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Lexical processing in online translation tasks. The case of Polish-English-German professional and trainee conference interpreters

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OŚWIADCZENIE

Ja, niżej podpisana

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studentka Wydziału Neofilologii
Uniwersytetu im. Adama Mickiewicza w Poznaniu

oświadczam,

że przedkładaną pracę doktorską

pt. *Lexical processing in online translation tasks. The case of Polish-English-German professional and trainee conference interpreters*

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(miejscowość, data) (czytelny podpis)

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List of abbreviations

AIIC	International Association of Conference Interpreters
A-language	interpreter’s first language or mother tongue or native language
AMU	Adam Mickiewicz University
ATH	Activation Threshold Hypothesis
BIA	Bilingual Interactive Activation
B-language	interpreter’s second language or the stronger non-native language
CAM	Context Availability Model
CEFR	Common European Framework of Reference for Languages
CI	conference interpreting
CIS	conference interpreting students group
C-language	interpreter’s third language or the weaker non-native language or the passive language
CLIN	cross-linguistic interaction
DFM	Distributed Feature Model
DMM	Dynamic Model of Multilingualism
ER	error rate
IA	interactive activation
IC	Inhibitory Control

L1	first language, native language or mother tongue
L2	second language or the stronger non-native language
L3	third language or the weaker non-native language
LDT	lexical decision task
LTM	long-term memory
LT-WM	long-term working memory
MHM	Modified Hierarchical Model
MIA	Multilingual Interactive Activation
OS	omission score
PDP	parallel distributed processing
PRO	professional conference interpreters group
RHM	Revised Hierarchical Model
RT	response time
SAS	Supervisory Attentional System
SI	simultaneous interpreting
SL	source language
SLA	Second Language Acquisition
SOA	stimulus-onset asynchrony
ST	sight translation
STM	short-term memory
T&I	translation and interpreting
TL	target language
TLA	Third Language Acquisition
TRI	trilingual control group
WM	working memory

Introduction

Conference interpreters comprise a very interesting research group in terms of the lexicosemantic processing skills they need for their job. From a cognitive or psycholinguistic perspective, simultaneous interpreting (SI) is the most challenging interpreting activity as it requires remarkably efficient lexical access and retrieval mechanisms between the two languages involved in order to ensure a smooth delivery (Grosjean 1997; Christoffels and De Groot 2005).[1] It is for this reason, perhaps, that professional interpreters are generally regarded as being capable of faster and more accurate lexicosemantic processing skills than novice interpreters or language users without any conference interpreting (CI) experience. For instance, there is evidence from studies of interpreting expertise that

> (…) expert interpreters' performance is characterised by fewer errors, faster responses, and less effort being made. Expert interpreters are better at providing more accurate and complete interpretations and they seem to be quicker at accessing lexical information, all performed using less effort. (…) Expert interpreters also (…) differ from novice interpreters (…) in their ability to use more flexible semantic processing" (Liu 2008: 173).

Regular language users, in turn, are said not to be very good interpreters because they lack "the necessary transfer skills needed for (…) interpretation, not to mention the specific online processing and memory mechanisms" required to perform this job (Grosjean 1997: 168). It appears, therefore, in the case of conference interpreters that there must be efficient retrieval structures (cf. Ericsson and Kintsch 1995) operating in the long-term memory (LTM) and working memory (WM) which enable rapid access to lexical information.

[1] For the purposes of the present study, lexical retrieval will be defined as a two-stage process of retrieving information about the form and meaning of lexical items from the long-term memory, i.e. from the lexicon. Lexical information becomes available only after its lexical entry has been accessed. In other words, lexical access precedes lexical retrieval (or lexical selection) (Garman 1990; Levelt 1989; cf. also Section 1.2.).

Moser-Mercer even speaks of conference interpreters' "having the contents of [their] declarative memory structured in a way that supports fast retrieval" (2000: 90).[2] If that be true, then in online (i.e. reaction-time based) translation tasks tapping lexical-semantic abilities professional conference interpreters could be expected to fare better than novice interpreters or language users untrained in CI. Yet, in the field of Translation and Interpreting (T&I) research, lexical retrieval has rarely been studied in isolation but rather as an inherent part of the interpretation process (e.g. error typologies in Kopczyński 1980; Barik 1994).

The nature of the lexicosemantic processing in SI has received some attention from cognitive scientists, especially from cognitive psychologists and psycholinguists (cf. Gerver and Sinaiko 1978; Danks et al. 1997). However, there have been very few empirical studies aimed at investigating lexicosemantic processing in bilingual or trilingual speakers having interpreting experience using online psycholinguistic research methods (Christoffels et al. 2006; Cieślicka and Kowynia 2008). Most experiments with regard to lexicosemantic processing in translation conducted so far with bilingual and trilingual speakers belong to the field of second and third language research.[3] While there is an ever-growing interest in the lexicosemantic processing studies of speakers with interpreting experience or skills, only a handful of researchers have so far embarked upon this particular research field of using online research methods with bilingual conference interpreters and CI trainees (e.g. Bajo et al. 2000) and, to the best of my knowledge, no similar studies have been carried out to date with conference interpreters and CI students with a command of three working languages.

Underlying the present study is the intention of using online translation tasks to measure the speed and accuracy of lexicosemantic processing in the case of trilingual speakers with differing amounts of CI experience. Since efficient lexicosemantic processing is claimed to be an important sub-skill of SI (Christoffels et al. 2003; Liu 2008), this study aims to investigate the impact of interpreting training and practice on the strength of interlingual lexical links in the mental lexicons of professional and incipient trilingual con-

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[2] Language learning and representation are believed to be subserved by declarative and procedural memory which are two anatomically and functionally distinct LTM systems: procedural memory underlies implicit linguistic competence (i.e. the 'mental grammar') while declarative memory is implicated in the explicit learning, representation and use of lexical-semantic knowledge (i.e. the 'mental lexicon') (Paradis 2004, 2009; Squire and Zola 1996; Ullman 2001a, 2001b, 2004).

[3] E.g. Kroll and Stewart (1994) in bilingual translation tasks, and De Groot and Hoeks (1995), Francis and Gallard (2005), and Ferré et al. (2006) in trilingual translation tasks.

ference interpreters as opposed to a control group of trilingual speakers untrained in CI. The initial assumption has been that single-word-translation presents a simple but direct means of exploring the speed and accuracy of accessing and retrieving lexicosemantic information from the lexicon (De Bot 2000). *E-Prime* has been used to explore the degree of interconnectivity between the formal and semantic/conceptual links in the mental lexicons of the three participating groups by furnishing exact online measurements of their response times, and also by providing data about the errors and omissions made in their translation performance (Schneider et al. 2002). This study does not purport to address directly the issue of the underlying organisation and representation of the language system, but rather the issue of the speed with which declaratively stored word forms and word meanings are accessed and retrieved from the mental lexicon during translation tasks. It is hoped that this approach will provide an insight into the degree of interconnectivity of lexicosemantic information in the mental lexicons of the three participating groups.

Twelve professional conference interpreters (PRO), twelve CI students (CIS) and fourteen non-interpreting trilinguals (TRI) have taken part in the study comprising two experiments, of which the first examined bottom-up processing in translation recognition, and the second investigated top-down processing in translation production. The unique language combination of the participants (Polish/A, English/B, German/C) makes it possible to test which of the following two factors have had the most influence on the speed and accuracy of their lexical processing. On the one hand, evidence from TLA (third language acquisition) studies (e.g. Cenoz et al. 2001, 2003; De Angelis 2007) suggests that the third language tends to retain stronger connections with the second language than the native language despite increasing proficiency, particularly when both foreign languages share a substantial number of similar lexical items (e.g. cognate representations). On the other hand, the connectionist view of the mental lexicon predicts that prolonged practice in CI is likely to produce natural, frequency-based changes in the mental organisation of languages to support more efficient lexical retrieval in the directionalities commonly used in daily interpreting practice (e.g. Elman et al. 1996; Setton 2003). In order to find out whether close lexical affinity or the amount of CI experience in a given directionality (i.e. the directionality effect) have the greatest impact on the speed and accuracy of lexical processing, the following translation directions have been investigated:

(i) German into English (C -> B) and German into Polish (C -> A) in translation recognition, and

(ii) Polish into German (A -> C) in translation production.

In the translation recognition experiment, the participants have been asked to decide as fast and as accurately as possible whether the pairs of words presented to them on the computer screen constitute the correct translation equivalents. Among the target language (TL) stimuli were included distractors related in form or in meaning to the translation equivalents of the source language (SL) stimuli. For example, in the German -> English translation direction, the stimuli have been paired with their respective correct translations, form- and meaning-related distractors in the following manner: *Zwiebel – onion* (correct translation equivalent), *Zwiebel– mirror* (form-related distractor, *Zwiebel* is perceptually similar to the German word *Spiegel* meaning 'mirror') and *Zwiebel – garlic* (meaning-related distractor). The experiment has been intended to help to determine whether professional conference interpreters do indeed exhibit a stronger network of interlingual form and meaning connections between German and Polish than between German and English. An indication for such an organisation of their mental lexicon could be inferred from their translation recognition performance; e.g., from the speed and accuracy of identifying correct translation pairs whilst suppressing incorrect translation pairs in C -> A translation recognition. The assumption with regard to the control group involves that they have retained stronger interlingual lexicosemantic links between their two foreign languages, so that their overall performance may be more prone to CLIN (cross-linguistic interaction) in German -> English than in German -> Polish translation recognition. In comparison to PRO, the overall performance of the CI students is expected to be marked by a less pronounced directionality effect. CIS are also assumed to show some CLIN in German -> English translation recognition.

In the Polish -> German translation production experiment the participants have been asked to translate single words (displayed on a computer screen) into the microphone. Although English has not been activated directly in this task (in fact, care was taken to put the participants in the C-language mode, cf. Grosjean 2001), some amount of CLIN has been presupposed since half of the German translations of the SL words were cognates with their English counterparts. To further investigate the processing of cognate representations, they have been subdivided into two groups according to the degree of interlingual form similarity: the category B cognates (*CogB*) were less perceptually similar (fewer shared phonemes and letters) than the category A cognates (*CogA*). The number of Polish stimuli whose translations were cognate between English and German has been counterbalanced by control stimuli (*ctrl*), i.e. Polish stimuli whose translations in German had no formal overlap with English. Thus, for example:

Stimulus type	*SL word*	*TL word*
CogA	orzech	Nuss ‘nut’
CogB	wyspa	Insel ‘island’
ctrl	kwiat	Blume ‘flower’

Apart from the speed of lexical retrieval, this experiment is aimed at assessing the amount of English-based CLIN in A -> C translation production. Given the participants’ high level of proficiency in German, conceptual mediation is expected to occur (e.g. Francis and Gallard 2005). However, some amount of cross-linguistic interaction is also presupposed in the case of cognate processing. If English-German cognates share interlingual representations at the level of form and meaning, then the category A cognates are predicted to lead to faster response latencies than the category B cognates. At the same time, CLIN is predicted to occur if the cognates map onto different orthographic and phonological representations and their activation is not timely suppressed by the study participants. As against the control group, the participants with CI training and experience are expected to be more adept at processing meaning information, and more resistant to B-based interference (i.e. by virtue of their more efficient inhibition/suppression mechanisms) in German translation production, despite the fact that this particular direction is not actually used in their interpreting practice.

CLIN is the only term which refers to all types of non-predictable dynamic interactions of synergetic and inferential nature between developed and developing language systems in the multilingual mind (cf. Herdina and Jessner 2002; Jessner 2006). Envisaged in terms of ongoing competition of related form and meaning representations both intra- and interlingually, it is preferable to ‘cross-linguistic influence’ or related terms in the context of this study.[4] Form-based competition is understood here to refer to the orthographic, phonological, morphophonological, and morphological features, while meaning-based competition refers broadly to semantic/conceptual features (cf. Section 1.2.).[5] Occasionally, the terms 'transfer' or 'interference' have been used to refer to an erroneous selection of lexical items (cf. Kellerman and Sharwood Smith 1986; Schachter 1992; Cherrington 2000).

One frequent methodological hurdle in translation and interpreting (T&I) research has been the difficulty of access to experienced practitioners (e.g. Gile 1994: 44). At the time when this study was conducted, the total number of Polish conference interpreters (i.e. both staff and freelance ones) working for the EU institutions in Brussels and having the required language combination was below twenty. Owing to a host of objective and personal reasons of the potential participants (business trips, domicile changes, pregnancy or a general unwillingness to participate), I succeeded in recruiting twelve professional conference interpreters for 20-minute experimental sessions which took place in Brussels. The interpreters were remunerated for their participation in the study.[6] The students (CIS and TRI) participated in the experiments on a voluntary basis. They constituted from a statistical point of view a controlled convenience sample (cf. Gile 1998) insofar as they were drawn from the student population at the School of English, AMU. However, only twelve CI students and fourteen non-interpreting students met the requirements of the experimental design.

It should be noted that in the present thesis bilinguals and trilinguals are considered to be speakers of two and three languages respectively, while multilinguals are considered to be speakers of more than two languages, irrespective of the proficiency level or the age of acquisition (Marini and Fabbro 2007: 51; cf. Vildomec 1971).[7] Moreover, for the purpose of the present investigation we favour a connectionist view of what is often referred to

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[4] For instance, I rejected the cumbersome term 'combined cross-linguistic influence' proposed by De Angelis (2007: 21) to refer to the interaction of two or more languages on the TL, or to the influence of one language on another language, which then influences a third language.

[5] In studies of foreign language learners' performance some researchers distinguish between semantic and conceptual transfer (e.g. Odlin 2005; cf. also Jarvis and Pavlenko 2008). This distinction will not be made here because the present study is concerned with the processing of single concrete words whose translation equivalents are unambiguous and straightforward in the target language.

[6] The research was supported by a research grant from the Ministry of Science and Higher Education awarded to the project "Lexical processing and mental lexicon of bi- and trilingual conference interpreters" headed by Prof. Alicja Pisarska (N N104 010637, 2009-2010).

[7] For the confusion surrounding those terms in the literature cf. also Baetens Beardsmore (1982: 1-36), Baker (2006: 2-19) and Ardila (2007: 7).

as the mind/brain dichotomy: the mind does not exist 'in se' but rather as an activity which is processed in the neural connections in the brain (Poersch 2007: 38-39). In other words, the mind is conceived here as a product of the activity of the brain.

