to master all of these skills (Christoffels and de Groot 2005: 469ff.). The question of interpreters’ aptitude has been widely discussed in the context of interpreter training (e.g. Moser-Mercer 1985, 1994; Lambert 1991; Mackintosh 1999). It was often assumed that language abilities and cognitive skills constitute the most significant predictors of interpreters’ future success. Some interpreting scholars expressed their concern and claimed that by focusing too much on the cognitive aspects of interpreting practice, researchers might have neglected the psychology of the interpreting process (Brisau et al. 1994; Pöchhacker 2011: 107). However, in recent years, one might observe that psycho-affective factors (i.e. those relating to emotions and psychological traits), such as motivation, stress resistance and personality, are gaining more and more attention from interpreting scholars and interpreting schools (e.g. Timarová and Ungood-Thomas 2008; Rosiers et al. 2011; Bontempo and Napier 2011).

In line with the psycholinguistic approach to conference interpreting, this thesis is an attempt to discuss the notion of psychological stress in simultaneous interpreting. Interpreting has often been referred to as a stressful activity (e.g. Seleskovitch 1978: 41; Roland 1982: 13; Riccardi et al. 1998: 97; Jimenez Ivars and Pinazo Calatayud 2001: 105; Kurz 2003: 52). Many interpreting scholars have assumed in an a priori fashion that interpreting might induce considerable stress. Nevertheless, such theoretical considerations have been only rarely verified in an experimental setting. As such, more
research is necessary in order to learn about the factors and working conditions which might lead to interpreters’ distress in the booth.

The speaker’s rate of delivery has often been discussed as a recurrent processing problem in simultaneous interpreting (Gile 1995; Gerver 1969; Barik 1973). When interpreting fast speakers, interpreters often work close to saturation level at which point their performance might deteriorate (Gile 1995). In such a case the processing requirements of an interpreting task exceed the interpreter’s available processing capacity which in turn compromises interpreting quality. Although the cognitive aspects of dealing with a fast speaker have been empirically tested, little is known about delivery rate as a stress factor in simultaneous interpreting. This study aims to explore whether delivery rate has an influence on psychological stress experienced by professional interpreters and interpreting trainees as well as on interpreting accuracy. Additionally, by means of survey research predominant coping strategies used by interpreting trainees and professional interpreters will be tested.

This dissertation is divided into two parts: a theoretical one (Chapters 1-3) and an empirical one (Chapter 4). In the theoretical part of the dissertation I will discuss simultaneous interpreting as a cognitive process, the notion of psychological stress and its measurement as well as the psychological framework of interpreting research with a special focus on stress and stress coping. In the empirical part of the thesis I will describe the study design, report on the results of both the experimental study and the survey research and formulate final conclusions along with the study’s implications, limitations and suggestions for further research.

Chapter 1 will discuss simultaneous interpreting as a cognitive process. At the beginning of the chapter process-oriented research on conference interpreting will be juxtaposed with product-oriented research. In line with the cognitive approach to interpreting, the notion of multitasking will be discussed by means of defining cognitive efforts inherent in the process of simultaneous interpreting (Gile 1995; Seeber 2011). Following this, selected processing models of simultaneous interpreting will be presented and discussed (Gerver 1975; Moser-Mercer 1978; Darò and Fabbro 1994). Processing theories and models of simultaneous interpreting are of crucial importance for the main topic of this dissertation as they will prove useful when discussing the results of the experimental study concerning the impact of the rate of delivery on interpreting accuracy. It will be argued that their advantage over Gile’s and Seeber’s models is that
they propose a temporal course of SI. At the end of the chapter I will discuss the most significant linguistic problem triggers in simultaneous interpreting; delivery rate being one of them.

Chapter 2 will be devoted to the notion of psychological stress and its measurement. The main theoretical approaches to psychological stress will be discussed: the situational approach to stress by Holmes and Rahe (1967), the biologically-oriented stress-response theory developed by Selye (1936; 1956; 1974) and the transactional model of stress by Lazarus and Folkman (1984). The concept of anxiety as an emotional reaction to distress will also be discussed. In the last part of the chapter I will provide an overview of psychometric, physiological and linguistic measures of stress. I will focus on how stress, stress coping and anxiety have been operationalised in survey research. The use of acoustic stress indicators in this dissertation could be a valuable contribution to Interpreting Studies as, to the best of my knowledge, they have never been used in experimental research on simultaneous interpreting yet.

Chapter 3 is where process-oriented research on conference interpreting and stress theories will be combined. The main objective of this chapter is to discuss the psycholinguistic aspects of conference interpreting, with a special focus on stress in simultaneous interpreting. The notion of interpreting aptitude will be defined and its main components will be discussed. It will be argued that, although neglected at times, the psycho-affective framework of interpreting research constitutes a crucial research avenue in Interpreting Studies. The main part of the chapter will be devoted to the discussion of research on psychological stress in interpreting which has been conducted to this date.

In the empirical part of this dissertation (Chapter 4) I will report on the results of the study on stress experienced in simultaneous interpreting and predominant coping strategies used by professional interpreters and interpreting trainees. The main part of the project is intended to test the effect of delivery rate on psychological stress and interpreting accuracy in an experimental setting. As well as a psychometric instrument (STAI X-1 – State-Trait Anxiety Inventory) the measurement of the level of stress in the experimental condition has been supplemented in the project by using a physiological stress measure (pulse rate) and two linguistic stress indicators: fundamental frequency (F0) and the number of hesitations. To compliment these findings, a research survey has been conducted in which coping strategies used by professional interpreters and
trainees were examined. To this end, the CISS (Coping Inventory for Stressful Situations) questionnaire and a semi-structured interview were undertaken with all the participants. The triangulation of research methods and stress measures is employed to enhance the reliability of the results and thus the study might provide a valuable insight into the question of psychological stress experienced by experts and novices in a simultaneous interpreting task.
Chapter 1: Simultaneous interpreting as a cognitive process

1.1. Introduction

Conference interpreting is often perceived as one of the most complicated language tasks (Christoffels and de Groot 2005). Being an interpreter is frequently referred to as one of the most demanding professions: both cognitively and psychologically. A conference interpreter must have a perfect command of at least two languages, be able to manage his or her cognitive resources to perform several language- and attention-related tasks simultaneously, as well as be ready to work under pressure. As mediators whose role is to facilitate communication, interpreters should also be bi-cultural, i.e. they should be aware of the specificity of the culture in which they provide their service. The process of simultaneous interpreting (SI) is intriguing in its complexity and has become a popular subject of research in Interpreting Studies.

The main objective of this chapter is to discuss the process of simultaneous interpreting. Process-oriented research on conference interpreting will be juxtaposed with product-oriented research. Then an overview of the main interpreting modes will be provided in order to show the specificity of the process of simultaneous interpreting. Together with the advent of product-oriented research in 1970s, several cognitive and processing models of simultaneous interpreting were developed by interpreting scholars; they will be presented and discussed in Sections 1.4., 1.5. and 1.7. At the end of the chapter selected problem triggers in simultaneous interpreting will be discussed. As defined by Gile (2009: 171), problem triggers are understood here as recurrent processing problems which may influence SI and which are generally known to be problematic for conference interpreters.
1.2. Product-oriented and process-oriented research in Interpreting Studies

Interpreting can be investigated from two different perspectives. First of all, interpreting scholars have been interested in interpretation as a *product* of linguistic mediation. Their focus has been on the textual and linguistic characteristics of a complete interpretation. The topics discussed in product-oriented research include interpreting quality (Bühler 1986; Kurz 1993), error analysis (Barik 1994; Altman 1994) as well as interpreting strategies (Gile 1995; Seeber 2011) and interpreting style (Shlesinger 1989, 1991; Kajzer-Wietrzny 2012). As for interpreting techniques and strategies, their manifestation in interpreting output has often been described by means of studying language corpora and discourse analysis (e.g. transcript of a given interpretation) (Roy 2000; Rosenberg 2002; Wadensjö 2002). Early product-oriented research was to a large extent behaviourist, i.e. interpreting scholars were mainly interested in interpreters’ behaviour as manifested in the tangible interpreting output. It seems that no assumptions about what happens in the interpreter’s mind (the “black box”) were formulated.

One of the key issues in the product-oriented approach to conference interpreting is interpreting quality. A question which has often been posed in this context is: what features make a high-quality interpretation? Several articles have been published on quality assessment in conference interpreting (e.g. Bühler 1986; Kopczyński 1994; Moser-Mercer 1996; Shlesinger 1997; Pöchhacker 2001, 2005; Collados Aís 2002) and the users’ quality expectations (Kurz 1993; Moser 1995). As phrased by Pöchhacker (2005: 143), “research on quality in interpreting stands out as an impressively rich and cohesive area of study” in the field of Interpreting Studies. Research on quality assessment appears to be a worthy contribution as it helps to set interpreting quality standards and show interpreters how their work is perceived by users. Such research might also make interpreters aware of the wide range of expectations users have. What is more, quality research contributes to the fact that conference interpreting is starting to be perceived as an academic field. It may also raise users’ awareness as to how interpreters work and what operations are involved in conference interpreting.

The cognitive turn in both Translation and Interpreting Studies visible in the second part of the 20th century led to a new perspective on the processes of translation and interpreting. A great many translation scholars shifted their focus from looking at translation as a product to the investigation of translation as a *process* (Holmes 1972;
Seleskovitch and Lederer 1984; Toury 1986; Lörscher 1991; Baker 1992; Snell-Hornby et al. 1992). The late 1980s and 1990s were characterised by the emergence of the empirical approach to Translation Studies which “deviated the attention from description of the translation product to research on the translation process” (Rojo and Ibarretxe-Antuñano 2013: 8).

A similar trend could also be observed in Interpreting Studies (Gerver 1975, 1976; Moser-Mercer 1978; Gran 1990; Darò and Fabbro 1994; Fabbro and Gran 1994; Gile 1995). The need to engage in more process-oriented research on simultaneous interpreting was described by Shlesinger in the following way: “[f]rom the time simultaneous interpreting stopped being viewed as sheer alchemy and turned into something worth studying and dissecting, we have been trying to devise ways of finding out what actually happens in the interpreters mind as s/he goes about performing this unusual task” (2000: 3). The first attempts were made to “peek inside the black box” (Shlesinger 2000: 3) of the interpreter and observe cognitive processes inherent in simultaneous interpreting (the Interpretive Approach, Seleskovitch and Lederer 1984, cf. Section 1.9.1.).

Apart from creating new theoretical concepts in the field of conference interpreting, many scholars collected empirical data in order to test hypotheses on interpreting as a cognitive and psycholinguistic process (e.g. Tommola and Niemi 1986; Moser-Mercer 1991; Isham 1994; Hyönä et al. 1995; Shreve and Diamond 1997). This made it possible to build theory upon empirical data collected by studying interpreters’ behaviour. For example, in process-oriented research on interpreting, interpreters and interpreting trainees were assigned an interpreting task and their behaviour was recorded by experimenters. Instead of assuming in an a priori fashion that certain mechanisms apply to the interpreting process, controlled experiments were conducted so as to check the veracity of researchers’ claims.

Together with the emergence of the cognitive turn in Translation and Interpreting Studies, new psycholinguistic research methods started to be applied in conference interpreting, which include, but are not limited to, Think Aloud Protocols (TAPs) (Lörscher 1986; Laukkanen 1993), key-logging (Tangsgaard Hvelplund 2011; Jakobsen 2011), electroencephalography (EEG) (Grabner et al. 2007), eye-tracking (Hyönä et al. 1995; Dragsted and Hansen 2008) and pupillometry (Tommola and Niemi 1986). Several research methods were often triangulated (Alves 2003), i.e. they were combined in
order to obtain more reliable data. It might happen that a researcher uses a given methodology in a wrong way which leads to the occurrence of systematic errors. Using multiple methodologies diminishes the risk of obtaining invalid and unreliable data. The triangulation of methods in Translation and Interpreting Studies is exemplified in the study by Lachaud (2011) who used eye-tracking, key-logging and EEG to study cognate transcoding in written translation. Elsewhere, Špakov et al. (2009), used electroencephalogram (EEG), electrooculogram (EOG) and electrocardiogram (ECG) to propose an integrated monitoring model of translation.

To summarise, what brings all the above-mentioned research methods together is the fact that they attempt to measure moment-by-moment changes in the interpreter’s behaviour. In process-oriented research, many scholars were interested in the dynamics of the interpreting process, i.e. they collected data which made it possible to confirm or refute hypotheses concerning interpreters’ actual behaviour. By means of psycho- and neurolinguistic research methods the researchers also attempted to identify how cognitively demanding it is to perform a given interpreting task.

1.3. Interpreting modes

Before I discuss the cognitive efforts inherent in the process of simultaneous interpreting, I will provide an overview of interpreting modes, simultaneous interpreting being only one of them. I will point out to the basic characteristics of each interpreting mode both from the cognitive and practical point of view.

In consecutive interpreting (CI) the interpreter interprets the speech after the speaker (delegate) has finished. The process of consecutive interpreting has been described by SCIC in the following way: “[t]he interpreter sits with the delegates, listens to the speech and renders it, at the end, in a different language, generally with the aid of notes. In the modern world consecutive interpreting has been largely replaced by simultaneous, but it remains relevant for certain kinds of meetings (e.g. highly technical meetings, working lunches, small groups, field trips)” (SCIC1). One of the central consecutive interpreting skills is the ability to take notes. Note-taking techniques in CI have

been widely studied in Interpreting Studies. Interpreting trainers and scholars discussed the role of note-taking in consecutive interpreting as well as provided (future) interpreters with suggestions as to how to take notes and use symbols (Rozan 2002; Matyssek 2006; Gillies 2007). Some empirical studies on note-taking in consecutive interpreting were also conducted. For example, in her research on the choice of language in interpreters’ notes, Dam demonstrated that “the choice of language in note-taking is governed mainly by the status of the language in the interpreters’ language combination, i.e. whether it is an A- or a B-language^2, and much less by its status in the interpreting task, i.e. whether it functions as the source or the target language” (2004: 3). Another distinguishing feature of consecutive interpreting is that long-term memory is more extensively involved in the process than in other interpreting modes due to the time delay between the input in the source language and the interpreter’s output.

Consecutive interpreting can also be perceived as challenging due to the fact that in this mode interpreters are often in the spotlight which might aggravate the risk of psychological stress affecting interpreting output. Furthermore, when performing on stage interpreters must rely only on their memory and interpreting skills: there is no (or limited) access to conference materials and glossaries prepared by the interpreter. Consecutive interpreting is at times criticised by clients, as in this mode meetings may get delayed significantly. Nevertheless, consecutive interpreting might be perceived by some interpreters as easier than simultaneous interpreting, since during the listening and note-taking stage they have enough time to analyse the structure of the whole interpreting chunk. Also, when juxtaposed with SI, consecutive interpreting does not entail a great risk of language interference (Agrifoglio 2004: 49).

*Liaison interpreting* (also referred to as *dialogue interpreting*) is “a form of interpreting practiced mainly in commercial negotiations” (Pöchhacker 2004: 14) and, thus, it seems to involve more dynamic interpersonal interaction than other interpreting modes (Pöchhacker 2004: 186). This interpreting mode resembles consecutive interpreting, although there are some features which distinguish the former from the latter. In liaison interpreting the chunks are shorter and interpreters usually do not take notes. Another feature of liaison interpreting is that it involves dynamic changes in interpret-

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^2The “A” language is the interpreter’s mother tongue. A “B” language is the interpreter’s active language, i.e. interpreters may work from their mother tongue into this language. A “C” language is the interpreter’s passive language. The interpreter understands this language perfectly but does not work into it (AIIC, http://aiic.net/page/4004/working-languages).
ing directionality and frequent turn-taking. To give an example, the interpreter may serve as a language mediator between an English and a Polish delegate. When the English speaker speaks to the Polish one, the interpreter interprets the message from English into Polish which makes it possible for the Polish speaker to respond. The answer is then interpreted from Polish into English for the English delegate.

The so-called sight translation constitutes a hybrid of translation and interpreting. Lambert stated that sight translation “involves the transposition of a message written in one language into a message delivered orally in another language” (2004: 298). Such a definition demonstrates that sight translation (also referred to as a-vista translation) is an intermediary form of language mediation, sharing features of both translation and interpreting. This issue has been addressed by Moser-Mercer, who claims that “[s]ince both aural and visual information processing are involved, sight translation could be defined as a specific type of written translation, as well as a variant of oral interpretation” (1991: 159). Sight translation is characterised by the co-occurrence of written input and oral output. Nevertheless, since sight translation involves a great deal of attention sharing and it is characterised by immediate transposition of the message into the target language, many scholars tend to refer to sight translation as an interpreting mode. Several articles have been published to this date on a-vista translation and its peculiar characteristics (e.g. Viezzi 1989; Moser-Mercer 1991; Lambert 2004; Dragsted and Hansen 2009; Shreve et al. 2010; Korpal 2012a; Chmiel and Mazur 2013).

Simultaneous interpreting (SI), the main focus of this thesis, is the mode which appears to be the most frequently used in a conference setting. As the name suggests, in simultaneous interpreting the interpreter provides his interpretation while the delegate is speaking. Pöchhacker defines SI as “spoken language interpreting with the use of simultaneous interpreting equipment in a sound-proof booth” (Pöchhacker 2004: 19). A description of SI has also been provided on the website of SCIC (Directorate-General for Interpretation, European Commission): “[t]he interpreter works in a soundproofed booth with at least one colleague. The speaker in the meeting room speaks into a microphone, the interpreter receives the sound through a headset and renders the message into a microphone almost simultaneously. The delegate in the meeting room selects the relevant channel to hear the interpretation in the language of his/her choice” (SCIC\(^3\)).

\(^3\) http://ec.europa.eu/dgs/scic/what-is-conference-interpreting/simultaneousindex_en.htm
Simultaneous interpreting has often been discussed in the literature due to multitasking as one of its central characteristics (e.g. Gerver 1975, 1976; Gile 1995, 1999; Lambert 2004; Christoffels and de Groot 2005; Seeber 2011; Seeber and Kerzel 2011). Interpreters themselves often report that the difficulty of simultaneous interpreting lies in the fact that they need to perform several cognitive operations at the same time, including self-monitoring. SI is also speaker-paced, i.e. interpreters need to adjust to the delegates’ rate of delivery. Another challenge of simultaneous interpreting is that interpreters might feel detached from what is going in the conference room, e.g. in the case of remote interpreting/a videoconference (Moser-Mercer 2005; Braun 2007, 2013). It might happen that they do not have access to the speaker, visual materials and other visual cues which could come in useful during the interpreting process. However, some interpreters hold that being separated from the conference room has also its advantages since it reduces public speaking anxiety. What is more, in the simultaneous mode, the interpreter is always accompanied by their colleague. When not interpreting, the colleague is off mike but on duty and supports the one being on mike, offering help if needed (Jensen 2006; Chmiel 2008).

An interesting sub-mode of simultaneous interpreting is the so-called whispered interpreting, also referred to as chuchotage. In whispered interpreting the interpreter is seated next to the delegate(s) and interprets simultaneously into their ears. Chuchotage is often used in bilateral meetings where only a few participants do not share a common language (SCIC⁴). Pöchhacker notices that whispered interpreting is “in fact done not by whispering but by speaking in a low voice” (2004: 19). An obvious limitation of chuchotage is that this mode can be used only for one or a few delegates (up to 3-4) who need to sit very close to one another. An important advantage (especially for the client) of both booth interpreting and chuchotage is that, due to the input-output simultaneity, the presence of interpreters as language mediators does not prolong a meeting.

Another sub-mode of simultaneous interpreting is the so-called simultaneous interpreting with text (Pöchhacker 2004: 19). In this type of simultaneous interpreting speakers read out a speech the transcript of which has been given to interpreters (Gile 2009: 181). It often happens at conferences that interpreters are given transcripts of speeches right before the interpretation starts. In this case, they are provided with both

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⁴ http://ec.europa.eu/dgs/scic/what-is-conference-interpreting/whispering/index_en.htm
the auditory (speaker’s words) and visual modality (the transcript). It appears that access to visual input may facilitate the process of simultaneous interpretation as some data does not have to be stored in the interpreter’s working memory. However, it must be remembered that access to visual materials may generate additional load on the part of the interpreter since they must constantly verify whether the information provided in the materials is reflected in the speaker’s words. More information on the advantages and disadvantages of SI with text can be found in Gile (2009: 181f.).

The interpreter’s processing capacity has often been discussed in the context of simultaneous interpreting, as this mode is a perfect example of multitasking and simultaneity of cognitive operations which need to be performed by the interpreter. SI is characterised by simultaneous listening/analysis of the speech in the source language and production in the target language. As opposed to written translation, SI is characterised by sequential reception, i.e. the interpreter perceives the message in the source language only once and cannot go back to it later on (Agrifoglio 2004: 49). There is also a high risk of interference (interlanguage negative transfer) which results from the immediacy of message reformulation (Agrifoglio 2004: 49).

The next sections will discuss subsequent processing efforts in simultaneous interpreting. The main cognitive and processing models of simultaneous interpretation will be presented. First, I will describe the Effort Models developed by Gile (1995) in which the capacity-sharing aspects of simultaneous interpreting are emphasised. Secondly, Gile’s Effort Models will be compared to Seeber’s Cognitive Load Model (2011) in which the dynamics of multitasking gains more prominence than in the models developed by Gile. Finally, I will discuss the main processing models of simultaneous interpreting developed by Gerver (1975), Moser-Mercer (1978) and Darò and Fabbro (1994) which attempt to display a temporal course of the process of simultaneous interpreting rather than the attention-sharing aspects of the process. Since in their model Darò and Fabbro (1994) refer to the concept of working memory, the main assumptions of Baddeley’s working memory model will also be presented here.
1.4. Cognitive efforts in simultaneous interpreting

A cognitive perspective on simultaneous interpreting is, to a large extent, based on the complexity of mental operations involved in an interpretation task. The uniqueness of SI is based on “a conjoined comprehension and production task that crosses languages” (Shreve and Diamond 1997: 244). The simultaneity of comprehending the message in the source language and producing it in the target language, self-monitoring, short-term memory processes and the activation of other cognitive skills are perceived as inherent parts of the process of simultaneous interpreting.

It appears that the interpreter needs to have a significant cognitive capacity at their disposal. The multitasking of simultaneous interpreting has been represented in Gile’s Effort Models. Gile (1995: 161) assumed that:

- “[i]nterpreting requires some sort of ‘mental energy’ that is only available in limited supply;
- [i]nterpreting takes up almost all of this mental energy, and sometimes requires more than is available, at which times performance deteriorates”.

Hence, the interpreter’s cognitive capacity may sometimes turn out to be insufficient to successfully perform an interpreting task. In order to better understand the cognitive demands of interpreting, the author enumerated the main cognitive efforts involved in the process. As suggested by Gile (1995), the process of simultaneous interpreting consists of the following cognitive components:

- the Listening and Analysis Effort (L);
- the Short-term Memory Effort (M);
- the Speech Production Effort (P);
- the Coordination Effort (C) which coordinates the three efforts mentioned above (Gile 1995: 169; 2009: 168).
1.4.1. The Listening and Analysis Effort

Gile characterised the Listening and Analysis Effort as “consisting of all comprehension-oriented operations, from the subconscious analysis of the sound waves carrying the source-language speech which reach the interpreter’s ears through the identification of words to the final decisions about the ‘meaning’ of the utterance” (Gile 1995: 162). When interpreting, the conference interpreter constantly needs to decode the meaning of the words and structures uttered by the speaker in order to be able to convey the same meaning in the target language later on in the process. Quite suggestively, Gile made a distinction between listening and analysis. The mere listening to the source speech is insufficient: the interpreter’s task is to decipher the meaning of the source speech, to get to the deep structure of what is being communicated by the speaker. During the process of simultaneous interpreting, interpreters need to constantly analyse the content of the source speech, forming a deverbalised meaning (the Interpretive Approach, Seleskovitch 1968; Seleskovitch and Lederer 1984). The necessity to relate linguistic signs to constructs of the extra-linguistic reality makes comprehension in simultaneous interpreting a non-automatic process (Gile 2009: 162).

There are some factors which might force interpreters to invest more cognitive effort in listening and analysis. In some situations, such as interpreting extremely fast speakers, the task is impossible to be executed because of the overwhelming mental overload that the interpreter would experience. It might happen that processing requirements for comprehending the source speech exceed the interpreter’s cognitive capacity which would be reflected in errors and omissions in their interpretation. “High density of the information content” may have a detrimental effect on interpreting quality (Gile 2009: 193). For instance, syntactic complexity of the source speech, often resulting from the fact that the speech is delivered by reading it out, can compromise the interpreter’s comprehension and the quality of the interpretation. Another factor which might possibly trigger processing problems is the speaker’s foreign accent. Having to deal with the speaker’s strong accent might also mean that the interpreter needs to use the available processing capacity to the Listening and Analysis Effort. This, in turn, may impair the interpreter’s memory capacity and production in the target language.
1.4.2. The Short-term Memory Effort

During the process of simultaneous interpreting, the interpreter must constantly use his short-term memory capacity. As there is a lag between what the speaker and the interpreter produce, some information must be stored in the interpreter’s short-term memory, before they provide their interpretation in the target language. The interpreter must wait with interpreting until he or she has heard, understood and correctly analysed a meaningful interpreting unit. Such a unit is understood as a chunk of speech in the source language which is understandable only in its entirety and carries a specific meaning that cannot be divided into smaller units (Lederer 1978).

The notion of short-term memory, used by Gile (1995), has been introduced by Atkinson and Shiffrin (1968). The authors proposed a human memory system divided into three memory stores: sensory memory, short-term memory (STM) and long-term memory (LTM). The memory system is presented in Figure 1:

![Fig. 1. Structure of the memory system (Atkinson and Shiffrin 1968: 93).](image-url)
As can be seen in Figure 1, external input first enters the *sensory register* “where it resides for a very brief period of time, then decays and is lost” (Atkinson and Shiffrin 1968: 90). Two components of sensory memory have been researched in cognitive psychology: *echoic memory*, i.e. the register which retains auditory information, and *iconic memory* which stores visual information (Nęcka et al. 2006: 340). When the information is attended to, it can enter the *short-term store*. Information can be stored in STM for about 30 seconds but “a control process called rehearsal can maintain a limited amount of information in this store as long as the subject desires” (Atkinson and Shiffrin 1968: 90f.). The short-term store was traditionally believed to have a capacity of around 7 items (plus or minus 2) (Miller 1956), however, Cowan (2001) has suggested that human STM has a smaller capacity limit, i.e. 4 elements. Information in STM which is no longer attended to, can be lost. Atkinson and Shiffrin (1968: 91) define the last memory component, i.e. the *long-term memory*, as “a fairly permanent repository for information, information which is transferred from the short-term store”. Its duration is permanent (although may be subject to forgetting and decay) and its capacity seems to be unlimited. It should be noted that transfer of information from LTM to STM is also possible (1968: 90). LTM may activate a given piece of information which is brought to the person’s attention at a specific point in time.

In his Effort Models, Gile used Atkinson and Shiffrin’s concept of STM. There are some factors which influence the extent to which interpreters use their short-term memory capacity (Gile 2009: 166). The case of German verb-final structures serves as a good example of the issue in question. Due to the fact that in some German complex sentences the main verb is placed at the end of the sentence, interpreters must sometimes wait until the whole structure is produced and only then convey the meaning in the target language. In such cases, the Short-term Memory Effort might take up a significant amount of the interpreter’s processing capacity which might impair comprehension and production. German verb-final clauses might be problematic for trainee interpreters. During interpreting courses, trainees are instructed on how to use the anticipation strategy which might be a good solution to the problem of verb-final structures in German. Apart from syntactic complexity of the source-language speech, information density and a vague, illogical structure of the speech may force the interpreter to store and manipulate more information in the short-term memory. Gile (2009: 171)
provides the readers with examples of enumerations, proper names and numbers, all of which might be problematic for interpreters in simultaneous interpreting due to density of information which they contain.

1.4.3. The Speech Production Effort

The Speech Production Effort was defined by Gile (2009: 163) as “the set of operations extending from the mental representation of the message to be delivered to speech planning and the performance of the speech plan, including self-monitoring and self-correction when necessary”. In other words, the Speech production Effort is not limited to the mere verbalisation of the message in the target language, but is also encompasses the interpreter’s ability to self-monitor what they are uttering.

Speech production appears to be of great importance in conference interpreting. Interpreting output is an element of the interpreting process which is available to the users who have certain expectations as to its quality. According to Gile (2009: 163) one of the main difficulties of production in simultaneous interpreting is that interpreters are not free to express themselves and they may often “find themselves forced to follow rather closely the path chosen by another speaker” (Gile 2009: 163). A fast speaker may again pose a serious problem to the interpreter. Having to adjust to the speakers’ speed of delivery and being focused on a clear articulation and grammatical rules of the target language, the interpreter might feel overwhelmed and all of their mental capacity might be taken up by the Speech Production effort. This, in turn, might impair comprehension of the incoming speech and short-term memory skills.

1.4.4. The Coordination Effort

As proposed by Gile (2009: 168), the Coordination Effort “corresponds to resources required to coordinate the three other Efforts”. The relationship between the cognitive efforts, as proposed by Gile, is represented in the following equation:

\[ SI = L + P + M + C \]
where SI stands for simultaneous interpreting, L represents the Listening and Analysis Effort, P – the Speech Production Effort, M – the Short-term Memory Effort and C – the Coordination Effort. Apart from investing their mental capacity to the processes such as comprehension of a source speech, storing and manipulating the information in the short-term memory, self-monitoring and verbalising the meaning of the source speech in the target language, interpreters need to have some additional processing capacity at their disposal which is used to coordinate the three other cognitive efforts.

1.4.5. Efforts combined: Operation of the models and comments

One of the central principles of Gile’s Effort Models is that every interpreter has their own general processing capacity as well as capacities available for the four separate efforts: the Listening and Analysis Effort, the Speech Production Effort, the Short-term Memory Effort and the Coordination Effort. The supply of the interpreter’s mental energy is, however, limited and may turn out insufficient to perform a given interpreting task. This corresponds nicely to Kahneman’s (1973) capacity theory of attention. In order for the interpretation to be successful two requirements must be met: (1) the total cognitive capacity of the interpreter must equal or be greater than the total processing requirement of the task, and (2) none of the four separate cognitive efforts requirements described above may exceed the corresponding available processing capacity (Gile 1995). There are several problem triggers which might influence the amount of cognitive effort invested in performing a given interpreting task. Some of them, such as: numbers, fast speakers and morphosyntactic features of the source language have been already mentioned. However, they will be described in detail in Section 1.9.

The idea of “the tightrope hypothesis” (Gile 1999) metaphorically presents the interpreter being exposed to work close to saturation level. Just like a rope walker who needs to balance his body, the interpreter needs to sensibly invest their mental capacity in a simultaneous interpreting task. Gile summarises the main idea of his hypothesis by stating that “most of the time, total capacity consumption is close to interpreter’s total available capacity, so that any increase in processing capacity requirements and any instance of mismanagement of cognitive resources by the interpreter can bring about
overload or local attentional deficit (…) and consequent deterioration of the interpreter’s output” (Gile 1999: 159). Gile holds that when the interpreter’s cognitive capacity is much greater than the capacity requirement of an interpreting task, potential errors and omissions are likely to result from the complexity of the source speech. He was interested in a situation when the source speech itself is relatively easy but the interpreter still makes mistakes and omits certain information. Gile claims that this is the result of working close to saturation level when the interpreter’s processing capacity is insufficient to provide an error-free interpretation (“the tightrope hypothesis”, Gile 1999).

This hypothesis has been corroborated by Gile in an empirical study. Ten professional interpreters were asked to interpret the same text twice in a row. It turned out that some segments which had been interpreted correctly in the first performance, were interpreted inadequately during the second interpretation, which led Gile to believe that this was the result of processing capacity deficits (Gile 1999: 160). When discussing the results of the experiment, Gile enumerated particular examples of errors and omissions emphasising whether they were corrected in the second version or not. He also listed instances of new errors and omissions in the second interpretation which served as a corroboration of the tightrope hypothesis.

To summarise, Gile’s models serve as a theoretical representation of mental operations involved in the process of simultaneous interpreting. They present the processing complexity of simultaneous interpreting tasks. The “tightrope hypothesis” is an illustrative concept which identifies that some mistakes made by interpreters result not from inherent difficulties of a source speech but from the fact that interpreters often work close to saturation level in the case of which they have run out of their cognitive capacity to be able to provide a high-quality interpretation.

Although not developed on the basis of empirical data, Gile’s Effort Models have become a well-known and frequently cited theoretical representation of cognitive demands involved in the process of simultaneous interpretation. The models prove useful in interpreter training as they constitute an illustrative representation of multitasking inherent in SI. They might help students understand which cognitive efforts are necessary to perform a simultaneous interpreting task and what might happen if such efforts outweigh the interpreter’s processing capacity. Gile’s assumptions have also been confirmed in some empirical studies on the impact of the speaker’s foreign accent on interpreting quality (e.g. Kurz 2008; Lin, Chang and Kuo 2013). In these experiments, com-
promised interpreting quality can indeed be explained with reference to higher cognitive processing requirements for the Listening and Analysis Effort.

However, potential limitations of Gile’s theory should be pointed out. First of all, Gile (1995) seems to turn a blind eye to the dynamics of the process of simultaneous interpreting. Although Gile (1995) points to variables which might result in an increment of processing difficulty (e.g. strong accent, fast rate of delivery), he focuses mainly on the capacity-sharing aspects of interpreting. In this way he neglects the fact that the interpreter’s processing difficulties and the ability to perform several tasks concurrently might change in time. In other words, it might be stated that Gile discusses the notion of multitasking globally rather than locally. Secondly, in compliance with Kahneman’s (1973) capacity theory, Gile assumes that there exists a single pool of cognitive resources available to the interpreter. Also, as suggested by Seeber (2011: 189), Gile’s model “implicitly assumes that resources can be shifted and re-allocated between or among tasks, which finds little support in the literature”. Thirdly, although Gile mentions the process of automation of translinguistic equivalences (2009: 205), he does not provide a comprehensive explanation of how the allocation of the interpreter’s cognitive resources to specific efforts changes with further training. He rather focuses on the allocation of cognitive efforts in favourable and unfavourable interpreting conditions (e.g. fast speakers, foreign accent etc.). Some of these problems were touched upon by Seeber (2011) in his Cognitive Load Model.

1.5. Seeber’s Cognitive Load Model

In his proposal, Seeber (2011) argues with Gile’s Effort Models (1995) and Kahneman’s (1973) single resource theory both of which make one believe that “all tasks involved in the SI process draw on one and the same pool of undifferentiated resources” (Seeber 2011: 189). Seeber’s model is based on Wickens’ (1984) Multiple Resource Model “in which the combination of two (or more) tasks requires more processing capacity than either (or any) of the tasks performed individually” (2011: 187). Seeber attempts at quantifying the cognitive demands inherent in simultaneous interpreting. He assumes that the amount of processing difficulty might depend on the modality of the task to be performed (i.e. visual, spatial, verbal, etc.). Seeber divides the SI process into
stages which are characterised by a different level of multitasking. The conflict matrix of simultaneous interpreting in which different modalities are listed is presented in Figure 2:

![Conflict matrix of simultaneous interpreting by Seeber (2011: 188).](image)

Fig. 2. Conflict matrix of simultaneous interpreting by Seeber (2011: 188).
As seen in Figure 2, Seeber (2011: 188) created a formula to calculate the total interference score showing “the amount of load generated by individual concurrent tasks” (Seeber 2011: 187). The most problematic situation appears when two tasks which need to be performed are of the same modality (the highest values of conflict coefficients). In this case, the danger of working close to saturation level, as understood by Gile (1995), is the most considerable.