This dissertation is organised in the following manner: Chapter One comprises a discussion of the available literature on the organisation of the mental lexicon, with particular emphasis on the RHM and DFM models and their empirical verifications in translation tasks performed by bilingual and trilingual speakers. In the chapter we develop an interconnected and dynamic view of the mental lexicon which is intended to account for lexical processing in translation tasks performed by trilingual speakers. We also identify a wide range of factors that can potentially determine the pattern of lexicosemantic organisation in the case of trilingual speakers with varying amounts of CI experience.

Chapter Two discusses the most pertinent frameworks and models designed to account for trilingual lexical processing in production and in recognition tasks. We attempt to establish how trilingual speakers carry out and control lexical processing in translation production and in translation recognition. In so doing, we enrich the connectionist/dynamic perspective of lexical processing with important elements of the modularity theory.

In Chapter Three we focus on the influence of the type (i.e. directionality) and amount of CI experience (i.e. expert/novice differences) on the strength of lexical connections in the trilingual mental lexicon. Also discussed are the most likely triggers of CLIN in the case of proficient trilingual speakers with varying degrees of CI experience. We then present working assumptions and preliminary hypotheses with regard to the speed and accuracy of trilingual lexical processing in translation tasks. These are illustrated with models of cognitive organisation in case of trilingual speakers with and without CI experience.

The methodological considerations involved in the use of translation recognition and translation production experiments are presented in Chapter Four.

The findings are presented and discussed in Chapter Five, followed by the conclusions and suggestions for further research in the area.

All translation experiments were carried out in the hope of shedding light on the speed and accuracy of lexical processing operative during conference interpreting. Online psycholinguistic methods were employed to further support the view that the application of concepts inherent in cognate disciplines can help broaden the scope of T&I studies and extend the repertory of research tools in current investigation into the lexicosemantic processing skills of trilingual speakers with CI experience (cf. Gile 2006; Halverson 2009; Chmiel 2010; Lehr 2010).

Chapter 1: The mental lexicon

1.1. Introduction

In any attempt at establishing the way in which professional conference interpreters, conference interpreting trainees and non-interpreting trilingual speakers use their languages (A/L1: Polish, B/L2: English, C/L3: German) for comprehension and production, the analysis of the most important psycholinguistic models of the mental lexicon is an absolutely essential priority.[8] Therefore, in this chapter hierarchical and dynamic approaches to the mental lexicon will be discussed in the light of experimental findings, mostly from studies which employed different types of translation tasks to investigate the performance of bilingual and trilingual speakers.

The main goal of the discussion will be to develop an integrated view of the organisation of the trilingual mental lexicon. Basing on studies investigating the translation performance of multilingual speakers (e.g. Herwig 2001; Goral et al. 2006), it will be postulated that not only the type and amount of linguistic experience, but also the degree of lexical similarity are likely to affect the arrangement and quality of interlingual connections. Drawing on the framework of the Dynamic Systems Theory (cf. Section 1.6.), I will argue that the principles of interconnectedness and variability may be applied to the case of

[8] In the present thesis the terminology used in the field of First, Second and Third Language Acquisition is used interchangeably with the one proposed by the International Association of Conference Interpreters (AIIC). Thus, the native language or the mother tongue is referred to as the L1 or language A, the stronger non-native language as the L2 or language B, and the weaker non-native language as the L3 or language C. Despite obvious differences in focus between CEFR and AIIC (the former was devised with language learners in mind while the latter pertains to conference interpreters), both frameworks are relevant to the present study because all participants have proved to be highly successful language learners.

trilingual speakers to account for changes in the strength of interlingual lexical links in relation to factors connected with individual language use.

A related objective will be to establish which of the currently available conceptualisations of the mental lexicon provides the most promising springboard for modelling interlingual connections in the case of trilingual speakers whose foreign languages share a substantial amount of lexical stock. For my research purposes, it is vital that the architecture of the trilingual mental lexicon is sufficiently flexible to reflect between-group differences in the strength of interlingual links as a function of factors related to language use, particularly the type and amount of translation and interpreting training and practice.

1.2. Levels of representation

The mental lexicon can be thought to comprise word forms (i.e. the lexical level) and word meanings (i.e. the semantic/conceptual level) together with paths that allow those components to be related to one another and to other elements in the processing hierarchy (Garman 1990: 243). This two-layered architecture of the mental lexicon, which constitutes the cornerstone of hierarchical models of language representation, may be traced to the Saussurean division of the linguistic sign into the 'signifier' and the 'signified'. The concept of a two-layered trilingual mental lexicon proves useful in considering the way in which trilingual speakers organise lexical information provided that both levels of representation are defined in an unambiguous manner. In view of the fact, however, that a number of researchers hold quite divergent views on this issue, the goal of this section will be to state what features a trilingual mental lexicon should possess in order to serve most effectively the intended purpose of this investigation.

The lexical level of representation is generally assumed to refer to the level of individual words and to the way that they are represented in the mental lexicon as lexical entries (Levelt 1989: 182). In linguistics, the lexical representation of a word contains a specification of its pronunciation, spelling, morphological characteristics, meaning(s), and its syntactic category membership (Levelt 1989: 183; Jackendoff 1994: 131). In cognitive psychology there is less agreement among various authors in that respect. Lexical entries either include or exclude the phonological, orthographic, morphological, syntactic or semantic properties, depending on the researcher in question (Francis 1999: 195). Moreover, inspired by the writings of de Saussure (1983), Kempen and Huijbers (1983) and Kempen and Hoenkamp (1987), some scholars distinguish between ‘lemmas’ (semantic-syntactic properties of lexical entries) and ‘lexemes’ (morphophonological properties), but even then there is confusion regarding the precise manner in which those two terms should be defined.[9]

Considerable confusion has also been detected in the literature with regard to the semantic/conceptual level of representation. Generally speaking, conceptual representations consist of mental images, schemas and scripts organised into categories of thought and meaning, while semantic representations refer to mental links that map words to their concepts as well as words to other words (Jarvis 2009: 100-101). Some scholars hold that those two levels of representation should be separated not only in theoretical models of the mental lexicon, but also in experimental investigations tapping into memory organisation. For instance, Pavlenko (2009: 148ff.) claims that by distinguishing between semantic and conceptual levels of representation it is possible to distinguish between instances of semantic transfer (errors at the level of linking) and conceptual transfer (errors that involve the structure of concepts themselves), while Paradis argues in favour of a common conceptual system where “conceptual features are grouped together in accordance with the specific lexical semantic constraints on words from each language and the relevant pragmatic circumstances at the time of their use” (2007a: 7). In this view, language-specific lexicosemantic constraints determine which features of the corresponding concepts are activated.[10] Francis, in turn, holds that the terms ‘semantic’ and ‘conceptual’ may be used interchangeably since their separation is unlikely to be achieved in experimental investigations: semantic representations are thought to constitute a subset of the set of possible conceptual representations (Francis 2005: 252; cf. also Francis 2000). Similarly, De Groot states that “pinpointing the

[9] For instance in Leveltian models the lemmas initially comprised the meaning and syntax of a lexical entry while the lexemes specified the morphophonological features (Levelt 1989, 1993). Later, however, lemmas were defined solely in terms of their syntactic specifications, whereas a node called the ‘lexical concept’ represented the lexical semantics (Levelt et al. 1999; Levelt 2001; cf. also Section 2.2.2.).

[10] For the sake of precision, some researchers refer to lexically-specific aspects of meaning as ‘lexical semantics’, and to the pre-linguistic meaning as ‘conceptual semantics’ (Nickels 2001: 293; cf. Cruse 1986, 1990; Frawley 2002). Put differently, words have their language-specific semantic properties but they are also connected to a common conceptual store, sometimes referred to as the Common Underlying Conceptual Base or CUCB (Kecskés and Papp 2000, Kecskés 2007).

difference between semantic and conceptual knowledge is a tedious task (…) both types of knowledge plausibly originate from one and the same source" (2002: 48).

In view of the above arguments, the following definitions have been adopted for the purpose of our experimental investigation:

- 'lexical' will refer to word form representations (orthographic and morpho-/phonological features)
- 'semantic' and 'conceptual' will be used jointly to refer to a general level of meaning representations.

This conflation seems justified for the experimental paradigms investigated in the present work (both translation recognition and production are out-of-context tasks in which participants deal with concrete nouns) all the more so that I subscribe to Kroll and Tokowicz's (2005: 536) view that such experimental conditions most probably evoke the same meaning, which makes it worthwhile to disregard differences between lexical semantics and conceptual semantics which would be otherwise relevant in sentence contexts.

At this point a question arises as to the manner of representation of translation equivalents in the mental lexicon. Having decided to use 'semantic' and 'conceptual' interchangeably, I propose, after Francis (2005: 252), to define translation equivalents as words which "refer to the same concept or have the same meaning." Arguably, this definition forestalls the presentation of arguments proposed by the architects of early hierarchical models in that it presupposes that language systems are interdependent and that the semantic/conceptual representations of translation equivalents are at least partially shared. However, the goal of the following section is not to present arguments in favour of shared or separate memory storage as nowadays researchers generally agree that languages are stored in interconnected lexicons (e.g. Jarvis and Pavlenko 2008: 222). Rather, in what follows attempts will be made to trace the development of the idea that such factors as proficiency or individual language experience (e.g. the amount of interpreting practice or directionality) can influence the strength of connections in the mental lexicon.

1.3. Early hierarchical models

Early hierarchical models of bilingual memory were based on the assumption that speakers organise their languages into one common conceptual level and a language-specific lexical level. Those models were mostly concerned with the way word forms map onto meaning, and did not distinguish between the semantic and conceptual levels of representation. Neither were they concerned with individual language subsystems like phonology, orthography or morphology (cf. Kroll and Tokowicz 2005). I nevertheless believe that Weinreich's (1953 [1968]), Ervin and Osgood's (1954 [1965]) and Potter et al.'s (1984) configurations of bilingual memory are worthy of discussion because of the insights they provide into the way a trilingual's languages are thought to be stored and organised in relation to language acquisition factors, proficiency, and individual language experience.

Basing on the relationship between the signifier and the signified, Weinreich (1953 [1968]) proposed three different types of arrangements of linguistic signs and their corresponding semantic content, depending on the way the words and concepts were thought to be represented in the bilingual brain:

- type A: coordinate (first called 'coordinative') – word forms from each language were combined with separate 'semantemes', i.e. two words signify two separate concepts; the languages are independent;
- type B: compound – two word forms were combined with a single compound semanteme, i.e. two words converge on a single shared concept; the languages are interdependent; to Weinreich this type was the desired state;
- type C: subordinate (or 'subordinative') – whereby the meanings for new words in one language referred to words in another language, not concepts; type C is presumed to arise when a new language is learned with the help of a previously acquired language; words from the weaker language are interpreted through the words of the stronger language; Weinreich assumed implicitly that that type of representation could evolve into one of the previous forms.

These types of arrangement had important implications for the way translation equivalents were thought to be represented in the bilingual brain. Weinreich ([1968]: 9-11) illustrated the three types of bilingual mental representation with English and Russian examples (Figure 1):

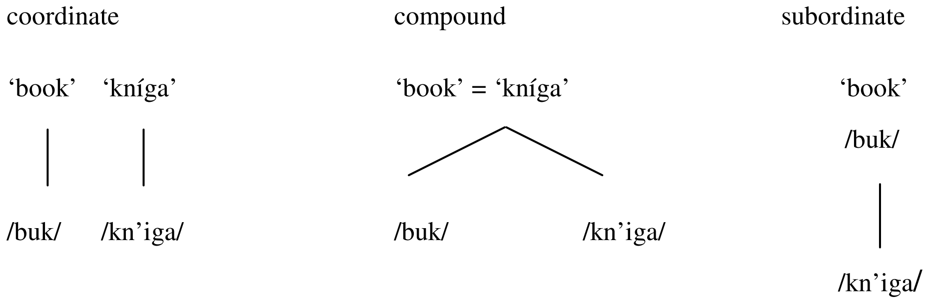

Figure 1. Types of bilingualism (after Weinreich [1968]: 9-11).

Weinreich limited the three kinds of mental configurations to the phonological and semantic representations of translation equivalents. Even though he made no direct claims about the language-learning histories leading to those configurations, the following implicit assumptions may be detected in his line of reasoning: early stages of additional language acquisition lead to subordinate organisation; languages acquired in the same context produce compound bilinguals; and those acquired in separate contexts produce coordinate bilinguals. Moreover, although Weinreich did not explicitly relate the three mental configurations to the level of proficiency, he noted that all three types of associations might coexist within an individual. A number of researchers have made related observations. For instance Wei (2008: 10) argues that concepts in the bilingual memory can be more compound, coordinate or subordinate at the same time, depending on such factors as age or the context of language acquisition. Grosjean (2008: 266) also emphasises that within the same speaker, some words can "have a coordinate relationship, others a compound relationship, and still others a subordinate relationship, especially if the languages were acquired in different cultural settings and at different times." Moreover, language learners are believed to go through a series of stages before becoming proficient in their languages (Heredia and Brown 2004: 227): (i) the subordinative stage consisting in linking every L2 word to their L1 equivalent at the form level; (ii) the compound stage involving ascertaining relationships between the L1 and L2 concepts; (iii) the coordinate stage by which learners should have managed to separate their two languages at the lexical and conceptual levels.

This developmental aspect implicit in Weinreich's models constitutes, in our view, his most important contribution to subsequent conceptualisations of memory organisation in speakers of two and more languages. For instance, Weinreich's influence is reflected in the Parasitic Model of vocabulary development in additional languages (cf. Hall 1992; Hall and Ecke 2003; Hall et al. 2009). This model rests on the assumption that new lexical representations are integrated by default into the rest of the network via connections with pre-existing representations at points of similarity or overlap (Hall and Ecke 2003: 71-72, 77). Woutersen et al. (1994) also largely followed in Weinreich's footsteps. They attempted to combine his ideas of bilingual mental organisation with the activation-spreading mechanism (outlined in Section 2.2.1.), their basic claim being that intra-and interlingual links between lexical form and meaning representations depend on the extent to which those links are used. They assumed that, due to prolonged exposure to the L2, most lexical representations evolve by developing and strengthening the said links in roughly the same way. That assumption enabled them to use Weinreich's terminology when speaking of different types of bilinguals whose mental lexicons were arranged according to the manner of organisation of most of their word representations.