Seeber (2011) placed a lot of emphasis on the notion of syntactic asymmetry between the source and the target language (e.g. German and English). He discussed the main interpreting strategies which might be used by interpreters in such a situation. For example, waiting is understood by Seeber as a strategy which involves halting production in the target language until the interpreter gets enough input to make sense of the whole interpreting chunk (Seeber 2011: 193). Stalling resembles waiting as the interpreter waits for more input before the encoding stage. However, it “postulates the production of ‘neutral padding’ (...) which fills the gap without adding any new information” (Seeber 2011: 193). Stalling can be perceived as being more listener-friendly, as interpretation users are not exposed to unnaturally long pauses in interpreting output. Chunking, the next strategy, “refers to the process whereby interpreters segment the input into smaller fragments that can be encoded without having to wait for the entire sentence to unfold” (Seeber 2011: 194). Chunking is referred to by Jones (2002) as the salami technique. This might be extremely useful in simultaneous interpreting from German into English. Instead of waiting for the main verb placed in German complex sentences in the final position, the interpreter starts verbalising their interpretation by means of creating the meaning from the information that they have already heard. The last strategy discussed by Seeber (2011) is anticipation. It can be understood as predicting a part of the speech in the source language before it has been produced by the speaker (Seeber 2011: 195).

Anticipation as an interpreting strategy has been widely discussed in Interpreting Studies (e.g. Jörg 1997; Van Besien 1999; Vandepitte 2001; Bartłomiejczyk 2008). It might be useful in simultaneous interpreting for two reasons. First of all, “cognitive resource demands appear to remain close to baseline values with the exception of the actual inference processing (...) which is believed by many to recruit cognitive resources” (Seeber 2011: 195). What is more, thanks to anticipation the interpreter can shorten the ear-voice span (i.e. the time lag between the moment a given unit is uttered...
by the speaker and the time when it is rendered by the interpreter) and prevent the spillover effect, understood as an increase in cognitive load which might happen when the interpreter waits too long before he or she starts interpreting (Seeber 2011: 193).

To summarise, based on Wickens’ (1984) Multiple Resource Model Seeber (2011) modified Gile’s theoretical representation of the SI process by assuming that there exists no single pool of the interpreter’s cognitive resources. Moreover, by taking into account specific conflict coefficients he attempted to show the dynamics of multi-tasking involved in simultaneous interpreting. In this way, he demonstrated a more accurate representation of the cognitive effort(s) inherent to SI. Using the example of the German-English syntactic asymmetry, he also provided examples of interpreting strategies used in simultaneous interpreting to deal with the problem.

However, it should be borne in mind that Seeber’s model has been developed only for one language pair, i.e. German-English. In order to be considered applicable to other language pairs, more empirical data should be collected. Moreover, it appears that Seeber (2011) does not provide a sufficient explanation of how specific conflict coefficients were calculated, e.g. 0.7 for cognitive-spatial vs. visual-spatial modality compared to 0.6 for auditory-spatial and visual-spatial modality.

To summarise, both Gile (1995) and Seeber (2011) focus on the capacity-sharing aspects of simultaneous interpreting. In the next sections I will discuss the three main processing models of simultaneous interpreting (Gerver 1975; Moser-Mercer 1978; Darò and Fabbro 1994) in which a temporal course of SI comes to the foreground. The concept of interpreters’ memory is one of the important elements of the models. That is why Baddeley’s (2000) working memory model, which is directly referred to in the model developed by Darò and Fabbro (1994), will be described here in detail.

1.6. Baddeley’s working memory model

Baddeley (2000: 418) defines working memory as “a limited capacity system allowing the temporary storage and manipulation of information necessary for such complex tasks as comprehension, learning and reasoning”. When compared to short-term memory (Atkinson and Shiffrin 1968) which stores memory traces, working memory is a much more dynamic system which enables an individual to perform cognitive opera-
tions at a given time. As phrased by Baddeley (2000a: 77), short-term memory is a “unitary store”, while working memory should be perceived as “a multicomponent system that utilized storage as part of its function of facilitating complex cognitive activities such as learning, comprehending and reasoning”. The initial working memory model proposed by Baddeley and Hitch (1974) consisted of three basic components: the central executive, the phonological loop and the visuospatial sketchpad (the tripartite structure):

![Diagram of working memory model](image)

**Fig. 3.** The initial model of working memory (Baddeley and Hitch 1974).

In 2000, however, the fourth component was added to the working memory model, i.e. the episodic buffer. The reformulated version of the model (Baddeley 2000) has been presented here in Figure 4:
The central executive constitutes an attentional control system which is aided by the following slave systems: the phonological loop, the visuo-spatial sketchpad and the episodic buffer, the last of which was added in the reformulated version of the model.

The *central executive* controls the operation of slave systems as well as manages one’s attention and cognitive resources. The *phonological loop* stores acoustic and verbal information, hence it plays a pivotal role in the process of language acquisition. It is also of great importance in simultaneous interpreting, where the interpreter needs to decipher what the speaker has just said and store this information in their working memory. The phonological loop comprises two separate components: the *phonological store* “in which an acoustic or phonological memory trace is held” (Baddeley 2000a: 83) and the *subvocal articulatory rehearsal*, i.e. a more active component of the loop, which can revive these traces. In contrast to the phonological loop, the *visuo-spatial sketchpad* holds visual and spatial information (Baddeley 2000a: 83). The visual component of the sketchpad is used in visualisation when one creates a mental image of what he or she hears or experiences. Visualisation is known to be one of the mnemonics which constitute a useful memory aid also in conference interpreting (Jones 2002: 29).

As already mentioned, in 2000 Baddeley added a new component of working memory, i.e. *the episodic buffer*, also controlled by the central executive. “The episodic buffer is assumed to be a limited-capacity temporary storage system that is capable of integrating information from a variety of sources” (Baddeley 2000: 421, emphasis
mine). It might seem that in the previous version of the working memory model the main focus was on the separation of roles performed by different components. Adding the episodic buffer pointed to the integrative nature of information stored in the working memory. The buffer stores integrated information from the phonological loop, visuo-spatial sketchpad as well as long-term memory (LTM). To summarise, by creating a reformulated version of the model, Baddeley stressed the importance of coordination and the relationship between working memory and LTM (Baddeley 2000: 422).

1.7. Processing models of simultaneous interpreting

One of the first processing models of simultaneous interpreting has been developed by Gerver (1975). One of the main characteristics of the model is that it presents simultaneous interpreting as a highly dynamic process. According to Moser-Mercer (2002: 150) two main aspects of the SI process, as illustrated by Gerver (1975), can be identified: “permanent structural features (various types of memory systems)” and “control processes to be selected at the option of the interpreter”. The graphic representation of the SI process, as proposed by Gerver (1975), is presented in Figure 5:
Gerver assumes the existence of a “buffer store” in which information can be temporarily stored and from which the interpreter can acquire knowledge when he or she is ready to provide the interpretation in the target language. The interpreter’s task is to decode the meaning of the source speech by going from surface to deep structure. According to Gerver (1975: 126) and his model, interpreters might begin output immediately, or they might wait to verify whether the segment of the speech that they have heard is a meaningful interpreting unit. When the interpreter’s rendition is accurate, they might proceed; if not, output can be stopped before the interpreter makes a decision whether to correct his or her mistake or not.

In his model of simultaneous interpreting, Gerver emphasised the notions of “continuous generation, monitoring and testing of the translation against the source language as understood by the interpreter” (Gerver 1975: 127). In other words, Gerver claimed that self-monitoring was a crucial and integral part of the process of simultaneous interpreting. Another novelty was that Gerver (1975) emphasised that both short-term and long-term memory systems are involved in the process of SI. While STM is
responsible for the temporary storage of information necessary to perform a given interpreting task, LTM activates linguistic items (Timarová 2008: 12). It is worth emphasising that Gerver's model was developed as early as the 1970s when the cognitive approach to conference interpreting had just started and was far from being dominant. Gerver's graphic representation of the SI process stresses the dynamics of simultaneous interpreting and points to the importance of self-monitoring as an inherent part of the interpreting process.

Another processing model of simultaneous interpreting was developed by Moser-Mercer (1978). In her model, she provided a moment-by-moment description of the tasks and processes which simultaneous interpreting encompasses. Moser-Mercer's model (1978) which, as the author herself puts it, "represents a flow diagram of the temporal course of simultaneous interpretation" (Moser-Mercer 2002: 150), is presented in Figure 6:
The processing model by Moser-Mercer (1978) represents both bottom-up and top-down processes (Moser-Mercer 2002: 151). Bottom-up processes relate to decoding what the speaker is saying on the phonetic level, parsing the syntactic structure and processing the input. Top-down processes, on the other hand, should be understood as the activity of integrating prior general, linguistic and contextual knowledge with the input to be processed. Whereas working memory is involved in bottom-up processes, the interpreter’s LTM is activated to perform top-down processes (Moser-Mercer 2002).

Similar to Gerver’s model (1975), Moser-Mercer’s model stresses the dynamic character of the SI process and emphasises the role of self-monitoring. While performing a simultaneous interpreting task, the interpreter listens to the string of perceptual units and recognises meaningful chunks. Moser-Mercer introduces the concept of general abstract memory (GAM) which can be understood as short-term memory in which
linguistic information is stored (1978: 356). When the meaning is understood, the interpreter activates “the TL [target language] elements residing at the nodes of the conceptual network” (Moser-Mercer 1978: 355). When the activation is complete, the interpreter starts to produce the output in the target language.

An important element of the model, which distinguishes Moser-Mercer’s theoretical representation of the SI process from the one proposed by Gerver (1975) is the prediction possible node. Moser-Mercer noticed that in some situations the interpreter can discard the input since they are able to predict what the speaker is going to say. Moser-Mercer gives examples of resources which make it possible for the interpreter to predict the input: “[e]xtensive exposure to a particular language, or two or more languages, relevant syntactic knowledge, contextual knowledge (knowledge of the subject matter under discussion in a conference, as well as knowledge of the ongoing discussion in a conference)” (Moser-Mercer 1978: 360).

Darò and Fabbro (1994) also developed a model of simultaneous interpreting in which they used the concepts of working memory and long-term memory. The model is presented in Figure 7:

Fig. 7. Model of simultaneous interpreting by Darò and Fabbro (1994).
The model of Darò and Fabbro (1994) centres around the notion of memory and its role in simultaneous interpreting. When creating the model the authors used two already existing principles of memory, i.e. Baddeley and Hitch’s working memory (1974) and the concept of sub-types of long-term memory (LTM) proposed by Tulving (1972). In order to transfer meaning from the source language into the target language, the interpreter needs a specific processing capacity. Darò and Fabbro (1994) emphasise the role of phonological store and subvocal rehearsal in the process of SI. However, one of the most crucial characteristics of the model proposed by Darò and Fabbro (1994) is that there exists a link between working memory and long-term memory, the latter of which comprises episodic memory (i.e. memory of a given event), semantic memory (i.e. memory of facts) and procedural memory (i.e. memory on how to perform certain operations) (Tulving 1972).

Although Darò and Fabbro (1994) use the concept of working memory proposed by Baddeley and Hitch (1974), in their own model they refer only to one of the slave systems, i.e. the phonological loop. Although storing visual data by means of visualisation may have an influence on the interpreting process, the visuo-spatial sketchpad was not included in the model by Darò and Fabbro (1994). Timarová (2008: 16) states that although the authors of the model adopted the notion of the central executive, they did not specify its task or specific functions. However, the model by Darò and Fabbro (1994) constitutes an attempt to translate the role of human memory into the conference interpreting reality.

1.8. Processing models revisited: Summary and comments

The main aim of this section was to discuss the main processing models of simultaneous interpreting. Gerver (1975), Moser-Mercer (1978) as well as Darò and Fabbro (1994) made an attempt to develop a graphic representation of the SI process. In contrast to Darò and Fabbro (1994), Gerver (1975) and Moser-Mercer (1978) see interpreting as a highly dynamic process and try to display moment-by-moment changes in their models. By stressing the importance of self-monitoring and the interaction between top-down and bottom-up processes, they also present simultaneous interpreting as a decision-
making process where the interpreter has a great influence on how the process would operate.

Although such graphic representations of the process of simultaneous interpreting might be useful from a didactic point of view, the models often lack empirical testing. They might refer to the concept of human memory but, in fact, it seems that the formulation of such models is not based on empirical studies in which the interpreter’s working memory capacity would be tested (Timarová 2008: 21). However, they might serve as an illustrative tool not only for professional interpreters and interpreting trainees but also for those who are interested in the cognitive and psycholinguistic components of the interpreting process.

Another problem of many processing models of SI is that they disregard the interpreting context, i.e. the factors which may have a great influence on the difficulty to perform a given interpreting task. None of the model presented here takes into consideration the distinction between different types of propositions which might influence the process. For instance, as they constitute non-contextual information, proper names and numerical data may be processed – and thus interpreted – in a different way than other lexical information. Moreover, processing models of SI also turn a blind eye to the effect of a given language pair on the interpreting process. One might expect that morphosyntactic features of a given language might determine the way in which an interpreting task will be performed. The problem triggers which might have a profound effect on the process of simultaneous interpreting will be discussed in the next section.

Finally, the models by Gerver (1975) and Moser-Mercer (1978) provide a comprehensive temporal representation of the process of simultaneous interpreting. However, the authors could elaborate more on the notion of bilingual language control, i.e. how the source and the target language are activated during the process of SI. Are words from the source language suppressed when the interpreter produces their interpretation (see, Inhibitory Control Model, Green 1998)? Does the interpreter possess separate language systems for all working languages (cf. Macnamara and Kushnir 1971)? And should we talk more of language systems or specific “input and output processing mechanisms” (cf. de Groot and Christoffels 2006: 197; Grosjean 2001)? All these questions seem to remain unresolved in the processing models of simultaneous interpreting described in this chapter. These issues have recently gained prominence in research on bilingual control, the description of which is beyond the scope of this thesis.
1.9. When simultaneous interpreting gets really complicated: Selected linguistic problem triggers

The phrase “problem triggers” was used by Gile (2009: 188) who noticed that there are factors which are often perceived as problematic by conference interpreters. They often require extra processing capacity and, hence, may compromise interpreting quality. In subsequent sections selected problem triggers based on the works by Gile (2009) and Jones (2002) will be presented. I will focus on lexical and semantic features of the source language and disregard those problem triggers which are related to interpreting working conditions (e.g. noise, poor sound, lack of visual access to the speaker and conference materials, asymmetrical power relations between the interpreter and the speaker/the audience) and the interpreter’s personality (e.g. lack of resistance to stress). Some of the factors which will be discussed in the next sections have been highlighted when presenting Gile’s Effort Models. They will be discussed now in detail: I will attempt to explain why they are often perceived as problematic in the interpreting community and provide examples of empirical studies which have been conducted on these recurrent problems. Examples of strategies which might reduce the cognitive load involved in the processing of these propositions will also be provided.

1.9.1. Numerical data

Conference interpreters often report that interpreting numbers is a challenging task to perform. Research on numbers as a type of proposition suggests that numerical data can be treated as a distinct form of representation of the world in the human mind (Nęcka 2006: 84). From a psycholinguistic point of view, numerical data might be regarded as problematic due to their low predictability, low redundancy and high informative content (Mazza 2001). In other words, rarely can one derive the meaning of a given number from the context (low predictability). The arithmetic value is expressed only once by the speaker (low redundancy). What is more, numerical data carry specific meaning which is often crucial to understand the content of the speech (high informative content) (Mazza 2001: 90). Jones (2002: 117) states that numbers “can be absolutely crucial pieces of information where no error is permissible. In particular, numbers have an objective
meaning and are in no way open to linguistic interpretation”. Jones also mentions that interpreting numbers in SI is complex as numerical data consist of five distinct elements which need to be rendered correctly by the interpreter: (1) the arithmetic value, (2) the order of magnitude (e.g. million vs. billion), (3) the unit (e.g. currency), (4) the extra-linguistic element that the number refers to and (5) the relative value of a given number (e.g. increase vs. decrease) (Jones 2002: 117f.).

Braun and Clarici (1996) developed a model of numerical data processing in which they suggested that numbers are interpreted in a more word-to-word fashion than other linguistic items. According to the interpretive school of interpretation, interpreters deverbalise the message which is uttered by the speaker in the source language and then transpose it onto the target language (Seleskovitch 1976). In other words, at the stage of decoding, the interpreter forms a mental representation of the content of the source speech. In this way, the process of interpreting is meaning-based, not literal and automatic (word-to-word). However, in the case of numerical data, this seems not to be the case. Braun and Clarici (1996 : 87) suggested that deverbalisation is not present in the interpretation of numerical data which might mean that number interpreting and interpreting of other linguistic data could in fact be regarded as separate processes.

What strategies can be used by the interpreter to reduce the cognitive load related to number interpretation? Jones suggests that writing down numbers can be helpful (2002: 119). In this way, the interpreter does not need to store the information on the number’s arithmetic value in their working memory. Using a boothmate’s help might also be useful. If the interpreter has a general problem with processing numbers, the boothmate might write down all the numbers for him or her. Thanks to this help, the interpreter will save some processing capacity which may enhance interpreting quality. Access to visual materials (e.g. conference slides) may also reduce the cognitive load involved in the process of number interpretation. Empirical data suggest that interpreters tend to perform better when accompanied with slides containing numerals used in the speech (Korpal and Stachowiak 2013).
1.9.2. Proper names

Interpreting proper names is similar to interpreting numbers in that deverbalisation, as understood by Seleskovitch (1976), is not involved in the process. In fact, the majority of proper names do not require interpretation as such at all. Instead of being decoded, analysed, deverbalised and encoded in the target language, they are merely transcoded, while transcoding is understood as “a simple, mechanistic conversion of signs into other signs” (Meyer 2008: 107).

Still, dealing with proper names in interpretation might transpire to be problematic for interpreters. Gile (1995: 173) perceives names as a problem trigger in interpreting, especially when they do not sound familiar to the interpreter. He stresses that “names whose language version is unknown to the interpreter, sharply increase the capacity requirements of the Memory Effort” (Gile 1995: 173). Hence, although proper names are not deverbalised, they might be problematic in interpreting, especially when interpreters need to learn their pronunciation by heart and cannot relate these names to any extralinguistic objects. Meyer (2008: 107) mentions another important feature of names and emphasises that “their use assumes a great deal of common knowledge between speaker and listener” (Meyer 2008: 107). In some cases, the interpreter’s failure to transcode a given proper name correctly may humiliate them in front of the speaker and the audience. It should also be noted that proper names, similar to numerical data, often consist of several elements. For example, when a keynote speaker is presented at the opening of the conference, there is a great chance that, apart from their name and surname, their academic title, position and affiliation would be provided. Ideally, the interpreter should be able to render all this information in the interpretation. In practice, however, the interpreter at times prioritises the information and, when working close to saturation level (Gile 1995), he or she may omit part of the proper name which is of lesser significance in the communicative situation (e.g. the delegate’s first name).

Similar to numbers, writing proper names down or asking a boothmate to do so may reduce the cognitive load related to storing the linguistic element in the interpreter’s working memory. Also, interpreters should be advised to familiarise themselves carefully with conference materials beforehand, learn problematic proper names by heart and look them up in the pronouncing dictionary.
1.9.3. Enumerations

According to Gile (2009: 205), enumerations may impose a significant load on the interpreter’s short-term memory. He points to the problematic nature of enumerations and claims that they are “dense, as they consist of information elements put next to each other without grammatical or other words or word groups of low information density in-between” (Gile 2009: 193). The more elaborate the list, the more elements need to be temporarily stored in the interpreter’s working memory. Since human working memory capacity is limited, storing too many elements at the same time may lead to forgetting and, in turn, result in the decrease in interpreting quality.

An empirical study on enumerations in simultaneous interpreting was conducted by Shlesinger (2003). The researcher used recordings containing numerous lists of attributive modifiers followed by a noun. One of the examples has been provided below:

- “No less annoying was a stupid, biased, shocking, public account.” (Shlesinger 2003: 42)

The experiment involved simultaneous interpretation from English (B language) into Hebrew (A language). In the course of the experiment the author wanted to check how many adjectives would be retained in interpreting output. It turned out that in the case of about one third of all strings not a single modifier was present in the interpretation. The author of the study concluded that “the dramatic loss of information (i.e. the omission of most of the items in the strings comprising the experimental materials) may be accounted for both as a by-product of WM [working memory] limitations and as the result of the subjects’ strategic decisions” (Shlesinger 2003: 45).

In order to reduce the cognitive load related to interpreting lists of elements, the interpreter can shorten the ear-voice span, i.e. the time elapsed from the speaker’s uttering a given element to its rendition in the interpreter’s output. In this way the information is stored in the working memory for a shorter period of time. It might also be a good idea to start with the last element(s), especially in the case of proper names. If the elements are easy to be transcoded, the interpreter might use their echoic memory (Gile 2009: 206). Of course, the strategy adopted depends on the type of list to be interpreted. If the speaker provides examples to illustrate an idea, changing the order of elements...
seems to be a useful strategy. However, if the elements have been ordered chronologically by the speaker or there is a causal relationship between them, the interpreter is not allowed to manipulate the order of items. In such a case, shortening the EVS seems to be a better idea.

1.9.4. Morphosyntactic features of the source language

The existence of the morphological typology of languages suggests that languages differ in how morphemes are combined to create lexemes. Also, languages may be classified by means of word order and other syntactic features. Studying the process of written translation, Catford (1978) noticed that translators often need to depart from formal correspondence by changing the syntactic structure of the original language (the so-called translation shifts). The question of the influence of morphosyntactic features of the source language on the process of simultaneous interpreting has been researched by some interpreting scholars (Jörg 1997; Riccardi 1996; Setton 1999; Seeber 2011; Hodzik 2013). German, characterised by verb-final structures and extensive nominal morphology, has often been discussed in this context.

Setton (1999: 128) points out that the structural characteristics of a given language might impact the amount of cognitive effort involved in performing an interpreting task. Riccardi (1996) carried out an experimental study in which she compared interpreting from English into Italian with interpreting from German into Italian. She investigated how interpreting students, recent interpreting course graduates and professional conference interpreters deal with German-Italian interpreting and whether they use anticipation strategies. It turned out that “[i]t is language specific difficulties which may still be a problem for interpreters” (Riccardi 1996: 216ff). Anticipation proved to be a commonly used German-to-Italian interpreting strategy. Elsewhere, Seeber (2011) concluded that word order asymmetry between the source and the target language might generate additional cognitive load on the part of the interpreter. Seeber and Kerzel (2011) corroborated the hypothesis that interpreting German verb-final structures is more cognitively demanding than interpreting verb-initial structures. Similarly, Hodzik (2014) conducted an empirical study in which she identified that word order has an influence on prediction in simultaneous interpreting from German into
English. She concluded that the results she obtained “underline the importance of language-specific sentence structure during SI” (Hodzik 2014: 10). To summarise, research conducted in the field seems to suggest that morphosyntactic features of the source language might be problematic in conference interpreting, especially when there exists a structural asymmetry between the source language and the target language.

1.9.5. Strong foreign accent

“Strong foreign or regional accent” has been listed by Gile (2009: 171) as one of the most common problem triggers in interpreting. The problem with strong foreign accent is that it might increase processing capacity requirements for the Listening and Analysis Effort (Gile 2009: 193). When the speaker speaks with a strong or regional accent, the interpreter is forced to channel a great deal of their mental energy into decoding the meaning of the speaker’s utterances. In this way only little capacity is left to other processing efforts. To give an example, the interpreter’s output might be compromised as a result of directing too much energy to analysing the source speech on a phonetic level.

The assumption that foreign accent may increase the interpreter’s processing capacity requirement has been confirmed in some empirical studies. Kurz (2008) identified the negative effect of non-native English speech on the performance of interpreting trainees in simultaneous interpreting. Lin, Chang and Kuo (2013) studied the effect of foreign accent on rendition accuracy and concluded that among the most significant comprehension problem triggers in simultaneous interpreting were: “deviated North American English post-vowel /r/, intonation and rhythm” (2013: 30). Also McAllister (2000) obtained results which suggested that interpreters may suffer from the effects of the speaker’s foreign accent (2013: 61).

In order to deal with the speaker’s foreign accent in the booth, interpreters sometimes wait longer before they start interpreting; a wider context can make it easier for them to understand what the speaker is saying. Nevertheless, lengthening the ear-voice span might backfire on the interpreter’s working memory, i.e. some information might be forgotten as a result of a greater number of units which must be stored in the working memory. It is difficult to find strategies that could help interpreters deal with strong accents as interpreters have little control over the speaker’s pronunciation. In such cases
visual access to the speaker and conference materials might be of crucial importance as it may compensate for the incomprehensibility of the aural input. Also, previous exposure to non-native speakers may be useful. Knowledge of the phonological system of a given language might also help in predicting speakers’ systematic mistakes, e.g. no r/l distinction in Japanese speakers or final devoicing by Polish speakers.

1.9.6. Rate of delivery

The rate of the speaker’s delivery has been often referred to as a factor which might affect the process of simultaneous interpretation (e.g. Gerver 1969; Barik 1973; Gile 1995). Gile (1995: 173) mentions “high rate of delivery” as a problem trigger; a factor that may make it impossible for the interpreter to provide a complete interpretation. High speed of delivery might affect the Listening and Analysis Effort, i.e. the interpreter might need some extra effort to deal with a fast speaker. This, in turn, may negatively affect interpreting output (the Production Effort) and distort the process of information storage in memory (the Short-term Memory Effort) (Gile 2009: 192). Also Jones (2002: 102f.) identifies fast speakers, especially those who read a text at speed, as problematic for interpreters.

However, sound arguments can be found which would prove that a very slow rate of delivery might also jeopardise the interpreter’s ability to provide a correct interpretation. As explained by Gile, (2009: 200), “[s]low delivery of speeches can be said to reduce cognitive pressure on listening and production, but if it is too slow, information elements have to be kept longer in short-term memory before they can be integrated into target speech sentences, which may cause cognitive saturation”.

In her study on enumerations in simultaneous interpreting, Shlesinger (2003) followed this logic of thinking and hypothesised that the interpreter’s performance would be better in the fast-rate condition. The participants in the experiment indeed rendered more adjectives at a higher presentation rate but the difference was not statistically significant (Shlesinger 2003: 43). In a study by Liu et al. (2004) on the effect of working memory skills and expertise on interpreting quality, delivery rate was also used as an independent variable. However, no general impact of presentation rate on interpreting quality was found (Liu et al. 2004: 35). The effect of high delivery rate on the number
of omissions was observed in the studies by and Dailidénaité and Noreikaité (2010) and Korpal (2012). In both experiments interpreting trainees omitted more information from the speech delivered at a high delivery rate. Also, there is evidence that anticipation accuracy decreases with a higher rate of input (Seeber 2005).

Jones (2002: 102) gives examples of strategies which might be appropriate for coping with fast speakers. For example, he suggests using the so-called salami technique which involves dividing one long sentence from the source speech into short consecutive sentences (Jones 2002: 92). The interpreter might need to strive for general economy of expression, simplify the speaker’s message or, if need be, omit some information and “convey as much as possible of the speaker’s meaning in as few syllables as possible” (Jones 2002: 102). Gumul and Łyda (2007) also suggest that economy of expression is a useful technique when dealing with time pressure in interpreting.

To summarise, in Section 1.9, selected problem triggers in simultaneous interpreting were discussed. As already suggested, a disadvantage of many psycholinguistic and processing models of SI is that they disregard the significant effect of lexical and semantic characteristics of the source speech on interpreters’ performance. My aim was to provide an overview of the most commonly discussed problem triggers, give examples of empirical research on the notions in question and suggest how interpreters might cope with these problems.

1.10. Conclusion

The main objective of this chapter was to look at simultaneous interpreting as a cognitive process. I discussed process-oriented research on conference interpreting, which stands in opposition to product-oriented approach. Based on Gile’s Effort Models (1995) and Seeber’s (2011) Cognitive Load Models, the cognitive efforts inherent in the process of simultaneous interpreting were discussed. The researchers’ valuable contribution to research on interpreting is that they make one reflect on the fact that simultaneous interpreting is a cognitive process in which a plethora of mental operations needs to be performed. The cognitive approach to conference interpreting makes one think that SI is indeed one of the most complex language tasks imaginable (Christoffels and de Groot 2005).
By discussing the cognitive and processing models of SI, I attempted to show how dynamic the process of simultaneous interpreting is. The model of Darò and Fabbro (1994) focuses on memory and its role in simultaneous interpreting. One of the central features of the model by Gerver (1975) and Moser-Mercer (1978) is that they present moment-by-moment changes in the process of simultaneous interpreting and, thus, confirm that SI can be regarded as a highly dynamic cognitive and linguistic process. One of the main problems of models is that they often constitute an over-simplified representation of the actual process. There is often no room to discuss the influence of external factors on the process. Hence, the final part of the chapter was devoted to the discussion of problem triggers in SI, understood as recurrent problems which are frequently referred to in the literature on conference interpreting (Gile 2009: 171).

The discussion of the cognitive approach to interpreting is crucial in this dissertation for two reasons. First of all, cognitive abilities constitute a significant part of interpreter aptitude, discussed here in Chapter 3. In the same chapter I will show how the cognitive approach to conference interpreting has been complemented by research on the psychological aspects of interpreting, including stress and stress coping. Also, the cognitive approach to simultaneous interpreting will be referred to in the final chapter of the thesis when discussing the results of the experimental study about the impact of delivery rate on interpreting accuracy.
Chapter 2: Stress: Psychological and linguistic measures

2.1. Introduction

The notion of stress has been widely discussed not only in medical research but also in social sciences such as psychology or pedagogy. Although psychological stress appears to be inherent in the life of every human being, defining the term is not an easy task. Numerous stress theories and stress models have emerged in recent decades; they conceptualise stress in different ways.

In the first part of the chapter I will discuss selected approaches to the notion of stress: the situational approach to stress developed by Holmes and Rahe (1967), the biologically-oriented stress-response theory by Selye (1936; 1956; 1974; 1976) and the transactional/relational theory of psychological stress by Lazarus and Folkman (1984). Then the notion of anxiety as an emotional reaction to stress will be discussed. Anxiety has been widely researched in the context of second language acquisition and language pedagogy. It has been perceived as a psychological factor that might hinder the process of language learning. Although interpreting training should not be perceived as foreign language teaching, it is assumed here that both foreign language students and interpreting trainees are exposed to anxiety in the classroom. In Section 2.7. I will focus on how stress, stress coping and anxiety have been operationalised in some psychometric instruments. The last part of the chapter will be devoted to both physiological and acoustic stress indicators used in empirical research.
2.2. The Social Readjustment Rating Scale (SRRS)

One of the possible ways to conceptualise stress is by looking at how specific events might result in a person’s feeling of anxiety and tension. Hence, stress might be discussed in terms of a stimulus coming from an individual’s environment (Bishop 2001: 178). In such theories it is assumed that there exist life events which have an inherent feature of being stress-provoking.

The Social Readjustment Rating Scale (SRRS) was developed by Holmes and Rahe to serve this purpose (Holmes and Rahe 1967; Rahe and Arthur 1978). The scale is composed of 43 empirically derived life events. In order to create the list the authors assigned an arbitrary value of 50 to “marriage” and then asked a number of patients to rate the amount of readjustment required for other life events in relation to marriage (Elvin 2004: 87). As a result, each item on the list was assigned a value pointing to the magnitude of a particular event and the amount of stress that it causes. The complete list of life events is presented in Figure 8:
Fig. 8. The Social Readjustment Rating Scale (Holmes and Rahe 1967: 216).

In the course of studies by Holmes and Rahe, participants were asked to mark the event which they had experienced in the previous 12 months (Bishop 2001: 178). If a person experienced a given life event more than once, the value was multiplied. Thanks to this procedure, the authors of the questionnaire were able to rate the level of stress that a given individual experienced in their life. The result was then translated into the probability of developing a stress-related physical or psychiatric illness by this person (Rahe et al. 1970).
To summarise, the Social Readjustment Rating Scale developed by Holmes and Rahe makes it possible to rate the amount of stress experienced by a given individual. It also serves a predictive purpose since it enables the authors to calculate the probability of developing a stress-related disorder as a result of a stressful experience. However, it should be noted that the SRRS neglects individual differences in experiencing and coping with stress. It seems logical to assume that coping with stress is subject to individual differences, i.e. people’s reactions to a given stimulus might be highly divergent. As phrased by Arnold: “[w]e cannot really speak of psychological stress without considering this subjective evaluation, for what is stress to one man may be a welcome challenge to another” (Arnold 1967: 126). By the same token, Appley and Trumbull (1967: 10) state that “[c]onsistent intra-individual but varied inter-individual psycho-biological response patterns occur in stress situations. The notion of a common stress reaction needs to be reassessed”. The subjectivity of stress coping will be emphasised in the transactional theory of stress by Lazarus and Folkman discussed in Section 2.4.

2.3. Hans Selye’s Stress Theory

Hans Selye developed a biological approach to stress in which stress is conceptualised as an individual’s physiological and psychological reaction to a given stimulus (Selye 1936; 1956; 1974; 1976). The term stress has been first defined by Selye as “the nonspecific response of the body to any demand for change” (1936: 32). Later on, the definition was rephrased and formulated as follows: stress is a “a state manifested by a specific syndrome which consists of all the nonspecifically induced changes within the biological system” (Selye 1976a: 64). As opposed to Holmes and Rahe, who concentrated on the stimulus itself, Selye focuses primarily on the physiological reaction to the stimulus. The reaction itself is referred to by Selye as stress, whereas the stimulus is known as a stressor. Hence, Selye’s stress theory may be regarded as reaction-oriented (Bishop 2001: 179; Heszen-Niejodek 2000: 17), or as the stress-response theory (Rice 2011: 22).

Central to Selye’s theory is the notion of the General Adaptation Syndrome (GAS) in which the author discusses stages of a generalised reaction to a given stimulus. The stages of the syndrome have been presented here in Figure 9:
In everyday situations, the organism functions at an optimal level of resistance and homeostasis. However, when the stressor exceeds an individual’s adaptive resources, the alarm reaction is initiated (Rice 2011: 24). The alarm reaction constitutes the first stage of the syndrome. It has been subdivided by Selye into “an initial shock phase (in which resistance is lowered) and a counter-shock phase (in which defensive mechanisms become active)” (Appley and Trumbull 1967: 3). The organism is concentrated on limiting the negative effects of the stressor, the sympathetic nervous system is activated in order to face the threat. The first stage is characterised by “autonomic excitability, adrenaline discharge, heart rate, muscle tone and blood content changes, and gastrointestinal ulceration” (Appley and Trumbull 1967: 3). During the second phase of GAS, the stage of resistance, maximum adaptation occurs (Appley and Trumbull 1967: 3). The organism continues to use its resources to fight the stressor. The organism mobilises its recourses to cope with the stressor which, unfortunately, might act to the detriment of other physiological and psychological functions (Bishop 2001: 183). As soon as the organism counteracts the adverse effects of the stressor, the body returns to the state of homeostasis. However, should the stimulus persist, the organism reaches the third stage of GAS, i.e. the stage of exhaustion when the adaptive mechanisms collapse (Appley and Trum-
bull 1967: 3). This, in turn, might lead to pathologies or even death of the organism (Terelak 1997: 14).

It is worth mentioning here that, apart from GAS, Selye also developed the idea of the Local Adaptation Syndrome (LAS) which produces more specific responses to a given stressor. LAS should be understood as the organism’s regional response to a stimulus, e.g. localised inflammation. The General and the Local Adaptation Syndromes are closely coordinated in overcoming the negative impact of a stressor (Rice 2011: 23).

Apart from modelling the General Adaptation Syndrome, Selye (1974) contributed to the psychology of stress by introducing a distinction between eustress and distress. The former refers to the positive aspects of stress, whereas the latter concentrates on the negative impact of stress on the organism. Eustress is also known as agreeable (healthy) stress whereas distress can be also referred to as disagreeable (pathogenic) stress (Rice 2011: 26). Although both of them produce similar physical reaction, unlike eustress, distress is considered to be detrimental to the individual’s health (Bishop 2001: 184).