This examination of Weinreich's ideas and their subsequent adaptations led me to an important question in the context of the experiments involving very proficient trilingual speakers, such as: what kind of relation does a third language establish in the mental lexicon if that language is typologically related to the second language? In answer to this question I would like to postulate that in the language acquisition process a new language may develop a subordinate relation to one of the languages already present in the trilingual mental architecture. Where the L2 and the L3 are typologically related, the third language is likely to develop a subordinate relation to the L2 rather than to the L1. This postulate is based on evidence provided by third language acquisition (TLA) studies in which the L3 learners were found to tend to associate their L2 with their L3, especially in cases where the foreign languages were typologically closer to each other than to their respective mother tongues (cf. Kellerman 1979; Hall and Ecke 2003; Singleton 2003: 169-170). Further to that, in addition to the fact that with increasing proficiency the third language develops direct links to concepts, it could also retain close lexical links to the L2, their extent depending on the degree of similarity of interlingual form representations. The resultant trilingual lexicosemantic network is expected to be subject to the influence of factors related to the individual linguistic experience of those participating in the experiments (cf. Chapter 3 for a more detailed discussion).

Ervin and Osgood's (1954 [1965]) models are worth mentioning at this point as they were devised on the basis of language-learning histories of individual speakers. Ervin and Osgood merged Weinreich's three types of bilingual memory systems into two representational systems: the compound and the coordinate systems, based on the differences in the cognitive organisation of the given bilingual's languages.[11] In a compound system, the sets of linguistic signs in both languages were associated with a single set of meanings, while in a coordinate system those same linguistic sets corresponded to two separate sets of meaning (cf. Figure 2).

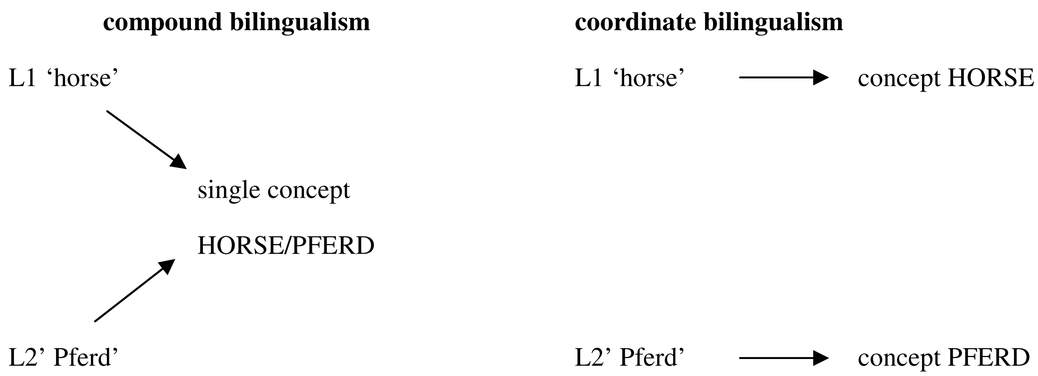

Figure 2. The compound-coordinate representation (after Ervin and Osgood [1965]: 139-140).

Often cited in support of Ervin and Osgood's compound-coordinate distinction is a study of Lambert et al. (1958) in which two groups of English-French bilinguals were investigated: those who acquired their languages in separate contexts (i.e. the two languages were presumed to be functionally separate), and those who acquired their languages in

[11] While there rarely exist ideal coordinate bilinguals, Ervin and Osgood were criticised for neglecting the difference between the true compound and subordinate relations, which might lead to oversimplifications. For instance, interference in a subordinate bilingual is supposed to be unidirectional, not bidirectional (Paradis 2004: 187; Javier 2007: 40).

fused contexts (i.e. the two languages were supposed to be functionally integrated).[12] The two contexts of acquisition were expected to lead to semantic differences between translation equivalents. In order to measure the differences in the meanings of concepts in the two languages (Exp. 1), the subjects were asked to rate common English words and their French equivalents using Osgood's semantic differential, i.e. to assess the connotative meanings of words on ten semantic scales (e.g. good vs. bad, pleasant vs. unpleasant). In order to measure the degree of the associative independence of translation equivalents (Exp. 2), use was made of the 'retroactive inhibition' paradigm. The subjects were first asked to learn a list of 20 common English words using the anticipation method and were then asked to learn a list of 20 three-letter nonsense words. Finally, they were given the English word list again in order to measure their retention rate. They were then asked to learn a second list of 20 English words, and then a list of French translations of those words instead of the said list of nonsense words. Results of the first experiment indicated that, in comparison with the compound group, there was a greater divergence in the meaning associations of translated equivalents in those coordinate bilinguals who had acquired their languages in different cultural settings. Results of the second experiment demonstrated the existence of the expected differences between the compound and coordinate groups (i.e. the compound group clearly benefited from the French list in the associative independence test). On the basis of those results Lambert et al. (1958: 243) concluded that language acquisition context influenced the functional separation of the bilingual's two languages because the coordinate bilinguals, in contrast to compound bilinguals, appeared to have more functionally independent language systems.

Compared to the results obtained by Lambert et al. (1958), the participants of my experiments could be regarded as compound trilinguals (i.e. to have shared memory systems) insofar as they acquired their languages in fused, not separate, contexts.[13] In the case of trilingual speakers, the shared/interdependence memory hypothesis predicts that in addition to the conceptual or amodal system, the language systems are connected in a more direct manner. Factors such as the level of proficiency or the type of linguistic experience

[12] Problems were identified with the choice of subjects for the study: subjects who had acquired their two languages at home but spoke a different language to each parent were put in the coordinate category, together with those bilinguals who had acquired their languages in two different cultural settings.
[13] In order to render the compound/coordinate distinction open to experimentation, the compound system has been reformulated as the 'shared memory hypothesis', and the coordinate system as the 'separate memory hypothesis' (Kolers 1963; Keatley 1992: 17; Heredia and Brown 2004: 229ff.; Heredia 2008: 50).

(e.g. the amount of exposure to a given language combination in interpreting) should thus find their reflection in the quality of connections between the three language systems.

Evidence for subordinative, compound and coordinative storage of lexical items depending on the proficiency level was found and similar conclusions were reached by Herwig (2001) who asked her multilingual participants to compose a story in their L1 on the basis of pictures and then to translate it in writing into their L2 with concurrent TAPs. It emerged that advanced L2s tended to form a compound system while other foreign languages seemed to be stored coordinatively (some words also subordinatively). Also the results of Abunuwara's (1992) study involving a trilingual Stroop colour naming test and a trilingual picture-word naming test (L1: Arabic, L2: English, L3 Hebrew) point to the existence of an independent relation between two proficiently known languages, and an interdependent relation between a proficient and a non-proficient language.[14]

The results of empirical verifications of bilingual memory models discussed so far point to the influence of the language acquisition context, proficiency and language experience on the functional organisation of languages in the brain. However, the developmental aspect of bilingual memory was mostly neglected in early hierarchical models. The notable exception is constituted by the Word Association and Concept Mediation models of Potter et al. (1984). Those models are important for my investigation because they were the first to reflect the consequences of developmental changes occurring in the arrangement of word-level and conceptual representations for translation (cf. Figure 3).

[14] The original Stroop task measures interference in colour naming (Stroop 1935). Subjects are presented with three sets of cards: cards with colour patches, cards with colour words printed in black, and cards with colour words printed in incongruent colours. Typically, the naming of colour patches takes longer than the naming of colour words, and the naming of colours presented in the form of incompatible colour words takes much longer that the naming of colour patches ('Stroop interference'). In the bilingual Stroop task, colour words in both languages are written in different ink colours. Subjects name the colour of the ink in their L1 or L2. Typically, colour naming interference in the L1 is greater in the within-language condition than in the between-language condition (e.g. Costa et al. 1999).

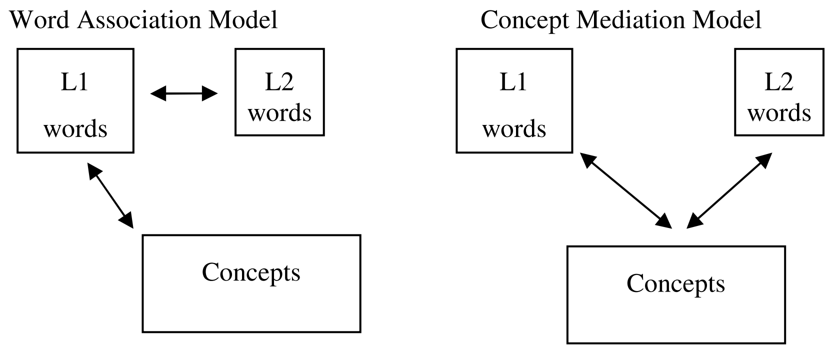

Figure 3. The Word Association and Concept Mediation models in translation (after Potter et al. 1984: 25).

In the Word Association model, which resembles Weinreich's subordinate structure, the word-form representations of the translation pairs in L1 and L2 are directly connected to one another but it is only the L1 word-form representations that have a direct access to the conceptual memory. In the Concept Mediation model, the L1 and L2 word-level translation pairs are only indirectly connected via the conceptual level which is common to both languages (cf. Weinreich's compound structure).

Potter et al. tested the correctness of predictions based on these models by comparing the performance of more (Chinese-English) and less (English-French) fluent bilinguals in word translation and picture naming. They hypothesized that if both tasks were accomplished conceptually, then they should take equally long to complete.[15] If, however, translation by-passed concept mediation, it should be faster than naming. Also considered was an intermediate or developmental model assuming a gradual replacement of word-association links by concept-mediation links between the L2 word forms and concepts in line with increasing proficiency. Potter et al. found that both tasks took about the same amount of time to complete, which supported the Concept Mediation model in the case of the more proficient and the less proficient bilinguals.

A number of subsequent studies (Kroll and Curley 1988; Chen and Leung 1989; Kroll and Sholl 1992; Kroll and Stewart 1994; Sholl et al. 1995) stated that Potter et al.

[15] That hypothesis was based on an earlier study by Potter and Faulconer (1975) who demonstrated that L1 words were named significantly faster than pictures in the L1, which was taken as support for conceptual access in picture naming.

were not right in rejecting the developmental hypothesis because their participants were sufficiently proficient in both languages and were thus able to use conceptual mediation. Studies using a similar design to that of Potter et al. (1984) conducted by Kroll and Curley (1988) or Chen and Leung (1989) supported the validity of the developmental model (i.e. beginner bilinguals exhibited a word-association pattern while proficient bilinguals showed the concept-mediation pattern). In the study by Kroll and Curley the subjects named words, translated words, and named pictures in both of their languages (L1: English, L2: German). There were two lists of conditions: one with semantically categorised words or pictures, and another one with mixed stimuli. The essential prediction was that relatively fluent bilinguals would use direct concept mediation in the L2, which should produce facilitation in the case of semantically ordered lists. However, instead of facilitating translation performance, the application of those lists triggered semantic interference in forward translation performed by the more fluent bilinguals. In picture naming, all subjects took longer to name pictures in the L1 when the list was semantically organised. Those findings led Kroll and colleagues (Kroll and Sholl 1992; Kroll 1993; Kroll and Stewart 1994; Sholl et al. 1995; Kroll and De Groot 1997) to propose the idea of a developmental shift from reliance on L1 meaning in the processing of L2 words to direct conceptual processing in the L2. The Revised Hierarchical Model (RHM) they put forward proved to be one of the most influential models of bilingual memory whose tenets were widely investigated in various translation tasks, chiefly in translation production and translation recognition tasks performed not only by bilingual but also trilingual speakers. Therefore, the RHM would appear to be a particularly useful tool for my experiments of translation performance, as it suggests a possibility of accounting for developmental changes taking place in the arrangement of the mental architecture of trilingual speakers with differing amounts of CI experience. A more detailed discussion follows.

1.4. The Revised Hierarchical Model

The RHM assumes the existence of direct bidirectional links between the word form representations of L1 and L2 translation pairs, and indirect connections between them through a conceptual node that is shared between the L1 and the L2. This model is sometimes referred to as the asymmetry model since it emphasises directional strength differences between the lexical and conceptual links in the bilingual's mind, which results in the so-called 'directionality effect' in translation. The RHM posits the existence of a development process in which L2 lexical connections shift from being linked indirectly to their meaning via L1 translation equivalents to direct links to their meanings in the conceptual store. Thus, the hierarchical model envisages separate but interconnected lexicons. Importantly, the lexical connections between the L1 and the L2 remain viable after direct conceptual links between the L2 and the conceptual store have been established (Kroll and Tokowicz 2001).

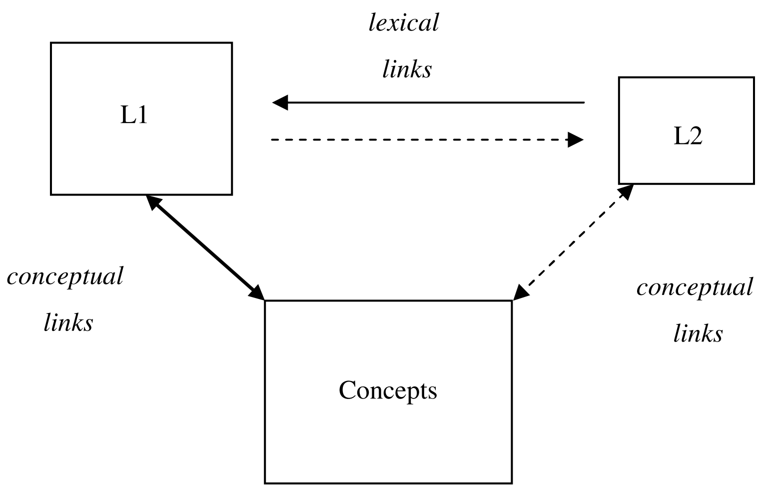

Figure 4. The Revised Hierarchical Model (after Kroll and Stewart 1994: 158).
Lexical links are stronger from L2 to L1 (solid line) than those from L1 to L2 (dashed line), but conceptual links are stronger for L1 (solid line) than those for L2 (dashed line). [16]

Figure 4 indicates that backward translation is available much earlier in L2 acquisition than forward translation. Backward translation engages lexical-level connections which are predicted to be in place relatively early in the L2 acquisition process. Forward translation involves conceptual mediation (that translation route is thus expected to gradually improve with increasing fluency).

The prediction that there will be a gradual reduction of the translation asymmetry with increasing proficiency has been tested in a number of studies involving bilingual

[16] Recently, Pavlenko (2009: 146-151) proposed the Modified Hierarchical Model (MHM) which retains RHM's developmental aspect but assumes that bilingual conceptual representations may be either fully shared, partially shared, or entirely separate. I decided not to differentiate between the three types of conceptual equivalence given the characteristics of the experimental stimuli (cf. Section 4.8.).

speakers performing translation tasks. In what follows the conflicting results obtained in those studies will be interpreted within the framework of the RHM, and then related to the mental lexicon of bilingual and trilingual conference interpreters.