To summarise, Selye developed the General Adaptation Syndrome model in which he described the effects of stress experience on the organism. It might be concluded that Selye contributed to the psychology of stress by modelling the body’s physiological response to a stressor. By means of operationalising the stage of exhaustion, Selye described the detrimental effects of prolonged stress on a human organism. However, Selye’s theory of stress has been criticised for a couple of reasons. First of all, Selye’s definition of stress and the concept of GAS seem not to “take into consideration cognition, perception, and interpretation of the stimulus” (Rice 2011: 26). Similar to the situational theory of stress developed by Holmes and Rahe, the stress-response theory seems to disregard individual differences in coping mechanisms and one’s perception of stimuli. What is more, scholars such as Mason (1975) criticise the fact that Selye put too much attention on the non-specifically induced changes as a result of the experience of stress. Finally, as noticed by Bishop (2001: 185), Selye focuses mainly on the organism’s biological response to a given stressor, thus, neglecting the role of non-biological and psychological processes which might be involved in stress response and coping with stress. This problem has been addressed in the transactional theory of stress developed by Lazarus and Folkman (1984) which will be discussed in the next section.
2.4. The transactional model of stress and coping

As already suggested, the situational and biological theories of stress seem to fail to recognise the importance of individual differences in reaction to and coping with stress. Several researchers expressed the need for a more individual approach to the notion of stress. To give an example, Appley and Trumbull (1967: 7) stated that “[w]ith the exception of extreme and sudden life-threatening situations, it is reasonable to say that no stimulus is a stressor to all individuals exposed to it”. In other words, what is stressful for one person can be positively stimulating for another. What is the reason for such divergent perceptions of a specific stimulus? The transactional theory of stress developed by Lazarus and Folkman has been well expressed in the following statement: “[p]eople use a wide variety of coping processes depending on their personal characteristics, the nature of the environmental demands and contingencies, and how these are appraised” (Lazarus 1977: 153). The aim of this section is to discuss the key assumptions underlying the transactional theory of stress, i.e. the cognitive appraisal and coping with stress.

*Psychological stress* has been defined by Lazarus and Folkman (1984) in the following way:

- stress is “a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being” (1984: 19, emphasis mine).

As one can see, Lazarus and Folkman understand stress as a *relationship* between the *environment* and the *resources* which a particular individual has at their disposal. Hence, unlike the previous theories of stress, stress is no longer understood as an objective stimulus or a reaction to it. Stress, as understood by Lazarus and Folkman (1984), is inextricably linked to the relationship between a given stressor and the resources which a person has to cope with it. The authors emphasised the role of cognitive *appraisal* of a stimulus. This suggests that there exist no objective stressors: the experience of stress is created by an individual’s perception of a given stressor. In other words, “subjective factors can play a much larger role than objective ones in the experience of stress” (Kossewska 2006a: 120). Whether a given situation is perceived as being stressful, neu-
tral or positive depends on the person’s individual characteristics. Wrona-Polańska (2003: 28) states that Lazarus and Folkman perceive psychological stress as a transaction; in order to comprehend the nature of this transaction, two terms need to be clarified: cognitive appraisal and coping.

2.4.1. Cognitive appraisal

As for cognitive appraisal, Lazarus and Folkman (1984: 31) make a distinction between primary appraisal and secondary appraisal. Primary appraisal refers to the perception of a situation. It constitutes “an intrapsychic process that translates objective events into stressful experiences” (Kossewska 2006a: 120). The question answered at the stage of primary cognitive appraisal is: “Am I in trouble or being benefited, now or in the future, and in what way?” (Lazarus and Folkman 1984: 31). The situation might be perceived in three distinct ways: as irrelevant, benign-positive or stressful. The situation is perceived as irrelevant when “an encounter with the environment carries no implication for a person’s well-being” (Lazarus and Folkman 1984: 32). The authors emphasise the adaptive nature of perceiving a given situation as irrelevant; thanks to this the organism mobilises its resources only when it is necessary. When the situation enhances (or helps to maintain) the well-being of a person, it is appraised as benign-positive. Such an appraisal leads to the feeling of love, happiness, joy or peacefulness (Lazarus and Folkman 1984: 32). However, it might be the case that a given situation is perceived by a person as stressful. Lazarus and Folkman further divided stress appraisals into harm/loss, threat and challenge (Lazarus and Folkman 1984: 32). Harm/loss might lead to the feeling of sorrow and remorse. Threat involves anticipating something that may be threatening in the future; interpreting a given situation as threat often leads to anxiety. Perceiving a situation as a challenge also mobilises the individual’s coping efforts. The main difference between threat and challenge is that “challenge appraisals focus on the potential for gain or growth inherent in an encounter and they are characterized by pleasurable emotions such as eagerness, excitement, and exhilaration, whereas threat centers on the potential harms and is characterized by negative emotions such as fear, anxiety, and anger” (Lazarus and Folkman 1984: 33).
To summarise, in primary appraisal an individual puts a subjective interpretation on a given objective situation. The situation may be perceived as neutral, benign-positive or stressful. When it is appraised as being stressful, some coping efforts are mobilised to overcome the effects of the stressor. In the relational theory of stress, it is understood as a situation in which the demands of a situation outweigh the coping mechanisms (Łosiak 2007: 20).

What is worth emphasising is the relationship between stress and emotions. As already suggested, different interpretations of a situation evoke various emotions. For example, anxiety seems to be a predominant emotion in the case of interpreting situations as a threat. Such emotions accompanying psychological stress are referred to by Arnold as *contending emotions* (1967: 125).

Secondary appraisal, as understood by Lazarus and Folkman, refers to “a complex evaluative process that takes into account which coping options are available, the likelihood that a given coping option will accomplish what it is supposed to, and the likelihood that one can apply a particular strategy or set of strategies effectively” (1984: 35). In other words, when a given situation has been classified by an individual as stressful, they must verify what kind of resources they have at their disposal which might help to: remove the cause of stress, minimise its negative effects and achieve possible gains (Kossewska 2006a: 121). It should be emphasised that primary and secondary appraisals are considered as dynamic, interrelated processes which depend on each other.

The dynamism of the process of cognitive appraisal is magnified by the fact that it is subject to modification as a result of changing environment. Lazarus and Folkman added the notion of *reappraisal* to their relational theory of stress. The term has been defined by the authors as “a changed appraisal on the basis of new information from the environment, which may resist or nourish pressures on the person, and/or information from the person’s own reactions” (1984: 38). Individual appraisals are never final, they constitute a succession of modifiable appraisals and emotions associated with them.

Interestingly enough, Lazarus and Folkman (1984) claim that the terms *primary* and *secondary appraisal* refer neither to their importance nor their chronological order. The authors emphasised a dynamic relationship between both types of appraisal. However, it seems that the evaluation of the situation (primary appraisal) must precede the evaluation of coping options and strategies used to minimise the negative effects of
stress (secondary appraisal). Thus, the authors’ suggestion that chronological order is not maintained in their theory of cognitive appraisal might be deemed confusing by the reader.

2.4.2. Coping with stress

In their theory of stress, Lazarus and Folkman (1984) placed a lot of emphasis on how people cope with their experience of stress. Coping has been defined by the authors as “constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person” (1984: 141). The authors state that the definition is process-oriented, rather than trait-oriented, which emphasises the dynamic nature of stress coping.

Lazarus and Folkman (1984: 150) distinguish two main forms of coping:

- problem-focused coping: it refers to actions which are directed at solving the problem itself, for example by means of defining the problem, generating alternative solutions, choosing the best one and making an effort to eliminate the problem (Lazarus and Folkman 1984: 152); a given coping strategy may be regarded as effective when it helps to dispose of the problem by means of acting; nevertheless, direct action is not the only form in which individuals may cope with stress;
- emotion-focused coping: unlike problem-focused coping, this form of coping is not concentrated on eliminating the problem itself but aims at lessening emotional distress experienced by a given person; this might include: “strategies such as avoidance, minimization, distancing, selective attention, positive comparisons, and wresting positive value from negative events” (Lazarus and Folkman 1984: 150).

Hence, as one can see, successful coping does not have to entail direct action aimed at solving the problem. Concentration on emotions might also help to reduce emotional distress and in this way it might be regarded as an effective coping strategy. The choice of either problem-focused or emotion-focused coping as a predominant coping style
may depend on the duration of stress. Emotion-focused coping seems to be more effective in the case of short-term and uncontrollable situations, whereas problem-focused coping is perceived as more adaptive in prolonged stress and controllable situations (Cohen 1987; Kossewska 2006b: 137). In some other works co-authored by Lazarus, four main modes of coping are distinguished (Lazarus and Launier 1978; Cohen and Lazarus 1979):

- information seeking: analysing one’s stressful situation; collecting information needed to deal with the problem in an effective way;
- intrapsychic coping: it overlaps to a large extent with emotion-focused coping as it encompasses all the processes connected with emotional self-regulation;
- inhibition of action: in some cases lack of action is more beneficial for a person than direct action; strategies such as avoidance or distancing may help alleviate distress that cannot be avoided;
- direct action: it overlaps to a great extent with problem-focused coping and comprises the effort made by an individual to dispose of the stressor; this might include introducing changes both to the environment and the individual (Terelak 1997: 19).

To summarise, Lazarus and Folkman (1984) perceive stress as a dynamic transaction between an individual’s coping resources and the demands of a situation. In the situational (Holmes and Rahe) and reaction-oriented (Selye) theories of stress, a lot of attention has been given to the stimulus and the way in which the organism reacts to it. Not neglecting the importance of the stressor itself, Lazarus and Folkman (1984) concentrated on the role of cognitive appraisal and individual coping styles in determining the effects of stress on a given person. Hence, the experience of stress stems not only from the objective characteristics of a situation but also from the way in which this reality is appraised and conceptualised by individuals.

Although it has been criticised for being too much cognitively-oriented (Hobfoll 1988), the transactional model of stress has gained a lot of attention in psychology in recent decades (Strelau and Doliński 2008: 703). The assumption that each individual appraises a potential stressor in a different way and has their own coping style is used in correlational research on stress coping. In this type of research one accepts the fact that
each person might react to a given situation in a totally different way. Lazarus and Folkman’s theory is often a point of reference in psychological diagnosis of stress-related problems. To give an example, a diagnostician verifies whether a person has sufficient resources to cope with stress and whether his or her stress responses are functional and make it possible to reduce tension. The assumption behind the transactional model of stress is that people can be taught how to change their perspective of a given stressor, build up confidence and self-efficacy, understood as one’s ability to succeed in a given task (Bandura 1977; 1993).

2.5. Stress and anxiety

In this section the relationship between stress and anxiety will be discussed. The Merriam-Webster Medical Dictionary provides the following definition of anxiety: “an abnormal and overwhelming sense of apprehension and fear often marked by physiological signs (as sweating, tension, and increased pulse), by doubt concerning the reality and nature of the threat, and by self-doubt about one’s capacity to cope with it” (The Merriam-Webster Medical Dictionary). Reading this definition, one might be inclined to believe that the terms stress and anxiety can be used interchangeably. Although they seem to pertain to the same phenomenon, the terms stress and anxiety are not synonymous. In the transactional theory of stress, one of the ways of perceiving a stressful situation is by treating it as a threat. This, in turn, is characterised, according to Lazarus and Folkman, by emotions such as fear, anger and anxiety (1984: 33). The authors add that anxiety “is itself likely to interfere with cognitive functioning, making it even more difficult to cope [with stress]” (1984: 92). Hence, anxiety results from the experience of stress. The Anxiety and Depression Association of America backs up such a claim by saying that anxiety is an emotional reaction to psychological stress. Such a view on anxiety is also present in the work of Terelak (2001: 251).

What should be introduced here is the distinction between state anxiety and trait anxiety proposed by Spielberger et al. (1970). State anxiety should be understood as a transient experience of anxiety as a result of a given event. In this sense anxiety may be

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5 http://www.merriam-webster.com/medical/anxiety
6 http://www.adaa.org/understanding-anxiety/related-illnesses/stress
understood as an emotion resulting from stress. Trait anxiety, on the other hand, is a stable personal characteristic, a predisposition to become anxious in different types of situations (Spielberger et al. 1970; Dörnyei 2005: 198). It remains inconclusive whether trait anxiety may be magnified as a result of chronic stress.

Anxiety has become a popular subject of study in second language acquisition (SLA) and language pedagogy (e.g. Horwitz 1987, 2000, 2001; Horwitz et al. 1986; Gardner and MacIntyre 1993). A great many scholars identified anxiety as a factor which has a considerable influence on a student’s ability to learn a foreign language and speak up in the classroom. In Interpreting Studies, interpreting trainees’ anxiety has also been tested either by means of already existing questionnaires, such as the Foreign Language Classroom Anxiety Scale (FLCAS) by Horwitz et al. (1986) or the measures adjusted to the interpreting classroom (The Interpretation Classroom Anxiety Scale by Chiang 2006). For this reason, the notion of foreign language anxiety will be explained in the following section.

2.6. Anxiety in the foreign language classroom

One of the first SLA scholars who highlighted the importance of affective factors in language learning was Krashen. He developed the idea of the Affective Filter which impacts the way in which languages are learned in the classroom environment. The main assumptions of Krashen’s hypothesis will be presented in the next section.

2.6.1. Krashen’s Affective Filter Hypothesis

Various factors may influence the way in which people learn and acquire new skills. Krashen (1982) claimed that psycho-affective factors such as motivation, self-esteem and anxiety play a pivotal role in the process of language learning. Discussing the principles of Krashen’s Affective Filter Hypothesis is of great importance for this thesis since I assume that similar mechanisms can be identified in interpreting training. Interpreting trainees may vary greatly with regard to the level of anxiety they experience in the classroom and this might result in differences in interpreting quality. It seems that
more and more scholars point to the importance of motivation and affect in the interpreting classroom (e.g. Class 2009: 43; Klimkowski 2015: 93). In Translation Pedagogy, Kiraly (2000) emphasises that translation learning should be based on transformation, and not knowledge transmission. The didactic style should proceed from more instructive to more constructive (Kiraly and Piotrowska 2014). Translation education is the process in which each learner is unique (Kiraly 2000) and able to make their own decisions (Kiraly 2003; Piotrowska 2002; 2007; Whyatt 2012). It seems that such considerations apply both to translator and interpreter training. Kajzer-Wietrzný and Tymczyńska (2014: 8) emphasise that “the role of the interpreting tutor also changes from that of authority and coach to that of motivator and guide, and even to that of facilitator, consultant and delegator depending on the extent to which students are able to self-direct their own learning”.

The affective filter has been defined by Krashen as “a mental block, caused by affective factors (...) that prevents input from reaching the language acquisition device” (LAD). LAD is understood as an individual’s innate mental capacity to acquire a language (Chomsky 1965; Krashen 1985: 100). The affective filter, discussed only in the context of L2 learning, works in such a way that it blocks the language input which, in turn, cannot reach the LAD and be translated into the learner’s acquired competence. This mechanism is presented in Figure 10:

As might be concluded from the model, the learner’s motivation or emotional state might prevent him or her from successfully acquiring the language. It should be emphasised that the strength of the affective filter is subject to individual differences. As stated by Krashen:
acquirers vary with respect to the strength or level of their Affective Filters. Those whose attitudes are not optimal for second language acquisition will not only tend to seek less input, but they will also have a high or strong Affective Filter - even if they understand the message, the input will not reach that part of the brain responsible for language acquisition, or the language acquisition device. Those with attitudes more conducive to second language acquisition will not only seek and obtain more input, they will also have a lower or weaker filter (Krashen 1982: 31).

One of the affective factors inherent in the filter is anxiety. Krashen claims that low anxiety level is conducive to language acquisition regardless of the fact whether it is personal or classroom anxiety (Krashen 1982: 31). Hence, acute anxiety will most probably have a debilitating effect on the way in which the learner learns the language. In the interpreter training context, anxiety may prevent the student from acquiring new interpreting skills or make him or her feel unease when interpreting, especially in stress-provoking situations such as when the student is asked to perform a consecutive interpreting task in front of other students.

Krashen stresses the role of the teacher in creating a friendly, anxiety-free atmosphere in the classroom. He states that “[t]he effective language teacher is someone who can provide input and help make it comprehensible in a low anxiety situation” (Krashen 1982: 32). By doing so, the teacher facilitates the process of language learning, especially for students who have a strong affective filter.

Although Krashen’s hypotheses have been criticised for the lack of empirical basis (e.g. McLaughlin 1978; Zafar 2009), it seems that the Affective Filter Hypothesis is an illustrative theoretical representation which concentrates on the effect of affective factors in the process of language acquisition. It might also be of great importance in language pedagogy as it points to the role of the teacher in motivating the students and creating a learning context which would be more conducive to gaining knowledge and acquiring new skills (Kiraly 2000; 2012).

2.6.2. The concept of foreign language anxiety

Language anxiety has been defined by Gardner and MacIntyre (1993: 5) as “the apprehension experienced when a situation requires the use of a second language with which the individual is not fully proficient”. The notion of anxiety in the foreign language
classroom has been researched by Horwitz (1987; 2000; 2001). Horwitz et al. (1986) distinguished between three types of foreign language anxiety:

- communication apprehension: it refers to anxiety associated with the necessity to communicate with other people in a foreign language; Du (2009: 163) states that personality traits such as shyness or quietness often correlate with communication apprehension;

- test anxiety: it is a psychological state in which a given learner is apprehensive of the fact that they will be tested or assessed which, in turn, may result in poor performance in the classroom; fear of failure, perfectionism, low self-esteem or lack of preparation may precipitate test anxiety (Du 2009: 163);

- fear of negative evaluation: it is a state in which anxiety is accompanied by fear of being criticised by others; such students are very concerned about opinions of other people and they tend to avoid situations in which they would be assessed (Du 2009: 163).

It seems that all of the types of language anxiety apply to interpreter training. In the conference interpreting classroom students may also be exposed to a significant level of stress and anxiety. The skills that they need to possess include, and are not limited to: a perfect command of both L1 and L2, short- and long-term memory skills, interpreting strategies, public speaking skills, good diction, etc. The need to master all these skills may make future interpreters susceptible to a high level of stress and anxiety. Obvious as this conclusion might appear, it is worth emphasising that poor interpreting quality does not have to result from insufficient linguistic skills or cognitive resources. Interpreter trainers should take into consideration that it might be the result of anxiety or other affective factors inhibiting the process of acquiring new skills.

The importance of anxiety in the process of language learning has also been highlighted by Arnold and Brown who claim that “[a]nxiety is quite possibly the affective factor that most pervasively obstructs the learning process” (1999: 8). Such a claim has been backed up by Dörnyei (2005: 198) who claims that there is no doubt that a learner’s knowledge and abilities deteriorate in the anxiety-provoking climate. Although a moderate level of anxiety is believed to have a facilitating effect on the process of foreign language learning (Dörnyei 2005: 198), there seems to a consensus among
scholars that anxiety often acts as an inhibitor of the learning process (e.g. MacIntyre 1999; 2002). MacIntyre and Gardner (1994) conducted an experimental study on the effects of anxiety on foreign language performance in which they came to the conclusion that “language anxiety tends to correlate with measures of performance in the second language but not in the native language” (1994: 301).

To summarise, both Krashen’s Affective Filter and other studies using the concept of foreign language anxiety developed by Horwitz and colleagues (1986) show that anxiety may have a negative effect on the process of language learning. Anxiety leads to distraction and, hence, may disrupt cognitive processing (Eysenck 1979). Poor performance in the foreign language classroom may result from the student’s cognitive and affective state. Although interpreter training should not be understood as foreign language learning, it seems that exposure to stress and anxiety applies both to foreign language students and interpreting novices. It is not uncommon of interpreting trainees to experience test anxiety and fear of negative evaluation discussed by Horwitz et al. (1986) in the context of foreign language learning. The studies by Chiang (2009; 2010) in which the Foreign Language Classroom Anxiety Scale was administered to interpretation students will be discussed in Chapter 3 of this thesis.

2.7. Selected psychometric instruments used to measure stress, anxiety and coping with stress

In previous sections I have attempted to define the notions of stress and anxiety. However, in order for these concepts to be used in correlational and experimental research, on needs their operational definitions. In other words, we need to focus on tangible indicators of both stress and anxiety. Psychometrics as a field of psychology makes it possible to measure theoretical concepts such as traits, skills and attitudes in a more objective way. Several psychometric instruments have been developed to this date which would measure stress, anxiety and coping with stress. The main aim of this section is to provide an overview of instruments which are widely used in empirical research.
2.7.1. STAI – State-Trait Anxiety Inventory

One of the most widely used questionnaires to measure the level of anxiety is STAI – State-Trait Anxiety Inventory developed by Spielberger et al. (1970). The authors make a distinction between trait and state anxiety which has already been discussed in Section 2.5. The first part of the inventory (STAI X-1) is used to measure the level of state anxiety whereas the second part (STAI X-2) – to measure a person’s trait anxiety, i.e. a stable predisposition to react anxiously in different types of situations. The measure is used both in clinical settings as an anxiety diagnosis tool and in research (The American Psychological Association\(^7\)). STAI X-1 is frequently used in experimental research in order to examine moment-by-moment changes in state anxiety as a result of experimental manipulation.

Both subscales (STAI X-1 and STAI X-2) consist of 20 statements. The participants are asked to rate each item on a 4-point Likert scale. The items included in the STAI X-1 scale refer to the participant’s state at a given point in time (e.g. \textit{I feel calm, I feel upset, I am tense}) whereas STAI X-2 statements refer to the person’s general predisposition to be anxious, or lack of it (e.g. \textit{I worry too much over something that doesn’t really matter; I feel satisfied with myself}). The final raw data score is calculated by means of adding the points, separately for both subscales. Internal consistency coefficients range from .83 to .92 for X-1 and .86 to .92 for X-2 (Wrześniewski and Sosnowski 1983: 8). The inventory’s high construct validity has been confirmed in experimental research (Psychological Test Laboratory of the Polish Psychological Association\(^8\)) (e.g. Oei et al. 1990). The STAI X-1 scale has been used in the experimental study on the influence of the speaker’s rate of delivery on interpreters’ stress and anxiety described in the final chapter of this thesis. The scale has been used here to measure state anxiety before and after simultaneous interpreting tasks.

\(^8\) http://www.practest.com.pl/stai-inwentarz-stanu-i-cechy-leku-stai
2.7.2. Foreign Language Classroom Anxiety Scale (FLCAS)

As previously mentioned, Horwitz et al. (1986) distinguished three types of foreign language anxiety, i.e. communication apprehension, test anxiety and fear of negative evaluation. The authors developed the Foreign Language Classroom Anxiety Scale (FLCAS) to investigate whether learners experience these types of anxiety in the process of language learning. Foreign language anxiety has been perceived as pertaining only to the language learning process which does not necessarily need to correlate with the learner’s trait anxiety. In other words, “language anxiety turned out to be a relatively independent factor, displaying only low correlations with general trait-anxiety” (Dörnyei 2005: 199). The scale yielded satisfactory reliability values: “[t]he scale has demonstrated internal reliability, achieving an alpha coefficient of .93 with all items producing significant corrected item-total scale correlations” (Horwitz et al. 1986: 129).

The scale is a self-report questionnaire, consisting of 33 questions. The Likert scale has been used to rate the level of communication apprehension, test anxiety and fear of negative evaluation in the classroom. Examples of the FLCAS items have been provided below:

- “It frightens me when I don’t understand what the teacher is saying in the foreign language.” [1];
- “It embarrasses me to volunteer answers in my language class.” [2];
- “I can feel my heart pounding when I’m going to be called on in language class.” [3] (Horwitz et al. 1986: 129).

The subjects are asked not only about their emotional states (questions 1 and 2) but also about some physiological indicators of anxiety and tension (question 3). Horwitz et al. (1986) perceive foreign language anxiety as a construct comprising “self-perceptions, beliefs, feelings, and behaviors related to classroom language learning arising from the uniqueness of the language learning processes” (Horwitz et al. 1986: 128, as cited in Pérez-Paredes and Martínez-Sánchez 2000-2001: 339).

Horwitz et al. (1986: 131) highlighted pedagogical implications of the Foreign Language Classroom Anxiety Scale. They claimed that the task of the teacher is to acknowledge that foreign language anxiety exists and it can have a detrimental effect on
the learner’s performance in the classroom. The authors give examples of two types of action that the teacher can take when dealing with an anxiety-driven student. First of all, they can teach the learners how to deal with anxiety-provoking situations. On the other hand, they can modify the teaching context so that it is less stressful. The authors emphasise that educators should always consider the option that the student’s poor performance is a result of anxiety, and not necessarily of their cognitive deficits or the lack of eagerness to learn (Horwitz et al. 1986: 131).

2.7.3. Coping Inventory For Stressful Situations (CISS)

CISS (Coping Inventory for Stressful Situations) developed by Endler and Parker (1990) is used to measure an individual’s preferred coping style. The inventory may be used in research as well as in intervention, e.g. when recruiting staff for specific positions, such as police officer, soldier or driver (Psychological Test Laboratory of the Polish Psychological Association⁹). Although the original version of the questionnaire has been designed to test people aged 18 and more, the normalised Polish version proved to be a valid and reliable measure also for people aged 16-17 (Strelau et al. 2005: 72). In this dissertation I am going to use the CISS questionnaire to investigate predominant coping styles among conference interpreters who are believed to be exposed to occupational stress.

The questionnaire consists of 48 items. Each of them describes a particular action that people can take when coping with stress (e.g. talking to a friend, preparing an action plan, pretending that nothing has happened). Each item is rated on a 5-point Likert scale indicating how frequently a given action is taken by an individual. The participants are evaluated on three scales indicating the main coping styles:

- Task-Oriented Coping: people who use task-oriented coping as a predominant coping style tend to take action to dispose of the stressor; they focus on modifying stressful situations; the main focus is on direct action as well as planning and

implementing measures to address the problem (cf. *problem-focused coping*, Lazarus and Folkman 1984);
- Emotion-Oriented Coping: in this case people tend to concentrate on their emotional states and fantasise; the aim of such coping mechanism is to alleviate tension resulting from a stressful experience; while in task-oriented coping finding a solution to the problem is at the forefront, in emotion-oriented coping one deals with stress by controlling the negative effects of emotions such as anger or guilt (cf. *emotion-focused coping*, Lazarus and Folkman 1984);
- Avoidance-Oriented Coping: people who use avoidance-oriented coping tend to refrain from direct action so as not to analyse and experience the problem (Strelau et al. 2005: 17).

Additionally, Avoidance-Oriented Coping is tested on two subscales: Distraction and Social Diversion. Distraction refers to doing other things so as to deny that the problem exists. Social Diversion, on the other hand, involves socialising with other people (Strelau et al. 2005: 17). What needs to be emphasised is that Endler and Parker focus on the avoidance-related aspects of socialising, i.e. that it enables the person experiencing stress to have his or her mind busy with other things which can be discussed with their families and friends. Social Diversion, thus, does not entail seeking emotional support in dealing with a stressful situation itself.

### 2.7.4. The Coping Orientations to Problems Experienced (COPE)

COPE (the Coping Orientations to Problems Experienced) has been developed by Carver et al. (1989). Similar to CISS, COPE measures predominant coping strategies. The questionnaire may be used both in psychological diagnosis and research. The current version of COPE consists of 60 items manifesting ways in which one can deal with stress and reduce tension. All the items are rated on a 4-point Likert scale indicating how frequent a given strategy is used by an individual. The complete list of COPE items has been published in the article by Carver et al. (1989: 272). The list of the original version of the COPE items, based on Carver et al. (1989), accompanied by the examples of items is as follows:
- Active coping: *I take additional action to try to get rid of the problem.*
- Planning: *I think about how I might best handle the problem.*
- Suppression of competing activities: *I focus on dealing with this problem, and if necessary let other things slide a little.*
- Restraint coping: *I hold off doing anything about it until the situation permits.*
- Seeking social support – instrumental: *I talk to someone who could do something concrete about the problem.*
- Seeking social support – emotional: *I try to get emotional support from friends or relatives.*
- Positive reinterpretation and growth: *I try to see it in a different light, to make it seem more positive.*
- Acceptance: *I accept that this has happened and that it can’t be changed.*
- Turning to religion: *I put my trust in God.*
- Focus on and venting of emotions: *I feel a lot of emotional distress and I find myself expressing those feelings a lot.*
- Denial: *I pretend that it hasn’t really happened.*
- Behavioral disengagement: *I admit to myself that I can’t deal with it, and quit trying.*
- Mental disengagement: *I turn to work or other substitute activities to take my mind off things.*
- Alcohol-drug disengagement: *I drink alcohol or take drugs, in order to think about it less* (Carver et al. 1989: 272).

Thus, the original version of COPE consisted of 14 scales. It should be emphasised that Carver et al. conceptualise socialising in a slightly different way than Endler and Parker, the authors of CISS. In the COPE questionnaire, the aspect of instrumental and emotional support is emphasised, whereas in CISS, as already suggested, interaction with others was perceived as a form of mental disengagement.

Carver et al. (1989) suggest grouping the scales of COPE into four main categories: problem-focused coping, emotion-focused coping, “less useful” strategies and recently developed strategies:
Humor was added to the original list of the scales of the COPE inventory, the names of some of the scales were also modified by the authors of the questionnaire. Humor involves making fun of the problem and might be classified as an avoidance-oriented strategy. Thus, the current version of COPE consists of 15 scales and 60 items, while each scale is represented by 4 items.

### 2.7.5. Perceived Stress Scale (PSS)

The Perceived Stress Scale (PSS) has been developed by Cohen et al. (1983). As the authors state, the measure “is suggested for examining the role of nonspecific appraised stress in the etiology of disease and behavioral disorders and as an outcome measure of experienced level of stress” (Cohen et al. 1983: 385). The PSS has acceptable psychometric properties such as validity and reliability (Cohen et al. 1983: 384) which has been confirmed by Lee (2012) who has conducted a meta-analysis of studies on psychometric properties of the PSS.

The questionnaire consists of 14 questions in which subjects are asked to indicate how often they felt (or thought) in a certain way on a 5-point Likert scale. Examples of questions are provided below, they are taken from the article by Cohen et al. (1983: 394):

### Table 1. The 15 Scales of the COPE Inventory (after Litman 2006: 275).

<table>
<thead>
<tr>
<th>Developed to assess</th>
<th>Scale</th>
<th>Typified by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem-focused</td>
<td>Active coping</td>
<td>Taking steps to eliminate the problem</td>
</tr>
<tr>
<td></td>
<td>Planning</td>
<td>Thinking about dealing with the problem</td>
</tr>
<tr>
<td></td>
<td>Suppression of Competing Activities</td>
<td>Focusing only on the problem</td>
</tr>
<tr>
<td></td>
<td>Restraint coping</td>
<td>Waiting for the right moment to act</td>
</tr>
<tr>
<td></td>
<td>Instrumental Social Support</td>
<td>Seeking advice from others</td>
</tr>
<tr>
<td>Emotion-focused</td>
<td>Positive reinterpretation</td>
<td>Reframing the stressor in positive terms</td>
</tr>
<tr>
<td></td>
<td>Acceptance</td>
<td>Learning to accept the problem</td>
</tr>
<tr>
<td></td>
<td>Denial</td>
<td>Refusing to believe the problem is real</td>
</tr>
<tr>
<td></td>
<td>Turning to Religion</td>
<td>Using faith for support</td>
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<tr>
<td></td>
<td>Emotional social support</td>
<td>Seeking sympathy from others</td>
</tr>
<tr>
<td>&quot;Less useful&quot;</td>
<td>Focus on &amp; venting emotions</td>
<td>Wanting to express feelings</td>
</tr>
<tr>
<td></td>
<td>Behavioral disengagement</td>
<td>Giving up trying to deal with the problem</td>
</tr>
<tr>
<td></td>
<td>Mental disengagement</td>
<td>Distracting self from thinking about the problem</td>
</tr>
<tr>
<td>Recently developed</td>
<td>Substance use</td>
<td>Using alcohol or drugs to reduce distress</td>
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<tr>
<td></td>
<td>Humor</td>
<td>Making light of the problem</td>
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</tbody>
</table>
“In the last month, how often have you been upset because of something that happened unexpectedly?”;
“In the last month, how often have you felt nervous and ‘stressed’?”;
“In the last month, how often have you felt confident about your ability to handle your personal problems?”
“In the last month, how often have you found that you could not cope with all the things that you had to do?”;
“In the last month, how often have you felt that you were on top of things?”
(Cohen et al. 1983: 394f.).

When answering the questions subjects are asked to recall situations last month when they experienced stressful situations and/or managed to cope with stress. They are not asked about specific behaviour which would enable a researcher to draw conclusions about the level and magnitude of stress experienced by the person. In the Social Readjustment Rating Scale (Holmes and Rahe 1967) data was collected on the occurrence of particular stressful life events. In the case of the Perceived Stress Scale, on the other hand, the subjects are directly asked about stress and coping. Hence, the assumption behind the questionnaire is that the respondents are able to create their own definition of stress and coping.

Interestingly enough, Cohen et al. (1983) also developed a four-item version of the Perceived Stress Scale which is used when data needs to be collected over the phone. As the authors suggest, a shorter version facilitates the process of data collection in large samples (Cohen et al. 1983: 393). Nevertheless, they point to the psychometric side of the coin and claim that “because of the limited number of items, the abridged scale suffers in internal reliability and thus provides a less adequate approximation of perceived stress levels than the entire scale” (Cohen et al. 1983: 393).

A 10-items version of the Perceived Stress Scale (PSS-10) has been in use recently (Psychological Test Laboratory of the Polish Psychological Association10). The items are rated on a 5-point Likert scale (ranging from 0 to 4), a total sum of 40 points can be achieved with higher scores indicating greater perceived stress (Al-Dubai et al.

2014: 9). The measure can be used as a screening tool and to identify people who would require psychological counselling (Juczyński and Ogińska-Bulik 2009: 22).

To summarise, in Section 2.7. I have discussed some of the most widely used psychometric instruments which have been developed to measure the level of stress, anxiety and coping with stress. The content of the questionnaires’ items constitute operational definitions of theoretical concepts relating to the notions of stress and anxiety. The majority of them can be used both in research and psychological diagnosis. They make it possible to measure the actual level of stress and anxiety to which a person is exposed (e.g. STAI X-1, PSS, FLCAS) or predominant coping strategies used by them (e.g. CISS, COPE). The next section will be devoted to stress indicators which can be used in empirical research as a physiological manifestation of the experience of stress.

2.8. Stress indicators in experimental research

In this section I will refer to some of the stress indicators which can be used in experimental research on stress and anxiety. Both physiological and acoustic (linguistic) markers of stress will be discussed.

2.8.1. Heart rate and blood pressure

The autonomic nervous system (ANS) constitutes part of the peripheral nervous system. It is further divided into two main branches: the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). The SNS’s role is to prepare the body to counteract the potential threat; the organism’s reaction to threat is often referred to as the fight-or-flight response, characterised by the activation of the sympathetic nervous system (Cannon 1932). The SNS “signals the adrenal glands to release adrenaline and cortisol. These hormones make the heart beat faster, raise blood pressure, change the digestive process and boost glucose levels in the bloodstream” (The American Institute
of Stress). The PNS, on the other hand, in most cases plays an inhibitory function as it puts the body to rest. It is “most active under unchallenging situations” (Choi and Gutierrez-Osuna 2009: 219). Whereas the SNS activates the physiological reaction, the PNS operates in the opposite way, i.e. it inhibits the reaction. For example: the SNS dilates the pupils and the PNS constricts them. The operation of both systems has been graphically presented in Figure 11:

![Graphical presentation of the autonomic nervous system](http://www.austincc.edu/rfofi/NursingRvw/PhysText/PNSefferent.html)

One of the bodily functions that is regulated by the autonomic nervous system is heart rate. The sympathetic nervous system accelerates heart rate as a reaction to potential stress. That is why heart rate has been used in experimental research as a stress indicator. Elevated heart rate may, thus, serve as an operational definition of the experience of stress.

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11 http://www.stress.org/stress-effects/
Apart from the heart rate (HR) itself, heart rate variability (HRV) has been identified as a marker of stress (Choi and Gutierrez-Osuna 2009: 219). HRV is understood as “the temporal variation between sequences of consecutive heart beats”, i.e. the fluctuations of heart rate around the mean value of heart rate (Karim et al. 2011: 71). Low heart rate variability, indicating low parasympathetic activity, has proved to serve as a reliable stress indicator in children in a study by Michels et al. (2013).