Support for the asymmetry model can be found in studies involving translation production and translation recognition. For example Kroll and Stewart (1994) investigated picture naming, and forward and backward translation production of English-Dutch unbalanced bilinguals.[17] They found that the response times for the backward translation were shorter than those for the forward translation. Moreover, meaning-related variables (i.e. whether the words to be translated appeared in semantically categorised or randomly ordered lists) were found to affect both picture naming and the forward, but not the backward, translation direction. Kroll and Stewart interpreted their results as being indicative of the fact that the said two translation directions proceed via connections of different strength, and thus in accordance with the main tenets of the RHM presented above.[18] Talamas et al. (1999) tested the developmental assumption of the RHM in a translation recognition task in which a set of more and less fluent English and Spanish bilinguals were to decide whether the second of two words was the correct translation of the first word. The more proficient bilinguals experienced greater interference of semantically related distractors, while the less proficient bilinguals showed more frequently the form-related interference (e.g. *man - hambre* instead of *hombre*, and *man- mujer* instead of *hombre*). The results support a proficiency related progression from the reliance on form (lexical mediation) to the reliance on meaning (conceptual mediation) in the second language. Similar results were obtained by Ferré et al. (2006) who explored the development of lexical and semantic representations in three groups of Spanish-Catalan bilinguals differing with respect to proficiency and the age of acquisition. The translation recognition task included formal and semantic distractors (either close or very close in meaning). In accordance with the RHM, both early and late proficient bilinguals were shown to be more sensitive to semantic than to form manipulations in the case of words with a very close meaning. The late-nonproficient group exhibited larger effects of form manipulations.

However, there is a number of translation production and translation recognition studies in which the translation asymmetry hypothesis was not corroborated. De Groot et al.

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[17] Unbalanced or dominant bilinguals have a relatively low proficiency in the non-native language.
[18] Cf. Snodgrass (1993) for an exhaustive comparison of the translation and picture naming tasks.

(1994) tested fairly fluent, unbalanced Dutch-English bilinguals in forward and backward translation. It emerged that variables related to the meaning of a given word, such as concreteness or context availability, affected also the backward translation (albeit to a slightly smaller extent than in forward translation). This particular finding led those researchers to reject the stronger version of the asymmetry model, according to which conceptual memory is not involved in backward translation in favour of the weaker version thereof according to which L1 processing is more likely to engage meaning than L2 processing. De Groot and Poot (1997) studied three groups of Dutch-English bilinguals at different levels of proficiency in a translation production task. Experimental stimuli were manipulated with respect to imageability/concreteness and translation direction.[19] Contrary to the asymmetry model, word imageability/concreteness was shown to affect the performance of all three subject groups. They concluded that those groups did not differ in terms of conceptual memory involvement in word translation in either of the two directions investigated. Similarly, Sunderman and Kroll (2006) found inhibitory effects in Spanish (L2) -> English (L1) translation recognition for semantic distractors, irrespective of their participants' proficiency levels. Their results also suggest that meaning information is available in L2 word recognition even at low proficiency levels.

The reviewed studies suggest strongly that the conceptual memory is implicated in both forward and backward translation but to varying degrees. I believe that the best explanation of the experimental evidence reported above is to assume that while translation is concept mediated in both directions, proficiency has a stronger effect on production than on comprehension. Consequently, translation to the dominant language proceeds faster (cf. Snodgrass 1993). Similarly, Paradis (2004: 29) observed that producing an item is more difficult than comprehending that same item because comprehension does not require as much activation as production. With that caveat in mind, I would like to postulate that the RHM is, in fact, sufficiently broad in scope to represent developmental changes in the strength of interlingual lexical links as a function of translation and interpretation training and practice. In the case of bilingual conference interpreters, it is logical to assume that the translation asymmetry predicted by the RHM will be greatly reduced, as the interlingual

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[19] Some studies draw a distinction between word imageability and concreteness, in which case the former relates to the ease of recalling a mental image of a given word, and the latter to the possibility of sensual examination of the word's referent (De Groot et al. 1994: 602; De Groot and Comijs 1995: 475).

conceptual and lexical links become stronger owing to prolonged practice. While the strength of interlingual conceptual links is not necessarily a function of interpreting practice, lexical links between the L1 and the L2 (or A and B language) are likely to become stronger whenever they are activated concurrently for both comprehension and production, with the strength of interlingual lexical links relying on directionality. The point, thus, is that the mental lexicon of a unidirectional interpreter will differ from that of a bidirectional interpreter:

> If the interpreter works not only from his/her B language (L2), but also into it, the connections may develop more or less equally. On the other hand, if the interpreter works only from his/her L2 and L3 (i.e. C languages) into A, the linguistic links from other languages to the mother tongue may be stronger than the opposite links (Chmiel 2007: 71).

In the case of a trilingual interpreter, directionality is likewise postulated to be a powerful determinant of mental architecture. In the case of an experienced trilingual interpreter, for example, it is reasonable to suppose that the C language will be more strongly connected to the A language than to the B language (professional interpreters work only from their C language into their A language). The architecture of the RHM seems to be sufficiently flexible to accommodate one more lexicon while paying heed to this and other between-group differences in the quality of interlingual links related to language use.

These preliminary postulates concerning the organisation of the mental lexicon of conference interpreters will now be confronted with the predictions of the Distributed Feature Model which emphasises the individual word type characteristics rather than the strength of connections which depend on the processing direction.

1.5. The Distributed Feature Model

In contrast to the RHM, De Groot in her Distributed Lexical/Conceptual Feature Model (the Distributed Feature Model, DFM) elaborated on how the conceptual store might be represented at the word level for different types of words. The DFM predicts that concrete words are more likely to share meaning across languages than abstract words because the former have access to a shared set of semantic features, while the latter overlap in meaning only partially across languages. Cognates, i.e. orthographically, phonologically and semantically similar words across languages, are thought in that model to display a high level of both lexical and conceptual overlap.[20] Thus, a high level of feature overlap leads to rapid conceptual activation and shorter response times. The DFM (cf. Figure 5) is in fact sometimes called a mixed model because its meaning representations may range from a complete overlap (cf. compound architecture) to the absence of such an overlap (cf. coordinate architecture), depending on the word type in question (De Groot 1992a, 1992b, 1993; De Groot et al. 1994; Kroll and De Groot 1997).

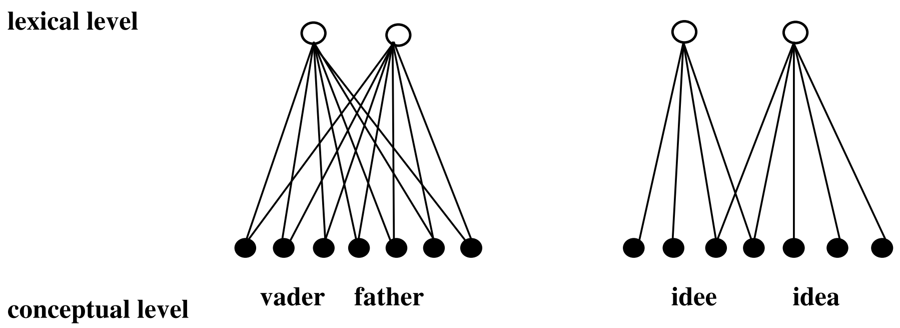

Figure 5. The Distributed Lexical/Conceptual Feature Model (after De Groot 1993: 36). Concrete words (*vader-father*) share more semantic features across languages than abstract words (*idee-idea*).

Evidence supporting the DFM is provided by results of experiments involving the manipulation of word concreteness and cognate status. It emerged from those experiments that concrete words were recognised and translated faster than abstract words, and that cognates were recognised and translated faster than noncognates.[21] The cognate advantage was more robust in less proficient bilinguals however, which suggests that they relied on the

[20] The definition provided by Altarriba and Basnight-Brown (2009: 91) is deemed to be the most appropriate here. Cf. Section 2.3.1. for further information about cognates and their processing.

[21] It was Schwanenflugel and Shoben (1983) who found that concrete words are identified faster than abstract words in a lexical decision task. Subsequently, the Context Availability Model (CAM) was put forward, according to which comprehension critically depends on the context. CAM predicts that the differences in processing between concrete and abstract words tend to disappear when inserted in a meaningful sentence context (cf. Van Hell and De Groot 1998). A related proposal was put forward by Paivio (1986) in his Dual-Coding Theory of Bilingual Memory according to which concrete words and some translation equivalents may be represented both by a verbal code ('logogens') and an imaginal code ('imagens'). In contrast, abstract words are supposed to be represented separately in the language systems of a bilingual (i.e. they do not arouse common referent images), and are only connected through translation.

direct lexical rather than on the conceptual translation route, as indeed predicted by the RHM. For instance, De Groot (1992a) demonstrated that fluent Dutch-English bilinguals translated concrete words faster than abstract words, and that cognates were translated faster than noncognates in a study employing three versions of the word-translation task (normal translation, cued translation, and translation recognition, all exclusively in the forward direction).[22] Experimental stimuli applied in that study were manipulated with regard to word frequency and imageability (Exp. 1 and 2) and also, among others, their cognate status (Exp. 3). The cognate results were then replicated with English-Spanish bilinguals in both directions, the following result having been obtained: while cognates were found to be translated equally fast in both directions, noncognates were translated faster in backward than in forward translation (Sánchez-Casas et al. 1992). De Groot and Comijs (1995) showed that the directionality effect predicted by the RHM was present in translation production and translation recognition only in the case of noncognate words.

The usefulness of De Groot's model for translation and interpreting lies in the fact that it can explain some similarities and differences at the word form level across languages. For instance, the DFM is able to account for the word concreteness effect and the cognateness effect in translation: concrete and cognate words are easier to retrieve than abstract and non-cognate words because the former share more features at the conceptual level. The DFM also predicts that translation equivalents share a considerable amount of semantic feature overlap. Kroll and Dussias (2004) demonstrated that the greater the degree of semantic/conceptual overlap, the easier and faster the retrieval of the translation equivalent. The above advantages constitute the model's major limitation since it does not enable more generalised findings and predictions apart from the word level effects (e.g. Heredia and Brown 2004: 241-242). As opposed to the RHM, De Groot's model lacks a developmental component and so it does not consider changes in the strength of lexical connections that are in line with the development of translation or interpreting expertise. For instance, in spite of its focus on the degree of interlingual overlap between the lexical and conceptual features, the DFM disregards how partial translation equivalents are learned, and ignores the various denotations and connotations which are acquired for individual words (particularly at the lexical level) in the course of translation or interpreting practice (cf. Chmiel

[22] In cued-translation, participants are given a visual cue as to what response should be given (e.g. the first letter of the desired translation equivalent).

2007). Further, I would like to concur with Pavlenko (2009: 144-145) that the model equates the strength of interlingual connections with the degree of meaning overlap, so that word type characteristics such as word frequency or cognateness are conflated with conceptual properties such as word concreteness. Thus, although the DFM does present a convincing account of the representation and processing of cognates or translation equivalents, its scope is too narrow to be the guiding model for the purposes of this research.

Finally, let us consider whether Finkbeiner et al.'s (2004) Sense Model may be used to illustrate the arrangement of interlingual links in the case of a trilingual speaker. Based on a study of polysemy in masked semantic and translation priming with stimuli in Japanese (L1) and English (L2), Finkbeiner et al. (2004) proposed to enrich De Groot's model with the idea of 'senses' defined as bundles of semantic features corresponding to specific usage.[23] In other words, senses are understood to represent a number of different meanings that a given word may have. The more semantic senses are shared between words across languages, the more similarities there are to be found at the conceptual level. The Sense Model should theoretically be able to account not only for the existence of translation asymmetries in the case of unbalanced bilingual or trilingual speakers without interpreting experience, but also for the absence of such translation asymmetries in the case of proficient bilingual or trilingual speakers having interpreting experience. However, the Sense Model has been discarded in this work for two reasons. Firstly, sufficient experimental evidence for that model is currently lacking, Finkbeiner and associates having so far tested it using within-language word pairs. Secondly, and most crucially, the Sense Model does not render itself amenable to direct application in this study because it is not sufficiently discriminating to render clearly the arrangement of lexical and conceptual links in a trilingual lexicon.

Although none of the above models was designed with trilingual speakers in mind, the foregoing discussion points to the conclusion that solely the RHM has the potential to accommodate an additional lexicon and, in so doing, reflect quite effectively the complex nature of connections between three different lexical stores. However, it should be stressed that any attempts at modelling the trilingual mental lexicon in my work will need to be suf-

[23] In masked priming, a forward-masked, lowercase prime is presented for around 30-60 ms, and is followed by an uppercase target (e.g. De Groot and Nas 1991; Forster and Jiang 2001). Under these conditions, participants are usually oblivious to the prime's existence, let alone to its language identity.

ficiently flexible and adaptable to render the complex nature of lexical processing in translation while taking account of (i) close lexical similarity between the L2/B and the L3/C, and (ii) the impact of directionality on the strength of interlingual lexical connections. It is evident, therefore, that two models of the mental lexicon will have to be conceived to suit the purpose of this study: one concerned with trilingual speakers having some CI experience, and the other concerned with trilingual speakers without any CI experience (those models will be presented and discussed in Section 3.4.).

1.6. The trilingual mental lexicon – an interconnected and dynamic perspective

Prior to modelling the trilingual mental lexicon, it is essential to examine the results of translation experiments involving trilingual speakers. Therefore, in this section I discuss the implications of experimental evidence from trilingual word translation studies for our view of cognitive organisation in trilingual speakers.

To begin with, it is important to note that different types of memory representations can coexist within a trilingual mind depending on the level of L3 proficiency. For example, conceptual mediation occurred for the stronger of the trilinguals' foreign languages but not for the weaker language in the case of two groups of unbalanced Dutch-English-French trilinguals in translation production and in translation recognition (De Groot and Hoeks 1995). It appears, therefore, that "bilingual (multilingual) memory organization is not fixed within an individual nor uniform across individuals" and that "different types of lexicosemantic memory structure can coexist within one and the same multilingual individual" (De Groot and Hoeks 1995: 684, 713). Similar results were obtained in two recent studies investigating the translation performance of English-Spanish-French (Francis and Gallard 2005) and Polish-English-Chinese trilingual speakers (Kujałowicz and Zajdler 2009): the reaction times (RTs) recorded in those studies varied according to proficiency differences across the respective language combinations. Also De Angelis (2007: 95) has stressed that "multilinguals' lexical organisation can change over time (…) language proficiency is a key factor in generating such change."