Heart rate measured by a wearable heart rate monitor seems to have two main advantages: it is affordable (e.g. not as expensive as electrocardiographic measurements). It also appears to be relatively unobtrusive: the device needs to be put on before the experiment and it records heart rate data until the experiment finishes. In this thesis, heart rate is particularly useful as it can be used also in an experimental task involving language production, i.e. the fact that interpreters produce speech during the experiment does not distort the data obtained. Although the use of heart rate as a stress measure seems to be unobtrusive, the fact that it needs to be fastened to the participant’s body (usually the sternum) may lead to their discomfort and in turn increase the level of anxiety experienced by them (Korpal, manuscript in preparation). Also, it needs to be remembered that the participant’s heart rate might be elevated due to a chronic cardiovascular disease. Hence, in studies using heart rate as a measure of stress it is necessary to measure the individual’s baseline heart rate. The measures collected in the course of the experiment should then be compared to the baseline value (e.g. measured in the morning on the same day or after the experiment).

Apart from heart rate, blood pressure has also been widely used as an indicator of stress. It has been proved in several studies that chronic exposure to stress may elevate an individual’s blood pressure which, in turn, aggravates the risk of developing a cardiovascular disease (e.g. Stansfeld and Marmot 2002; Gasperin et al. 2009). Hence, blood pressure measurement may be used to identify whether there is a risk that chronic stress will lead to the development of a psychosomatic disease.

Both systolic (maximum) and diastolic (minimum) blood pressure was used as a stress marker in a pilot study to the experiment described in the final chapter of the thesis. However, unlike heart rate, blood pressure failed to prove to be a valid measure of stress in the experiment involving an interpreting task (for details on the pilot study, see: Korpal, manuscript in preparation). However, it appears that blood pressure could be used in longitudinal studies in which it is verified whether excessive interpreting practice might lead to chronic stress or in transversal (cross-sectional) studies in which in-
interpreters would be compared to representatives of other professions with regard to chronic stress experienced by them.

### 2.8.2. Galvanic skin response

Another frequently adopted marker of stress is the so-called galvanic skin response (GSR), also referred to as the skin conductance level (SCL), which is a type of electrodermal activity. The procedure of skin conductance measurement can be described in the following way: “[s]kin conductance (SC) is normally measured with 8mm diameter silver/silver chloride electrodes positioned on the medial phalanx of the index and middle fingers held in position by double sided sticky electrode collars. A non-saline jell is used” (Psychlab\(^{12}\)). Since the sympathetic nervous system controls sweating, increased skin conductance can be interpreted as physiological arousal and activation of the SNS. GSR is thus also based on the fight-or-flight reaction (Cannon 1932), as cooling down the body helps the organism cope with the perceived threat or a stressful situation (Psychlab\(^{13}\)). An example of GSR responses can be seen in Figure 12:

\(^{12}\) http://www.psychlab.com/SC_explained.html
\(^{13}\) http://www.psychlab.com/SC_explained.html
Fig. 12. Four GSR startle responses (taken from Kurniawan et al. 2013: 211).

The onset of the response and the peak are denoted by “o” and “x”, respectively. The amplitude and the rising time are marked with “A” and “R”, respectively (Kurniawan et al. 2013: 211). As might be seen in Figure 12, a classic SCR (skin conductance response) is characterised by its onset, rising time, peak and exponential decay (Psychlab\(^\text{14}\)).

Galvanic skin response has been used in experimental research as a marker of stress (e.g. Jacobs et al. 1994). It has been proved to be a valid measure of the activity of the sympathetic nervous system. Although it seems to be unobtrusive, it might be problematic in studies involving conference interpreters due to electrodes positioned on the participant’s finger which may restrict his or her movements during the interpreting process. In this way, galvanic skin response may compromise the ecological validity of an experimental study to a great extent. Nevertheless, GSR has been used in Interpreting Studies in the experiments conducted by Kurz (2002; 2003). Details on the studies’ results will be provided in Chapter 3.

\(^{14}\)http://www.psychlab.com/SC_explained.html
2.8.3. Concentration of cortisol

Concentration of cortisol is one of the most commonly used markers of stress in experimental research (Kirschbaum and Hellhammer 1989). Cortisol is secreted as part of the body’s physiological reaction to a stressful situation or a perceived threat. The hormone is “synthesised and secreted from the adrenal glands and released into the circulating blood where it is bound rapidly to carriers such as cortisteroid-binding globulin (CBG), albumin and erythrocytes” (Kirschbaum and Hellhammer 2000: 379).

In experimental research, cortisol concentration is most often measured in two ways: either from blood or saliva samples. Kirschbaum and Hellhammer (2000: 379) compared blood and salivary sampling in experimental research and concluded that saliva sampling has several advantages over blood sampling. First of all, saliva sampling is less obtrusive than blood sampling; in the case of the latter the researcher needs to use venipuncture which may be found unethical, let alone the ecological validity of the experiment. What is more, it is much easier to obtain saliva samples at regular, short intervals which might be required by the experimental design (Kirschbaum and Hellhammer 2000: 379).

In experiments involving conference interpreters concentration of salivary cortisol has been used as a marker of stress by Moser-Mercer et al. (1998) and Moser-Mercer (2005). Although secreted cortisol is generally believed to be a valid stress indicator, it should be used with caution in empirical research on interpreters due to methodological reasons. Collecting saliva samples from interpreters when they perform an interpreting task may be perceived by them as obtrusive and psychologically invasive. This could impact their performance and skew the results by compromising the ecological validity of the experiment to a significant extent.

2.8.4. Linguistic (acoustic) markers of stress

It probably happened to the majority of people to hear someone speaking and come to the conclusion that the person one listens to is tense or experiences stress. In an impressionistic fashion one can assume that someone is under stress by identifying high pitch,
voice tremor or speech disfluencies and hesitations. This might suggest that stress detection in speech is possible.

Such a claim has been confirmed by some scholars (Jessen 2006; Kirchhübel et al. 2011; Kurniawan et al. 2013). Several acoustic markers of stress have been identified in empirical studies. In this dissertation the terms “acoustic markers” and “linguistic markers of stress” will be used interchangeably. Kirchhübel et al. (2011: 75) attempted to draw up a classification of the “acoustic correlates of speech when under stress”. In this section I will use the authors’ classification and discuss some of the most valid acoustic markers of stress. The discussion of linguistic indicators of stress constitutes an important part of the thesis. To the best of my knowledge, such acoustic measures have not been used so far in Interpreting Studies as stress markers. In the experimental study described in the last chapter of the thesis, I will verify whether such measures can be regarded as valid stress indicators in experiments involving simultaneous interpreting.

The sympathetic nervous system affects respiration and causes muscle tension. This, in turn, may be reflected in several speech qualities. Some examples of the effects of modified respiration and muscle tension on speech quality include the mechanisms described below. They have been explained in detail in Kirchhübel et al. (2011).

As for respiration, its rise “leads to an increase in sub-glottal pressure and as a consequence supra-glottal pressure and airflow through the supra-laryngeal vocal tract also increases” (Kirchhübel et al. 2011: 81). This, in turn, may result in higher speech signal intensity, friction and turbulence. Increased muscle tension, on the other hand, “is likely to result in a tensing of the vocal folds which in turn most likely causes a raising of fundamental frequency” (Kirchhübel et al. 2011: 81). As facial muscles can also be affected by the increased muscle tension, vowels and consonants may be articulated in a modified way. Muscle tension in the vocal tract can result in ‘tense voice’ (Laver 1991). Moreover, “a possible lack of coordination between the laryngeal muscles involved in phonation on the one hand and irregular respiration patterns on the other could lead to voicing irregularity and voicing variability (jitter)” (Scherer 1979, as cited in Kirchhübel et al. 2011: 81f). Such a claim has been backed up by Apple et al. who concluded that “there is considerable evidence that stressful situations do produce discernible changes in voice quality” (1979: 725). A study by Hecker et al. (1968) demonstrated that task-induced stress may indeed change some characteristics of the speech signal, such as frequency.
**Fundamental frequency** (F0/f0), i.e. the lowest frequency of a waveform, is yet another acoustic measure which has been regarded as a stress correlate. The term is often used as a synonym of pitch. Although pitch and F0 values have been proved to be correlated, it should be emphasised here that “[p]itch is a subjective phenomenon whereas fundamental frequency is open to physical measurements” (Howard 1991: 68). In other words, pitch indicates “the measurable height of fundamental frequency as presented on a spectrogram” (Michelsson et al. 2007: 35).

The co-occurrence of stress and the elevation in the mean fundamental frequency has been empirically tested (e.g. Hicks 1979; Benson 1995). For example, modified mean fundamental frequency was reported as a reaction to cognitive stressors or when the participant was asked to solve a cognitively demanding task (Kirchhübel et al. 2011: 83). Crucial to this thesis are the results of the study conducted by Hicks (1979), as reported by Kirchhübel et al. (2011: 83). Hicks (1979) found that the fundamental frequency was increased in an experimental condition involving public speaking. This might be explained by the fact that in such a context people tend to speak louder and faster which may have an effect on speaking intensity and fundamental frequency values. As the interpreters’ job involves a great deal of public speaking, it would be interesting to verify whether the elevation of fundamental frequency would be observable in an interpreting task as compared to other linguistic tasks which do not involve public speaking.

An increase in F0 in stress was also observed in other empirical studies. Ruiz et al. (1996) observed an increase in mean F0 both in the real-stress and the laboratory-stress condition. In other words, data obtained in the experiment by Ruiz et al. (1996) show that one may expect the increase in F0 values not only in real-life stressful situations but also in experiments, which are often criticised for the lack of ecological validity. In another controlled experiment, Brenner et al. (1983) also observed an increase in mean F0 in the stressful condition. Elsewhere, possible correlations between the speaker’s emotional state and the fundamental frequency were investigated by Williams and Stevens (1972). They demonstrated that F0 might indicate emotions such as fear or anger (increased F0) or sorrow (reduced F0) (1972: 1249).

Jitter, understood as “the random variability in vocal fold vibration from one cycle to the next” (Kirchhübel et al. 2011: 84) has also been tested as a potential marker of stress. The metaanalysis performed by Kirchhübel et al. (2011) shows that the results
of studies investigating potential correlations between stress and jitter are highly inconclusive, i.e. some studies identified an increase in jitter in stressful conditions (Brenner et al. 1983; Vilkman et al. 1987), whereas other researchers concluded the opposite (Fuller et al. 1992). In other experiments no correlation was found between stress and jitter (Jessen 2006). Hence, the question of jitter as a potential marker of stress has not been scientifically resolved yet.

As already suggested, stress may manifest itself in speaking intensity and speaking tempo. Again, the results of studies in which stress and speaking intensity were used as variables appear to be inconclusive. In the words of Kirchhübel et al. (2011: 85), “[s]ome studies reported measurements of overall amplitude of the speech data but the results from these are inconsistent”. As for speaking tempo, one might purport that people tend to speak faster, when under stress. Indeed, the results of most laboratory studies (e.g. Hecker et al. 1968; Karlsson et al. 2000) show that speaking tempo increases in stressful conditions (Kirchhübel et al. 2011: 85). There have also been attempts to look at the number of pauses and disfluencies as potential marker of stress (Kirchhübel et al. 2011: 85f.). Disfluencies have been defined by Silverman and Silverman (1975) as “repeating part of a word or an entire word, repeating a phrase, inserting extra sounds between words (ah, um), changing the wording of a sentence, prolonging the sounds of a word, or breaking up the sounds of a word” (1975, as quoted in Hicks 1979: 24). In their study, Silverman and Silverman (1975) observed a decrease in the number of disfluencies in the stressful condition. The participants were told that electric shocks would be administered to them in each instance of disfluency when they read a short passage (Hicks 1979: 24f.). It seems that fear of being punished motivated the participants to produce a more fluent speech. Even though they were distressed, they were able to perform a task for fear of being punished. In some other studies (e.g. Hicks 1979; Siegman 1993) the authors observed an increase in hesitations in the stressful condition. Hence, the research on hesitations and disfluencies as correlates of stress provides inconclusive results.

It seems that studies on the effect of stress on voice quality suggest that stress can be accompanied by the following acoustic features: changes in pitch (f0), voicing irregularities and ‘voicing breaks’ (Kirchhübel et al. 2011: 87). It would be interesting to see whether speech disfluencies constitute a valid measure of stress in simultaneous interpreting: a process which, on the one hand, requires the interpreter’s fluency but, on
the other hand, a process which might induce considerable stress. Hesitations and disfluencies could be a useful measure in experiments involving a simultaneous interpreting task as they are easy to abstract and do not require advanced phonetic analysis. What is more, it could be interesting to see whether performing a speaker-paced task, i.e. simultaneous interpreting, especially in a fast-speech condition, would increase the number of hesitations and disfluencies in interpreters’ speech. Hesitations (encompassing disfluencies, voice breaks and false starts) will be used as a potential stress marker in the experiment described in the final chapter of this thesis.

To summarise, the list of potential markers of stress in speech production was based on the article by Kirchhübel et al. (2011). Apart from the measures referred to in this section, Kirchhübel et al. (2011) also mention formants, i.e. a vowel’s three overtone pitches: F1, F2 and F3 (Ladefoged and Johnson 2010: 187). They have not been described in detail in this section as it is difficult to find any tendencies which would prove this measure to be a valid marker of stress. The analysis of the studies’ results makes one believe that more research needs to be conducted in this area to draw any definite conclusions. However, some of the measures discussed by Kirchhübel et al. (2011) seem to be relatively stable stress markers. Kirchhübel et al. suggest that “[o]f all the parameters investigated F0 appears to offer the most reliable acoustic correlate of stress” (2011: 88). For this reason, F0 will be used as a stress marker in the experimental study on the effect of delivery rate on interpreters’ stress described in the final chapter of this thesis.

2.8.5. Markers of stress: Concluding remarks

This section has been devoted to stress indicators used in experimental research. The notion of psychological stress is a theoretical construct which requires operational definitions in order to be tested empirically. The measures described here have been used in research as indicators of the concept of stress. The indicators discussed here do not constitute a comprehensive list of stress markers. Scholars have provided examples of other stress indicators, such as immunoglobulin M (IgM) levels (Moser-Mercer 2005), electromyography (EMG) (Lundberg et al. 1994) and respiration (Kurniawan et al. 2013).
However, the ones presented here seem to be the most frequently used in experimental research, especially when language production is involved.

The next chapter will be devoted to the psycholinguistic approach to conference interpreting and exposure to stress in interpreting. When discussing the results of the experiments conducted by interpreting scholars, I will refer to stress indicators discussed in this section.

### 2.9. Conclusion

The main objective of this chapter was to present the theory of stress and anxiety. At the beginning of the chapter three main theories of stress were discussed: the situational approach to stress developed by Holmes and Rahe, the stress-response theory by Selye and the transactional model of psychological stress developed by Lazarus and Folkman. As previously shown, Holmes and Rahe perceived stress as a stimulus, whereas Selye conceptualised stress as a physiological reaction to a given stressor. Lazarus and Folkman, on the other hand, perceived stress as a relationship between the individual’s coping resources and the environment. Then, the difference between stress and anxiety was explained, as these two terms are often used interchangeably. The question of anxiety was discussed here mainly in the context of second language acquisition (SLA) with some references to interpreter training. Having defined the notions of stress, I have provided examples of psychometric instruments which are widely used in research and which provide operational definitions of theoretical constructs such as stress, anxiety and stress coping. In the final part of the chapter, stress indicators in experimental research were discussed. A lot of attention has been given to acoustic markers of stress and the possibility to use these measures in empirical research in Interpreting Studies.

The content of this chapter is crucial in this thesis as it shows how stress – one of the dependent variables in the experimental study described in the final chapter – has been conceptualised in theoretical considerations. I also attempted to show how stress can be operationalised in empirical research. To this end, I referred to psychometric, physiological and linguistic stress indicators. As some of them will be used in the experimental study (Chapter 4), much attention has been devoted to describing their specificity.
To summarise, the first chapter of this thesis was devoted to conference interpreting as a cognitive process whereas in the second one I concentrated on the theory of stress and anxiety. In the third chapter these two fields will be brought together as I will concentrate on the psycholinguistic approach to interpreting as well as research on stress experienced by conference interpreters and interpreting trainees.
Chapter 3: The psycholinguistic approach to interpreting: Conference interpreting and stress

3.1. Introduction

As discussed in the first chapter, the cognitive approach to conference interpreting has been dominant for the last couple of decades. A lot of emphasis has been placed not on interpretation as a product (product-oriented approach) but rather on the intricacies of the process of consecutive and simultaneous interpreting (process-oriented approach). A great many scholars focused on multitasking as a central feature of the simultaneous interpreting mode (e.g. Gerver 1975, 1976; Gile 1995; Christoffels and de Groot 2005; Seeber 2011; Seeber and Kerzel 2011). Simultaneous interpreting (SI) involves processes and skills such as: self-monitoring, memory skills, verbal fluency and concurrent listening and production. It is believed that all of them must be mastered by interpreters so that they are able to provide high-quality interpreting (Christoffels and de Groot 2005: 469ff.).

Since interpreting requires mastering numerous skills, several researchers touched upon the question of interpreters’ aptitude in the context of interpreter training (e.g. Moser-Mercer 1985, 1994; Lambert 1991; Mackintosh 1999; Timaróvá and Un- goed-Thomas 2008; Chabasse 2009). Linguistic and cognitive abilities were often treated as the main predictors of interpreters’ future success. It is reasonable to assume that a perfect command of at least two languages is a prerequisite for future interpreters. However, as pointed out by Rosiers et al. (2011: 54), “[a]lthough the importance of adequate linguistic skills for both translators and interpreters is indisputable, sufficient proficiency in one’s working languages does not in itself guarantee high quality transla-
tion or interpreting”. I do agree that cognitive and language-related skills are of great importance in interpreting. Nevertheless, I strongly believe that in order to be able to provide a comprehensive definition of interpreter aptitude, psychological components should also be taken into consideration, including stress management. In this chapter I will focus on psychological stress experienced by interpreters and its impact on interpreting quality.

The main objective of this chapter is to discuss the relevance of psycholinguistic factors in conference interpreting. In Section 3.2. the findings of interpreting scholars regarding interpreters’ aptitude and interpreter training will be presented. Then I will discuss cognitive and psychological factors which may have an impact on interpreting skills. The main part of the chapter will be devoted to the discussion of studies on psychological stress in interpreting which have been conducted to this date.

3.2. Interpreter aptitude and interpreters’ success

Aptitude seems to be one the most widely discussed concepts in educational psychology. In broad terms it can be defined as “a potential to attain ability” (Salkind 2008: 48). Other definitions taken from the Merriam-Webster online dictionary show that the notion may be understood either as “a natural ability” or “capacity for learning” (Merriam-Webster15). However, it must be emphasised that this “natural ability” might be understood both as (1) an innate capacity, an inherent ability, a set of cognitive resources forming an individual’s general intelligence, and as (2) an acquired ability for proficiency in a given field. The latter definition (“capacity for learning”) introduces a very interesting point to the question of one’s “talent”: aptitude may refer to the person’s ability to learn new material and develop new abilities. In the interpreting context: we might expect that students who display a special aptitude for interpreting would be more effective in acquiring interpreting skills, when compared with other students.

Such an interpretation is consistent with a definition of learner’s aptitude proposed by Carroll (1961). He understood it as “an inverse function of the amount of time which, other things being optimal, will be required for him [the learner] to attain a crite-

15 http://www.merriam-webster.com/dictionary/aptitude
rion mastery in the task to be learned” (Carroll 1961, as cited in Russo 2011: 12). The question of aptitude for interpreting is one of the key points in interpreter training. Can anyone be a successful interpreter? Do professional interpreters differ from bilinguals? Can interpreting skills be mastered and if so, to what extent? What does interpreter aptitude consist of and, consequently, what skills should be taught in the course of interpreter training? Such questions are often posed by interpreting scholars as well as interpreting trainers whose task is often to select the best candidates during admission testing.

Nature vs. nurture (or born vs. made) is one of the most heated debates in the field of developmental psychology. Similar debates have erupted in Interpreting Studies with regard to interpreter aptitude. Although it seems that more scholars tend to believe in the significant role of training interpreting skills (Mackintosh 1999; Kalina 2000; Timarová and Salaets 2011), there have been some scholars who opted for the innateness of the ability to translate and interpret. Harris and Sherwood (1978) called this a ‘natural translation’. The authors studied children who interpreted from early childhood. The authors stated that the ability to interpret and translate develops as a third ability, simultaneously with the process of acquiring both languages (Harris and Sherwood 1978). Such a standpoint might suggest that interpreting skills are a direct consequence (or an added value) of bilingualism. By accepting this statement one might come to the conclusion that bilinguals are perfect candidates to become successful interpreters and no extra training is necessary.

The truth about interpreters’ success seems to be much more complicated. It appears that an inherent cognitive capacity is not sufficient for a person to become a successful interpreter. Figure 13 might serve as an explanation of the relationship between interpreter aptitude and interpreter’s success.
As might be concluded, there are three main elements which influence human performance: capacity, willingness and opportunity. *Capacity* refers to an individual’s intelligence, cognitive resources, acquired skills and physical shape (Moser-Mercer 2008: 4). Hence, this element encompasses aptitude understood as the ability to learn new material and acquire new skills. However, capacity is only one of the three elements which determine an individual’s performance. The concept of *willingness* involves a person’s (internal) motivation as well as their attitude to perform a given task (Moser-Mercer 2008: 4). Hence, willingness hinges on a range of affective factors involved in human performance. Last but not least, *opportunity* refers to physical work environment which enables a person to master new skills (Moser-Mercer 2008: 4). Although Blumberg and Pringle (1982) meant human performance in general, all these elements may fit the interpreting context too. In order to provide a high-quality interpretation, interpreters must use their cognitive resources to perform this demanding task (*capacity*). The interpreter’s positive attitude to performing an interpreting task, resistance to stress and motivation to further develop their skills and learn new strategies may also have a significant influence on the quality of their performance (*willingness*). However, it should also be remembered that inappropriate working conditions (e.g. not enough room in an inter-
interpreting booth, noise) might negatively impact interpreting output as the interpreter does not have appropriate work environment to master interpreting skills (*opportunity*) (cf. AIIC Workload Study 2002).

On the whole, Blumberg and Pringle’s (1982) classification serves here as a representation of factors which might influence the interpreter’s performance. The role of innate cognitive resources should by no means be neglected when discussing interpreters’ performance but it stands to reason that one should also take affective and situational factors into account.

To summarise, linguistic abilities and a perfect command of (at least two) working languages are a prerequisite to become an interpreter. This is reflected in the fact that (almost) every single interpreting school tests a candidate’s proficiency in working languages as part of the admission test\(^{16}\). As conference interpreting is a linguistic process, it is expected of candidates to prove satisfactory language abilities and linguistic awareness. However, it can be firmly stated that being a bilingual speaker is not enough to become a successful interpreter. Several interpreting scholars have indicated the necessity to consider both cognitive and psychological factors which might determine interpreting skills, and to include them in admission testing (Moser-Mercer 2008; Timarová and Ungoed-Thomas 2008; Chabasse 2009; Macnamara et al. 2011; Rosiers et al. 2011; Russo 2011; Shaw 2011; Timarová and Salaets 2011). The idea behind these tests is that they should serve as valid indicators of interpreter aptitude. Chabasse and Kader (2014) conducted a study in which they verified whether the results of selected interpreting admission tests correlate with interpreting performance operationalised by the final interpreting exam grades. The authors concluded that the cognitive shadowing test based on interpreting exercises developed by Kurz (1992) was the best predictor of interpreting success (Chabasse and Kader 2014: 31). Hence, the ability to listen, produce speech and think at the same time with no prior experience in interpreting turned out to be a substantial prerequisite to become a successful interpreter. The importance of such cognitive abilities in interpreter aptitude will be discussed in the next section.

\(^{16}\) For details, see Timarová and Ungoed-Thomas (2008: 38). The authors conducted a small-scale study in which they investigated the structure of admission tests in 18 different interpreting schools.
3.3. Cognitive abilities and interpreting skills

As already stated, cognitive abilities may serve as a significant factor in determining one’s interpreting skills. The idea of cognitive resources needed to perform a simultaneous interpreting task has been reflected in Gile’s Effort Models referred to in Chapter 1. In order to provide a successful interpretation, the total cognitive capacity of a given interpreter must outweigh or equal the total processing requirement, as well as none of the four separate capacity requirements (the Listening and Analysis Effort, the Short-term Memory Effort, the Speech Production Effort and the Coordination Effort) may exceed the corresponding available capacity (Gile 1995; Gile 1999). This clearly indicates the significance of cognitive skills and their effect on interpreting performance.

The role of cognitive abilities in determining interpreters’ success has been verified empirically by Macnamara et al. (2011) who investigated domain-general cognitive abilities in two groups of interpreters: the highly skilled ones and the less skilled ones. In order to classify interpreters on the basis of their interpreting abilities, five raters were used. The authors of the study concluded that “high levels of mental flexibility, cognitive processing and psychomotor speed, task switching ability, a low level of risk sensitivity, and possibly working memory capacity increase the likelihood that one will be a highly skilled interpreter” (Macnamara et al. 2011: 138). These seem to be the most important cognitive abilities which might prove useful in conference interpreting. However, it must be pointed out that, although the main focus of the study was on interpreters’ cognitive abilities, personality traits were also examined. Having classified the interpreters, the authors administered seven cognitive ability tests and three emotion-interaction measurements to the participants (Macnamara et al. 2011: 128). The cognitive ability tests involved traits such as reasoning, working memory capacity, cognitive processing speed, psychomotor speed, cognitive control, mental flexibility and task switching. Within the emotion-interaction measurements the authors tested engagement in complex tasks as well as sensitivity to reward and risk. The authors concluded that the battery of tests proved useful in determining interpreter aptitude. The authors correctly classified 76.9% of highly skilled interpreters and 90.9% of less skilled interpreters (Macnamara et al. 2011: 137). Among the traits and abilities which were tested, “mental flexibility, cognitive processing speed, task switching ability, psychomotor speed, and aversion to risk appear to be important in differentiating interpreters with a
high level of SI skills from those with a low level of SI skills” (Macnamara et al. 2011: 137). The results of the study seem to corroborate the authors’ hypothesis about a significant role of cognitive abilities in determining interpreting skills.

Several studies have been conducted on conference interpreters’ working memory capacity. Intuitively, experienced interpreters should have more efficient (if not exceptional) working memory skills when juxtaposed with the rest of the population. This might be explained by the fact that during simultaneous interpreting interpreters need to perform a plethora of cognitive operations at the same time which requires substantial working memory resources. Nevertheless, the results of empirical studies seem to remain inconclusive. Padilla et al. (1995) tested professional interpreters, interpreting trainees and bilinguals with no interpreting experience on working memory capacity by administering two tests on them: a reading span test by Daneman and Carpenter (1980) and a digit span test. The authors corroborated their hypothesis about a greater working memory capacity in experienced interpreters; this was reflected in both the digit span test and the reading span test. The superiority of working memory skills in expert interpreters over non-interpreters was also observed in the studies by Christoffels et al. (2006) and Stavrakaki et al. (2012). Nevertheless, there are studies in which the group effect between interpreters and non-interpreters was not visible (e.g. Moser-Mercer et al. 2000; Liu et al. 2004; Chmiel 2012). Hence, one should not jump to conclusions about more efficient working memory skills in professional conference interpreters. Köpke and Signorelli (2011) suggested that such a discrepancy might result from methodological reasons, e.g. the type of memory task which was administered to the participants. For example, Signorelli et al. (2011: 198) concluded that expert interpreters out-perform non-interpreting bilinguals in tasks involving non-word repetition and reading span, but not necessarily in cued recall and articulation rate tasks. It seems that, in general, professional interpreters obtain better results than trainees and non-interpreting bilinguals in tasks involving free recall, i.e. with no regard to order of recalled items (Köpke and Signorelli 2011: 185). On the contrary, in tasks based on serial recall (when the order of recall needs to be respected) the superiority of expert interpreters is no longer observed. This might support the claim that “interpreters develop the capacity to establish meaningful links between items as requested for elaborative rehearsal” (Köpke and Signorelli 2011: 195).
It must be remembered that even if the results of a study show the superiority of professional interpreters over interpreting trainees and non-interpreting bilinguals in terms of their working memory capacity, it says nothing about the effect of interpreter training on memory skills. This is because in such a study design different groups of people are tested at the same time (cross-sectional studies; between-group design). Interpreters' superiority may stem from: (1) their inherent cognitive capacity or (2) the effect of efficient interpreting training. In order to check the veracity of the statement that extensive interpreter training enhances memory skills, one should conduct a longitudinal study (within-group design, dependent data) in which interpreting trainees would be tested at the beginning and at the end of an interpreting course (Chmiel 2015). In one of the studies on the relationship between SI experience and working memory, Timarová et al. (2014: 162) found that the ability to resist interfering distractors was related to interpreting experience.

To summarise, in this section the role of cognitive abilities in interpreting was discussed. Gile’s Effort Models were referred to as they proved useful in explaining that the interpreter’s performance might depend on the efficient memory skills. According to Gile (1995) the interpreter is able to perform a given interpreting task when their cognitive capacity outweighs the total processing requirements of the task. Then, using a classification compiled by Macnamara et al. (2011), I listed the most important cognitive abilities which were found to influence the interpreter’s performance. At the end of this section, I reported on some of the studies concerning the role of working memory in interpreting. It transpired that the results are quite inconclusive and more longitudinal studies are needed to take a firm stand about the effect of working memory skills on interpreting performance.

3.4. Psychological factors and interpreting skills

Several interpreting scholars have noticed that the significance of psycho-affective and personality factors has long been neglected in Interpreting Studies and admission testing. To give some examples:
“most language learning approaches in general, and interpreter training programmes in particular, appear to disregard the learner as a human being and neglect the psychoaffective framework he brings to the task of learning a language” (Brisau et al. 1994: 87);

“[a]s coping tactics are a fundamental skill in interpreting, they should be taught within the framework of practical exercises” (Kurz 2003: 64);

“schools rarely administer tests explicitly aimed at more “soft” skills, such as motivation, ability to learn quickly, open-mindedness, etc., despite identifying these skills as an integral part of a good candidate” (Timarová and Ungoed-Thomas 2008: 43);

“[i]n subsequent decades, as conference interpreters came to do most of their work in the booth, the balance between cognitive and affective characteristics apparently shifted towards the former” (Pöchhacker 2011: 107);

“[a]lthough most interpreter training schools take non-linguistic skills such as ‘analytical ability’, ‘clarity and precision’, or ‘delivery style’ into account when testing students for admission, very few seem to link these to underlying personality profiles” (Rosiers et al. 2011: 54);

“[t]o concentrate research efforts on the cognitive factors that may predict performance in a profession is neglectful of the range of affective factors that have implications for the psychology of work” (Bontempo and Napier 2011: 87); “[t]o date however, there appears to be little empirical research on the emotional stability of interpreters” (Bontempo and Napier 2011: 88);

“education should not be reduced to the processes of mastering skills or knowledge, but it should provide a chance for the students and the teachers to engage as complex personalities in individual and collaborative learning processes” (Klimkowski 2015: 92f.).

The interest in psychological factors in interpreting started to emerge as early as the 1990s (Brisau et al. 1994) but, as the claims cited above seem to suggest, it has become dominant in recent years. In other words, one might observe that psycho-affective factors in conference interpreting are gaining more and more attention of the interpreting scholars and interpreting trainers admitting new candidates. Attention is placed not only on language proficiency and cognitive abilities, but also on psychological notions and
their effect on interpreters’ success. These include, but are not limited to: motivation, personality profile, communication abilities, anxiety control or stress resistance. In this section, research on the role of psycho-affective factors in conference interpreting will be discussed.

One of the earliest articles which aimed at creating a psycholinguistic profile of a conference interpreter was the one published by Brisau et al. (1994). The authors expressed the need to take into consideration psycho-affective factors in interpreter training. They went on to note that there might be a strong relationship between such factors and interpreting skills (Brisau et al. 1994: 87). Although they did not neglect the need to consider linguistic abilities and neurological factors, they enumerated a dozen of psychological concepts which could be used in defining a perfect interpreting student: the interpreter’s self-concept, cognitive style, anxiety, attitude, stress resistance and metacognition (Brisau et al. 1994: 90ff.). However, the selection of concepts proposed by Brisau et al. (1994) was rather prescriptive than based on empirical data. The authors stated that the objective of the article was to set guidelines for further empirical research in which these concepts would be tested (Brisau et al. 1994: 93).

In recent years such empirical studies have been conducted. Timarová and Salaets (2011) investigated the role of soft skills in interpreter training. They felt that in admission tests for interpreters there was a great focus on hard skills, i.e. those concerning language processing and interpreting skills (Timarová and Salaets 2011: 32). Hence, in their study they focused on three soft skills and their role in interpreting: learning styles, motivation and cognitive flexibility, the last of which was defined as “readiness to change cognitive content and its attributes (Scott 1962) or the ability to switch to a different action as required by the situation and to avoid stereotypical behaviour (Hill 2004)” (Timarová and Salaets 2011: 35). To test these traits, the authors of the study used the following psychometric instruments: the Inventory of Learning Styles (by Vermunt and Rijswijk 1987), the Achievement Motivation Test (by Hermans 1968/2004) and the Wisconsin Card Sorting Test (by Grant and Berg 1948). The researchers found that successful interpreting graduates were characterised by a higher level of cognitive flexibility, were more resistant to stress and were more able to make use of the feeling of anxiety in a positive way (Timarová and Salaets 2011).

Bontempo and Napier (2011) explored the role of emotional stability in aptitude for interpreting. Emotional stability is a theoretical construct perceived as a continuum
from full emotional stability to emotional instability, the latter of which if often referred to as neuroticism (Bontempo and Napier 2011: 87). In order to explain the concept of neuroticism better, the authors of the study enumerated its sub-trait which encompass: “insecurity, fearfulness, worry, tendency towards depression/negative moods, feelings of guilt, high emotional reactivity and irritability” (Bontempo and Napier 2011: 87f.).

110 interpreters took part in a survey research. Based on the results of the study, the authors concluded that emotional stability might be regarded as a predictor of performance in conference interpreters and emphasised the importance of psycho-affective factors in the interpreting classroom (Bontempo and Napier 2011: 101).

An interesting question which has been recently posed in Interpreting Studies is whether it is possible to construct and describe an interpreter’s personality profile. Are there any personality traits that can be often found in interpreters? Are interpreters predestined to work in a stressful and constantly changing working environment? To give an example, would they be more extroverted than a control group, given the nature of their work as language mediators? Such a claim was not supported in research conducted by Schweda Nicholson (2005). She carried out a study in which she employed the Myers-Briggs Type Indicator (MBTI, Myers 1962) based on Jung’s psychological types to test interpreters’ personality. The results of the study in a way go against conventional thinking since the examined group of interpreters comprised a more or less equal number of Extraverts and Introverts. Schweda Nicholson (2005) demonstrated that in the group of interpreters Thinkers (“head-dominated”, favouring a logical approach, Barr and Barr 1989: 4; Schweda Nicholson 2005: 117) outnumbered Feelers (“heart-dominated”, taking a subjective view, focused on social relationships, Barr and Barr 1989: 4; Schweda Nicholson 2005: 117) which might suggest that analytical thinking is one of the predominant features in conference interpreters (Schweda Nicholson 2005: 137).

Frishberg (1990: 30f.) suggested that interpreters should be good public speakers and held that “[p]ublic speaking skills, including poise, appropriate breath control, varieties of intonation, volume, and vocal quality are of great value to the interpreter”. Public speaking skills might prove useful in consecutive interpreting, when the interpreter performs on stage and is in the spotlight. Florczak (2013: 51), apart from the quality of the interpreter’s voice, discussed the significance of the ability to speak fast in the interpreter’s job.
Other interpreting scholars have also given examples of psychological factors which are worth considering when discussing interpreting skills. Łyda et al. (2011) investigated whether gender is a factor which influences performance in conference interpreting. Interestingly enough, the authors identified that in consecutive interpreting female interpreting trainees used more distance-building structures (e.g. nominalisations) than male students when they identified themselves with the audience which was evaluated, positively or negatively, by the speaker (Łyda et al. 2011: 52). Rosiers et al. (2011) compared interpreting trainees with translation trainees with regard to language anxiety, motivation and linguistic self-confidence. The results suggest that interpreting trainees consider themselves to be more communicative than translation trainees. They also experience less language anxiety than translation trainees (Rosiers et al. 2011: 65).

Elsewhere, in her study on “cognitive and motivational contributors to aptitude”, Shaw (2011: 73) mentioned motivation, personal habits and optimism as psychological factors which may have an influence on the interpreting process.

To summarise, factors which might affect interpreting performance can be divided into four main groups: language abilities, situational factors (e.g. working conditions), cognitive factors and psycho-affective factors. In recent years one might observe a tendency to investigate the process of interpreting from a psychological perspective by combining cognitive and psychological aspects of aptitude for interpreting. A graph by Chabasse and Kader (2014) summarises the main points in question:
Chabasse and Kader (2014) classified factors contributing to aptitude into cognitive and non-cognitive factors. Situational factors are not neglected either: the authors noted that the interpreter’s or interpreting trainee’s significant others (family, friends) might also play an important role in his or her development (environment). What is more, the authors also pointed to coincidence experiences which might have an impact on the interpreters’ cognitive abilities. All of these factors can impact the process of gaining systematically acquired expertise by interpreters.
3.5. AIIC on interpreters’ key skills

AIIC (International Association of Conference Interpreters)\textsuperscript{17} also partook in the discussion on the qualities of a successful conference interpreter by formulating suggestions to future interpreters. On the official website of the association one reads that there are several skills that a conference interpreter might use on a daily basis:

- “a polished command of their own native language over a range of registers and domains;
- a complete mastery of their non-native languages;
- a familiarity with the cultures in the countries where their working languages are spoken;
- a commitment to helping others communicate;
- an interest in and understanding of current affairs, plus an insatiable curiosity;
- world experience away from home and school and a broad general education;
- good training (and usually at least an undergraduate university degree);
- the ability to concentrate and focus as a discussion unfolds;
- a pleasant speaking voice;
- a friendly, collegial attitude;
- \textit{calm nerves}, tact, judgment and a sense of humor;
- a willingness to adhere to rules of conduct (e.g. confidentiality)” (AIIC 2010\textsuperscript{18}; emphasis mine).

The list of skills proposed by AIIC corresponds to a large extent to the previous discussion on factors affecting interpreting performance. Language command has been placed at the top of the list and has been followed by, among others, knowledge about the world and current affairs, the ability to cooperate with others, appropriate training, cognitive factors such as being able to concentrate, a pleasant voice, and some psychological traits such as stress resistance (\textit{calm nerves}), tact and the ability to work with other people.

\textsuperscript{17} AIIC is a non-profit organisation, founded in 1953. It brings together around 3,000 professional conference interpreters from more than 90 countries all over the world (AIIC, http://aiic.net/).

\textsuperscript{18} http://aiic.net/page/56
One of the psychological traits which has been mentioned in some empirical studies as well as in suggestions to future interpreters published by AICC is stress resistance. It seems that interpreting scholars agree that being able to cope with stress is a useful trait in conference interpreting. Also, they would agree that interpreting induces a significant level of stress which, as a consequence, might negatively impact interpreting quality.

The next sections of this chapter are intended to discuss the notion of psychological stress in conference interpreting. I will report on the Workload Study commissioned by AIIC and other empirical studies which have been conducted in this field to this date.

3.6. Conference interpreting and psychological stress: The AIIC Workload Study

In 1999 the Research Committee of the International Association of Conference Interpreters (AIIC) started their work on the Workload Study concerning psychological and physiological aspects of stress experienced by conference interpreters. The report published in 2002 summarises the results of the study commissioned by AIIC. The aim of the research was to identify the main stressors involved in the interpreter’s job which would, in turn, make it possible to cope with the situation. The specific research goals included the following:

- “to map out both positive characteristics and sources of stress in the interpreter’s work;
- to characterize physical stress (air quality, noise level, etc.) in the interpreter’s work environment;
- to test the implications of the work characteristics for the interpreters’ quality of life (burnout, desire to remain in the profession, job satisfaction) and for their performance;
- to enable recommendations as to ways of improving the work characteristics and environment for interpreters” (AIIC 2002: 3).

The AIIC study is an example of the integrative approach to the issue of stress in conference interpreting in which different methodologies were combined. First of all, the
researchers measured physical working conditions in interpreting booths and investigated, among others, humidity level and air quality. Furthermore, interpreters’ attitudes were measured by means of psychometric instruments (questionnaires). The measurement of stress levels during the interpreters’ working day was carried out by means of recording their blood pressure, heart rate and analysing salivary cortisol concentration. What is more, the researchers aimed at verifying whether stressful working conditions had an impact on interpreting quality. To this end, both self-assessment and objective parameters were adopted.

In the theoretical part of the report, the authors of the study referred to factors which might lead to the interpreter’s experience of psychological distress and, in turn, impair the quality of their performance:

- “delivery of speech – e.g. speed of delivery, type of speech (scripted or spontaneous), unfamiliarity with text etc.;
- increased time on task;
- impaired visual contact with the speaker and/or audience;
- uncomfortable work conditions (temperature, air circulation, air quality, noise etc.);
- high level of physiological effort” (AIIC 2002: 16).

Although the list does not constitute a comprehensive classification of potential stressors in interpreting, it points to some problematic aspects of the interpreter’s work. Below I will report on the results of both a mail survey (i.e. survey research conducted via email) and an on-line study in which the interpreters’ work was recorded and analysed.

In order to investigate the notions of job satisfaction, occupational stress and burnout, a survey research was carried out on a representative sample of conference interpreters. The response rate was 41% which equals a significant number of 607 questionnaires returned to the researchers (AIIC 2002: 22). It transpired that the majority of participants were satisfied with their job and they were willing to continue working as interpreters in the future. When calculating overall satisfaction, the researchers used factors such as: status of the job, perceived significance, lack of routine, frequent travel, fees and workplace relations (AIIC 2002: 44). Although the data point to the interpret-
ers’ general satisfaction with their job, in the case of professional status and frequent travel the reported index of job satisfaction was relatively low.

As for stress in interpreting, there emerged a clear distinction between those interpreters who perceive their occupational stress as a positive and motivating factor (51% of the participants) and those who believe that stress has a harmful effect on interpreters’ work (30% of the participants). For 19% of the interpreters stress was neither harmful nor useful (AIIC 2002: 35). Three main factors emerged as contributing to stress to the greatest extent: difficulty of delivery and text (i.e. the way in which a speech is structured and produced), unsatisfactory booth conditions and preparation difficulties (AIIC 2002: 44). These results point to a great variety of stressors embedded in conference interpreting. Not only do they refer to interpreters’ physical environment but also to the characteristics of the source-language input. This seems to be a salient point in the discussion on stress in interpreting as it suggests that increasing interpreters’ physical comfort (e.g. lack of noise, appropriate booth temperature) is not enough to help interpreters reduce their work-related stress. Some more attention also needs to be paid to speaker characteristics which might have a significant impact on the interpreter’s well-being and the quality of their performance. In this context it must also be emphasised that in the Workload Study between 40-60% of interpreters referred to stress as a factor contributing to a decrease in interpreting quality (AIIC 2002: 44).

The main objective of the on-line study was to “examine the relationship between physical, physiological and psychological factors and performance, during various periods of the workday” (AIIC 2002: 47). A sample of 48 conference interpreters was tested in the course of their working day. The following physiological measures of stress were used in the study:

- ambulatory blood pressure, which is believed to show significantly higher values in the case of people exposed to job strain; heart rate (cf. Section 2.8.1);
- salivary cortisol: a hormone which is one of the most commonly used indicators of the body’s physiological reaction to a stressful situation (AIIC 2002: 48, after Kirschbaum and Hellhammer 1989) (cf. Section 2.8.3).

Physiological measurement of stress was supplemented by the interpreters’ subjective appraisal of stress in various situations such as: when interpreting, resting, during a cof-
fee break, etc. In this way the researchers were able to verify whether the perceived stress level was congruent with the physiological reaction of the sympathetic nervous system. As can be predicted, interpreters experienced the highest level of stress when being on mike. Being off mike (but on duty) transpired to be significantly less stressful. This tendency was observed in both cardiovascular and cortisol responses to occupational stress and was also confirmed by the interpreters’ self-ratings (AIIC 2002: 61).

Although the fact that interpreters experience stress when interpreting is not surprising, it is worth noticing that interpreters were, to a large extent, aware of their mental and psychological state which was reflected in a positive correlation between objective physiological measures of stress and the interpreters’ subjective appraisal of potentially stressful situations.

As already pointed out, one of the main aims of the AIIC workload study was to investigate the quality of interpreters’ working environment and its impact on their performance. Several problems were identified. First of all, it was found that there was not enough fresh air in the booths which led to the fact that the concentration of CO₂ was higher than recommended. The temperature in the booths was also higher than recommended values. Another problem was insufficient lighting in permanent booths. It may be a grave problem since poor light is commonly believed by light ergonomics experts to have a negative impact on task performance and may be detrimental to a person’s health by being a direct cause of eye strain. Moreover, the amount of space in booths was found to be insufficient at times. It influenced the organisation of the interpreters’ work and could impair their performance (AIIC 2002: 124). The majority of the ergonomic problems described here were also mentioned in the answers given by interpreters in the mail survey, which was part of the AIIC workload project. More than 70% of the interpreters named the condition of interpreting equipment as a stress-inducing factor. Another factor which the interpreters mentioned (57%) was poor visibility of a speaker and visual aids the aim of which, quite paradoxically, is to reduce the cognitive effort invested in performing an interpreting task. The researchers identified a positive correlation between the condition of the booth and the experience of stress (r=0.23) (AIIC 2002: 124). Although the r value shows only a moderate relationship between the variables, it still suggests that there is a great chance that the bad condition of interpreting equipment would co-occur with the interpreter’s feeling of stress and anxiety.
One of the additional objectives of the AIIC project was to compare the burnout level of interpreters with other professions. It turned out that the burnout level of people working as interpreters is comparable to that of teachers or Israeli army officers and much higher than in hi-tech employees (AIIC 2002: 122). Such a comparison led the authors of the study to believe that the burnout risk for interpreters is considerable.

Crucial to the experiment presented in Chapter 4 of this dissertation is the fact that the AIIC researchers touched upon the question of the impact of a source speech delivery on the level of stress experienced by interpreters. They concluded that (1) fast speech delivery, (2) textual complexity of a source speech and (3) the overall theme of the meeting were the main stress factors for the interpreter being on mike (AIIC 2002: 123). The researchers explained a stress-provoking nature of delivery in interpreting by saying that “[t]he interpreter has no control over the pace of delivery. Another factor over which interpreters have no control, is the type of speech, i.e. spontaneous or prepared. Spontaneous speeches, or unprepared texts, are relatively chaotic, repetitive, highly redundant and often implicit” (AIIC 2002: 123). This may suggest that the problem of speech delivery and the type of speech is that such factors are perceived as uncontrollable and unpredictable.

To summarise, the study commissioned by AIIC can be regarded as a landmark project concerning interpreters’ working environment, job satisfaction and occupational stress (Blumenthal et al. 2006). Kurz (2003: 56) pointed out that the project is the first comprehensive study in which all the following parameters were investigated: psychological, physiological, environmental and performance-related. Before the AIIC project was carried out, it was often assumed, in an a priori manner, that interpreting induces a great deal of stress. Nevertheless, little empirical work was done to validate this issue (Cooper et al. 1982: 97; Klonowicz 1991: 446f.). The AIIC study made it possible to test empirically that interpreters are exposed to a high level of stress on a daily basis and they are prone to occupational burnout. What is more, by investigating the quality of interpreting booths and the interpreter’s job satisfaction, the researchers demonstrated that there is still a lot to be desired with regard to interpreters’ working conditions. In the full report on the AIIC study several recommendations and suggestions were provided which could reduce the level of anxiety and stress experienced by interpreters as well as make them more motivated to continue their job. The study clearly shows that
psychological and physiological costs to interpreting practice may compromise the quality of interpreters’ performance.

3.7. Conference interpreting and psychological stress: Other empirical studies

Although still considered to be quite scarce, empirical research on interpreters’ stress is gaining popularity. It seems that until the end of the 20th century stress and anxiety have never been perceived as one of the main research avenues in empirical studies concerning conference interpreting. However, there have been a lot of references in the literature that conference interpreting is a stress-provoking activity (e.g. Seleskovitch 1978: 41; Roland 1982: 13; Ricardi et al. 1998: 97; Jimenez Ivars and Pinazo Calatayud 2001: 105; Kurz 2003: 52). Thanks to the process-oriented approach to Interpreting Studies, such theoretical considerations can be verified empirically. The objective of this section is to discuss the results of the studies on psychological stress and anxiety in conference interpreting.

One of the first experimental studies on occupational stress experienced by conference interpreters was the one conducted by Cooper et al. (1982) with the support of AIIC. In their article, the authors emphasised the need to empirically test the stress-inducing nature of the profession. They stated that “[a] great deal has been written about the pressures and strains imposed on interpreters working in international forums (…). Little serious empirical work has been undertaken, however, to identify the sources of stress acting on them” (Cooper et al. 1982: 97). Hence, the main purpose of the study was to identify the sources of occupational stress among conference interpreters. The authors used a method of survey research to obtain information on the issue in question. A significant number of 826 questionnaires were returned to the authors of the study. Among the notions discussed in the questionnaire where the following: “characteristics of interpreters (attitude toward work, stress at work, behavioural manifestations of such stress), job satisfaction, indications of present physical health, type A/B personality characteristics19, perceived stress on the job and mechanisms for coping with stress”

19 The type A/type B personality theory was developed by Friedman and Rosenman (1959). Type A individuals, as opposed to type B individuals, are more sensitive, competitive, impatient and anxious which is believed to result in higher life stress levels.
Almost 50% of the interpreters stated that more than 40% of stress experienced by them in their lives was related to being a conference interpreter, a slightly higher value than the one obtained in the AIIC study. Nevertheless, interpreters were in general satisfied with their job. Cooper et al. concluded that individual perception of stress had a more significant impact on interpreters’ well-being and performance than the objective stressfulness of the job (Cooper et al. 1982, as cited in Kurz 2001: 114 and Kurz 2003: 59). In other words, individual differences in reacting to a stressful situation may have a significant influence on interpreters’ job satisfaction. This is consistent with Lazarus’ stress theory in which psychological stress is understood as a subjective notion, influenced by personality traits and the perception (the appraisal) of a task to be performed (Monat and Lazarus 1977; Lazarus and Folkman 1984) (cf. Section 2.4).

Klonowicz (1994) carried out a study on physiological stress responses in conference interpreting. The author discussed the problem from the perspective of information processing in conference interpreting. She stated that the choice of a particular resource strategy may be a consequence of stress experienced by the interpreter (Klonowicz 1994: 215). In her study, Klonowicz chose blood pressure and heart rate as indicators of stress. As phrased by the author herself: “[t]he experiment was focused on patterns of cardiovascular activity as a measure of stress” (Klonowicz 1994: 216). Systolic blood pressure, diastolic blood pressure and heart rate were measured both before and after each of the four successive interpreting turns. The study’s results indicated that at the beginning of each turn there was a significant, as Klonowicz (1994: 219) put it, “mobilization wave”, characterised by a high increase in the values of all the measures, i.e. systolic blood pressure, diastolic blood pressure and heart rate. During the turn the systolic blood pressure usually normalised, while the diastolic blood pressure remained significantly high. As for heart rate, its normalisation was observed only during the first two turns (Klonowicz 1994: 221). The author of the experiment emphasised that the results indicate “the functional significance of the pattern of changes in cardiovascular activity” (Klonowicz 1994: 221). To be more specific, the existence of the mobilisation wave and the elevation of diastolic blood pressure in the course of interpreting help the interpreter to actively engage in an interpreting task.

A study by Moser-Mercer et al. (1998) was also one of the pioneering ones in the field of stress and anxiety in simultaneous interpreting. The aim of the study was to
investigate “the effect of prolonged turns, those lasting longer than 30 minutes on the quality of interpreters’ output as well as the interaction between prolonged turns and physiological and psychological stress experienced by the interpreters” (Moser-Mercer et al. 1998: 49). The researchers used both a physiological stress marker (concentration of cortisol) and a psychometric measure (a take-home questionnaire designed to investigate the participants’ stress coping mechanisms) (Moser-Mercer et al. 1998: 52). The results obtained from the questionnaire showed that interpreters tend to perceive interpreting as a set of uncontrollable situations which might lead to their passivity understood as “not engaging in any attempt to actively influence the situation” (Moser-Mercer et al. 1998: 60). The authors of the study demonstrated that prolonged turns in simultaneous interpreting caused stress among interpreters and compromised the quality of interpretation (Moser-Mercer et al. 1998: 52). One might argue that the complexity of the study and multiple measurements of cortisol secretion in the interpreters’ saliva had a significant influence on the ecological validity of the study. What is more, due to technical reasons, the number of participants was limited to five which makes it reasonable to treat the results with caution. Nevertheless, the experiment provides an important insight into the issue of prolonged turns and their impact on interpreting quality.

In their study Riccardi et al. (1998) focused on the feeling of anxiety experienced by conference interpreters and interpreting trainees. The authors limited their methodology to psychometric instruments as they found physiological measures of stress and anxiety obtrusive. Riccardi et al. (1998) used three different psychological tests:

- the ASQ - IPAT Anxiety Scale (Krug et al. 1976) – used to measure anxiety levels in adults;
- the CDQ - IPAT Depression Scale (Krug and Laughlin 1976) – providing information on depression levels measured on the basis of factorial analysis;
- MMPI-2 (The Minnesota Multiphasic Personality Inventory) (Hathaway and McKinley 1989) – one of the most extensive and commonly used personality tests used in the study to investigate anxiety as a general feature outside the conference setting (Riccardi et al. 1998: 102f.).
The ASQ and CDQ tests were administered before and after interpreting which enabled the researchers to observe changes in anxiety levels as a result of an interpreting task which was performed. It was shown in the study that the depression and anxiety values before and after the conference vary more in interpreting trainees than in the case of professional interpreters (Riccardi et al. 1998: 102). This seems to be a very interesting conclusion from a didactic point of view as it might suggest that, when compared with students, professionals have more functional stress coping strategies at their disposal. In other words, the results might suggest that there is a positive effect of interpreting practice on stress coping strategies and, in turn, on interpreting quality. As for the MMPI-2 test, no statistically significant differences were observed between the two experimental groups. Riccardi et al. (1998) also identified that interpreters, when juxtaposed with the rest of the population, are characterised by lower depression and anxiety values. However, the interpretation of such results is not easy as in correlational research it is impossible to establish a cause-and-effect relationship. Thus, one does not know whether interpreting practice makes a person less prone to stress and anxiety or whether possessing these traits influences interpreters’ choice of their future job.

Another study in which novices and professional interpreters were compared with regard to their susceptibility to stress is the one conducted by Kurz (2003). The author of the experiment measured the level of physiological stress in both experimental groups during an interpreting task by using pulse rate and skin conductance as indicators of stress. Professionals and interpreting trainees were found to differ in four dimensions: meaningful patterns of information, organisation of knowledge, context and access to knowledge as well as fluent retrieval (Kurz 2003: 58f.). The aim of the study was to verify whether the differences between the two groups would also be reflected in physiological stress responses. It turned out that there were significant differences in the pulse rate values between experts and novices, the latter being characterised by significantly higher average values. As for skin conductance, the authors did not observe any significant differences between the experimental groups. It must be emphasised that Kurz’s (2003) experiment was a pilot study in which 2 professionals and 3 interpreting trainees took part. A proper experiment would be necessary to verify whether the observed difference in pulse rate is statistically significant and, hence, whether one could generalise the results onto the whole population.
In her article, Kurz (2003) emphasised the need to implement stress coping strategies into the didactics of conference interpreting. She agrees with Gile (1995) that interpreting courses “should be designed in such a way as to facilitate the acquisition of productive interpreting strategies” (Kurz 2003: 64). By referring to coping strategies as fundamental ones, Kurz suggests that their importance should by no means be neglected. Interpreting trainees should be provided by their trainers with functional ways to deal with stress and anxiety in order to provide high-quality interpreting.

Jimenez Ivars and Pinazo Calatayud (2001) conducted a correlational study on the relationship between state anxiety, fear of public speaking experienced by interpreting trainees and their performance in the final interpreting exam. To this end, they used two psychometric instruments which would provide operational definitions of both fear of public speaking and state anxiety:

- **STAI – State-Trait Anxiety Inventory** (Spielberger et al. 1970): as explained in Chapter 2; the questionnaire measures two types of anxiety – state anxiety (anxiety about an event) and trait anxiety (anxiety as a stable personal characteristic, independent of a given situation); in their study, Jimenez Ivars and Pinazo Calatayud (2001) used the concept of state anxiety to examine a temporary condition of tension caused by an interpreting task;

The authors of the study formulated three hypotheses: (1) about the positive correlation between fear of public speaking and anxiety; (2) about the negative correlation between fear of public speaking and performance in interpreting; (3) about the negative correlation between anxiety and performance in interpreting (Jimenez Ivars and Pinazo Calatayud 2001: 108).

The first hypothesis was corroborated in the study, i.e. the authors found a positive correlation between fear of public speaking and state anxiety. Although the correlation between the two variables proved to be statistically significant, the authors noticed that the correlation coefficient was not high enough for the purposes of their study. The observed value of the coefficient of determination ($R^2$) was .115 which means that the
relationship between fear of public speaking and state anxiety explains only 11.5% of the variance (Jimenez Ivars and Pinazo Calatayud 2001: 113). Surprisingly enough, Hypotheses 2 and 3 were not confirmed. To conclude, there was a correlation between anxiety and fear of public speaking experienced by interpreting trainees but neither of them proved to influence the quality of interpreting output. This might be surprising as one could predict that a significant anxiety level would co-occur with low quality of the student’s interpretation. This result might be in part explained by the distinction between the two main types of stress: eustress (stress as a motivating factor) and distress (debilitative stress which leads to maladaptive behaviour and has a negative influence on the perception of the task to be performed). It might be true that the final examination tension motivated at least some of the students and, thus, did not have a negative impact on their performance. The authors of the study also suggested that factors such as: the feeling of self-efficacy, the wish to perform well in an exam situation as well as the students’ maturity and responsibility could mitigate the relationship between anxiety and performance (Jimenez Ivars and Pinazo Calatayud 2001: 114f.).

It might be a good idea to replicate this study by taking into consideration different interpreting settings. It would be interesting to measure the level of state anxiety in a regular in-class situation in the case of which no formative assessment is provided. Although test anxiety may affect students’ performance in every condition, it seems reasonable to assume that an exam situation is extremely stress-provoking and thus may influence the results of a study. When measuring students’ anxiety during an exam it is hard to determine whether the tension stems from the perception of a task or from the fact that the performance is assessed and the consequences of not satisfying the assessors’ expectations might result in failing the exam.

Kao and Craigie (2013) also touched upon the question of psychological stress and tension experienced by interpreting trainees. Apart from adopting a psychological measure of stress based on self-reports, they were also interested in stress coping strategies used by student interpreters. The Interpretation Classroom Anxiety Scale (ICAS; Chiang 2006) was used to measure the level of stress. The test comprised 44 statements concerning the potentially stressful situations in the interpreting classroom. Respondents gave their answers on a 5-point Likert scale where they reported how much they agreed with a given statement (Kao and Craigie 2013: 1038). The Coping Strategy Indicator (CSI; Amirkhan 1990) was adopted to investigate stress coping strategies pre-
ferred by interpreting trainees who participated in the study, i.e. whether they engage in problem-solving coping, avoidance coping or seeking social support coping.

The authors identified that the majority of interpreting trainees (85%) experience a high level of psychological stress while interpreting. What is more, such results “seem to support the assumption that interpreting might be associated with higher stress levels than most other language activities” (Kao and Craigie 2013: 1040). This might again suggest that there is a need to include stress coping strategies in the curriculum of any interpreting course. The analysis of the Coping Strategy Indicator scores showed that the most prevalent coping style was problem-solving coping, followed by avoidance coping and seeking social support coping (Kao and Craigie 2013: 1039). This seems to be in contrast to the results obtained by Moser-Mercer et al. (1998). The prevalence of active problem-solving coping seems to be functional and it suggest that the difficulties that the interpreting trainees encounter while interpreting are perceived by them as temporary and controllable (Kao and Craigie 2013: 1040). As for avoidance coping, the authors of the study took a firm stand by saying that the use of this strategy had a negative impact on the participants’ well-being as it increased the level of stress experienced by them. Although social support did not transpire to be the most commonly used coping strategy in the study by Kao and Craigie (2013), the authors emphasised the buffering role of social support in dealing with stress. To be more specific, they stated that “this form of coping provides a sense of mastery over the problem and is highly effective at reducing stress” (Zeidner and Saklofske 1996, as cited in Kao and Craigie 2013: 1040).

Chiang (2009) touched upon the question of anxiety experienced by interpreting trainees in the classroom. He noticed that anxiety and tension are often perceived as an inherent part of interpreter training but there is paucity of studies which would link these two notions and test interpreting trainees’ anxiety empirically. In order to fill this empirical void, Chiang (2009) adopted the Foreign Language Classroom Anxiety Scale (FLCAS) questionnaire by Horwitz et al. (1986) the content of which was believed to operationalise the notion of foreign language (FL) anxiety. It needs to be emphasised that FL anxiety is a unique type of anxiety which encompasses beliefs, perceptions and pre-suppositions concerning the language learning process (Chiang 2009: 606; Horwitz et al. 1986: 31). The summary of the results of the study are provided in the quote:
Results showed that about one-third of Taiwanese student interpreters had FL anxiety, a scope smaller than Asian L2 learners’, similar to American L2 learners’, and wider than European L2 learners’, and the level of Taiwanese student interpreters’ FL anxiety was slightly lower than most university learners of various nationalities with various target languages, including American students of Spanish, French, and Japanese (Chiang 2009: 617).

The results of the study suggest that interpreter training and instructed L2 learning are almost equally stress-provoking. How can this be explained? To give some examples: in both contexts students need to perform and speak up, they are susceptible to test anxiety and they need to communicate the message in a foreign language. It might seem surprising that only about one-third of Taiwanese interpreting novices experienced foreign language anxiety. It might mean that interpreters-to-be are relatively more stress-resistant than their peers. However, such results might simply mean that speaking in a foreign language is not a primary stressor in the interpreting classroom. In other words, stress in the interpreting classroom may be a result of some more specific stressors.

In another study Chiang (2010) correlated FL anxiety with trait anxiety. To this end, Spielberger’s (1983) State-Trait Anxiety Inventory was adopted apart from the Foreign Language Classroom Anxiety Scale (FLCAS) questionnaire by Horwitz et al. (1986). It must be remembered that trait anxiety, as opposed to state anxiety, is a general personality feature. In his study, Chiang tested whether there is a relationship between:

- the trainees’ trait anxiety and their FL anxiety;
- the trainees’ trait anxiety and their learning outcomes in the interpretation classroom;
- the students’ FL anxiety and learning outcomes;
- the individual items of the FLCAS and learning outcomes (Chiang 2010: 591).

The author found a positive correlation between the trainees’ trait anxiety and FL anxiety (r=.339, p<.01). Although there exists a correlation between these two notions, it must be noticed that they have a common variance of only 11.2% (Chiang 2010: 592). Moreover, as stated by Chiang, “student interpreters’ trait anxiety had a negative relationship with mid-term exam scores, but the relationship did not reach a significant level” (2010: 593). The same relationship was observed for the students’ semester grades. FL anxiety, in turn, was significantly and negatively correlated with both outcome measures: semester grades and mid-term exam results (Chiang 2010: 593). This might
imply that speaking in a foreign language is a significant stressor in interpreter training. When looking at individual FLCAS questionnaire statements, it turned out that the majority of them were negatively associated with interpreting trainees’ semester grades and exam results (Chiang 2010: 596). To summarise, the novelty of Chiang’s studies is in the fact that apart from measuring context-free trait anxiety, he investigated student interpreters’ foreign language anxiety manifested, inter alia, in the fear of negative evaluation, communication apprehension and test anxiety (Chiang 2010: 598).

With the advent of new communication technologies, remote interpreting has been more often used at various conferences. In her research, Braun (2007; 2013) demonstrated that remote interpreting may lead to decline in interpreting performance faster than in the case of a traditional face-to-face setting. The remote interpreting setting was also perceived by some scholars as a potential stressor (Kurz 2002; Moser-Mercer 2005; Roziner and Shlesinger 2010). In her study, Kurz (2002) compared physiological stress responses in conference interpreting and media interpreting. The author pointed out that case reports concerning media interpreting indicate that it may trigger more acute stress responses than other conference interpreting settings (Kurz 2002: 195). Specific stressors involved in media interpreting might include:

- physical environment: being distanced from the speaker and the conference room, lack of feedback from the audience;
- work-related factors: poor sound quality, potential technical problems, no time for preparation;
- psycho-emotional stress factors: large audience from which the interpreter is separated, high expectations of interpreting quality (Kurz 2002: 195f.).

The main purpose of Kurz’s study was to verify whether interpreters’ subjective beliefs about the idiosyncrasy of media interpreting with regard to its stressfulness would be reflected in an empirical study (Kurz 2002: 196). So as to verify this, two physiological stress measures were selected: pulse rate and skin conductance level/galvanic skin response (Kurz 2002: 199). In order to be able to investigate the dynamics of stress responses, pulse rate and skin conductance level were recorded at regular intervals during a 5-day conference and then compared with the live TV interpreting performance. The results of the experiments clearly showed that when compared with on-site conference interpreting, media interpreting induced more stress. Such a relationship was reflected
in the measurement of both skin conductance level and pulse rate (Kurz 2002: 200). Interestingly enough, interpreters’ stress measurements were within a normal range even during a highly technical medical conference. It was stated that part of interpreters’ professionalism is about being accustomed to heavy demand of conferences at which they provide interpreting services (Kurz 2002: 201).

Moser-Mercer (2005) touched upon a similar question and investigated psychological and cognitive constraints of remote interpreting. In the theoretical part of her article she enumerated the most significant human factors which might be problematic 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” (Moser-Mercer 2005: 75).

As may be seen, psychological aspects and coping strategies were put at the top of the list. The aim of Moser-Mercer’s study (2005) was to verify whether there was a difference between live and remote interpreting in terms of both physiological and psychological stress as well as fatigue reflected in a poor quality of interpretation (Moser-Mercer 2005: 80). The author adopted a within-subject design, i.e. every participant (out of 12) interpreted in both interpreting settings.

Three psychological questionnaires were administered in the experiment (Moser-Mercer 2005: 84):

- Eysenck Personality Questionnaire (Eysenck and Eysenck 1975) the aim of which was to identify the interpreter’s general personality profile; EPQ uses four basic features abstracted by means of factor analysis: Psychoticism (P), Extraversion (E), Neuroticism (N), and Social desirability (L);
• the State-Trait Anxiety Inventory (STAI) (Spielberger 1983): it is worth mentioning that Moser-Mercer used both STAI Y-2 to measure trait anxiety (anxiety as a stable feature of a person) and STAI Y-1 to measure state anxiety (anxiety resulting from being faced with a given situation);
• a questionnaire concerning technical aspects of remote interpreting administered so as to identify obstacles which interpreters might encounter due to the use of novel equipment.

The analysis of the results of the EPQ questionnaire showed, inter alia, that interpreters are characterised by low values on the Neuroticism scale (neuroticism is understood as lack of emotional stability) and high values on the Psychoticism scale (referring to traits such as achievement-orientation and aggressiveness, Eysenck and Eysenck 1975). The latter might be surprising; Moser-Mercer provides the following plausible explanation: it might stem from the fact that free-lance interpreters are employed only for the duration of a given contract and then they are forced to work in another social grouping. The specificity of their job might explain their being solitary and troublesome at times and these features are included in the Psychoticism scale (P) (2005: 86). The STAI Y-1 test was administered a couple of times in the course of the experimental session in order to check the veracity of the statement that there exists a difference in stress levels between live interpreting and remote interpreting. The author of the study summarised the results of the STAI Y-1 questionnaire by saying that “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” (Moser-Mercer 2005: 89). The analysis of the answers given by interpreters in the questionnaire concerning technical aspects of remote interpreting showed that in general interpreters accept remote interpreting. However, it must be emphasised that being detached from the speaker and the conference hall emerged as the most problematic aspect of remote interpreting.

As previously mentioned, apart from the psychometric instruments (questionnaires), the measurement of the level of stress in Moser-Mercer’s experiment was supplemented by physiological measures such as: cortisol concentration (often referred to as stress hormone) and Immunoglobulin M (IgM) levels. Saliva samples were collected from the participants at regular intervals during the experiment to measure the amount
of salivary cortisol and IgM. Values for remote interpreting were compared with values for live interpreting so as to check whether the former is more stressful for the interpreters than the latter. It was corroborated in the study that stress levels were higher in the case of remote interpreting. Nevertheless, Moser-Mercer pointed to the fact that cortisol measures in both experimental conditions were not as varied as the participants’ self-assessment (STAI Y-1) (2005: 90). This might be a very intriguing observation as it shows that bodily reactions to stress (reactions of the sympathetic nervous system) do not have to go hand in hand with a person’s subjective perception of stress.

The effect of the impact of fatigue on interpreters’ performance was studied by using an error matrix designed by Moser-Mercer (2005). Apart from meaning errors, other grammatical parameters, style and prosody were perceived as having an impact on interpreting quality. Moser-Mercer demonstrated that fatigue clearly influenced the participants’ performance, i.e. the more tired the interpreter, the worse the quality of their interpretation. The discrepancy between live and remote interpreting with regard to the effect of fatigue on performance was also observed. As phrased by the author of the study, “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” (Moser-Mercer 2005: 92).

To summarise, in her experiment Moser-Mercer (2005) studied the impact of interpreting setting (remote vs. live interpreting) on the level of stress experienced by interpreters. Stress was operationalised both psychometrically (questionnaires) and physiologically (concentration of secreted cortisol and IgM levels). Hence, interpreting setting served as an independent variable in the experiment and the level of stress/fatigue was a dependent variable. However, the impact of fatigue on the interpreter’s performance was also investigated. I have provided a detailed report on the results of the study since I believe that Moser-Mercer’s experiment is an instructive example of a controlled experiment in which interpreters’ stress was measured both psychometrically and physiologically. Moser-Mercer’s stated that her study constituted the first controlled experiment in which human factors in remote interpreting were investigated (Moser-Mercer 2005: 94). Although on the scale of research methods a controlled experiment is the one in which ecological validity is always hampered, I believe that the choice of cortisol concentration and the need to collect saliva samples had additional
impact on the ecological validity of the experiment. The choice of pulse rate could solve this problem at least to some extent.

A question of performance and stress in remote interpreting (RI) was also discussed by Roziner and Shlesinger (2010). In their article, the authors provided the list of the following stress factors in simultaneous interpreting: “difficulty of input text and delivery”, “poor booth conditions”, “lack of feedback”, “insufficient visibility of speaker and/or audience” (Roziner and Shlesinger 2010: 219). It seems that the last two factors are crucial in remote interpreting.

Thirty-six simultaneous interpreters took part in the study. The experiment was conducted in two consecutive stages. First, the interpreters worked for two weeks in the traditional face-to-face setting, and then – for the next two weeks – they interpreted remotely (a within-subject design) (Roziner and Shlesinger 2010: 219). The study’s research areas included: ergonomics of interpreters’ work, their health condition, interpreting quality and stress factors in remote interpreting as opposed to on-site interpreting. The authors of the study observed higher burnout and perceived stress values for RI (2010: 236f.). No differences in the physiological measures of stress (heart rate and blood pressure) were observed (2010: 232). The researchers studied both the interpreters’ subjective perception of stress and the performance quality rated by independent judges. The authors concluded that “[w]hereas the interpreters themselves were significantly less satisfied with their own performance in RI, the objective judgments of a panel of judges (…) point to almost no decline in quality” (Roziner and Shlesinger 2010: 242). The results suggest that even if remote interpreting does not compromise interpreting quality, it leads to a decline in the interpreters’ self-efficacy and well-being and, hence, should be a subject of further research in the area.

The summary of the studies described in this section with regard to methodologies used and the main results is provided in Table 2:
Table 2. Summary of empirical studies on psychological and physiological stress in conference interpreting.