Apart from proficiency, a number of factors were found to influence the lexicosemantic processing in trilingual translation. For instance, the pattern of translation in six directions (involving concrete and abstract words, cognates and noncognates, and one and multiple translation equivalents) obtained in a case study of a Hebrew-English-French aphasiac (Goral et al. 2006) suggests that the ease of lexical access in translation is determined by the age of language acquisition, the degree of language recovery and use, and by the prevalence of the shared vocabulary (lexical similarity). Goral et al. pay considerable attention to the existence of what they termed "resilient lexical connections" between the two foreign languages, independent of their connections to the native language. They emphasise that

> a third language (L3) may be learned in connection with a previously learned non-native language (L2), and thus develop strong lexical connections with that language. These connections can be detected even in the presence of a language deficit resulting from aphasia. (…) we are unable, on the basis of the present case, to dissociate whether the strong connections between English and French are due to their status as non-native languages, their being used regularly at the time of the aphasia onset or their shared vocabulary. We can, however, posit that any or all of these factors contributed to sustained ties between words in the two languages (Goral et al. 2006: 244).

Although the body of research on cross-language connections in trilingual translation is relatively small compared to the case of bilingual translation, the results of studies reviewed above permit the conclusion that

> the memory of every individual is likely to contain structures of various types and these structures will occur in various proportions across individuals. These will depend on factors such as level of proficiency of the languages known, the characteristics of the words, the strategy used to learn them, the context in which they are used, the age at which a language was acquired, and so on. In sum, one should be extremely wary of discrete classifications that do not do full justice to the representational and processing complexity found within the individual bilingual (Grosjean 2008: 267).[24]

The above results have two major implications for my investigation of trilingual lexical processing in translation. I address each of them in turn.

First of all, despite the fact that those participating in the experiments are very proficient in their foreign languages, it seems erroneous to predict solely conceptual mediation to be present in their translation performance. Instead, it is proposed that English will be readily accessed conceptually but German lexical items may be stored in a mixed fashion,

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[24] Grosjean (1992: 51) defines bilinguals as persons who speak two or more languages. Cf. Herdina and Jessner (2002: 52) or Myers-Scotton (2002: 1) for similar definitions.

i.e. in subordinate, compound, or coordinate representations, reflecting a developmental sequence on the one hand and "resilient lexical connections" on the other. Given the fact that English and German are Germanic languages which share a substantial amount of their lexical stock, the processing of similar or overlapping lexical representations between English and German may be effected via direct lexical mediation and so it may yield relatively short reaction times. At the same time it should be noted that processing by means of direct lexical mediation in an online translation task may increase the likelihood of succumbing to interfering language representations. It is beyond the scope of the present chapter, however, to hypothesise about any between-group differences as regards the susceptibility of falling prey to interference. For the moment, suffice it to say that, in contrast to the remaining groups, professional conference interpreters are claimed to be quite "aware of the dangers of linguistic interference and constantly endeavour to avoid it" (Gile 1995: 222).

Moreover, it seems that the strength of lexical and semantic/conceptual links in the trilingual mental lexicon depends on the degree of stimulation received in the linguistic environment. Variables related to individual linguistic experience (e.g. the frequency or context of use) are thus believed to produce changes in the mental organisation of languages residing in the brain, which should manifest itself in the speed and accuracy of lexical processing in trilingual translation.[25] Crucially to the present investigation, the strength of interlingual connections in the trilingual mental lexicon is thought to depend on the type and amount of CI training and experience. It follows that directionality should be a strong determinant of trilingual lexicosemantic organisation in the case of conference interpreting professionals and trainees (this line of thought will be pursued in depth in Section 3.2.).

The Dynamic Model of Multilingualism (DMM) provides substantial support for these preliminary remarks with regard to the organisation of the trilingual mental lexicon. Arguably, the scope of the DMM (Herdina and Jessner 2002) is too large to make it directly applicable to the present investigation because it aims to explain such processes as the acquisition, maintenance, and attrition of multiple languages. Nevertheless, several features of the DMM were found to be particularly relevant to forming my view of the trilingual mental lexicon. According to the DMM, individual language systems in the multilingual

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[25] In a study of Spanish-English bilinguals, language dominance was found to affect translation performance in ways unpredicted by the RHM (Heredia 1997; Heredia and Brown 2004: 239). This proves that bilingual lexicosemantic organisation is not static but rather evolves over time to reflect changes in the frequency of language use.

mind are mutually interdependent rather than autonomous, so that "the behaviour of each individual language system in a multilingual system largely depends on the behaviour of previous and subsequent systems", "subject-specific factors determine both the complexity and variability of the system", and "the given systems are influenced both in their development and structure by crosslinguistic effects" (Herdina and Jessner 2002: 92). The DMM is grounded in the framework of the Dynamic Systems Theory (DST; De Bot et al. 2007; Larsen-Freeman 1997) which stresses that the systems are flexible and adaptable: they develop through interaction with the environment and through internal self-reorganisation. Variation is thus seen as an inherent property of a dynamic system: change in one variable is considered to have an impact on all other variables which are part of the system (De Bot et al. 2007: 8).

The above examination of the general underlying principles of the DMM contributes to our view of the trilingual mental lexicon in the following manner:

- the individual lexicons are to a large extent interconnected (i.e. the interconnectedness principle), which provides a convincing explanation of such phenomena as cross-linguistic interaction (cf. Section 3.3.) or priming (cf. Section 2.2.1.),
- the entire lexicon is very pliable to the influence of external factors (i.e. the variability principle), such as those related to language use, which can trigger internal restructuring.

At this point I would like to pursue a particularly interesting assumption resulting from the application of the DST to the present study, namely that which holds that changes in one factor tend to trigger changes in the entire system. Some support for this assumption can be found in Paul Meara's (1999, 2006) Random Autonomous Boolean Network Models. His models are meant to investigate the properties of bilingual and trilingual lexicon networks in computer simulations. From Meara's simulations it emerges that L3 interference appears to be a natural property of the trilingual network: "if you mix your languages, then you are particularly likely to be plagued with interference from L3, even if you are actually using only your L1 and your L2" (Meara 1999: 140).[26] It should be noted, how-

[26] His lexicon models comprise on average one thousand words. Dijkstra's (2003) model of the trilingual lexicon includes over 2600 words. To the best of my knowledge, a more mathematically complex model is DevLex, i.e. a connectionist architecture incorporating links trained by Hebbian learning, which comprises a phonological map, a semantic map, and a phonemic sequence map and functions similarly to a self-organising

ever, that Random Autonomous Boolean Networks are a mere approximation of the complex interrelations in real mental lexicons. Meara acknowledges the limitations of his simulations while reiterating the opportunities offered by computer modelling:

> The words in these models do not have separate phonological, orthographical, or semantic representations, or any of the other features which are sometimes ascribed to words in more complex models. They reduce the idea of varying levels of activation to a simple binary distinction. Nonetheless, even with these very simple properties, we have a network structure which produces some surprising behaviours, and they can provide us with some inklings of the sort of properties which we might expect a real lexical network to exhibit (2006: 625).

The picture of the mental lexicon of trilingual speakers having varying amount of CI experience will henceforth be treated as a dynamic and interconnected network system of lexical and semantic/conceptual connections whose arrangement depends critically on factors related to individual linguistic experience.

1.7. Conclusions

The main goal of the present chapter has been to develop an integrated view of the mental lexicon which would account for lexical processing in translation tasks performed by trilingual speakers with varying amount of CI experience. Our conclusions point strongly to a dynamic and interconnected view of the mental lexicon where a wide range of factors can potentially determine the pattern of lexicosemantic organisation, and also the relative ease or difficulty of lexical retrieval for processing purposes. These factors include, but are not limited to, proficiency, translation direction, stimuli characteristics, age and context of acquisition, frequency and recency of use. Crucially to the present investigation, differences in the type and amount of CI experience are claimed to produce changes in the mental organisation of all languages residing in the brain, which should manifest itself in the speed and accuracy of lexical processing in translation. At the same time, evidence from computer simulations of trilingual lexical networks indicates that the influence of close lexical similarity between the L2/B and the L3/C should not be underestimated.

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feature map, and is designed to model the way lexicons might be expected grow (cf. Li et al. 2004; Hernández et al. 2005). However, DevLex has so far been tested for two languages only.

While the principles of the DST (as applied to the DMM) can help elucidate the origin and dynamics of cross-linguistic interaction or priming, I conceive of them as complementary to the view of mental organisation propounded by the makers of hierarchical models. These models were studied extensively using translation tasks, which justifies their application in the present investigation. While the DFM was shown to offer a cogent account of the representation and processing of cognates or translation equivalents, we have argued that solely the RHM can provide a concise means of representing the way in which three languages are interconnected in the mental lexicon. This is because, apart from its global architecture, the RHM is able to account for the developmental dynamics in the trilingual mental lexicon as a function of language use. It is precisely because of its developmental aspect that this model is so interesting in the discussion of interlingual lexical links in the conference interpreter's mental lexicon. Therefore, the RHM will be used as a springboard to developing my models of the cognitive organisation in trilingual speakers, including those with and without previous CI experience (cf. Section 3.4.).

To the best of my knowledge, no psycholinguistic study has yet investigated the trilingual mental lexicon of subjects with differing amounts of CI experience. Based on the evidence and arguments presented in this chapter, it is reasonable to postulate that the strength of lexical links between languages depends not only on experience and directionality in interpreting, but also on the age and context of acquisition, and the extent to which the three languages are genetically and typologically related. I therefore expect that the L1 and L2 lexicons will be strongly interconnected due to their repeated activation for either comprehension or production in the interpreting practice. Conceptual links between L2 words and their meanings in the lexicon are also expected to be similar in strength to those between L1 words and the conceptual store (cf. Chmiel 2007). Interpreting practice suggest that the L3 should have stronger lexical and conceptual connections to the L1 than to the L2, but one should also take into account the possibility that the L3 may be connected at the word form level to the L2 in case of overlapping lexical representations. Those preliminary assumptions will be developed in the following chapters in the form of hypotheses applied in trilingual translation experiments described in detail in Chapter 5 of the present dissertation.

The principles of interconnectedness and variability hitherto present in the discussion of the trilingual mental lexicon are, in fact, quite similar to connectionist ideas of mental organisation which will constitute the starting point for the discussion of models of lexical processing in the following chapter.

Chapter 2: Lexical processing

2.1. Introduction

In this chapter we will be concerned with how trilingual speakers carry out and control lexical processing in comprehension and in production. To this end, we will examine the usefulness of frameworks and models of lexical processing designed for multilingual speakers. It should be stressed that the few currently available models of multilingual speech processing are, in fact, extensions of models of bilingual speech processing (cf. De Angelis 2007: 67). Therefore, selected psycholinguistic frameworks and models designed to account for bilingual lexical processing will also be examined. It will be shown that some of their ideas and solutions are able to meet the processing requirements of trilingual translation tasks.[27]

In order to understand how trilingual speakers use and control their languages in translation recognition and in translation production, we will discuss interactive activation models of bilingual and multilingual word recognition (the BIA, Van Heuven et al. 1998; the BIA+, Dijkstra and Van Heuven 2002; the MIA, Dijkstra 2003), and De Bot's (2004) model of multilingual speech production. We will also consider Green's control framework (1986, 1993, 1998), Paradis' (2004) Subsystems' hypothesis and Activation Threshold hypothesis, Grosjean's (2001) Language Mode framework, and Gile's (1995, 1999) and Setton's (2003) ideas about lexical availability in conference interpreters based on the concept of spreading activation (cf. Collins and Loftus 1975; Dell 1986).

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[27] The present thesis is concerned with the investigation of trilingual translation recognition and production based on visually presented stimuli. Therefore, models of spoken word recognition (e.g. the Cohort Model, Marslen-Wilson 1989) do not fall into its scope.

Although the principles underlying these frameworks and models (connectionism and modularity) are commonly viewed as opposing approaches (Poersch 2007; Singleton 1999), I would like to postulate that certain aspects of the modularity theory can help extend the connectionist perspective of trilingual lexical processing suggested in the previous chapter.

2.2. Connectionism or modularity?

The modularity theory is rooted in the symbolist tradition which considers cognition to be based on the manipulation of symbols (processed serially) according to rules that specify how those symbols may be composed or transformed (Singleton 1999: 123). Connectionism, on the other hand, is a model of cognition based on parallel distributed processing which "places itself between behaviourism and symbolism, [and which] aims at explaining mental processes based on patterns established ad hoc in the neural networks (circuits)" (Poersch 2007: 38). In what follows we examine the connectionist and modular approaches to lexical processing so as to be able to integrate them to model trilingual lexical processing in translation.

2.2.1. Connectionism and lexical processing

In a connectionist perspective, the knowledge of a language is stored in connections existing between individual processing units or nodes which can organise themselves into networks, depending on differences in the relative strength of connections between those units (Rumelhart and McClelland 1987: 195-196). The said differences in the strengths of connections are believed to develop according to frequency-based interactions present in the linguistic environment. From this perspective, learning occurs on the basis of association, rather than the construction of abstract rules. Mitchell and Myles ([1998] 2004: 121) point out that "the human mind is predisposed to look for associations between elements and create links between them. These links become stronger as these associations keep recurring, and they also become part of larger networks as connections between elements become more numerous." In an attempt to link language, neurology and neurobiology, connectionists relate the establishment of associative links between words in the mind to adjustments to the weights of synapses in the brain:

> It is postulated that the brain has to change the strength of its synapses to acquire knowledge; learning, besides reinforcing synapses, causes the existing neural networks to get rearranged. The neurons adjust the strength of their synapses during the information processing. Hence, knowledge acquisition is related to subtle changes in neural connections (synapses) (Poersch 2007: 43).

In other words, acquiring knowledge is viewed as a process by which some connections are strengthened by activation, while other are weakened by the lack of activation. Networks of linguistic information are believed to rearrange themselves by adjusting the weights on the connections every time speakers activate their knowledge of a language for comprehension or production purposes. While not entirely discarding the possibility of some surrogate form of nativism, since its very inception connectionism rests on the assumption that lexical representations are networks of associations that emerge naturally from experience: "almost all connectionist models assume innate architectural constraints, and very few assume innate representations" (Elman et al. 1996: 31).

Connectionism favours parallel processing, which entails a substantial degree of top-down and bottom-up interactivity in language processing (Garman 1990: 174-175).[28] Let us take the example of the interactive activation (IA) model of visual word recognition in monolingual speakers (McClelland and Rumelhart 1981; Rumelhart and McClelland 1982). Although it was meant to account for word context effects in letter perception, it can also be seen as a component of a general model of visual word recognition.[29] Its architecture and the underlying principles inspired subsequent conceptualisations of word recognition mechanisms in bilingual and trilingual speakers which proved helpful when developing my ideas on the type of processing required in trilingual translation recognition (cf. Section 2.3. and 4.2.). The IA model belongs to the class of localist connectionist models as, for the

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[28] It is important to note that 'parallel' refers to the independence of processing operations rather than to temporal relations. Parallel processing can be characterised by both simultaneity and sequentiality (Garman 1990: 175).