<table>
<thead>
<tr>
<th>authors</th>
<th>research question</th>
<th>number of participants</th>
<th>type of research</th>
<th>tests and measures used</th>
<th>main results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooper et al. (1982)</td>
<td>the sources of occupational stress among conference interpreters, perceived stress and job satisfaction</td>
<td>826 professional interpreters</td>
<td>survey research</td>
<td>a questionnaire developed by Cooper et al. (1982)</td>
<td>almost 50% of interpreters state that over 40% of stress in their lives is work-related; a general satisfaction with the profession; the importance of the subjective perception of stress</td>
</tr>
<tr>
<td>Klonowicz (1994)</td>
<td>physiological stress responses in simultaneous interpreting (reflected in blood pressure and heart rate)</td>
<td>16 professional interpreters</td>
<td>experimental study</td>
<td>systolic blood pressure, diastolic blood pressure and heart rate</td>
<td>the existence of a mobilisation wave in simultaneous interpreting; normalisation of systolic blood pressure and elevation of diastolic blood pressure during an interpreting turn; the functional role of the activation of cardiovascular responses</td>
</tr>
<tr>
<td>Moser-Mercer et al. (1998)</td>
<td>the effect of prolonged turns on psychological and physiological stress as well as interpreting quality</td>
<td>5 professional interpreters</td>
<td>both survey and experimental</td>
<td>concentration of salivary cortisol, a standardised take-home questionnaire (Reicherts and Perrez 1993)</td>
<td>prolonged turns in simultaneous interpreting caused stress among interpreters and compromised interpreting quality</td>
</tr>
<tr>
<td>Riccardi et al. (1998)</td>
<td>anxiety and depression experienced by conference interpreters and interpreting trainees</td>
<td>30 interpreting trainees and 15 professional free-lance interpreters</td>
<td>survey research</td>
<td>the ASQ - IPAT Anxiety Scale - (1976), the CDQ - IPAT Depression Scale - (1976), MMPI-2 (The Minnesota Multiphasic Personality Inventory)</td>
<td>higher depression and anxiety values in students than in professional interpreters; lower depression and anxiety values in professional interpreters than in the control group</td>
</tr>
<tr>
<td>Kurz (2003)</td>
<td>the level of physiological stress in novices and professional interpreters</td>
<td>2 professionals and 3 interpreting trainees</td>
<td>experimental study</td>
<td>pulse rate and skin conductance</td>
<td>higher pulse rate values in the group of trainees, no statistically significant difference for skin conductance measures</td>
</tr>
<tr>
<td>Study</td>
<td>Methodology</td>
<td>Results</td>
<td></td>
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<tr>
<td>Jimenez Ivars and Pinazo Calatayud (2001)</td>
<td>correlational study</td>
<td>a positive correlation between fear of public speaking and state anxiety; no effect of fear of public speaking and state anxiety on interpreting quality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kao and Craigie (2013)</td>
<td>survey research</td>
<td>most interpreting trainees (85%) experience a high level of psychological stress while interpreting; problem-solving coping as the strategy most commonly used by interpreting trainees</td>
<td></td>
<td></td>
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<tr>
<td>Chiang (2009)</td>
<td>survey research</td>
<td>one-third of interpreting trainees experienced FL anxiety</td>
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<tr>
<td>Chiang (2010)</td>
<td>correlational study</td>
<td>a positive correlation between trainees’ trait anxiety and FL anxiety; no association between trait anxiety and learning outcomes; a negative correlation between FL anxiety and learning outcomes (for both semester grades and mid-term exam results) – the relationship reflected in the majority of FLCAS questionnaire items</td>
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<tr>
<td>Kurz (2002)</td>
<td>experimental study</td>
<td>media interpreting inducing more stress when compared with on-site conference interpreting (reflected in both pulse rate and skin conductance level)</td>
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<tr>
<td>Moser-Mercer (2005)</td>
<td>the psychological and cognitive constraints of remote interpreting; the effect of remote interpreting on stress and fatigue reflected in the quality of interpreting output</td>
<td>12 professional interpreters</td>
<td>both survey and experimental</td>
<td>psychometric instruments: (1) Eysenck Personality Questionnaire (Eysenck and Eysenck 1975), (2) the State-Trait Anxiety Inventory (STAI) (Spielberger 1983), (3) a questionnaire concerning the technical aspects of remote interpreting; physiological measures: (1) concentration of cortisol, (2) IgM levels</td>
<td>working under remote conditions more stressful than live interpreting; general acceptance of remote interpreting by conference interpreters; higher stress levels in remote interpreting, when compared with live interpreting; the interpreters’ fatigue reflected in their performance</td>
</tr>
<tr>
<td>Roziner and Shlesinger (2010)</td>
<td>interpreters’ stress and performance in face-to-face vs. remote interpreting; ergonomics of interpreters’ working environment</td>
<td>36 professional interpreters</td>
<td>both survey and experimental</td>
<td>self-designed questionnaires aimed at testing the interpreters’ subjective perception of stress, burnout, their satisfaction with interpreting and working environment; an eye test to measure eye strain; a general health test; physiological measures: heart rate and blood pressure; independent judges</td>
<td>no significant differences in environmental conditions; a higher burnout rate in RI; RI perceived by interpreters as more stressful than on-site interpreting (although no statistically significant differences were observed with regard to physiological stress markers); interpreters more happy with on-site interpreting but no decline in quality observed by independent judges</td>
</tr>
</tbody>
</table>
In Table 2 I have summarised the main findings from empirical studies concerning the psychological and physiological manifestation of stress and anxiety in conference interpreting. Several conclusions may be drawn from the analysis of the table. First of all, the majority of the studies were confirmatory, i.e. the authors had a specific research question in mind about the relationship between variables and they wanted to check the veracity of their statements empirically. Quite often, a given independent variable was abstracted and the authors investigated whether it had an impact on psychological stress, physiological stress responses and, in turn, interpreting quality (Moser-Mercer et al. 1998; Kurz 2002; Moser-Mercer 2005). One of the few exploratory studies discussed here is the one carried out by Cooper et al. (1982) in which they investigated, inter alia, the sources of occupational stress among conference interpreters.

Moreover, both experimental and correlational studies were carried out regarding stress and anxiety in Interpreting Studies. In an experimental setting, one attempts to establish a cause and effect relationship between an independent variable and a dependent variable (here: stress/anxiety and interpreting quality). On the other hand, correlational research is about associations between variables, i.e. one explores how the value of one variable changes when the measurement of another variable also changes. Examples of correlational research in which different types of anxiety in conference interpreters were correlated are the ones by Jimenez Ivars and Pinazo Calatayud (2001) and Chiang (2010). It is worth mentioning that there is a substantial discrepancy between the number of participants in the correlational and experimental studies. The data clearly point to the old-age problem of external validity in experimental research where conference interpreters are involved. A relatively small population of professional conference interpreters makes it difficult to collect a representative sample. Obtaining experimental data from too few participants may unfortunately lead to lack of statistical power of a given study.

Finally, one can see that both psychometric and physiological measures were studied in order to investigate stress among conference interpreters and interpreting trainees. In some studies (e.g. Moser-Mercer et al. 1998; Moser-Mercer 2005) both methods were used simultaneously. The advantage of psychological tests and questionnaires is that they usually do not compromise the ecological validity of an empirical work. It is also easier to recruit participants for survey research as filling in questionnaires is not time-consuming and in most cases such measures can be administered online. However, they have one major disadvantage: one cannot be sure whether an-
answers given by participants are true. It might happen that participants, driven by social desirability bias (Fisher 1993), conceal the truth purposefully. More reliable data on stress responses in conference interpreting might be obtained by experimental studies using physiological measures. However, a researcher needs to bear in mind the ecological validity of a study. The use of some invasive physiological measures might make the interpreting process too artificial for the experimenters to obtain reliable data. Paradoxically, applying some methods to measure stress levels, such as collecting saliva samples from interpreters, might be stressful in itself and inconvenient for the participants. To give an example, Kurz (2002) decided not to measure salivary cortisol concentration because she found the procedure too invasive. Instead, she chose two other parameters: heart rate and skin conductance level.

What appears to be interesting is the fact that little attention has been paid to the difference between simultaneous interpreting and consecutive interpreting with regard to interpreters’ stress responses. It might be interesting to test whether the element of public speaking and being in the conference spotlight make the consecutive mode more stress-inducing than simultaneous interpreting where the interpreter is more distanced from the audience and the speaker. This might constitute an interesting research question in a further study in which the problem of stress in conference interpreting is explored.

3.8. Conclusion

The main purpose of this chapter was to provide an overview of psychological aspects of conference interpreting. At the beginning of the chapter I discussed different factors which might have an influence on interpreters’ performance. The main theme of the chapter, however, was the relationship between psychological stress and conference interpreting. My objective was to discuss the problem by referring to empirical work which has been conducted in this field to this date.

Having discussed interpreter aptitude, psycho-affective contributors to interpreting quality and the notion of psychological stress in conference interpreting, I have to clarify one thing. Although I believe that psycho-affective factors do impact the interpreter’s performance, I am not in favour of accepting or dismissing interpreting candidates on the basis of their personality profile, e.g. susceptibility to stress. I would find
such procedures highly unethical. Also, research does not clearly show that psychological traits which might seem to exert a debilitative influence on interpreting trainees will impact his or her performance in the classroom and during the final interpreting exam (cf. Chiang 2010).

Instead of assessing students based on their psychological traits, it is crucial for interpreting trainers to be aware of how such features influence the student’s behaviour in the classroom. One can assume that it is possible to teach students how to cope with stress in interpreting even if their psychological profile indicates a relatively high level of trait anxiety. Hence, I believe that it is worth including stress theory and stress coping strategies into the curriculum of interpreting courses. Nowadays, every interpreting trainer is aware of the importance of the interpreter’s cognitive capacity. Several memory enhancement exercises are offered in the interpreting classroom as no one denies the role of working memory capacity in the process of interpreting. However, what seems to be neglected at times are the psycholinguistic aspects of interpreting. Interpreting teachers should be aware of the psycho-emotional difficulties embedded in interpreting practice. Their role is to support their students in becoming successful interpreters. This, I believe, should not be limited to linguistic skills and interpreting strategies but should encompass stress coping strategies. Interpreting trainers should be aware of the potential stressors involved in the interpreter’s job and should teach their students how to deal with them and, as a consequence, how to provide high-quality interpreting.
Chapter 4: Stress in simultaneous interpreting: The effect of delivery rate

4.1. Introduction

As already suggested, although many interpreters would agree that simultaneous interpreting is a stress-provoking activity, research on psychological stress in the booth is still scarce. Interpreting scholars often assume in an a priori fashion that stress is an inherent part of interpreting practice. However, there seems to be a need to validate this point by means of empirical work which would discuss the factors which make the interpreter’s job so stressful. By the same token, only a few studies have been conducted in which one would compare the level of stress experienced by interpreting trainees and professional interpreters. The study described in the following sections might be a valuable contribution to empirical research on interpreters’ stress and stress coping.

4.2. The aim of the study

The main purpose of the experimental study described here is to verify whether the speaker’s rate of delivery influences interpreting accuracy and the level of stress experienced by interpreting trainees and professional interpreters. It will be examined whether interpreting a fast speaker elevates the level of stress experienced by interpreters and interpreting novices and compromises interpreting accuracy. It will also be verified whether professional interpreters are more resistant to stress and are able to provide a more accurate interpretation than interpreting trainees.
The secondary aim of the project is to investigate predominant coping strategies in interpreters and interpreting trainees by means of the Coping Inventory for Stressful Situations (CISS questionnaire) as well as a semi-structured interview administered to all the participants after the experiment. This is an attempt to establish whether being an interpreter triggers specific coping styles and whether experienced interpreters use different coping strategies than interpreting trainees.

4.3. Study design

A mixed factorial design has been adopted to answer the study’s research questions. It involves a combination of a within-subject design, where the same participant is tested in various conditions, and a between-group design, where the performance of two groups is compared. A within-subject design is used here to study changes in the participants’ stress in the course of the experiment. Also, the study intends to examine whether there exist any differences in the level of stress experienced by interpreting trainees and professional conference interpreters (between-group design). The following independent variables have been included in the study: delivery rate (slow vs. fast) and group membership (professional interpreters vs. interpreting trainees). I will test the effect of independent variables on the following dependent variables: stress and interpreting accuracy.

In this project, the experimental study, which tests the effect of delivery rate on stress and interpreting accuracy, has been supplemented by a survey research where the CISS questionnaire and a semi-structured interview have been adopted to identify predominant coping styles in interpreters and interpreting trainees.

It should be noted that although the word experiment has been used, the design described here is rather quasi-experimental as there has been no random assignment of participants to experimental groups (or an experimental group vs. a control group). Although it might be perceived as (over)simplification, the study described in this chapter will be referred to as an experiment in which the effect of a specific factor on a given outcome is tested.
4.4. Independent variables

*Speed of delivery* and *experimental group membership* serve as independent variables in the experiment. The rate of delivery has often been reported by interpreters as one of the most considerable challenges in simultaneous interpreting. Such a claim has been supported by Gile (1995: 188) who included the rate of delivery as one of the “problem triggers” in interpreting (cf. Section 1.9.6). Fast speakers may force the interpreter to use more mental energy to process the input and this might, in turn, impede the production in the target language. In other words, processing requirements of the interpreting task may outweigh the interpreter’s cognitive resources at hand which would compromise the quality of the interpretation.

Along with the cognitive turn in Interpreting Studies, a potentially detrimental effect of the speed of delivery on the interpreting process was discussed on several occasions and by many interpreting scholars (e.g. Gerver 1969; Barik 1973; Gile 1995). It seems reasonable to assume that interpreting fast speakers may be cognitively demanding for many conference interpreters. It is generally assumed that in interpreting from English a rate between 100 and 120 words per minute (wpm) is optimal for interpreters (Li 2010; AIIC: 199920). Thus, any value higher than 120 wpm may be considered problematic for simultaneous interpreters, especially in the case of “dense” speeches or texts which are read out. To the best of my knowledge, the effect of the rate of delivery on interpreters’ well-being has not been studied yet in an experimental setting (only in survey research, see: AIIC 2002). Only experimental research makes it possible for a researcher to formulate conclusions about a causal relationship between an independent variable and a dependent variable, i.e. to identify what outcome occurs when a particular factor is manipulated. In this experiment, the effect of the rate of delivery (factor) and group membership on the psychological stress and interpreting accuracy (outcomes) is investigated.

*Experimental group membership* serves as another independent variable in the experiment. The study design also involves between-group comparisons. There are two experimental groups in the experiment: interpreting trainees and professional conference interpreters. In order to check whether there exist any differences in the level of

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20 http://aiic.net/page/28
stress or accuracy scores between the groups, the performance of students is juxtaposed with that of professionals. Detailed information on the composition of each group can be found in the Participants section.

4.5. Dependent variables

The main dependent variables (outcomes) included in the experiment are as follows:

1. Stress/anxiety:

This study was intended to measure the participants’ stress by means of several stress indicators. First of all, physiological stress responses were recorded by measuring the participants’ heart rate before, during and after the experimental task. The assumption behind heart rate as a physiological stress indicator is as follows: the higher the heart rate values, the greater the stress experienced by a given person. The advantage of heart rate as a physiological marker of stress in an experiment involving simultaneous interpreting is that the values are believed to be insensitive to speech production (unlike blood pressure, cf. Hellmann and Grimm 1984) which is an inherent part of the interpreting process.

In a pilot study involving 10 interpreting trainees blood pressure was also used as a physiological marker of stress, i.e. the participants’ blood pressure was measured (1) at the beginning of the experiment, (2) when the first interpretation was completed, (3) when the second interpretation was completed and (4) at the end of the whole experimental procedure. However, unlike heart rate, blood pressure did not prove useful as a valid and reliable marker of stress and, hence, it was no longer used in the experiment proper. This phenomenon can be explained in the following way: high blood pressure (hypertension) can be perceived as a marker of chronic stress. However, momentary stress induced in the experimental setting appears not to be reflected in the participant’s blood pressure (Korpal, manuscript in preparation).

Apart from the physiological stress responses, self-reported anxiety (an emotional manifestation of stress) was also measured. The STAI X-1 questionnaire,

21 For details, see Korpal (manuscript in preparation).
described in detail in Chapter 2 of this thesis, was administered to all the participants in order to investigate moment-by-moment fluctuations in self-reported anxiety in the course of the experimental procedure. STAI X-1 measures the so-called *state anxiety*, i.e. anxiety about an event, and not anxiety understood as a stable characteristic of a given person (Spielberger et al. 1970). The X-1 form has often been used in experimental research as it makes it possible to study changes in perceived anxiety as a result of experimental manipulation. Here, STAI X-1 was adopted to verify whether interpreting a fast speaker will increase the level of the participants’ anxiety, i.e. whether the interpreters/interpreting trainees would be more anxious having interpreted the fast-paced speech than at any other time during the experiment. As stress and anxiety are known to be interrelated concepts, in this experiment STAI X-1 scores will be referred to as a “psychometric indicator of *stress*”.

The study also intended to address both psychological and linguistic/acoustic aspects of stress in simultaneous interpreting. Although speech production is an inherent part of the process of simultaneous interpretation, it seems that the manifestation of stress in language production in SI has not been researched yet. The number of hesitations and fundamental frequency (F0) were chosen as *acoustic measures of stress* in this experiment. *Hesitations*, as they are collectively referred to in the analysis, included: disfluencies (as understood by Silverman and Silverman 1975, cf. Section 2.8.4.), voice breaks and nervous false starts. They were counted manually by the experimenter based on the recordings of each interpretation. *Fundamental frequency* (*F0 value, pitch*) was used here since this measure is believed to be one of the most reliable acoustic measures of stress (Kirchhäbel et al. 2011: 88).

2. **Accuracy**: this study also aimed to answer the question of the potential influence of the rate of delivery on the accuracy of simultaneous interpretation. The notion of interpreting *quality* has been a contentious issue in Interpreting Studies as it seems to be a very complex phenomenon (Kopczyński 1994; Moser-Mercer 1996; Shlesinger 1997; Pöchhacker 2005). In order for the interpretation to be of high quality, it needs to meet certain requirements. It needs to be accurate, logical and the structure of the original speech must be reflected in the target lan-
guage output. Moreover, it should be coherent, ideally with no false starts and hesitations. The register and the emotionality of the source speech must also be reflected in the interpretation. Crucial to the assessment of a given interpretation is the way in which it is produced, i.e. the audience would probably pay attention to the interpreter’s voice, diction and intonation. Hence, interpreters should also consider paralinguistic features of their interpretations, such as hesitation markers, as they may hamper the quality of the final output.

All of this shows that assessing interpreting quality is a very complicated task. Thus, in this study I decided to focus only on the accuracy of interpretations, i.e. to check whether the information contained in the source speech was correctly rendered in the interpretation. Both speeches to be interpreted in the course of the experiment have been prepared in such a way that they contained the same number of numerical data items. The specificity of interpreting numbers has been described in detail in Chapter 1. Briefly speaking, numerical data is often non-contextual and it is often difficult to infer the exact value from the context. Moreover, numbers are characterised by high informative content (Mazza 2001). That is why interpreters often report number interpreting to be one of the most cognitively demanding task in simultaneous interpreting. In this thesis the number of correctly rendered numerical data items serves as a marker (operational definition) of interpreting accuracy. My aim is to verify whether the participants will be less successful in interpreting numbers in the fast-speech condition.

Apart from the experimental study in which the effect of delivery rate on stress and interpreting accuracy is tested, the study discusses predominant coping strategies used by interpreters and interpreting trainees. Data from the CISS questionnaire and interviews has been collected to verify whether being a professional interpreter (or an interpreting trainee) triggers a specific coping style, i.e. task-oriented coping.

4.6. Research questions

In the following study I intend to address the following research questions:
1) Does the speed of the speaker’s delivery influence the level of stress experienced by interpreting trainees and professional interpreters?
2) Does the speed of the speaker’s delivery influence interpreting accuracy?
3) Is there a correlation between stress experienced by interpreters/interpreting trainees and interpreting accuracy?
4) Are professional interpreters less susceptible to stress than novices when they perform a simultaneous interpreting task?
5) Do interpreters provide a more accurate interpretation than novices?
6) Are there any predominant stress coping strategies used by interpreters and interpreting trainees?

The first five hypotheses are related to the experimental procedure in which the effect of delivery rate on stress and interpreting accuracy is tested. The last research question is more concerned with stress coping which was investigated by means of the CISS questionnaire and a semi-structured interview.

4.7. Hypotheses

Six hypothesis have been formulated with a view to answer all the research questions:

Hypothesis 1: The speed of delivery influences the level of stress experienced by interpreting trainees and professional interpreters. While interpreting a faster speech the participants will experience a higher level of stress than when interpreting a slower speech.

As already pointed out, a range of indicators have been used as operational definitions of stress (and anxiety) in this study. They might be divided into three distinct groups: (1) heart rate as a physiological measure of stress, (2) self-reported anxiety (the STAI X-1 questionnaire) as well as (3) two acoustic/linguistic markers of stress (the number of hesitations and F0). It is hypothesised that delivery rate will influence the level of stress manifested by all the above-mentioned stress markers. I expect a positive correla-
tion between the physiological indicator of stress (heart rate) and self-reported anxiety reflected in the results of the STAI X-1 questionnaire.

Hypothesis 2: *The speed of delivery influences interpreting accuracy in both experimental groups. While interpreting a faster speech the participants will provide a less accurate interpretation than when interpreting a slower speech.*

Not only is it hypothesised that the high rate of delivery elevates the level of stress experienced by interpreting novices and professional interpreters, but I also assume that high delivery rate compromises interpreting accuracy. When dealing with a fast speaker the participants will be less successful in providing a correct rendition of numerical data items.

Hypothesis 3: *A high level of stress experienced by interpreters and interpreting trainees is negatively correlated with the accuracy of interpretation.*

As stated above, the experiment is an attempt to demonstrate that the speed of delivery has an impact on both stress/anxiety level and interpreting accuracy. Hypothesis 3 has been formulated so as to check whether the elevated stress level is negatively correlated with interpreting accuracy, i.e. it is assumed that the higher the stress experienced by a participant, the lower the accuracy of the interpretation they provide.

Hypothesis 4: *Professional interpreters will experience a lower level of stress than interpreting trainees in both experimental conditions (slow/fast).*

Hypothesis 4 is an attempt to test whether there is a statistically significant difference between the level of stress experienced during the experiment between interpreting trainees and professional interpreters (between-subjects design). It has been assumed that extensive practice makes interpreters more used to stressful working conditions and, hence, they should be more resistant to stress in the experimental setting. The higher level of stress in the group of interpreting trainees will be reflected in increased heart rate values, the STAI X-1 scores, F0 values and the higher number of hesitations.
Hypothesis 5: *Professional interpreters will provide a more accurate interpretation than interpreting trainees in both experimental conditions (slow/fast).*

Similar to the previous hypothesis, it has been assumed that interpreters will be able to provide a more accurate rendition of the original speech as a result of experience that they have gained throughout their professional career. They are expected to be more successful in performing a cognitively demanding task, i.e. interpreting fast speakers. It is assumed that interpreters will score higher and render more numbers correctly in their interpretations as compared to trainees.

Figure 15 presents the experimental design by means of which Hypothesis 1-5 are tested:

![Experimental design diagram](image)

**Fig. 15.** Experimental design (IV – independent variable, DV – dependent variable).

Hypothesis 6: *Task-oriented coping is a predominant stress coping strategy used by conference interpreters and interpreting trainees.*

Apart from examining the level of interpreters’ stress in the experimental condition the study also intends to investigate whether there exist any predominant stress coping strategies used by interpreters and interpreting trainees. In the Coping Inventory for Stressful Situations (CISS questionnaire) the construct of stress coping differentiates three main coping styles: task-oriented coping, emotion-oriented coping and avoidance-oriented coping (Endler and Parker 1990) which have been described in detail in Chapter 2 of this thesis.
It has been assumed here that task-oriented coping is a predominant coping style both among professional conference interpreters and interpreting trainees. It seems that in their job interpreters are often exposed to stressful situations where they need to take action to dispose of the stressor. In task-oriented coping the main focus is on direct action and implementation of measures which aim at addressing the problem. It is hypothesised here that the interpreter’s profession is often chosen by individuals who are able to face the challenges (instead of avoiding them). In other words, task-orientation seems to be a functional coping style in the interpreter’s job. The results of the CISS questionnaire will make it possible to verify this claim.

4.8. Participants

20 interpreting trainees and 18 professional interpreters participated in the study. The former were students of the interpreting programme at the Faculty of Modern Languages and Literatures (12 students recorded in May 2014) and the Faculty of English (8 students recorded in May 2015) of Adam Mickiewicz University. At both faculties there exist interpreting programmes. The only difference between the participants recorded in 2014 and 2015 was that the former had both a B (active) and a C (passive) language in their language combination whereas the latter had only a B language, i.e. English. For 7 out of 12 students recorded in 2014 English was a B language, whereas for the remaining 5 trainees English was a C language. The recording sessions took place a couple of weeks before the students’ final interpreting examination. This means that all of them completed three semesters of interpreter training. Organising the recording sessions in two subsequent years aimed at collecting an experimental group on which inferential statistics tests could be performed, i.e. around 20 participants. There were 8 male and 12 female participants in the group of interpreting novices. Their age ranged from 23 to 26 years old ($M=24; SD=.94$).

One of the main objectives of the study was to compare the students’ interpreting performance with that of the professional conference interpreters. To this end, a group of 18 interpreters was selected. The participants were selected on the basis of the following inclusion criteria: either (a) they had completed interpreter training and had been working as interpreters for at least 3 years after graduation; or (b) they had been
interpreting for at least 5 years prior to the experiment in the case when they had not received any formal education in interpreting. The recording sessions took place in April-September 2015. There were 11 male and 7 female participants in the group of professionals. 15 out of 18 professionals completed formal training in conference interpreting. All of them had English as an active language in their language combination. Their age ranged from 29 to 55 (\(M=39.78; SD=7.83\)). Their interpreting experience ranged from 7 to 31 years (\(M=13.72; SD=6.26\)).

4.9. Materials

In the course of the experiment the participants simultaneously interpreted two speeches from English into Polish. The speeches were similar in terms of topic, structure and the level of difficulty (LIX readability measures: Speech 1 – Copenhagen = 42, Speech 2 – Stockholm = 41, indicating equal text difficulty). The transcripts can be found in Appendices A and B to the thesis. Speech 1 was about basic information on Copenhagen: its population, history, weather conditions, culture, night life, education and economy. In Speech 2 (about Stockholm) this structure was maintained. The texts were prepared on the basis of information found on several websites, including Wikipedia. Both speeches were matched for numerical data items, i.e. they contained the same number of numerals (35) which is used in this study as an operational definition of interpreting accuracy. The speeches were recorded by a native speaker of Polish with a near-native command of English (C2 level). Both speeches (Copenhagen and Stockholm) were then prepared in two versions (slow and fast) by means of the Audacity software. Details on the length and speed of both recordings are specified in Table 3:

<table>
<thead>
<tr>
<th></th>
<th>slow</th>
<th>fast</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Speech 1 (Copenhagen)</strong></td>
<td>10 min 43 sec (107 words/min)</td>
<td>8 min 43 sec (144 words/min)</td>
</tr>
<tr>
<td><strong>Speech 2 (Stockholm)</strong></td>
<td>10 min 40 sec (106 words/min)</td>
<td>8 min 32 sec (143 words/min)</td>
</tr>
</tbody>
</table>
4.10. Experimental procedure

At the beginning of the experimental session the participants were presented with the description of the experiment and asked to sign an informed consent in which it was stated that the project involves the cognitive and psychological aspects of simultaneous interpreting. The experiment was conducted in one of the labs at the Faculty of English of Adam Mickiewicz University. The participants were seated in front of a computer and equipped with headphones and a microphone. They were informed that their task would be to simultaneously interpret two speeches from English into Polish.

Each participant interpreted two speeches: a slow-paced one and a fast-paced one. The term *slow* is being used here in contrast to the *fast*-speech condition. However, it should be noted that 106-107 words per minute is rather a standard (optimal) delivery rate in simultaneous interpreting. In order to minimise the effect of any confounding variables, the order of the speeches to be interpreted was counterbalanced across the participants:

<table>
<thead>
<tr>
<th>Participant</th>
<th>Task 1</th>
<th>Task 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant 1</td>
<td>Copenhagen – slow</td>
<td>Stockholm – fast</td>
</tr>
<tr>
<td>Participant 2</td>
<td>Copenhagen – fast</td>
<td>Stockholm – slow</td>
</tr>
<tr>
<td>Participant 3</td>
<td>Stockholm – slow</td>
<td>Copenhagen – fast</td>
</tr>
<tr>
<td>Participant 4</td>
<td>Stockholm – fast</td>
<td>Copenhagen – slow</td>
</tr>
</tbody>
</table>

The following procedure was then repeated for participants 5-8, etc. Such a procedure was adopted so as to make sure that the speed of delivery is the only independent variable which influences the level of dependent variables (i.e. psychological stress and interpreting accuracy) in both experimental groups. Each participant was assigned a code. This helped to ensure anonymity when analysing the results of the study. All the interpretations were recorded in Audacity for further analysis. In order to record the participants’ physiological stress responses, the “POLAR” heart-rate monitor was used. It was fastened to the participant’s sternum by means of an adjustable strap. Their heart rate was continuously recorded during both interpreting tasks (slow-speech and fast-speech condition).
A summary of consecutive steps in the experimental procedure is provided below:

1) The participant signs an informed consent.
2) The participant fills in the STAI X-1 questionnaire for the first time.
3) The participant interprets the first speech.
4) The participant fills in the STAI X-1 questionnaire for the second time.
5) The participant interprets the second speech.
6) The participant fills in the STAI X-1 questionnaire for the third time.
7) The participant fills in the CISS questionnaire.
8) The experimenter conducts a semi-structured interview with the participant.
9) The participant fills in the STAI X-1 questionnaire for the fourth time.
10) The participant is informed about the main objective of the study in detail. i.e. the effect of delivery rate on stress/anxiety and interpreting accuracy (debriefing).

The description of the procedure shows that apart from the physiological stress responses, data on self-reported anxiety was collected. The participants were asked to fill in the STAI X-1 questionnaire (paper form, in Polish) four times in the course of the experiment in order for the experimenter to be able to study changes in perceived anxiety as a result of experimental manipulation (fast/slow rate of delivery).

Shortly after they interpreted the second speech and filled in the STAI X-1 questionnaire for the third time, the participants were asked to fill in the CISS questionnaire (Coping Inventory for Stressful Situations – Endler and Parker 1990; paper form, in Polish). The questionnaire was administered to all the participants in order to examine whether there exist any differences in predominant stress coping strategies between interpreting novices and professional conference interpreters. The main drawback of the CISS test in the context of this thesis is that it measures coping strategies in general, and not only in the workplace, let alone interpreting practice. In order to collect qualitative data on stress coping strategies used in interpreting practice, a semi-structured interview was conducted as soon as the participant had completed the CISS form. The three main themes have been explored:

- potential stressors in interpreting;
• the difference between consecutive and simultaneous interpreting with regard to the level of stress experienced by the participants;
• stress coping strategies used by the participants in interpreting practice (Korpal, manuscript in preparation).

Since it was a semi-structured interview aimed at collecting qualitative data, there was no rigorous set of questions. The three main questions addressing the themes specified above were formulated in the same way to all the participants. Follow-up questions were asked on several occasions as well.

Each experiment session ended with a debriefing session during which the participants were informed about the main objective of the study, i.e. the impact of delivery rate on stress and interpreting accuracy. The average total duration of the whole session was 50 minutes.

4.11. Data analysis

As already stated, physiological stress responses were recorded by means of a heart rate measure. Although the data was collected during the whole experiment, four heart rate values were selected for further analysis:

1) a single value at the beginning of the experiment;
2) the mean heart rate value for the first minute of the slow speech;
3) the mean heart rate value for the first minute of the fast speech;
4) a single value after a semi-structured interview which followed the main experiment (Korpal, manuscript in preparation).

The value collected after the interview was used in the experiment as an individual participant’s baseline heart rate value. Baseline heart rate values could possibly be collected prior to the experiment. However, one of the main problems inherent in experimental research on psychological stress is that stress response values may be elevated as a result of test anxiety or fear of negative evaluation (Du 2009: 163). In order to solve this
problem, in the study I used the value which was collected after the experiment as the baseline heart rate value.

The participants’ heart rate was monitored during the interpretation of the whole speeches. However, the mean heart rate value only for the first minute of each interpretation was abstracted for further analysis. One of the characteristics of stress is that when it occurs, an individual mobilises their resources to cope with it as soon as possible. Hence, in order to collect more noticeable differences in the participants’ physiological response to stress, only the heart rate values during the first minute of each interpretation were analysed.

The participants’ interpretations were recorded for further analysis of the output (accuracy, phonetic analysis, etc.). As for accuracy, each speech contained 35 numerical data items. The following assessment key was adopted to calculate the scores:

- 1 point for a correctly rendered number;
- 0.5 point for an approximated number (e.g. “almost 2 million” instead of “1,969,900”)
- 0 points for an incorrectly rendered number, or omission.

The acoustic analysis of the output was conducted in Praat\textsuperscript{22} in order to collect F0 values which serve here as one of the measures of stress. Similar to heart rate values, the mean value of F0 was calculated only for the first minute of each interpretation.

The questionnaires used in the project were purchased from Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego (Psychological Test Laboratory of the Polish Psychological Association). Raw data were calculated on the basis of the score key included in the test kit. Then the results were normalised and returned as standard ten scores (in the case of CISS) and standard hundred scores (Pl. \textit{skala tenowa}, in the case of STAI) in order to be able to make any inter-group comparisons. The results presented in subsequent sections constitute normalised data.

Inferential statistics was adopted so as to be able to make conclusions about the population of interpreters and interpreting trainees on the basis of the data collected from the samples. To this end, the IBM SPSS Statistics 21 software was used. No outli-

\textsuperscript{22} Praat is a computer software used for the acoustic analysis of speech.
ers were identified in the samples analysed in this project. However, the F0 values of two interpreting trainees and two professional interpreters were unreadable due to relatively low quality of the recordings. Hence, these four participants were excluded from the acoustic analysis of interpreting output.

### 4.12. Results of the experiment

A mixed-design repeated measures ANOVA was conducted to verify Hypothesis 1 about the effect of the rate of delivery on the level of stress experienced by interpreting trainees and professional interpreters. Heart rate was used as a physiological marker of stress in the experimental procedure. Mean heart rate values for interpreting trainees and professional interpreters are presented in Table 5:

<table>
<thead>
<tr>
<th></th>
<th>before</th>
<th>slow (1st minute)</th>
<th>fast (1st minute)</th>
<th>after (baseline)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>mean heart rate: TR</strong></td>
<td>$M=89.8$</td>
<td>$M=95.35$</td>
<td>$M=102.15$</td>
<td>$M=83.95$</td>
</tr>
<tr>
<td></td>
<td>$(SD=12.30)$</td>
<td>$(SD=11.48)$</td>
<td>$(SD=15.15)$</td>
<td>$(SD=9.57)$</td>
</tr>
<tr>
<td><strong>mean heart rate: PR</strong></td>
<td>$M=84.33$</td>
<td>$M=91.06$</td>
<td>$M=97$</td>
<td>$M=81.28$</td>
</tr>
<tr>
<td></td>
<td>$(SD=8.93)$</td>
<td>$(SD=8.65)$</td>
<td>$(SD=9.44)$</td>
<td>$(SD=7.44)$</td>
</tr>
</tbody>
</table>

It can be noticed that the highest heart rate values were observed in the fast-speech condition in both experimental groups whereas the lowest values were found in the baseline condition (after the experiment). In order to verify whether there is any impact of delivery rate on stress in both groups, a mixed-design repeated measures ANOVA was conducted with heart rate values as a within-subject factor and experimental group as a between-subjects factor. The results show that the heart rate changes in the course of the experiment are statistically significant, i.e. there is the main effect of delivery rate on stress operationalised by heart rate values, $F(2.508, 90.291)=58.058$, $p<.001$, $\eta^2_p=617$. Degrees of freedom were corrected using the Greenhouse-Geisser estimates of sphericity, as Mauchly’s test showed that the assumption of sphericity was violated. Pairwise comparisons confirmed that the difference between the slow-speed condition and the
fast-speed condition is statistically significant both in the group of interpreting trainees ($p=.002$) and professional interpreters ($p=.014$). No interaction between variables was observed ($p>.05$). Parallel lines indicate that the pattern of changes in heart rate values is similar in both experimental groups:

Stress in this project was also psychometrically tested by means of the STAI X-1 questionnaire. Mean standard hundred scores for interpreting trainees and professional interpreters are presented in Table 6:
Table 6. Mean STAI X-1 scores in interpreting trainees (TR) and professional interpreters (PR) (with standard deviations = SD).