[29] The IA model may be regarded as an elaboration of the Morton's Logogen Model (1969). Morton claimed that all words and morphemes have their own 'logogens' (basically lexical receptors) with different activation thresholds. His model was able to explain the word frequency effect: words of high frequency are believed to have lower activation thresholds. An earlier parallel model of visual recognition is the Selfridge's 'Pandemonium' Model (1959 [1988]). The 'Pandemonium' model envisages the mind as being composed of data/image, feature, cognitive, and decision 'demons' (roughly corresponding to neurons). Only those demons whose connection weights are the highest are selected for further processing.

sake of simplicity, it entails the use of localised input representations of the main processing levels (i.e. feature, letter and word levels).[30] In this model (cf. Figure 6) visual word perception is interactive and combines bottom-up (data-driven) and top-down (conceptually-driven) information. Each processing unit is connected to the unit in the preceding and following levels by means of excitatory and inhibitory connections, which introduces an element of competition to the whole process (McClelland and Rumelhart 1981: 377-378). The unit which receives the largest amount of excitation energy sends out the strongest inhibitory signal to the competing units. This is called the "winner takes all" architecture (Ingram 2007: 81).

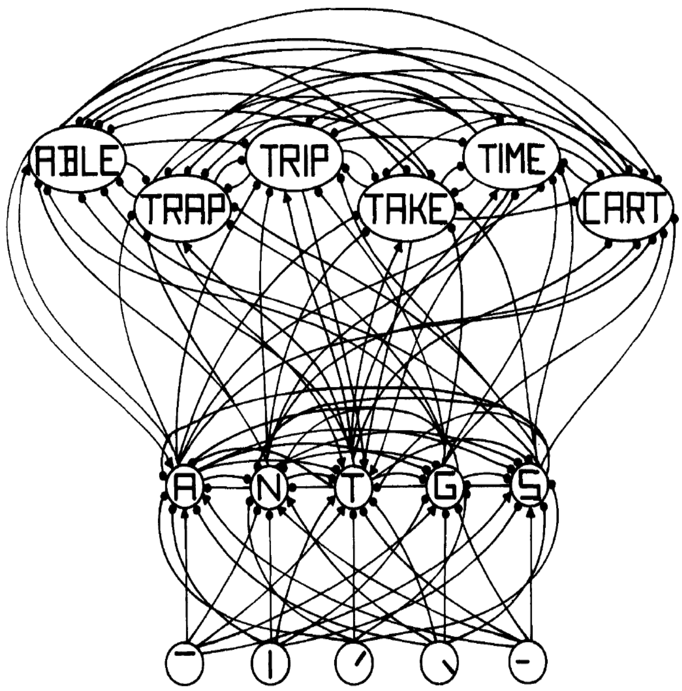

Figure 6. The Interactive Activation Model of word recognition (after McClelland and Rumelhart 1981: 380).
The pointed arrows represent excitatory connections while the circular headed arrows represent inhibitory connections. The intralevel inhibitory loop reflects lateral inhibition of incompatible units within the same level.

[30] In the localist models, every node in the network refers to a functionally significant element, such as a particular feature, letter or word, while in the distributed network models the functional elements are distributed across the activation patterns of whole populations of 'hidden' units rather than stored in particular nodes (Ingram 2007: 82).

Although it lack a semantic level, the chief merit of the IA model lies in its ability of explaining the frequency effects in word recognition by means of activation spreading between the feature, letter and word levels.[31] The activation of similar but incompatible units is minimised in this model thanks to intralevel inhibitory connections. Early network models of semantic processing (Collins and Quillian 1969; Collins and Loftus 1975) are also based on the idea of activation spreading through an interconnected network of links and nodes. In the Collins and Loftus (1975) model the search for a particular concept in the network results in the activation of all related concepts in a manner akin to a sound wave sending outward ripples from its source in all directions simultaneously. Activation is attenuated as it travels outward from the point of its origin. In addition, activation from different sources can summate at points of intersection. Thus, processing in this model is subject to the spreading, summation and decay of activation (Collins and Loftus 1975; cf. Dell 1986).[32] Despite obvious limitations (concepts are represented in isolation rather than in relation to the phonological, morphological or syntactic properties of lexical items), the model proposed by Collins and Loftus is not only able to account for the word frequency effect but also for the activation of semantically related words: the strongly connected nodes facilitate processing to a much greater extent than the weakly connected nodes (cf. Balota 1994: 342).[33]

The connectionist perspective outlined above provides a cogent explanation for a number of phenomena which are particularly relevant to the present investigation. First of all, the related concepts of spreading activation and parallel processing offer a useful framework in which to analyse how similar form and meaning representations become activated (or primed) in lexical processing.[34] To illustrate this point, let us consider the fol-

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[31] The frequency effect (the more frequently a word occurs in the language, the faster the lexical access) was found to shorten response times in naming (Forster and Chambers 1973) and in lexical decision (Whaley 1978; Balota and Chumbley 1984).

[32] Dell's interactive model of speech production in monolinguals is not included in the present discussion. I believe that the ideas of Levelt, Paradis, Green and De Bot provide a more coherent conceptual framework for understanding the nature of lexicosemantic processing in translation production.

[33] Collins and Loftus (1975) also postulated the existence of a lexical network linked closely to the semantic network, with words being connected to specific concept nodes, but the exact manner in which both networks interacted could not be determined.

[34] Priming is believed to occur "when one stimulus, the prime stimulus, affects the processing of another stimulus, the test stimulus. [It is] the activation or the establishment of internal codes by the prime stimulus that correspond in some way to the test stimulus" (Johnston and Dark 1986: 46). In this dissertation I decided to define priming as "the phenomenon in which prior exposure to language somehow influences subsequent language processing, which may occur in the form of recognition or production" (McDonough and Trofimovich 2009: 1).

lowing example taken from a classic study by Meyer and Schvaneveldt (1971). In the first experiment the participants were presented with two strings of letters simultaneously. Their task was to decide whether the strings of letters were words or non-words. Of the word-word pairs, half were related in meaning. The participants' responses to the related pairs (e.g. *doctor – nurse*) were faster than to unrelated pairs (*doctor – chair*), which is consistent with the connectionist account: word/non-word judgments will be faster for related (i.e. associated) words than for unrelated words.[35] The pattern of results obtained in translation recognition tasks can also be explained by making recourse to the phenomenon of activation spreading in parallel to related form and meaning representations. For instance, in the Spanish-English translation recognition experiment Talamas et al. (1999) asked their participants to decide whether the second of the words presented on the screen was a correct translation of the first. Apart from the correct translation equivalents, the target stimuli included words related in form (e.g. *ajo – eye*) and in meaning (e.g. *ajo – onion*) to the source stimulus. Erroneous decisions were explained in the following manner. In the form-related condition, the activation of the word *ajo* 'garlic' spread intralingually at the lexical level to formally related words (or neighbours, i.e. *ojo*), which then activated their corresponding translation equivalents (i.e. 'eye') in parallel to the activation of the correct translation equivalent (i.e. 'garlic).[36] In the semantically-related condition, the word *ajo* activated other semantically related words (i.e. *cebolla*), which then activated their respective translation equivalents (i.e. 'onion'), again in parallel to the activation of the correct translation equivalent of the original stimulus word. This point has been aptly underscored by Setton in the context of SI (2003: 140):

> The input words are so present to the ear and brain in SI as to make it highly unlikely that all their features disappear from its circuits without trace once their conceptual essence is extracted and passed to central cognition. Experimental work in psycholinguistics shows pervasive unconscious priming effects, and what it has revealed about cross-connections in the mental lexicon has not been fully taken on board our models of the interpreting process.

Our second point is that the phenomenon of higher or lower lexical availability in language processing is also quite conveniently explained if one adopts the connectionist

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[35] Early studies did not distinguish between semantic and associative priming. The study conducted by Meyer and Schvaneveldt (1971) actually obtained associative priming because the stimuli they used were drawn from word association norms (e.g. *doctor – nurse*).

[36] According to Coltheart et al. (1977), words that share all but one letter with the stimulus word are called orthographic neighbours (N) of the stimulus, e.g. *gold, hold, bolt* etc. are all neighbours of *bold*.

perspective. In a network of formal and semantic/conceptual connections, activation will be propagated to related connections depending on the degree of external stimulation received and the strength of association between them. In the present investigation it seems reasonable to assume that the three participating groups had different "pattern[s] of connectivity" (Mitchell and Myles 2004: 125) which emerged as a result of associations established in response to the type of linguistic processing required in their everyday environment. In the case of conference interpreters, this assumption is supported by Gile's (1995: 212-223) Gravitational Model of lexical availability. Basing on the principle of spreading activation, Gile put forward a claim that words which receive frequent stimulation are readily available for processing while words which do not receive adequate stimulation require more cognitive effort to retrieve and process (the Centrifugal Principle and the Centripetal Effect). Moreover, he emphasised that increased availability of some words tends to increase the activation levels of lexical items which are associated with those words either perceptually or psychologically (the Escort Effect and the Interference Effect). Setton (2003) also proposed to model lexical processing in connectionist terms. I fully concur with his arguments that

> [l]exical processes are more effectively captured in a connectionist network. (…) the lexicon and the semantic space in which it is embedded are open-ended, potentially developing throughout life; associative paths can be imprinted or weighted by episodic as well as semantic learning, conditioning and priming (…). The preference for a connectionist scheme for lexical processing should be extended to conceptual representation and the interface process between them where concepts are matched to expressions and vice versa (Setton 2003: 158).

The fact that connectionist models can be trained by the selective weighting of connections led Setton (2003: 163) to a supposition that the mental lexicons of CI trainees undergo a similar kind of 'programming' during their training which is meant to enhance conceptual and linguistic availability in interpreting. In addition to performing online interpreting tasks, Setton also stressed the importance of compiling glossaries for the "initial and ongoing maintenance and cultivation of the lexicon" (2003: 164).

This brings us to our third related point, namely that the connectionist perspective can enhance our earlier definition of translation equivalents (cf. Section 1.2.) as words which "refer to the same concept or have the same meaning" (Francis 2005: 252). In connectionist terms, I would like to argue that associative links will be formed in the lexicon between translation equivalents, their strength being directly related to the intensity and length of stimulation.[37] It is plausible to assume that over a prolonged period of time direct memory connections will be established between translation equivalents, which should be manifested in their efficient processing in translation. I thus share De Groot and Christoffels' (2006: 198) view that "any translation act will become reflected in a memory trace that connects the two terms of the translation; the more often the same two terms (words or longer phrases) co-occur in a translation act, the stronger the memory connection between them will be." Recently, Gile (2009: 239) espoused a similar view while stating that "it also makes sense to think of a Gravitational Model of Translinguistic Equivalences (TEs)" defined as "regular associations or 'links' between particular LCs [i.e. declaratively stored language constituents] in two languages, essentially between lexical units and between set phrases." Our third point is therefore inextricably linked to the more general question of directionality: frequent and prolonged interpreting practice in a given directionality should result in the strengthening of interlingual lexical links between translation equivalents in that directionality. Basing on the assumption that strongly associated word pairs are easier to retrieve, the directional effect is quite likely to be manifested by relatively short reaction times in translation tasks (cf. Sections 3.2. and 3.4.).

Connectionist assumptions were tested in computer-based simulations which received some criticism from the research community. It is beyond the scope of this chapter to report on the successes and failures of parallel distributed processing (PDP) models to reflect the process of gradual adjustment of weights on the connections in response to experience (cf. Balota et al. 2006: 298ff.).[38] Suffice it to say that the central idea behind PDP models has been to simulate neural activity in the brain. Therefore, processing in those models takes place as a result of a combined activity of many interconnected units. Activation is propagated between those units as a function of the individual strengths of connections between them, which are in turn established by frequency patterns. The key element of the PDP models is constituted by learning algorithms, such as those of Hebbian learning

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[37] This argument is similar to Cieślicka's postulate that associative links "connect semantically related items both within and across languages, as well as translation equivalents" (2000: 33). However, her *variable interconnection hypothesis* distinguishes between a semantic/syntactic level and an amodal conceptual level of representations, a distinction which we decided to disregard here (cf. Section 1.2.).

[38] To give but one example, Seidenberg and McClelland (1989) developed a distributed representation model to account for the interaction of phonology and orthography in word recognition and naming. Its key feature is the replacement of pronunciation rules by a learning mechanism that processes words and nonwords based on experience from spelling-sound correspondences implicit in the words from which it learns (Seidenberg and McClelland 1989: 525).

or back propagation that are applied for modifying the connectivity patterns as a function of experience (Thomas and McClelland 2008: 23-58).[39] The so-called 'neural plausibility' of those models is thought to be determined by the following three facts: (i) connectionist modelling is structurally and functionally based on biological networks with the nodes being equivalent to neurons and the links to axons and dendrites, (ii) connectionist networks (also called artificial neural networks; ANN) are capable of learning, (iii) they react to simulated damage similarly to the way the human brain does when responding to lesions (Stillings et al. 1995: 70ff.; Friedenberg and Silverman 2005: 221). Although PDP models yield quite inspiring simulations of neural activity in the brain, they have a number of shortcomings, the most obvious of them being that they are quite limited in scope. PDP models have been criticised on account of dealing solely with the microstructure of processing basing on manipulations of artificial data in controlled laboratory experiments. This line of criticism holds that PDP models are too far removed from real life to be able to offer adequate explanations of lexical processing (e.g. Mitchell and Myles 2004: 127-128). In view of those arguments, I propose to enrich the connectionist perspective of lexical processing with the dynamic approach (delineated in Section 1.6.) because the latter takes into account cognitive and social aspects of language use.