<table>
<thead>
<tr>
<th></th>
<th>before</th>
<th>slow</th>
<th>fast</th>
<th>after</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>mean STAI</strong></td>
<td>M=43.7</td>
<td>M=45.75</td>
<td>M=49.9</td>
<td>M=41.65</td>
</tr>
<tr>
<td>X-1 result: TR</td>
<td>(SD=7.57)</td>
<td>(SD=8.21)</td>
<td>(SD=8.49)</td>
<td>(SD=8.45)</td>
</tr>
<tr>
<td><strong>mean STAI</strong></td>
<td>M=47.22</td>
<td>M=48.56</td>
<td>M=52.33</td>
<td>M=43.39</td>
</tr>
<tr>
<td>X-1 result: PR</td>
<td>(SD=7.82)</td>
<td>(SD=6.41)</td>
<td>(SD=6.61)</td>
<td>(SD=5.44)</td>
</tr>
</tbody>
</table>

Similar to heart rate as a marker of stress, the same pattern of stress fluctuations throughout the experiment can be observed, i.e. the highest values can be found in the fast-speech condition while the lowest scores can be observed after the experiment.

A mixed-design repeated measures ANOVA with STAI X-1 score as a within-subject factor and experimental group as a between-subjects factor was conducted again to verify whether there is any effect of the rate of delivery on anxiety in both groups. The results show that the changes in the results of the STAI X-1 questionnaire in the course of the experiment are statistically significant, $F(3, 108)=51.665$, $p<.001$, $\eta_p^2=.589$. Pairwise comparisons confirmed that the difference between the slow-speed condition and the fast-speed condition is statistically significant both in the group of interpreting trainees ($p<.001$) and professional interpreters ($p=.002$). Again, no interaction between the variables was observed ($p>.05$):
It appears that Hypothesis 1 has been corroborated for both the physiological measure of stress (heart rate) and self-reported anxiety (STAI X-1). The next step in the analysis is to examine whether the same pattern can also be observed in two linguistic measures of stress, i.e. the number of hesitations and F0 values. Table 7 presents the average number of hesitations in both groups:

<table>
<thead>
<tr>
<th></th>
<th>slow</th>
<th>fast</th>
</tr>
</thead>
<tbody>
<tr>
<td>mean hesitation no.: TR</td>
<td>$M=13.15$ (SD=5.12)</td>
<td>$M=13.45$ (SD=5.23)</td>
</tr>
<tr>
<td>mean hesitation no.: PR</td>
<td>$M=9.06$ (SD=3.42)</td>
<td>$M=10.28$ (SD=3.01)</td>
</tr>
</tbody>
</table>

At first glance, it appears that the differences between the two conditions (slow-speech and fast-speech) with regard to the number of hesitations are not great enough to reach
statistical significance. The results of a mixed-design repeated measures ANOVA manifested the lack of effect of the speed of delivery on stress operationalised by the number of hesitations in the participants’ interpreting output $F(1, 36)=1.635; \ p=.209$. Hence, Hypothesis 1 has not been confirmed for this measure of stress.

The acoustic analysis in the Praat software made it possible to abstract mean fundamental frequency values for the first minute of each interpretation. The average values for both groups are presented in Table 8:

Table 8. Mean F0 values in interpreting trainees (TR) and professional interpreters (PR) (with standard deviations = SD).

<table>
<thead>
<tr>
<th></th>
<th>slow</th>
<th>fast</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>mean F0</strong></td>
<td><strong>M=176.13</strong></td>
<td><strong>M=180.70</strong></td>
</tr>
<tr>
<td><strong>value: TR</strong></td>
<td><em>(SD=49.05)</em></td>
<td><em>(SD=49.32)</em></td>
</tr>
<tr>
<td><strong>mean F0</strong></td>
<td><strong>M=158.03</strong></td>
<td><strong>M=162.94</strong></td>
</tr>
<tr>
<td><strong>value: PR</strong></td>
<td><em>(SD=58.06)</em></td>
<td><em>(SD=60.14)</em></td>
</tr>
</tbody>
</table>

A mixed-design repeated measures ANOVA with F0 values as within-subject factor and experimental group as between-subjects factor was conducted again to look for a statistically significant effect. The results demonstrate that the difference between the participants’ pitch (F0) in the slow-speech condition and in the fast-speech condition is statistically significant $F(1, 32)=28.929, \ p<.001, \ \eta^2_p=.475$. No interaction between variables was observed ($p>.05$) which is represented in the line chart by two parallel lines:
To summarise, Hypothesis 1 has been corroborated for three out of four stress indicators adopted in this experiment, i.e. heart rate, STAI X-1 and fundamental frequency.

Although the main effect was found both for heart rate and STAI X-1, it might happen that the values of both stress indicators are not correlated, e.g. due to social desirability bias which might encourage the participants to conceal the truth about the anxiety that they experience at a given point in time (STAI X-1). Thus, I was interested to see whether there exists a positive correlation between heart rate and the results of the STAI X-1 questionnaire.

A relatively strong positive correlation between the heart rate values and the STAI X-1 questionnaire results ($r=.477; p<.001$) was identified. Pearson’s correlation test was performed on each participant, with no distinction between interpreting trainees and professional interpreters.
In Hypothesis 2 I tested the influence of delivery rate on interpreting accuracy operationalised by the number of correctly rendered numerical data items. The maximum number of points in both conditions (slow-speech and fast-speech) was 35:

Table 9. Mean accuracy scores in interpreting trainees (TR) and professional interpreters (PR) (with standard deviations = SD).

<table>
<thead>
<tr>
<th></th>
<th>slow</th>
<th>fast</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>mean accuracy score: TR</strong></td>
<td>M=20.03 (SD=8.86)</td>
<td>M=15.38 (SD=4.24)</td>
</tr>
<tr>
<td><strong>mean accuracy score: PR</strong></td>
<td>M=24.89 (SD=4.97)</td>
<td>M=19.56 (SD=4.13)</td>
</tr>
</tbody>
</table>

In Table 9 mean accuracy scores are provided. The table presents the differences between fast and slow speakers in both groups.

Individual results of all the participants are presented on the line charts:

![Accuracy scores for all trainees](image)

Fig. 19. Individual accuracy scores (trainees).
As can be noticed, every single participant in both groups scored lower in the fast-speech condition than in the slow-speech condition which manifests the stability of the effect of the speed of delivery on interpreting accuracy across all trainees and professionals.

In order to find out whether there was the main effect of delivery rate on interpreting accuracy, a mixed-design repeated measures ANOVA was conducted. The results clearly show that such an effect exists and is characterised by a large effect size, $F(1, 36)=85.395, p<.001, \eta^2_p=.703$. In this way, Hypothesis 2 has been confirmed. No interaction between the within-subject factor and the between-subjects factor was observed ($p>.05$) which can be seen on a line chart:
In Hypothesis 3 I tested whether there was a correlation between the participants’ stress and interpreting accuracy. It has been assumed that a high level of stress experienced by the participants is negatively correlated with interpreting accuracy. Correlations between the accuracy and all the stress indicators used in this study are presented in the correlation matrix:

![Accuracy - line chart.](image)

The analysis of the matrix makes us conclude that interpreting accuracy is negatively correlated with stress manifested by: heart rate ($r=-.348; p=.002$), the STAI X-1 questionnaire scores ($r=-.337; p=.003$) and F0 values ($r=-.287; p=.018$). The correlation between interpreting accuracy and the number of hesitations has not been observed. This
is not surprising as hesitations (disfluencies, false starts and voice breaks) did not seem to be a valid measure of stress in this study (Hypothesis 1). To summarise, Hypothesis 3 has been confirmed for each stress measure except for the number of hesitations.

Hypotheses 4 and 5 concerned inter-group differences with regard to stress levels and interpreting accuracy. In Hypothesis 4 it was assumed that interpreting trainees would experience a higher level of stress than professional interpreters in both experimental tasks. Pairwise comparisons were made to verify whether there was a statistically significant difference between stress levels observed in the group of professional interpreters and interpreting trainees as manifested by heart rate, the STAI X-1 scores and the number of hesitations. It transpired that, although the mean heart rate values were higher in interpreting trainees, none of the differences reached statistical significance.

To be more specific:

- the difference between the heart rate values in interpreting trainees ($M=89.80; SD=12.30$) and professional interpreters ($M=84.33; SD=8.93$) before the experiment was not statistically significant ($p=.129$);
- the difference between the heart rate values in interpreting trainees ($M=95.35; SD=11.48$) and professional interpreters ($M=91.06; SD=8.65$) when interpreting a slow speaker was not statistically significant ($p=.205$);
- the difference between the heart rate values in interpreting trainees ($M=102.15; SD=15.15$) and professional interpreters ($M=97.00; SD=9.44$) when interpreting a fast speaker was not statistically significant ($p=.223$);
- the difference between the heart rate values in interpreting trainees ($M=83.95; SD=9.57$) and professional interpreters ($M=81.28; SD=7.44$) after the experiment was not statistically significant ($p=.347$).

Surprisingly, higher mean values for the STAI X-1 scores were observed in the group of professional interpreters. Nevertheless, the inter-group differences did not reach statistical significance:

- the difference between the STAI X-1 scores in interpreting trainees ($M=43.70; SD=7.57$) and professional interpreters ($M=47.22; SD=7.82$) before the experiment was not statistically significant ($p=.167$);
• the difference between the STAI X-1 scores in interpreting trainees ($M=45.75; SD=8.21$) and professional interpreters ($M=48.56; SD=6.41$) after the interpretation of the slow speech was not statistically significant ($p=.252$);

• the difference between the STAI X-1 scores in interpreting trainees ($M=49.90; SD=8.50$) and professional interpreters ($M=52.33; SD=6.61$) after the interpretation of the fast speech was not statistically significant ($p=.335$);

• the difference between the STAI X-1 scores in interpreting trainees ($M=41.65; SD=8.45$) and professional interpreters ($M=43.39; SD=5.44$) after the experiment was not statistically significant ($p=.461$).

Such a discrepancy might stem from the fact that there is a separate normalisation table for students provided in the Appendix to the STAI X-1 questionnaire on the basis of which the normalised scores of interpreting trainees were calculated here. The same set of raw data could have given lower normalised values in the group of students (as they in general can be regarded as more exposed to stress than non-studying populations) than in adults. The scores obtained by professional interpreters were compared to the norm for adults.

I observed a statistically significant difference in the number of hesitations present in the interpretations provided by interpreting trainees ($M=13.15; SD=5.12$) and professional interpreters ($M=9.06; SD=3.42$) in the slow-speech condition ($p=.007$). A similar tendency was observed in the fast speech condition where the difference between the number of hesitations in the interpretations provided by interpreting trainees ($M=13.45; SD=5.23$) and professional interpreters ($M=10.28; SD=3.01$) was statistically significant ($p=.03$). However, it should be borne in mind that the effect of the speed of delivery on stress manifested by the number of hesitations was not confirmed in the analysis.

The analysis of inter-group differences in F0 values was not performed here as these values are highly dependent on the participant’s sex and there was no equal distribution of male and female participants in both experimental groups. To summarise, Hypothesis 4 has not been corroborated.

In Hypothesis 5 it was assumed that professional interpreters would provide a more accurate interpretation than interpreting trainees in both experimental conditions (slow/fast). The analysis of pairwise comparisons showed that:
• the difference between interpreting accuracy in interpreting trainees ($M=20.03; SD=3.86$) and professional interpreters ($M=24.89; SD=4.97$) when interpreting a slow speaker was statistically significant ($p=.002$); professionals provided a more accurate interpretation;
• the difference between interpreting accuracy in interpreting trainees ($M=15.38; SD=4.24$) and professional interpreters ($M=19.56; SD=4.13$) when interpreting a fast speaker was statistically significant ($p=.004$); again, professionals provided a more accurate interpretation.

Hence, Hypothesis 5 was fully corroborated in the course of the experiment.

4.13. Results of the CISS questionnaire

Apart from measuring stress levels in the experimental condition, the study aimed to investigate predominant stress coping strategies in interpreters and interpreting trainees by means of the CISS questionnaire. The results are summarised in Table 11:

Table 11. The results of the CISS questionnaire: interpreting trainees (TR) and professional interpreters (PR) (with standard deviations = $SD$).

<table>
<thead>
<tr>
<th></th>
<th>task-oriented coping</th>
<th>emotion-oriented coping</th>
<th>avoidance-oriented coping</th>
</tr>
</thead>
<tbody>
<tr>
<td>mean results: TR</td>
<td>$M=7$ ($SD=1.97$)</td>
<td>$M=5.5$ ($SD=1.6$)</td>
<td>$M=4.65$ ($SD=1.6$)</td>
</tr>
<tr>
<td>(sten scores)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean results: PR</td>
<td>$M=7.33$ ($SD=1.61$)</td>
<td>$M=5.17$ ($SD=1.51$)</td>
<td>$M=4.39$ ($SD=1.24$)</td>
</tr>
<tr>
<td>(sten scores)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Consistent with Hypothesis 6, task-oriented coping transpired to be a predominant stress coping style both among interpreting trainees and professional interpreters. A mixed-design repeated measures ANOVA with CISS scores as a within-subject factor and experimental group as a between-subjects factor was conducted to perform a statistical analysis of the results. The main effect was found, $F(2, 72)=24.404; p<.001; \eta_p^2 =.404$, with a statistically significant difference between task-oriented coping and emotion-
oriented coping ($p<.001$). The difference between the use of emotion-oriented coping and avoidance-oriented coping did not reach the significance level ($p=.091$).

4.14. Results of the interview

As previously mentioned, after the experiment a semi-structured interview was administered to each participant in both groups. The aim of the interview was to collect data on potential stressors in conference interpreting and stress coping strategies used by the participants in interpreting practice. Each session lasted about 10 minutes. The interviews were recorded for further analysis. No quantitative data was collected from the interviews, the data presented in this section is qualitative.

A great many interviewees reported that *public speaking* is one of the main stressors in conference interpreting, especially in consecutive interpreting when the interpreter needs to perform on stage and, hence, is exposed to the audience’s judgment. The question of being “in the spotlight” was present in the majority of answers to the question about the potential stressors in conference interpreting. Some interpreting trainees also mentioned *fear of making mistakes* as one of the challenges inherent in interpreter training. It seems that at least some interpreting trainees have a problem with accepting the fact that a perfect interpretation does not exist and there is always some room for improvement. It is very probable that this kind of perfectionism would make the students more distressed and tense in the classroom. More experienced interpreters often referred to *unsatisfactory working conditions* (e.g. *poor sound/visibility*) as one of the stressors in the interpreter’s job. No materials, such as the speaker’s slides, available prior to the event may make the interpreter feel less confident and, in turn, increase the level of stress experienced before and while providing interpreting service. Many interviewees also named the rate of delivery and foreign accent as potential stressors in interpreting.

The participants were also asked which interpreting mode is more stress-provoking to them: consecutive or simultaneous. It seems that the majority of trainees and professionals stated that consecutive interpreting is more stressful due to the fact that consecutive interpreters are often forced to perform on stage and might feel intimidated by being constantly observed. When talking about simultaneous interpreting, the
participants mainly focused on its cognitive aspects, i.e. that it involves multitasking which might lead to fatigue faster than in consecutive interpreting.

The last question asked during the interview was related to stress coping strategies. The participants were asked about strategies that they adopt and actions that they take in order to minimise the negative effects of stress on interpreting performance. The main ideas have been summarised in Table 12 starting from strategies predominant in trainees, then professionals and those present both in trainees and professionals:

<table>
<thead>
<tr>
<th>Stress coping strategy/actions taken to reduce tension</th>
<th>Predominant in:</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>positive reinterpretation (Carver et al. 1989):</td>
<td>trainees</td>
<td>Positive reinterpretation is one of the most common stress coping strategies. It involves appraising a given stressful situation in a more favourable light. Some trainees mentioned that before the exams they tried to convince themselves that the examination was only a test of skills that they possess. Such a strategy might also prove useful in the process of accepting failures: failing an exam may be appraised as a chance to further develop one’s interpreting skills.</td>
</tr>
<tr>
<td>self-esteem</td>
<td>trainees</td>
<td>Some interpreting trainees believed that self-confidence is a building block which might lead to better quality of interpreting. One of the students admitted that at the beginning of interpreter training he was unsure about his skills. However, some positive feedback provided by his teachers and classmates made it possible for him to build up confidence in what he was doing which translated into high-quality interpreting (Korpal, manuscript in preparation). This suggests that a positive attitude and self-esteem might play an important role in developing one’s interpreting skills.</td>
</tr>
<tr>
<td>enough rest</td>
<td>professionals</td>
<td>Some experienced professionals suggested that, as obvious as it might seem, physical and mental well-being is a great contributor to interpreters’ success. It was stated by the interviewees that fatigue would most probably be reflected in the interpreter’s stress and lower interpreting quality.</td>
</tr>
<tr>
<td>focus on the task</td>
<td>both trainees and professionals</td>
<td>Many participants claimed that one of the most effective stress coping strategies is focusing on the interpreting task itself and refraining from thinking about the whole situational context. The idea behind task-oriented coping (Lazarus and Folkman 1984) in booth interpreting is that interpreters isolate themselves from the interpreting context in order not to feel anxious about performing a cognitively demanding task. For example: professional interpreters might not think about the audience’s potential criticism and, instead,</td>
</tr>
</tbody>
</table>
concentrate on the service that they are supposed to provide. Such observations are consistent with the results of the CISS questionnaire described in the previous section.

**preparation**

both trainees and professionals

Both novices and professional interpreters suggested that thorough preparation for interpreting classes/interpreting service helps to reduce tension and anxiety. For example, some trainees said that background research on the topic covered in the classroom made them feel more confident during the class. Thorough preparation is believed to enhance the participants’ self-efficacy (Bandura 1977; 1993).

**boothmate**

both trainees and professionals

One of the most characteristic features of the simultaneous interpreting mode is that the interpreter is (or at least should be) accompanied by a boothmate. Those trainees who practiced teamwork during their training reported that another student might be of great help in simultaneous interpreting and, in turn, may make the active interpreter less distressed.

To summarise, the aim of the interview was to collect qualitative data on potential stressors in interpreting, the difference between simultaneous and consecutive interpreting with regard to their stressfulness as well as stress coping strategies used by the interviewees in their interpreting practice. The results of the CISS questionnaire provide insight into stress coping strategies used by the participants in everyday life. The interviewees’ answers, on the other hand, contained information about the ways in which stress and anxiety can be reduced while interpreting and, hence, they might constitute a valuable contribution to the research questions explored in this project.

**4.15. Discussion**

Apart from Hypothesis 4, all the hypotheses have been confirmed in the course of the experiment. Hypothesis 1 has been corroborated for all the stress indicators except for the number of hesitations. The data obtained in the experiment demonstrate that, in general, high speed of delivery influences both stress in simultaneous interpreting and interpreting accuracy. In subsequent sections I will attempt to interpret the results with reference to theoretical considerations in Interpreting Studies and the results of previous research. I will also point to further research areas and limitations of the study. The sec-
tion will start with the discussion of specific hypotheses followed by the discussion of the interviews, some general comments and didactic considerations.

4.15.1. Hypothesis 1

The data obtained show that high rate of delivery influences the level of stress experienced by interpreting trainees and professional interpreters. Hypothesis 1 has been confirmed for the three stress markers used in the experiment, i.e. heart rate, STAI X-1 and fundamental frequency (F0). However, the hypothesised effect was not observed in the number of hesitations. To the best of my knowledge, no previous studies have been conducted to determine the effect of delivery rate on interpreters’ stress in an experimental setting. Previous research on the effect of interpreters’ working conditions on stress showed that remote interpreting induces more stress than traditional face-to-face interpreting (Kurz 2002; Moser-Mercer 2005). Gerver (1969), Barik (1973) and Gile (1995) all claimed that high rate of delivery may also be a problem trigger in interpreting, connected with interpreters’ working conditions. A survey research conducted by AIIC (2002) shows that interpreters perceive interpreting fast speakers as stressful. Here, the results of a controlled experiment show that the speed of delivery can also be regarded as a “stress trigger” in conference interpreting in that it may compromise the interpreter’s well-being in the booth. The study provides empirical verification of theoretical considerations provided by previous authors on the complexity of interpreting fast speakers. In other words, the assumption that interpreting fast speakers may be problematic to interpreters has been verified here in a controlled experiment.

As for specific stress correlates used in the experiment: previous studies show that heart rate allows for the measurement of stress reactivity (e.g. Dobkin and Pihl 1992; Vrijkotte et al. 2000). Here, heart rate proved to be a valid stress measure in the experimental setting involving simultaneous interpreting. What is worth emphasising is that a positive correlation was found between the heart rate values and the STAI X-1 scores, i.e. the participants’ self-perceptions of their stress experience was reflected in the physiological stress response of their bodies. In this study, a survey research method (STAI X-1) was triangulated with behavioural data (heart rate and acoustic measures of stress) which made it possible to obtain more reliable results. A positive correlation
between the STAI X-1 results and the heart rate values enhances the reliability of data collected. One of the main problems of survey and correlational research is that the results may be subject to social desirability bias resulting from “the desire of respondents to avoid embarrassment and project a favourable image to others” (Fisher 1993: 303). This problem seems to be of great significance in research on stress. Some interpreters may find it hard to admit that they experience stress when interpreting as they believe that it could be perceived as a lack of professionalism. What is more, some STAI X-1 scores could potentially differ from the heart rate values in the case when the participants are not aware of stress or anxiety that they experience. However, although self-perception of stress in the experimental procedure can be regarded as problematic, the results of the STAI X-1 questionnaire correlated with the participants’ heart rate in this experiment. Hence, we may conclude that the STAI X-1 questionnaire can be a useful tool to measure anxiety in an experimental setting.

The main effect of delivery rate on stress was also observed for F0 values. Consistent with Kirchhübel et al.’s (2011) conclusions, it seems that fundamental frequency can be a valid measure of stress, here: in the experiment involving a simultaneous interpreting task. The results confirm previous findings (e.g. Hicks 1979; Benson 1995) that the elevation of mean fundamental frequency can be observed in distress. The experiment appears to be a valuable contribution to research on stress in interpreting as the notion of acoustic correlates of stress has not yet been discussed in Interpreting Studies. A possible limitation of the study is that the fast-speed condition might make the participants speak faster. It seems that when people speak louder and faster, it may also influence speaking intensity and F0 values. Hence, the results obtained for this particular stress measure should be treated with caution. Nevertheless, when triangulated with other measures of stress, F0 values may offer a valuable insight into the question of the influence of delivery rate on stress.

Another problem of experimental research on stress is that additional tension might be generated in the participants as their performance is assessed (test anxiety and fear of negative evaluation – Horwitz et al. 1986; Du 2009). When there is a teacher-student relationship between the experimenter and the participants, the effect of fear of negative evaluation can be even magnified (Korpal, manuscript in preparation). Also, students might be apprehensive of taking part in a controlled experiment (laboratory anxiety – Sesen and Mutlu 2014). It might be difficult to isolate stress and anxiety re-
sulting from the effect of an independent variable from laboratory anxiety. To solve this problem, it seems reasonable to assume that the level of laboratory anxiety is more or less the same during the whole experiment and any stress increment observed during the procedure is subject to the effect of the independent variable.

As already suggested, the use of a heart rate measure which is placed on the participant’s sternum (by means of an adjustable strap) may lead to their discomfort. Although no such reservations were expressed by the participants of this study, one should bear these considerations in mind when conducting an experiment in which bodily reactions are recorded.

4.15.2. Hypothesis 2

In the second hypothesis I tested whether the rate of delivery influences interpreting accuracy both in the group of interpreting trainees and professional interpreters. The hypothesis was corroborated in the course of the experiment. As already mentioned, the results confirm previous findings about a detrimental effect of high rate of delivery on interpreting accuracy. In the studies by Dailidėnaitė and Noreikaitė (2010) and Korpal (2012) it was observed that high speed of delivery triggers more omissions. The experiment described here also showed that both interpreting trainees and professional interpreters scored higher in the slow delivery rate condition.

As already suggested, interpreting quality remains one of the most contentious issues in Interpreting Studies. In this experiment, I decided to focus only on the accuracy of interpretations, i.e. whether the information contained in the source speech was correctly rendered in the interpretation. Having decided to test interpreting accuracy, the next step was to operationalise this theoretical concept. As number interpretation is believed to be one of the most cognitively demanding tasks in simultaneous interpreting, for reasons described in Chapter 1, I have decided to treat “the number of correctly rendered numerical data items” as an operational definition of interpreting accuracy in the experiment.

The fact that all the participants (out of 38) scored lower in the fast-speech condition can be explained with reference to the cognitive approach to simultaneous interpreting referred to in Chapter 1. First of all, it should be reminded that number interpre-
tation as such is believed to be a cognitively demanding task. As the arithmetic value of
the number cannot be deverbalised to the extent some other linguistic representations
can, it seems that more cognitive resources are needed for the Listening and Analysis
Effort in number interpretation. As the interpreter’s processing capacity is limited, this
might distort memory storage (the Short-term Memory Effort) or be reflected in the
output (the Speech Production Effort, Gile 1995). Processing numerical data seems to
be complex, as they are characterised by “low predictability” and “low redundancy”
(Mazza 2001). All this might explain why the participants obtained relatively low scores
for number rendition in both conditions (fast/slow). As hypothesised, the scores were
lower in the fast-speech condition, which is believed to be one of the main problem
triggers in simultaneous interpreting (19.56/35 points in the group of professionals; 15.38/35 points in the group of trainees).

However, one should also consider another interpretation of relatively low
scores, especially in the fast-speech condition. Although numbers are characterised by
“high informative content” (Mazza 2001) and hence interpreting trainees are often in-
structed that this kind of information is often of crucial importance, it might happen that
some participants omitted (or approximated) some numbers deliberately in order to save
some processing capacity, especially when interpreting the fast speaker. Such a partic-
ipant could think that it is much more important to show the logic and the structure of
the speech with no regard to details such as dates or other statistical data. Although it is
not an easy task, a more comprehensive approach to interpreting accuracy could be
adopted in further research. Another possible interpretation of relatively low accuracy
scores is that interpreting numbers in general proved to be a bit too difficult for the par-
ticipants (floor effect). The processing requirements of the task might have exceeded the
interpreters’ available processing capacity (saturation, as understood by Gile 2009: 190)
or, consistent with Gerver’s assumptions, the interpreters did not manage to self-
monitor their output effectively (1975: 127).

4.15.3. Hypothesis 3

In Hypothesis 3 I intended to check whether the elevated stress level was negatively
correlated with interpreting accuracy, i.e. the higher the stress experienced by a partici-
pant, the lower the accuracy of the interpretation he or she provides. Consistent with assumptions, it was observed that interpreting accuracy is negatively correlated with stress manifested by heart rate, the results of the STAI X-1 questionnaire and F0 values. The highest correlation coefficient was observed for the heart rate values.

As mentioned in Chapter 2, two types of stress can be distinguished: eustress and distress (Selye 1974). Eustress is a motivating type of arousal whereas distress is referred to as debilitative stress which has a negative impact on the perception of the task to be performed. Although correlation does not imply causation, the fact that stress co-occurs with low interpreting accuracy might suggest that the participants are distressed when they interpret. Such results seem to be crucial from the didactic point of view. When interpreting trainees experience stress and anxiety, there is a great chance that this will co-occur with lower accuracy (or quality) of their interpretations. Hence, it is worth instructing future interpreters how to cope with stress not only for the sake of their well-being, but also to ensure higher interpreting quality. Moreover, the results show that professional interpreters are also exposed to stress in their job. This empirical observation may be of great importance to occupational psychology as well as HF&E (human factors and ergonomics). It would be interesting to verify whether in-house interpreters, who are more used to daily routine, are more resistant to stress than freelance interpreters who interpret on various topics in several different settings.

4.15.4. Hypothesis 4

It was also assumed that professional interpreters would experience a lower level of stress than interpreting trainees both in the fast-speech condition and in the slow-speech condition. Surprisingly, the hypothesis was not corroborated in the course of data analysis, i.e. the difference between stress experienced by interpreting trainees and professionals transpired not to be statistically significant. This is in contrast to the study by Kurz (2002) where the inter-group differences with regard to stress levels were observed.

The study described in this thesis can be a valuable contribution to research in which the performance of interpretation students was compared to that of professional conference interpreters. Several studies have been conducted to prove the superiority of
professionals over interpreting trainees in terms of working memory capacity. In some studies such an effect was not observed (e.g. Liu et al. 2004; Chmiel 2012). Similarly, the results of this experiment show that the difference in the mean level of stress experienced in both experimental groups is not statistically significant. In other words, it cannot be said that interpreting trainees experience a higher level of stress than professional conference interpreters. On the other hand, in some studies on interpreters’ and interpreting trainees’ working memory capacity, the superiority of professionals was observed (e.g. Fabbro et al. 1991; Padilla et al. 1995; Sunnari 1995). Hence, one might also speculate that professionals are more skilled than trainees in some respects but stress resistance does not seem to be one of these skills.

One of the possible explanations of the results obtained in this study might be that the ability to cope with stress does not increase with practice. However, in order to be able to draw valid conclusions about the effect of training on stress coping, a longitudinal study should be conducted, i.e. the same participants should be tested at regular intervals over time. Another explanation seems to be probable too: since the trainees were tested a month before their final interpreting exam, they had already had enough time to develop the ability to cope with stress while interpreting. Hence, it would be interesting to examine whether such an ability develops with training by means of a longitudinal study in which the same participants would be tested at the beginning and at the end of interpreter training. Another possible explanation of the surprising result is that the conference interpreting programme is chosen by those individuals who already have reasonable stress resistance levels.

Although no statistically significant inter-group differences were observed for the heart rate values and the results of the STAI X-1 questionnaire, the comparison of the means brings interesting results. Consistent with predictions, higher heart rate values were observed in the group of trainees. However, a reverse trend was apparent in the STAI X-1 scores, i.e. professionals obtained higher state anxiety scores than novices. How can such a discrepancy be explained? One of the possible explanations has already been provided in the Results section, i.e. the discrepancy might stem from the fact that the results were normalised in both experimental groups based on two different normalisation tables, as advised in the STAI manual. Two other explanations of this scenario seem to be plausible as well. Firstly, the STAI X-1 scores could be skewed due to social desirability bias. In other words, students, who wanted to be perceived as professional
by the experimenter, answered the questions in such a way that they would appear calm, relaxed and ready to perform a task. On the other hand, professionals did not feel the need to create such an image as they were confident in their interpreting abilities. Alternatively, it is possible that professionals were more critical of their own performance. For example, they would think that as professionals they should provide a high-quality interpretation which made them feel more anxious. Another possible explanation is that laboratory conditions are more stressful to professionals than professional conference settings. Professional interpreters might be apprehensive of the fact that their interpretations will be recorded and further analysed by the experimenter.

4.15.5. Hypothesis 5

Hypothesis 5 concerned inter-group comparisons with regard to interpreting accuracy. The hypothesis that professional interpreters would provide a more accurate interpretation than interpreting trainees in both experimental conditions (slow/fast) was corroborated in the course of data analysis. These findings are in line with other studies showing quality advantage of professional interpreters over trainees (e.g. Fabbro et al. 1991; Sunnari 1995; Liu et al. 2004). A reasonable explanation of such results would be that professional interpreters have more experience and competence and thus are more likely to provide a high-quality interpretation than interpreting trainees. As a result of their experience, they are also more successful in performing a cognitively demanding interpreting task, i.e. interpreting numbers, also in the fast-speech condition. The results show that interpreting practice translates into higher-quality service. The data obtained seem to suggest that interpreting trainees who almost completed the course are not yet at the peak of their interpreting skills and there is still great room for improvement.

Interestingly enough, the difference between the mean accuracy scores of interpreting trainees and professionals was almost the same in both conditions, i.e. professional interpreters outscored trainees by 4.86 points in the slow-speech condition and by 4.18 points in the fast-speech condition. One might expect a more significant advantage of professionals in a more cognitively demanding task (interpreting a fast speaker). However, it proved not to be the case in this experiment. This might mean that the interpreter’s advantage in the ability to multitask and allocate cognitive resources to sev-
eral efforts (as understood by Gile 1995) manifests itself regardless of the speaker’s rate of delivery.

4.15.6. Hypothesis 6

The secondary aim of the project was to investigate predominant coping strategies in interpreters and interpreting trainees by means of the Coping Inventory for Stressful Situations (CISS questionnaire). I have confirmed the hypothesis that task-oriented coping is a predominant coping style in both experimental groups. Similar results for interpreting trainees have been obtained by Kao and Craigie (2013).

It is generally believed that problem-focused coping (task-oriented coping) is perceived as more adaptive in controllable situations (Cohen 1987; Kossewska 2006b: 137). In other words, when one is able to control an unfavourable situation, the most effective way to dispose of the stressor is to modify the situation, to act directly and to implement specific measures to address the problem. It seems that in their job interpreters are often exposed to stressful situations which they can control. It was hypothesised here that the interpreter’s profession is often chosen by people who have the ability to face the challenges (instead of avoiding problems or pretending that troubles do not exist). The results of the CISS questionnaire show that task-oriented coping is indeed a predominant coping strategy used by interpreting trainees and professional interpreters. This is in line with Gile’s suggestions for coping strategies in interpreting. Gile describes several comprehension, preventive and reformulations tactics the aim of which is to keep the interpretation going (e.g. consulting resources in the booth or taking notes) (Gile 2009: 201ff.). Hence, such techniques correspond to a great extent to task-oriented coping. Although Gile discusses switching off the microphone (avoidance-oriented coping) as a possible reformulation tactic, he makes it explicit that it should be treated as a last resort, used only when “continuing to interpret would be worse than providing no interpreting” (Gile 2009: 211).
4.15.7. The interview

The main objective of the interview was to collect qualitative data on the following issues: stressors in conference interpreting; stress in consecutive and simultaneous interpreting as well as stress coping strategies used by the interviewees (professionals and trainees) in interpreting. Adopting the CISS questionnaire made it possible to investigate predominant coping styles characteristic of each participant. Nevertheless, it is not crystal clear that this style will be reflected in stress coping strategies used by the participants in interpreting practice. The interviews were conducted with a view to getting an insight into the notion of stress experienced when providing professional interpreting service (professionals) or interpreting in the classroom (novices).

The fact that task-oriented coping is a predominant coping strategy used by the participants seems to have been reflected in their accounts. As described in Table 12, many interviewees mentioned focus on the task and preparation (both of which can be classified as task-oriented coping) as effective stress coping strategies. Such strategies were often accompanied by emotion-oriented coping, e.g. positive reinterpretation (Carver et al. 1989) or self-esteem/self-efficacy (Bandura 1993). In simultaneous interpreting a boothmate’s help was considered to be very helpful which is in line with suggestions offered by some interpreting scholars (e.g. Jones 2002: 119; Kalina 2001: 27; Chmiel 2008; Gile 2009: 206). Hence, it appears to be a good idea to include teamwork practice in interpreter training as the presence of a boothmate may help the active interpreter perform well.

4.15.8. General discussion

An interesting discrepancy can be observed with regard to stress research in Interpreting Studies. On the one hand, interpreting scholars often assume that interpreters are exposed to stress but only some empirical research has been conducted to validate this claim. Similarly, in occupational psychology the interpreter’s job is often referred to as one of the most stressful professions. However, research on specific context-related factors which might be stressful to interpreters still seems to be in its infancy. Being unable to cope with occupational stress for a longer period of time can lead to chronic
stress, often resulting in the development of a psychosomatic disorder. Bearing this in mind, it seems that research aiming at understanding the nature of stress in interpreting is needed.