So far in the discussion we have seen that the connectionist framework provides a plausible rationale for the phenomenon of intra- and cross-lexical activation of related form- and meaning-representations in translation contexts. We have also claimed that connectionism allows for various patterns of connectivity to emerge and develop in the lexicosemantic network depending on individual linguistic experience. We have thus extended the dynamic perspective on the trilingual mental lexicon and processing advocated in the previous chapter by proposing to treat lexical processing in terms of spreading activation. Both approaches are, in fact, quite similar as regards their views on the emergence, development and maintenance of the web of lexical and semantic/conceptual connections in the mental space of a trilingual speaker. We can therefore say that "[c]onnectionist systems are

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[39] In Hebbian learning (cf. Hebb 1949 [2002]: 70ff.) the weights between units change as a function of units' activity, so that "units that fire together, wire together", thus reflecting statistical regularities in the environment (Munakata and Pfaffly 2004: 141). Back propagation is a feedback algorithm: "each time the network receives an input and produces an output, that output is compared with the correct output for that input (…). If there is any error in the value produced by a particular output unit, the weights on the connections coming into that output unit are changed (…) to correct the error. Error signals are then propagated back through the successive layers of hidden units where error-correcting adjustments to weights are also made" (Stillings et al. 1995: 56).

dynamical systems, and like other dynamical systems, they can have complex emergent properties which themselves may be described by dynamical variables (rates of change with respect to time) and dynamical structures (attractors, transitions, and instabilities)" (McClelland and Vallabha 2009: 5). We shall presently consider how modularity can supplement the thus far connectionist and dynamic view of trilingual lexical processing.

2.2.2. Modularity and lexical processing

Modularity rests on the assumption that the mind consists of innate, distinct, specialised, functionally and structurally autonomous modules that include input (reception) and output (production) systems which interact with other cognitive structures to a limited extent (Friedenberg and Silverman 2005: 95-100). In a modular system linguistic processing progresses serially (i.e. in discrete stages) within informationally encapsulated modules, "with each stage dependent on the output of the previous stage" (Singleton 1999: 122).

An example of a modular approach to lexical processing is Levelt's (1989) Blueprint for the Speaker. Levelt (1989) proposed a strictly serial model of speech processing with no room for feedback between the different levels of encoding (cf. Figure 7). Levelt envisaged four separate production stages: (1) conceptualisation (i.e. message generation), (2) grammatical encoding, (3) phonological encoding, and (4) articulation. Grammatical and phonological encoding consists in selecting the semantic, syntactic, morphological and phonological information. Processing is incremental and parallel in each of the three processing components (the Conceptualizer, the Formulator and the Articulator). The communicative intention is specified by the speaker in the micro-planning stage of the preverbal message. The information from the micro-planning stage is then forwarded to the Formulator which has access to the lexicon. In the Formulator the preverbal message is converted into meaning by retrieving information at the lemma and lexeme levels. Semantic activation precedes form activation. In grammatical encoding, lemmas are accessed from the lexicon. Lemma activation supplies the necessary syntactic information to produce a surface structure. In phonological encoding, the surface structure is used to produce a phonetic plan (internal speech) which is then fed into the Articulator. There are only two possibilities for detecting mistakes in speech production: (i) before articulation, any mistakes in the internal speech can be fed back to a speech-comprehension system for repair, (ii) after articulation, the speech-comprehension system serves to detect and eliminate any mistakes made in the overt speech.

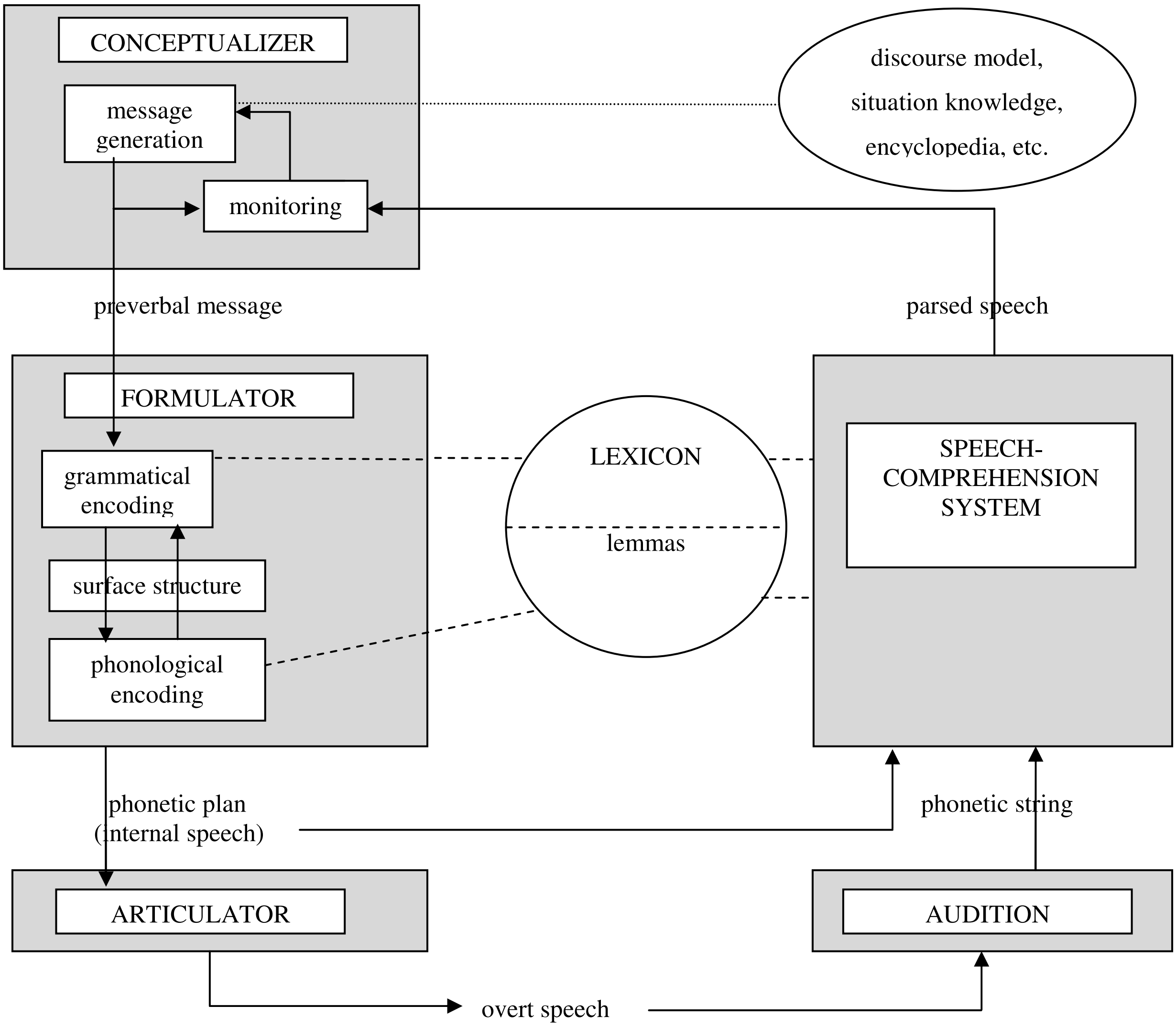

Figure 7. Levelt's Blueprint for the Speaker (after Levelt 1989: 9).

Boxes represent the processing components (procedural knowledge), while circles and ellipses – the knowledge stores (declarative knowledge).

This and subsequent models developed by Levelt and colleagues (Levelt 1989, 1993, 2001; Levelt et al. 1999) are commonly viewed as milestones in the psycholinguistic literature on speech production in speakers of one and more languages. They served as an inspiration for De Bot's (2004) model of multilingual speech production which proved useful when developing my ideas on the type of processing required in trilingual translation production (cf. Sections 2.3. and 4.3.). It should be pointed out, however, that the strictly serial processing perspective of Levelt's Blueprint model entails a limited capacity to rectify errors in lexeme or lemma selection before the articulation stage. It appears, therefore, that a more elaborate mechanism may be necessary to control the language output, particularly in case of trilingual speakers. We will return to this issue in Section 2.3.3.

In the architecture of Leveltian models one can trace a number of features advanced by Fodor, the main proponent of the modular approach in relation to language processing mechanisms.[40] The Fodorian architecture of the mind comprises a number of peripheral, functionally specialised modules which are to a large extent independent of one another and which forward the results of their processing operations to a central executive processing system. These modules are said to be: (i) domain-specific and (ii) mandatory in operation, (iii) inaccessible to consciousness with a limited central access to modular processes, (iv) fast-acting, (v) informationally encapsulated, (vi) capable of performing only shallow (surface form) analysis of the input, (vii) able to employ a fixed neural architecture, (viii) subject to particular breakdown patterns (aphasic syndromes), and (ix) equipped with specific developmental features (Fodor 1983: 47-101). We will not go into detail about how the individual properties relate to the operation of the modules other than to say that neither property is a necessary condition of a modular system (1983: 127). Nor are the modules themselves necessarily associated with any fixed neural architecture (1983: 98-99). Fodor's version of the modularity theory, albeit very influential (cf. Pinker 1997; Coltheart 1999; Jackendoff 2002), has raised much controversy. In what follows we examine two controversial aspects of his theory which will lead us to postulate that Fodorian modularity is essentially compatible with the connectionist view of language processing, particularly so in case of trilingual speakers.

Fodor sees informational encapsulation as a crucial aspect of modularity (1983: 71) since it enables the input systems to process information efficiently. He also proposes the existence of distinct processing levels within modules. Those levels are supposed to communicate with each other within modules, but not between them. The idea that modules are

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[40] We focus on the Fodorian view of modularity as we concur with Singleton (1999: 113) that "Fodor's version of the modularity hypothesis has been more influential than any other among psycholinguists working on processing issues."

'informationally encapsulated' has been the most controversial aspect of the Fodorian modularity hypothesis since it assumes that general knowledge or contextual information do not influence intramodular processing (Singleton 1999: 114). However, in Fodor's theory only the low-level peripheral systems are referred to as modules, while high-level perception and cognitive systems are seen as essentially non-modular. In fact, Fodor (2001: 64ff.) objects fervently to the evolutionary psychologists' proposal of viewing the mind, or human cognition in general, as essentially modular, i.e. subserved by domain-specific, autonomous computational devices.[41] Instead, Fodorian modules are similar to transducers that operate in parallel and mediate between 'peripheral' sensory stimuli and higher-level functions controlled by central processing systems (Fodor 1983: 60). Fodor's another contentious idea is that the language module is essentially non-semantic (semantics is one of the central systems). A non-semantic language module is at odds with his other postulate of interlexical excitation, i.e. intramodular excitation of connected lexical forms (Singleton 1999: 116-118). In claiming that lexical activation proceeds via meaning-based pathways, Fodor's conception is actually strongly reminiscent of the connectionist idea of spreading activation. Fodor conceives of the mind as a graph with lexical items at the nodes being connected to other lexical items so that once an item has been accessed in the lexicon, it also results in the excitation of pathways that lead from that node to several others. In a manner not unlike connectionists, Fodor states that "when excitation spreads through a portion of the lexical network, response thresholds for the excited nodes are correspondingly lowered. Accessing a given lexical item will thus decrease the response times for items to which it is connected" (Fodor 1983: 80). In this respect, Fodorian modularity does not stand in that stark a contrast to connectionism, and both approaches may be compatible to some extent. In the following section I provide more support for this contention.

[41] Evolutionary psychologists propose to treat of modularity in broader terms than Fodor originally advanced (i.e. the so-called 'massive modularity' thesis). For instance, Pinker argues that modules should be defined by the specific operations they perform on the input rather than by a list of necessary and sufficient conditions (1997, 2005). He thus suggests that functional specialisation rather than automaticity or informational encapsulation should be at the core of modularity (cf. Barrett and Kurzban 2006).

2.3. A combined perspective

Already in the 1980s and 1990s some researchers emphasised the importance of combining the interactionist/connectionist and symbolist/modular approaches to gain a deeper understanding of lexical organisation and processing. Rumelhart and McClelland (1987: 196) hinted at this possibility using the example of the honeycomb: ”The regular structure of the honeycomb arises from the interaction of forces that wax balls exert on each other when compressed. The honeycomb can be described by rule, but the mechanism which produces it does not contain any statement of this rule.” This example can be extrapolated into the discussion of trilingual lexical organisation and processing in the following manner. Connectionism and modularity both endeavour to show neural plausibility: connectionist models are meant to mirror the structure of the human brain and the operation of neural networks, while modularists claim that there are specialised neural structures in the brain responsible for the processing of linguistic information (i.e. modules). It therefore seems plausible that networks of connections in the brain that are responsible for effecting a certain type of processing on a regular basis will eventually form module-like structures (cf. Paradis 2004: 123). In this respect, connectionism does not preclude modularity. Quite to the contrary, modularity appears to be an emergent property of connectionist systems.

To substantiate this claim, let us consider the following idea. “[I]f we adopt a parallel processing system that is completely unconstrained as far as what interactions among levels are permissible and then build in the structure necessary to account for language processing, we may then find varying degrees of modular organization emerging for computational reasons ” (Tanenhaus et al. 1991: 85). Similarly, Elman et al. (1996: 101) postulate that some degree of modularity appears necessary in connectionist models if they are to be scaled up. Some researchers even argue for a form of connectionism which is neither anti-modularist nor anti-innatist: “connectionism is perfectly compatible with the recognition that some aspects of a neural network are not the result of learning but they are genetically inherited. For example, since most simulations start from a fixed neural network architecture one could argue that this network architecture is genetically given and the role of learning is restricted to finding the appropriate weights for the architecture” (Calabretta and Parisi 2005: 312). In an evolutionary connectionist view, the so-called ‘neural modules’ are seen as “a sub-set of network units with more internal connections linking the units of the module among themselves than external connections linking the units of the module with units outside the module. Or, more functionally, [as] an observed correlated activity of a sub-set of the network's units, even without 'anatomical' isolation of that sub-set of units" (Calabretta and Parisi 2005: 316-317). While it is beyond the scope of this thesis to debate the nature of neural modules, I tend to agree that the network of intra- and interlingual lexical links and connections in the brain needs to be organised in some modular fashion to support efficient lexical processing, particularly in the case of trilingual speakers.[42] I therefore propose to consider the idea that the individual languages of a trilingual speaker are organised into quasi-modules or subsystems "within a larger module, namely, the language system, or implicit linguistic competence" (Paradis 1997: 333). I believe that such a perspective may be helpful in our further deliberations on language membership and control of processing in translation tasks.