This project was an attempt to measure stress experienced by conference interpreters and interpreting trainees in a controlled experiment. The pioneering nature of the study involved the triangulation of physiological, psychometric and acoustic indicators of stress in the experiment involving interpreting. The interdisciplinary nature of the project is demonstrated by the fact that it combines knowledge from the following fields of study: Interpreting Studies, stress research, cognitive psychology, psycholinguistics, acoustic phonetics and occupational psychology. The study constitutes an empirical verification of a common belief that interpreting fast speakers in simultaneous interpreting is challenging and may induce considerable stress.

The results of the study may be a useful contribution to research in Interpreting Studies. It was found that interpreting fast speakers is stressful to interpreting trainees and professional interpreters alike. This might suggest that interpreting competence does not have to translate into stress resistance. It seems that more attention should be paid to stress management in interpreter training. When dealing with a cognitively demanding task (i.e. interpreting numbers is the fast-speech condition) interpreters experience a high level of stress which correlates with low interpreting accuracy. Moreover, the study may be a valuable contribution to occupational psychology; relatively high heart rate values suggest that interpreting is indeed stressful both to professionals and interpreting trainees. This is in line with previous research (Cooper et al. 1982; Chiang 2010; Kao and Craigie 2013). There should be more focus on human factors and ergonomics of the interpreter’s job in order to safeguard interpreters’ well-being and boost interpreting quality. The results of the study may provide a useful contribution to stress studies in that they show that physiological measures of stress may be triangulated with psychometric and acoustic correlates of stress in order to obtain more reliable data. In this study a positive correlation between heart rate values and STAI X-1 scores was observed.

In this thesis I intended to describe the emergence of a new trend in Interpreting Studies which is referred to here as the psycholinguistic approach to interpreting (cf. Chmiel 2010 on synergy between Interpreting Studies and psycholinguistics; Gile 2015). My aim was to demonstrate that apart from linguistic and cognitive abilities,
psycho-affective factors (non-cognitive factors, Chabasse and Kader 2014), are important components of interpreter aptitude. Stress is only one of the topics which can be discussed in the psycholinguistic approach to interpreting. Investigating other “soft skills”, such as motivation (Timarová and Salaets 2011), or personality features may provide a more detailed picture of a conference interpreter. Are interpreters more willing to take risks? Do interpreters adapt to changes more easily than representatives of many other professions, as they usually work in several different contexts? Are public service interpreters extraverts? And, more importantly, are interpreters pre-disposed to practice such a stressful profession? These are only some of the research questions which could be posed in empirical research on psychological and personality-related factors in interpreting.

To conclude, the study has been an attempt to study interpreters’ stress in an experimental setting. By pointing to specific areas for further research, I will try to demonstrate that the notion of psychological stress in conference interpreting is still to some extent unexplored and more studies are needed to have a wider perspective on the issues in question. Nevertheless, I believe that the results of the experiment shed new light on the notion of psychological stress in simultaneous interpreting by identifying that the rate of delivery can be regarded as a “stress trigger” in simultaneous interpreting which may as well have a detrimental effect on interpreting accuracy.

4.15.9. Limitations of the study and further research

One of the recurrent problems inherent in experimental research involving conference interpreters concerns a limited number of participants. The population of conference interpreters (let alone interpreters with a specific language combination and enough experience) itself is quite small which makes it difficult to compose a representative sample. In order to make sure that there is a clear-cut distinction between the two experimental groups and that professionals have enough experience, specific inclusion criteria were adopted when selecting professional interpreters: either 3 years of experience in simultaneous interpreting (with formal training) or 5 years of experience in simultaneous interpreting (without any formal interpreter training). In this way a sample of 18 professional interpreters was collected. In the case of interpreting trainees, both students
with English as a B language and English as a C language participated in the experiment so as to increase the number of participants in the sample. However, it should be borne in mind that the status of English in a student’s language combination could possibly act as a confounding variable. To summarise, the recording sessions with interpreting trainees took place in two consecutive years in order to collect a representative sample and, thus, give the study more external validity. Irrespective of that, far-reaching generalisations should be made with caution with experimental groups comprising ca. 20 participants.

Also, one of the contentious issues in empirical research is the relationship between a controlled experiment, where the effect of an independent variable on a dependent variable is tested, and naturalistic observation in the case of which the situation is not manipulated by the researcher. The contentious nature of this comparison lies in the fact that both types of research have advantages and disadvantages. An experimental design makes it possible to formulate conclusions about a causal relationship between two variables. However, experiments (not only on interpreters) are often criticised for their limited ecological validity, i.e. that they do not approximate the real world and, thus, participants’ behaviour might differ from how they would behave in their natural environment. In studies on interpreters in which experimental manipulation is necessary the speeches to be interpreted must often be designed by the researcher and then recorded, which may compromise ecological validity too. A research method which is more ecologically valid and much supported by Gile (1998) is observation. Conducting observational research on interpreters’ stress seems to be plausible, e.g. one could visit one of the institutions of the European Union, ask the interpreters to wear a heart rate measure and let them interpret real-life meetings. The reason why observation was not applied here was that it would not be possible to examine the effect of independent variables (rate of delivery and group membership) on dependent variables (stress/anxiety and interpreting accuracy).

Having discussed potential limitations of the study, let me proceed to areas for further research. The experimental design was tailored to test the effect of delivery rate on stress and interpreting accuracy in simultaneous interpreting. Further research might be extended to include other variables such as foreign accent, lack of access to visual materials and the speaker, technical language, syntactic complexity of the source speech, etc. It seems that more empirically-driven data on the most salient stress factors
in simultaneous interpreting is needed. Testing other “problem triggers” (Gile 1995) and their impact on stress and accuracy/quality could provide a broader picture of factors which may have a detrimental effect on the interpreter’s well-being in the booth. For example, it has been verified that the speaker’s strong foreign accent might negatively influence interpreting quality (e.g. Kurz 2008). What has not been empirically tested yet is whether foreign accent makes interpreters more distressed, anxious or unwilling to perform a given task.

Another possibility to extend the scope of this research would be to check whether interpreting specific elements of the source speech elevates the level of stress experienced by the participants. In this study I used mean heart rate values for the first minute of each interpretation. However, studying moment-by-moment changes in the interpreters’ stress responses could also bring interesting results. For example, it might be the case that heart rate values increase when the interpreter needs to process and render a complex number in the target language. By the same token, the interpreter may prove to be more distressed when having to deal with a long list of proper names. Such an analysis would help one identify stress triggers in a given speech. In such a way one would focus more on momentary physiological stress reactions which could make it possible to analyze stress locally, rather than globally.

Studying interpreters’ stress could also involve directionality of interpreting. Interpreting directionality has been widely researched in Interpreting Studies (e.g. Donovan 2004; Monti et al. 2005; Pavlovic and Jensen 2009; Chang 2009). It is not uncommon for interpreters to show a preference either for B-to-A interpreting or A-to-B interpreting (retour). However, to determine which one is in general more demanding seems to be a moot question. B-to-A interpreting may be more difficult when the original speech in a foreign language contains technical language which might pose comprehension problems. On the other hand, retour interpreting may be considered to be more demanding when the A-language is more synthetic than the B-language in which the interpreter must render the message. To summarise, B-to-A interpreting appears to require more Listening and Analysis Effort, while retour interpreting might force the interpreter to invest more energy in the Speech Production Effort, as understood by Gile (1995). Regardless of this, comparing stress levels in interpreting in both directions could provide interesting insight into the question of the manifestation of stress in conference interpreting. What is more, one could conduct interviews with interpreters and
ask them which directionality is more problematic to them. Then one might conduct an experiment in which physiological stress responses would be recorded so as to verify whether subjective beliefs would correlate with experimental data.

The results of previous research show that remote interpreting may be more stressful than traditional face-to-face interpreting (Moser-Mercer 2005; Roziner and Shlesinger 2010). Hence, access to visual materials and the speaker, visibility of audience and the sense of presence can help the interpreter feel at ease when interpreting. To the best of my knowledge, no studies have been conducted to this date in which interpreting modes (e.g. simultaneous and consecutive) would be compared with regard to their stressfulness. As suggested in Chapter 1, consecutive interpreting may be perceived as challenging due to the fact that it often involves performing on stage which might aggravate the risk of psychological stress affecting interpreting output. In the consecutive mode the interpreter is rarely accompanied by another colleague. Interpreters have to rely on their memory as there is limited access to conference materials and glossaries prepared beforehand. A between-subjects design could be adopted to investigate differences in physiological stress responses in both interpreting modes, i.e. some participants would interpret simultaneously, and some other – consecutively. A heart rate monitor could be used as a measure of stress in the experimental procedure. Alternatively, one might develop a questionnaire consisting of questions related to the problematic aspects of both consecutive and simultaneous interpreting.

Another area for further research concerns the potential effect of stress on memory. From the cognitive point of view, the experience of stress may prevent interpreters from remembering the content of the speech which they interpreted. Working close to saturation level (Gile 1995) might lead to depletion of cognitive resources. In order to remain vigilant and prevent performance breakdown in simultaneous interpreting, the interpreters could stop focusing on the meaning of their output (form-based interpreting, Gile 2009: 208) (Muñoz Martin, personal communication). In order to verify whether stress has an impact on memory in simultaneous interpreting, one might investigate whether there is a correlation between the level of stress (e.g. manifested by the mean heart rate value) and the score obtained by the interpreter in a reading comprehension test given to him after the experiment.

Another idea for further research would be to modify the design of the study described in this dissertation. It should be stated explicitly that the impact of stress on in-
terpreting accuracy was not tested in the experimental design of my study. In this experiment I tested the influence of delivery rate (IV = independent variable) on stress (DV1 = dependent variable 1) and interpreting accuracy (DV2 = dependent variable 2). Then, it was verified whether interpreters’ stress is negatively correlated with interpreting accuracy, i.e. the higher the stress experienced by the interpreter/interpreting student, the lower the accuracy of the interpretation he or she provides. However, it could also be interesting to empirically verify whether interpreters’ stress influences interpreting accuracy (or interpreting quality).

4.15.10. Didactic considerations

Having discussed and interpreted the results of the study, I would like to demonstrate how the research findings (and the psycholinguistic approach to interpreting in general) can be applied to interpreter training. From the didactic perspective, the project may be valuable, as it shows that stress can indeed be regarded as an inherent part of conference interpreting. Not only does high rate of delivery lead to interpreters’ stress but, as has been shown, it may also compromise interpreting accuracy. In interpreting pedagogy there is much focus on linguistic and cognitive skills as the main elements of interpreter aptitude (Timarová and Ungoed-Thomas 2008: 43). Teaching interpreting skills is often accompanied by memory enhancement exercises. In other words, there is much focus on trying to equip students with cognitive resources which are needed to sustain vigilance and successfully perform an interpreting task.

However, I would like to suggest that both cognitive and psychological approach to interpreting should be implemented in interpreting pedagogy as a means to enhance interpreting trainees’ skills and competencies. Apart from practising their memory and interpreting skills, it is important that students master the skill of public speaking, learn how to improvise, control their voice and cope with anxiety and stress. Teaching students how to cope with stress might involve making them aware of the physiology of stress, practicing positive reinterpretation (Carver et al. 1989) and, quite paradoxically, getting students accustomed to a stressful situation by means of practicing consecutive interpreting in the standing position. All these skills seem to be important in interpreter training and without them a student might not be able to provide high-quality interpret-
ing. Some would say that the form in which a given interpretation is provided is also important for its assessment by the users (Kurz 1993). Even if the interpretation was accurate and grammatically correct, it would not be perceived as being of high quality if it was rendered by an extremely distressed, hesitant interpreter. That is why interpreting trainers should raise their students’ awareness of the importance of psycholinguistic factors in interpreting.

It could also be a good idea to collect information on psychological profiles of (future) interpreting students. I believe that it is crucial for interpreting trainers to be aware of how personality traits (e.g. extraversion, willingness to take risks) might influence the student’s behaviour in the classroom. For example, an extravert might engage with his boothmate in a totally different way than an introvert would do it. What is more, a student with a high trait anxiety score might need some extra support from the trainer. Maybe providing a more extensive feedback, in which the positive aspects are highlighted, would help the student feel more relaxed in the classroom.

It is one of the tasks of interpreting trainers to help interpreting trainees prepare for their stressful profession and, in turn, to boost interpreting quality. One of the inspirations to carry out this research is from the observation of students. I have noticed that some interpreting trainees seem to possess necessary language and cognitive skills but stress that they are exposed to when they interpret exerts a debilitative influence on their performance and the process of acquiring new interpreting skills. To summarise, this project may contribute to Interpreting Studies by providing empirical data on the psycho-affective aspects of interpreting, the importance of which should by no means be neglected.
Concluding remarks

In line with the psycholinguistic approach to interpreting, this dissertation was an attempt to discuss the notion of psychological stress in simultaneous interpreting. The main objective of the experimental study presented above was to verify whether the speaker’s rate of delivery influences (1) stress experienced by interpreting trainees and professional interpreters and (2) interpreting accuracy. In Interpreting Studies, delivery rate has been identified as a problem trigger in simultaneous interpreting (Gile 1995; Gerver 1969; Barik 1973). What is known from previous survey research is that interpreters themselves report speed of delivery as one of the main stress factors (AIIC 2002). In this study the impact of delivery rate on stress responses has been tested in a controlled experiment. To this end, I adopted the following stress indicators: heart rate as a physiological measure of stress, the STAI X-1 questionnaire used to measure self-reported anxiety and two acoustic measures of stress: fundamental frequency (F0) and the number of hesitations. The triangulation of research methods was employed to give the results more credibility. The secondary aim of this thesis was to investigate predominant coping strategies in both experimental groups: professional interpreters and interpreting trainees. The results of the CISS questionnaire were supplemented by semi-structured interviews in which the participants were asked about potential stress factors in interpreting and stress coping strategies that they used in interpreting practice.

The results of the experiment showed that delivery rate influences the level of stress experienced by interpreting trainees and professional interpreters, i.e. while interpreting a fast speaker the participants experienced a higher level of stress than when interpreting a slower speech. This effect was observed for heart rate, the results of the STAI X-1 questionnaire and F0 values (Hypothesis 1 – confirmed for all the stress indi-
cators except for the number of hesitations, i.e. heart rate, STAI X-1 scores and F0 values). Moreover, high speed of delivery had a detrimental effect on interpreting accuracy, operationalised by the number of correctly rendered numerical data items (Hypothesis 2 – confirmed). Consistent with my predictions, the level of stress experienced by interpreters and interpreting trainees was negatively correlated with interpreting accuracy (Hypothesis 3 – confirmed). Hypothesis 4 and 5 were formulated to test inter-group differences with regard to stress experienced by the participants during simultaneous interpreting tasks and the accuracy of their interpretations. Although it was hypothesised that professional interpreters would experience a lower level of stress than interpreting trainees in both experimental conditions (slow/fast), no such effect was observed (Hypothesis 4 – refuted). Such a result might suggest that the ability to cope with stress does not necessarily increase with practice, or that trainees, who were tested a month before their final interpreting exam, had already developed the ability to cope with stress while interpreting. A statistically significant inter-group difference was found with regard to interpreting accuracy, i.e. professionals provided a more accurate interpretation than trainees (Hypothesis 5 – confirmed). Hypothesis 6 concerned stress coping strategies used by professional interpreters and interpreting novices. Consistent with my predictions, task-oriented coping was a predominant stress coping strategy in both experimental groups (Hypothesis 6 – confirmed).

In general, the findings from the study may shed new light on the question of psychological stress in simultaneous interpreting by demonstrating a detrimental effect of delivery rate on interpreting accuracy. Moreover, it was observed that both interpreting trainees and professional interpreters experienced a high level of stress during a simultaneous interpreting task. This might be interpreted as a confirmation of a common belief that interpreting (especially in a laboratory setting) is a stressful activity. In order to obtain more reliable results, survey research methods (STAI X-1, CISS and the interview administered to the participants) were combined with behavioural data (the physiology of stress and selected acoustic correlates of stress). This points to the interdisciplinary nature of the project in which what is known from Interpreting Studies was supplemented by the knowledge from other fields of study such as stress research, cognitive psychology, acoustic phonetics and occupational psychology.

The results of the study may be a useful contribution to interpreting pedagogy. They suggest that stress is an inherent part of conference interpreting. The data obtained
show that high rate of delivery does not only lead to students’ stress but it may also compromise interpreting accuracy. It has been suggested in this dissertation that the psycholinguistic approach to interpreting should be implemented in interpreter training as a means to enhance interpreters’ skills. As well as practicing their memory and interpreting skills, students should be instructed on how to cope with anxiety and stress in the classroom. Moreover, the study may offer valuable insight into the question of human factors and ergonomics of conference interpreting. The results of the study are in line with previous research which shows that interpreters are exposed to psychological stress (Cooper et al. 1982; Chiang 2010; Kao and Craigie 2013). Finally, the study may be a valuable contribution to stress research as it exemplifies a successful effort to triangulate physiological measures of stress with psychometric and acoustic correlates in order to obtain more reliable data.
ABSTRACT

The cognitive approach to conference interpreting has been dominant for the last couple of decades. In 1995 Gile proposed his Effort Models in which he described distinct processing efforts inherent in the process of simultaneous interpreting: the Listening and Analysis Effort (L); the Short term memory Effort (M); the Speech production Effort (P) and the Coordination Effort (C) (Gile 1995: 169). In the cognitive approach to interpreting several studies have also been conducted on conference interpreters’ working memory capacity (Padilla et al. 1995, Daneman and Carpenter 1980, Moser-Mercer et al. 2000). A great many scholars focused on multitasking as a central feature of simultaneous interpreting (Gile 1995; Seeber 2011). Processing models of simultaneous interpreting were also developed (Gerver 1975; Moser-Mercer 1978; Darò and Fabbro 1994). Since interpreting requires mastering numerous skills, several researchers touched upon the question of interpreter aptitude (e.g. Moser-Mercer 1985, 1994; Lambert 1991; Mackintosh 1999; Chabasse 2009). Linguistic and cognitive abilities were often treated by interpreter trainers as predictors of interpreters’ future success. However, in recent years, it can be observed that psychological factors in conference interpreting are gaining more and more attention of interpreting scholars (e.g. Timarová and Ungoed-Thomas 2008; Rosiers et al. 2011; Bontempo and Napier 2011).

One of the psychological factors which might influence the process of simultaneous interpreting is psychological stress. Interpreting can induce a significant level of stress which, as a consequence, may have a negative impact on interpreting quality. It seems that interpreting scholars agree that being able to cope with stress is a useful trait in conference interpreting. In recent decades, some studies have been conducted on stress in interpreting (e.g. Klonowicz 1994; Moser-Mercer et al. 1998; Riccardi et al. 1998; AIIC 2002; Kurz 2002, 2003; Moser-Mercer 2005; Roziner and Shlesinger 2010).

In line with the psycholinguistic approach to conference interpreting, this thesis is an attempt to discuss the notion of psychological stress in simultaneous interpreting. The main objective of the project is to examine whether the speaker’s delivery rate influences (1) the level of stress experienced by professional interpreters and interpreting trainees in simultaneous interpreting and (2) interpreting accuracy. The following stress indicators were used in the experiment: heart rate as a physiological measure of stress, the STAI X-1 questionnaire used to measure self-reported anxiety and two acoustic
measures of stress: fundamental frequency (F0) and the number of hesitations. As well as this, predominant coping strategies used by interpreting trainees and professional interpreters were investigated in the study. To this end, the CISS (Coping Inventory for Stressful Situations) questionnaire and a semi-structured interview were administered to the participants. The results of the experiment show that high delivery rate increases the level of stress experienced by the participants and has a detrimental effect on interpreting accuracy. A negative correlation between stress levels and interpreting accuracy was observed. Contrary to predictions, no inter-group difference was observed with regard to stress levels. However, professional interpreters provided a more accurate interpretation than interpreting trainees. With regards to stress coping, task-oriented coping proved to be a predominant coping style in both experimental groups. The results of the study may offer a valuable contribution to Interpreting Studies, acoustic phonetics, stress research, occupational psychology and human factors in interpreting.


W niniejszej rozprawie poruszono tematykę stresu w tłumaczeniu symultanicznym. Głównym celem projektu jest zbadanie, czy szybkość wygłaszania tekstu przez prelegenta wpływa na (1) doświadczenie stresu u tłumaczy ustnych i studentów tłumaczenia konferencyjnego w tłumaczeniu symultanicznym oraz na (2) dokładność tłumaczenia. Użyto następujących wskaźników stresu: puls jako fizjologiczny wskaźnik stresu, kwestionariusz STAI X-1 mierzący lęk jako uwarunkowany sytuacyjnie stan oraz
dwa akustyczne wskaźniki stresu: ton podstawowy (F0) oraz liczba zawahań. Poza tym, w badaniu dokonano pomiaru głównych strategii radzenia sobie ze stresem u tłumaczy i studentów tłumaczenia przy użyciu kwestionariusza CISS oraz wywiadu przeprowadzanego z uczestnikami badania. Wyniki eksperymentu pokazują, że szybko wygłaszany tekst podnosi poziom stresu u uczestników badania oraz obniża dokładność tłumaczenia. Zaobserwowano negatywną korelację pomiędzy poziomem stresu doświadczanego przez uczestników badania a wiernością tłumaczenia. Wbrew moim przewidywaniom, nie zaobserwowano istotnej statystycznie różnicy w poziomie stresu doświadczanego przez profesjonalistów i studentów. Jednakże tłumaczenia profesjonalnych tłumaczy były bardziej dokładne od tłumaczeń studentów. Jeżeli chodzi o strategie radzenia sobie ze stresem, uczestnicy przejawiali styl radzenia sobie zorientowany na zadaniu. Zaprezentowane tutaj wyniki mogą wnieść cenny wkład w badania nad przekładem ustnym, fonetyką akustyczną, badania nad stresem, psychologię pracy i organizacji oraz kwestię czynnika ludzkiego w pracy tłumacza konferencyjnego.
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Appendix A

Text 1: Copenhagen

Ladies and gentlemen!

Welcome to the 5th annual conference on the European capital cities. I hope that you are having a good time and that you are ready to listen to the story about the next city: Copenhagen. This is a city which I personally love and I hope that I will convince you that it is worth visiting.

By way of introduction, Copenhagen is the capital and the most populous city of Denmark, with an urban population of 1,246,600 inhabitants and a metropolitan population of 1,969,900 people. It is situated on the eastern coast of Zealand, 42 km northwest of Malmö in Sweden and 164 km northeast of Odense.

Originally Copenhagen was a Viking fishing village founded in the 10th century. Then it became the capital of Denmark in the early 15th century. During the 17th century, under the reign of Christian the Fourth, it developed into an important regional centre, consolidating its position as capital of Denmark with its institutions and armed forces. Since the turn of the millennium, Copenhagen has seen strong urban and cultural development, facilitated by investment in its institutions and infrastructure. The city is the cultural, economic and governmental centre of Denmark and one of the major financial centres of Northern Europe with the Copenhagen Stock Exchange.

What is the weather like in Copenhagen? Well, in general, Copenhagen is in the oceanic climate zone. June is the sunniest month of the year with an average of about eight hours of sunshine a day. July and August are warm too with daytime temperatures
around 20°C to 21°C although rainfall averages 69 mm per month. February is the coldest and driest month of the year. Apart from slightly higher rainfall from July to September, precipitation in Copenhagen is moderate. While there can be snow from late December to late April, there can also be rain with average temperatures around the freezing point. To sum up, Copenhagen is probably not the hottest place in the world but I am sure that this will not discourage you from visiting it.

Let me now focus on Copenhagen’s cultural life. Apart from being the national capital, Copenhagen serves as the cultural hub of Denmark and wider Scandinavia. Since the late 1990s, it has undergone a transformation from a modest Scandinavian capital into a metropolitan city of international appeal in the same league as Barcelona and Amsterdam. This is a result of huge investments in infrastructure and culture as well as the work of successful new Danish architects and designers.

Copenhagen has a wide array of museums of international standing. The National Museum is Denmark’s largest museum of archaeology and cultural history. It comprises the histories of Danish and foreign cultures. The museum covers 14,000 years of Danish history. Furthermore, the National Museum keeps Denmark’s largest and most varied collection of objects from the ancient cultures of Greece and Italy, the Near East and Egypt.

I would like to draw your attention to Louisiana Museum of Modern Art, the leading international museum of contemporary art in Denmark created in 1958. It is the most visited art museum in Denmark with an extensive permanent collection of modern and contemporary art, dating from World War II and up until now. It also has a comprehensive programme of special exhibitions. The museum is acknowledged as a milestone in modern Danish architecture, noted for the synthesis it creates of art, architecture and landscape.

The museum is located 25 miles north of Copenhagen. It has a panoramic view of Sweden across the Sound. It presents around eight special exhibitions annually and has a distinguished permanent collection with over 3,500 works. Louisiana is also a vibrant cultural centre, open in the evening Tuesday to Friday until 22:00, and offers a rich variety of activities and events. I remember that when I visited Louisiana for the first time, I fell for this place immediately! If you are in Copenhagen, you really have to visit this museum!
Copenhagen has the two oldest amusement parks in the world, one of them being the famous Tivoli Gardens. The Tivoli Gardens is an amusement park and a pleasure garden located in central Copenhagen next to the Central Station. It opened in 1843. It is the second oldest amusement park in the world. Among its rides are the oldest still operating rollercoaster from 1915 and the oldest big wheel still in use, opened in 1943. Tivoli Gardens also serves as a venue for various performing arts and as an active part of the cultural scene in Copenhagen.

And what about the nightlife in Copenhagen? Well, Copenhagen has one of the highest number of restaurants and bars per capita in the world. The nightclubs and bars stay open until around 5 in the morning. Some even longer. Denmark has a very liberal alcohol culture and a strong tradition for beer breweries, although binge drinking is frowned upon and the Danish Police take driving under the influence very seriously.

Many of you are students so let me talk for a while about the university of Copenhagen. The University of Copenhagen is the oldest and one of the largest universities and research institutions in Denmark. It was founded in 1479. It is the second oldest institution for higher education in Scandinavia after Uppsala University. The university has more than 38,000 students, and also more than 9,000 employees. The university has a couple of campuses located in and around Copenhagen. Its headquarter is located in central Copenhagen. Most courses are taught in Danish; however, many courses are also offered in English and a few in German. As you can see, you don’t have to speak Danish to study at the University of Copenhagen. If you would like to learn more about the university, I suggest you google “the University of Copenhagen” and look for the information you need.

I will finish my presentation about Copenhagen by saying a few words about its economy. Copenhagen is not only the economic and financial centre of Denmark but it is a major business centre for the entire Scandinavian-Baltic region. Statistics for 2010 show that of the total number of people working in Copenhagen, the vast majority are employed in the service sector, especially transport and communications, trade, and finance, while only 10,000 of people work in the manufacturing industries. The public sector workforce is around 110,000, including education and healthcare. Tourism is an increasingly important sector for Copenhagen’s economy, reaching record number in 2012. The number of room nights reached 8.1 million.
Ladies and gentlemen, I am afraid that I have run out of time and I will have to finish my short presentation. We will have a coffee break now and after the break the next speaker will tell you a few words about Danish Design – I hope that his presentation will convince you that visiting Copenhagen is a must! Thank you very much for your attention!
Appendix B

Text 2: Stockholm

Ladies and gentlemen!

Welcome to the 5th annual conference on the European capital cities. I hope that you will learn a lot today about some of the great cities and the speeches will encourage you to visit at least some of them. We will start this session with a presentation about Stockholm, its modernity and cultural potential.

Stockholm is the capital of Sweden. It is also the most populous city in Sweden and Scandinavia, with 897,700 people living in the municipality and a total population of about 2,163,000 in the metropolitan area, accounting for 22% of the Swedish population.

As a way of introduction, Stockholm was founded in 1250 and it has long been one of Sweden’s cultural, media, political, and economic centres. It is located on several islands in the south-east of Sweden at the mouth of Lake Mälaren. The city is known for its beauty, its buildings and architecture, its abundant clean and open water, and its many parks. Stockholm is the seat of the Government of Sweden and most government agencies, including the official residencies of the Swedish monarch and the Prime Minister.

What is the weather like in Stockholm? Stockholm has a humid continental climate. The average daytime temperature in the summer is about 22°C but temperatures can reach 30°C on some days. The average winter temperature ranges from −3 to −1 °C. Annual precipitation in Stockholm is moderate with around 170 wet days. Snowfall
occurs mainly from December through March. Snowfall may occasionally occur in late October as well as in April. I think this information about the climate will be enough for now. Let me now focus on Stockholm’s cultural life.

Apart from being Sweden’s capital, Stockholm houses many national cultural institutions. The Stockholm region is home to three of Sweden’s World Heritage Sites – spots judged as invaluable places that belong to all of humanity, for example The Woodland Cemetery. In 1998, Stockholm was named European Capital of Culture which shows its cultural potential.

Stockholm is one of the most crowded museum-cities in the world with a lot of museums, visited by many people every year. The most renowned museum is the National Museum, with Sweden’s largest collection of art. The museum is home to about half a million drawings from the Middle Ages to 1900, prominent Dutch 17th-century collection, and a collection of porcelain items, paintings, sculptures, and modern art as well. The museum also has an art library, open to the public and academics. The current building, built in 1866, was inspired by North Italian Renaissance architecture. It is the design of the German architect Friedrich August Stüler. The museum was then enlarged to accommodate the museum workshops.

Stockholm also houses The Museum of Modern Art (this is the official name of the museum). It is located in central Stockholm and it was first opened in 1958. The museum houses Swedish and international modern and contemporary art, including pieces by Picasso and Salvador Dalí. The museum is a venue for temporary contemporary art exhibitions throughout the year. Visiting the permanent collection was originally free of charge, but some of the temporary exhibitions had entrance fees.

Have you heard about the theft in the Museum of Modern Art in Stockholm? For those of you who haven’t, I will briefly tell you this story. In 1993, the works by Picasso and Georges Braque totalling more than £40 million were stolen from the museum. The burglars came in through the roof by night and stole the paintings. Only some Picasso’s paintings have been recovered.

Those who come to Stockholm should also visit a famous amusement park: Gröna Lund. It has many attractions and restaurants. It is a popular tourist attraction and it is visited by many people every day. It is open from end of April to middle of September. Gröna Lund features most attractions common to amusement parks, such as the tunnel of love as well as several roller coasters. Gröna Lund is also known for its rock
and pop music concerts; the capacity record is held by Bob Marley who attracted 32,000 people in 1980. This record is unbeatable since new regulations prevent such large audiences at Gröna Lund.

And what about the nightlife in Stockholm? Well, Stockholm has a very big number of bars per capita in the world. Sweden’s capital, Stockholm, has a hot nightlife scene and it is a bustling city that offers great nightclubs. The nightclubs and bars stay open until 6 in the morning, some even longer. Club Kharma is said to be the most visited and the most fabulous nightclub in Stockholm. The club is open until 5 am – if you are in Stockholm, you should definitely visit this place!

Many of you are students so let me tell you a few words about the university in Stockholm. Stockholm University has two scientific fields: the natural sciences and the humanities or social sciences. It has over 66,000 students at faculties such as: law, humanities, the mathematical and natural sciences making it one of the largest universities in Scandinavia. The institution is also frequently regarded as one of the top universities in the world. Stockholm University was granted university status in 1960 and is therefore the fourth oldest Swedish university. Stockholm University’s primary mission is to provide education and high quality research for the betterment of the Swedish community. A good thing about the university is that you don’t have to speak Swedish if you want to study there – many courses are also offered in English. If you would like to learn more about the university, I suggest you google “Stockholm University” and look for the information you need.

Let me finish my short presentation about Stockholm by saying a few words about its economy. The vast majority of Stockholm residents work in the service industry, which accounts for roughly 85% of jobs in Stockholm. The almost total absence of heavy industry (and fossil fuel power plants) makes Stockholm one of the world’s cleanest cities. The last decade has seen a significant number of jobs created in high technology companies. Large employers include IBM (with 8,430 employees) and Nordea (with 2,820 employees). In recent years, also tourism has played an important part in the city’s economy. Stockholm County is ranked as the 10th largest visitor destination in Europe, with over 10 million overnight stays per year. Among the European cities Stockholm had the 6th highest growth in number of nights spent in the period 2004-2008.
Ladies and gentlemen, I am afraid that due to the time constraints I will have to finish my presentation now. The next speaker will tell you a few words about Oslo – another Scandinavian city which is definitely worth visiting! I hope that you will enjoy the rest of the conference. Thank you very much for your attention!
Appendix C

Information about the experiment (given to the participants) – in Polish

INFORMACJA O BADANIU NAUKOWYM

Badanie naukowe w ramach projektu doktorskiego dotyczące aspektów poznawczych i psychologicznych tłumaczenia ustnego

Osoba odpowiedzialna:

mgr Paweł Korpal

Wydział Anglistyki, Uniwersytet im. Adama Mickiewicza w Poznaniu

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Proszę o uważne zapoznanie się z opisem realizowanego projektu naukowego i wyrażenie zgody na udział.

Opis realizowanego badania i procedur:

- Eksperyment polega na przetłumaczeniu wybranych tekstów symultanicznie. Przed badaniem otrzymasz od osoby prowadzącej dokładne instrukcje dotyczące przebiegu jego poszczególnych części.
W trakcie eksperymentu Twoja aktywność będzie rejestrowana przez rejestrator dźwięku oraz pulsometr. Zastosowanie ww. metod jest niezbędne do analizy danych, a zapis ww. aktywności nie będzie nikomu udostępniany.

Pulsometr umieszczany jest za pomocą paska bezpośrednio na skórze, poniżej mostka.

Na eksperyment możesz zabrać swoje własne słuchawki.

Eksperyment potrwa ok. 50 min.

Informacja dla uczestnika

Uczestnictwo jest świadome i dobrowolne, a odmowa nie wiąże się z żadnymi konsekwencjami. Również po wyrażeniu zgody, w trakcie trwania badania, można wycofać się bez podawania przyczyny. Istnieje też możliwość wycofania zgody na przetwarzanie uzyskanych danych po zakończeniu badania.

Uzyskane wyniki są poufne, to znaczy że indywidualne dane uzyskane od uczestnika nie będą rozpowszechniane w sposób umożliwiający identyfikację osoby, a jedynie przetwarzane w celu opracowania naukowego, zgodnie z ustawą z dnia 29 sierpnia 1997r. o ochronie danych osobowych.

W przypadku pytań lub wątpliwości, na każdym etapie badania należy zwrócić się do osoby przeprowadzającej badanie. Po zakończeniu badania w razie wątpliwości proszę kontaktować się z osobą odpowiedzialną za projekt. Osobie tej można również zgłosić chęć zapoznania się z wynikami swojego badania.
Appendix D

Informed consent – in Polish:

ZGODA NA UDZIAŁ W BADANIU

Badanie naukowe w ramach projektu doktorskiego dotyczące aspektów poznawczych i psychologicznych tłumaczenia ustnego

Osoba odpowiedzialna:

mgr Paweł Korpal

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Oświadczam, że zaznajomiłem/łam się i zrozumiałem/lam informację dla osoby badanej. Wyrażam dobrowolną i świadomą zgodę na udział w badaniu. Jestem również świadomy/a faktu, iż w każdej chwili mogę odstąpić od udziału w badaniu.

Wyrażam zgodę na przetwarzanie moich danych uzyskanych w trakcie eksperymentu, zgodnie z ustawą z dnia 29 sierpnia 1997r. o ochronie danych osobowych, lecz wyłącznie w celach naukowych.

Niniejszy dokument, potwierdzający zgodę na udział w badaniach będzie przechowywany zgodnie z zasadami przechowywania dokumentacji poufnej.
imię i nazwisko badanego

data i podpis badanego

Oświadczam, że osoba badana zapoznała się z informacją dla uczestnika badania, a dane uzyskane podczas eksperymentu będą przechowywane oraz przetwarzane zgodnie z ustawą z dnia 29 sierpnia 1997r. o ochronie danych osobowych.

data i podpis prowadzącego badanie
Appendix E

Questionnaires used in the study:

- STAI – State-Trait Anxiety Inventory developed by Spielberger et al. (1970): form X-1;
- CISS (Coping Inventory for Stressful Situations) developed by Endler and Parker (1990).

The content of the questionnaires cannot be published here due to copyrights.