Paradis (1997, 2004, 2007a, 2009) has made a strong case for the cerebral organisation of languages into subsystems which form part of a larger language functional system. He can therefore be said to favour massive modularity on a neurological level. Paradis regards language as a neurofunctional system divided into a number of neurofunctional modules which subserve phonology, morphosyntax and semantics. His modules are domain-specific (subserved by procedural memory), mandatory (computationally automatic), their computational procedures are fast and implicit, and they are informationally encapsulated and autonomous in terms of structure and function while not necessarily being innate. Moreover, each neurofunctional module is independently susceptible to inhibition (Paradis 2004: 119-125). The neurofunctional modules are thus understood here as an extension of Fodorian ideas to the case of speakers of two and more languages. This is because Paradisian modules can be subdivided into as many subsystems as there are languages spoken by the individual, so that in case of a multilingual speaker each language system is thought to consist of independent subsystems or functional modules which are subserved by a common independent conceptual system (Paradis 2004: 130-135). Within that shared conceptual system, the conceptual features are stored together according to language-specific lexi-

[42] We thus agree with Calabretta and Parisi (2005: 314) that human brains "are made up of anatomically distinct parts and distinct portions of the brain are clearly more involved in some functions than in others. (…) human brains are able to exhibit so many complex capacities not only because they are made up of 100 billion neurons but also because these 100 billion neurons are organized as a richly modular system."

cosemantic constraints (Paradis 2007a: 7).[43] Generally speaking, the associative connections between elements within a language subsystem will be stronger than the connections between elements across language subsystems. However, Paradis (2004: 136-137) stresses that certain elements across different language subsystems may be connected by associative links, their strength depending on the frequency of use. Although Paradis is a modularist, he assumes that the selection of features from a given linguistic subset is driven automatically by their respective activation threshold levels (Paradis 2009: 165). In accordance with his Activation Threshold Hypothesis (ATH), every time an item is activated (i.e. every time it receives a sufficient amount of positive neural impulses), its threshold is lowered so that fewer impulses are necessary to reactivate it (Paradis 2004: 28-30). In case of frequent stimulation, fewer resources are required to activate it. In case of infrequent stimulation, the activation threshold rises so that more resources are needed for its subsequent activation. Paradis further assumes that when an item is activated, its competitors are simultaneously inhibited (i.e. their activation thresholds are raised). Let us examine in how far Paradis' view on modularity relates to our putative understanding of lexical processing in trilingual speakers.

It is felt that the main tenets of Paradis' Subsystems' Hypothesis and Activation Threshold Hypothesis can be applied to the present study of trilingual speakers with differing amounts of CI experience. It is reasonable to suppose that a trilingual speaker's languages are stored in separate subsets, and that language-specific lexicosemantic constraints determine which features of the corresponding concepts are activated. I also tend to agree with Paradis' proposal that there are as many sets of neural connections as there are languages, and that each of them can be to a considerable extent activated or inhibited independently by virtue of the close associations existing between its elements (Paradis 2004, 2009). The idea of selective activation and inhibition of languages or language items meets fairly well the requirements inherent to interpreting situations (cf. Paradis 1994, 2000). It is thus expected that, as opposed to the remaining groups of participants, the professional conference interpreters will be quite adept at intensifying and suppressing relevant connection strengths between lexical representations used in regular interpreting contexts. This perspective also entails that lexical choices in translation tasks involving language combinations which any given group of participants use frequently will be more efficient compared

[43] Cf. also the Common Underlying Conceptual Base (Kecskés and Papp 2000; Kecskés 2007).

to lexical choices made in language combinations which the participants use rarely or not at all.

We have thus chosen to integrate selected aspects of the modularity theory (as understood by Fodor and later extended by Paradis) into the predominantly connectionist/dynamic view of lexical processing. A number of issues connected with trilingual lexical processing still remain unsolved, however. For instance, Paradis asserts that two or more language subsystems, despite their being closely associated, do not share items whose structure is identical in two or more languages. He therefore allows some degree of redundancy in the representation of cognates (Paradis 2004: 135, cf. Paradis 2007a). His view seems to be at odds with that of De Bot (2004) who proposed that language-specific subsets converge at the conceptual, syntactic and form levels in case of similar cross-linguistic representations. Further issues to be resolved include language membership and control of processing. We need to establish whether the position of a given representation in a network of closely associated elements suffices to determine its language membership. After that, we will need to ascertain how control of lexical access and retrieval is effected in the case of trilingual speakers, particular attention being paid to the case of translation.

2.3.1. The case of cognates

There is general support in the literature that cognate translations facilitate lexical access and retrieval in ways that non-cognate translations do not, but researchers still differ in terms of how they explain the cognate advantage in processing (e.g. Costa et al. 2005: 97-101; Dijkstra et al. 2010: 285-286). In this section we will try to establish how non-identical but similar cross-lingual cognates may be represented and processed in the case of trilingual speakers. This is essential since the processing of cognate representations will be investigated in the translation production experiment.

It was noted in the previous section that Paradis proposes to treat cognates as quasi-redundantly represented in each subsystem. He substantiates this proposal by stating that:

> (1) [a] particular word may be available to a bilingual aphasic patient, but not its cognate in the other language (…); (2) lexical meanings, as well as pronunciations, are very rarely identical; and (3) lexical items and their cognate translation equivalents have different intralingual connections and often possess different syntactic characteristics (Paradis 2007a: 10).

He also claims that cognates are similar in terms of representation and processing to intralingual synonyms "not because they are represented within a common system across subsystems, but because the form of the cognate serves as a cue to the recognition of the word in the other language (…)" (Paradis 2004: 218). This view can be considered divergent from that of De Bot (2004) insofar as the lexical level of representation is concerned. Although De Bot (2004) is not very specific about the representation of cognates in his Multilingual Processing model, he first regards cognates to be words sharing aspects of form and meaning (2004: 19), only to state later that language-specific subsets at the conceptual, syntactic and form levels "show overlap reflecting the cognateness of the languages involved (…) [so that] elements that are shared by more than one language may also activate the other subset (or subsets) they are part of" (2004: 28). Let us examine how these two views relate to other explanations of the cognate advantage in the case of bilingual processing.

In the theoretical framework of the RHM (Kroll and Stewart 1994) cognate translations have a common meaning representation. They are also connected at the word form level by associative links whose strength depends on the degree of form overlap and the frequency of stimulation. In the DFM (De Groot 1993) cognates are represented separately at the lexical level, but they may share some or all of their features at the conceptual level.[44] Kroll and De Groot (1997: 190) proposed to modify the DFM by adding a language-specific lemma level between the language-independent (i.e. shared) lexical level and the conceptual feature level. Their proposal entails that intralingual cognates "share aspects of form and meaning" (Kroll and De Groot 1997: 173; cf. also Kroll and De Groot 1997: 188). Sánchez-Casas and García-Albea (2005) present evidence which suggests that cognate relations cannot merely be reduced to the sum of form and meaning priming. They propose to capture cognate relations by adding a morphological level of representation which they locate between the lexical level and the lemma level in the Kroll and De Groot (1997) model. Cognate translations would thus appear to share a common root in addition to the lexical and conceptual features (Sánchez-Casas and García-Albea 2005: 239-243).[45] However, the results of recent studies of cognate processing in Greek-French masked translation priming (Voga and Grainger 2007) and in Dutch-English word recognition (Dijkstra et al.

[44] De Groot (1992a) suggested that cognates may also be linked by direct word-form representations.
[45] The idea of introducing a morphological level was already present in Kirsner et al.'s (1993: 228, 235) model of word recognition. There are also definitions of cognates which state that their perceptual similarity is due to their sharing a common morphological root (Voga and Grainger 2007: 938, cf. Crystal 2008: 83-84).

2010) suggest that there is not sufficient evidence to propose a separate morphological level of representations. Researchers generally agree that frequency effects (at least partially) contribute to the facilitated processing of cognate representations. "Given a shared representation in bilingual memory for cognates – a representation that is contacted each time each of the two words in a cognate translation pair is encountered – the frequencies of use in the separate languages would need to be summed up when determining the usage frequency for cognates" (De Groot et al. 2000: 421; cf. Caramazza and Brones 1979, Sánchez-Casas et al. 1992, Dijkstra et al. 2010). In T&I studies, bilingual cognate processing is associated with the activation of pre-existing schemas: "the act of mapping a lexical item onto a readily available cognate amounts to an automatic reaction, and avoidance of such a response entails a deliberate effort" (Shlesinger and Malkiel 2005: 173). The above arguments point to the existence of strong interconnections between cognate translations, which are probably a function of the degree of their form and meaning similarity coupled with the combined frequency of usage.

These different (albeit not necessarily incompatible) interpretations of the cognate advantage in bilingual processing provide useful insights for our discussion of cognate processing in the case of trilingual speakers. I suppose that cognate representations are most probably represented separately at the level of form across the three language subsystems. I nevertheless expect them to be joined by particularly strong interlingual links (which is probably due to their combined frequency of co-occurrence in language use), so that when a given cognate representation is activated in one subsystem (in comprehension or in production), this activation will spread to its translation equivalents quite rapidly. Similar but non-identical cognates may share some or even all of their semantic/conceptual representations. I thus consider the cognate facilitation effect in trilingual speakers to be due to a combination of cross-linguistic form and meaning similarity with frequency effects. It follows from the above that the processing of cognate representations across three languages should be faster than the processing of cognate representations across two languages. Let us examine in how far these assumptions can be corroborated basing on the results of the few existing studies of cognate processing of which we know that were carried out with trilingual speakers.

Dutch-English-German speakers were found to process 'triple' cognates (words which overlapped in form and in meaning in Dutch, German, and English) faster than ‘double’ cognates (i.e. words which overlapped in Dutch and in German but not in English) in a lexical decision task in their third language (i.e. German) (Lemhöfer et al. 2004). Thus, not only the L1 but also the L2 affected lexical processing carried out in the L3. A combined cognate effect was also found in word association and lexical decision performed by Dutch-English-French trilinguals in their L1 (Van Hell and Dijkstra 2002). Both these studies found cross-lexical activation of form and meaning representations regardless of whether the speakers performed in their L1 or their L3, which points to a high degree of interactivity in the trilingual processing of visually presented stimuli. To the best of my knowledge, no study to date focused on cognate processing in production tasks carried out by trilingual speakers. It therefore seems worthwhile to investigate whether and in what way trilingual translation performance will be affected by the processing of cognate representations.

2.3.2. Language membership

In Section 2.3. we decided to view the trilingual mental lexicon as an interconnected web of lexical and semantic/conceptual links which are organised into language-specific subsets. As a consequence of this perspective, we have tacitly assumed that language membership is determined by the strength of associations existing between lexical items in the mental environment. These associations are said to originate from the frequency and pattern of co-occurrence of lexical items in everyday language use. Apart from the mental representations of words from a given language, translation equivalents (and cognate translations in particular) are also thought to be closely associated. The aim of this section is to ascertain whether it is convenient for my research purposes to postulate any additional or alternative mechanism to specify language membership apart from that based on the unique position of a given item and its degree of interconnectivity to other items in the trilingual lexicosemantic network. To this end, I will consider the usefulness of various mechanisms meant to specify language membership information (and thereby determine language choice) that were incorporated into bilingual and trilingual models of language comprehension and production. I will then relate those mechanisms to the case of trilingual translation recognition and translation production tasks.

Several influential models of bilingual and trilingual language comprehension assume the existence of language-specific subsets or subsystems in combination with additional mechanisms which specify language membership. Let us consider the BIA model (Van Heuven et al. 1998) designed to account for bilingual word recognition (cf. Figure 8).

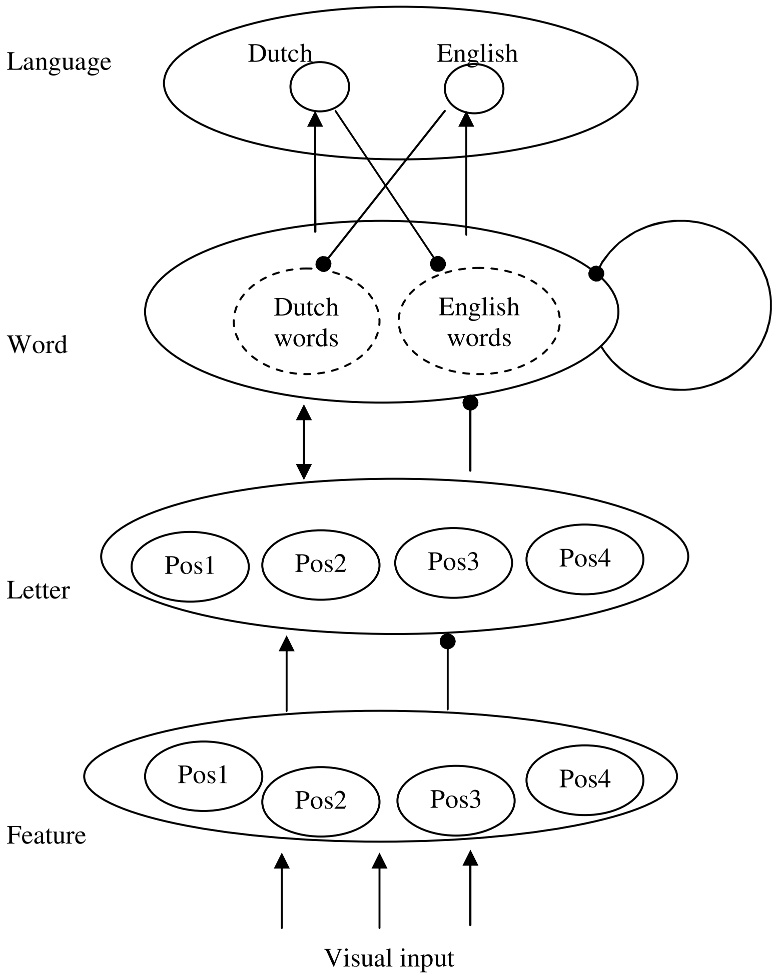

Figure 8. The Bilingual Interactive Activation Model (after Van Heuven et al. 1998: 475). This model is designed for bilingual word recognition with four positions for features and letters. The standard , pointed arrows indicate excitatory connections while the ball-headed arrows indicate the inhibitory connections.

The model envisages language non-selective bottom-up processing of visual input (there are two layers of feature and letter nodes which are shared by the two languages, and a word level where the words from both languages are integrated) and language-specific top-down processing of lexical information which is effected by means of 'language nodes'. The language nodes are connected to all the word nodes in both languages. Their task is to "collect activation from words in the language they represent and inhibit active words of the other language. The activation of the language nodes reflects the amount of activity in each lexicon. They also represent a simple means of storing knowledge about the language to which a particular word form belongs" (Van Heuven et al. 1998: 476). This setup ensures that the two language subsystems stay separate, yet interconnected.

The BIA predicts that, particularly in case of proficient language speakers, words from different languages will be activated in parallel and they will compete simultaneously for activation in visual word processing. When a given language node receives enough activation from its word representations, it will send inhibition to the word form representations of the competitor language. De Groot and Christoffels (2006: 192) point out that "[s]uch a process implies excitatory connections between each of the word-level elements of a language and the corresponding language node as well as inhibitory connections from the language node to the word-level elements of the other language." Therefore, we can say that the language nodes in the BIA model perform two crucial functions: they specify language membership and they are able to modulate language activation. It is the first function which is of interest to our further discussion. The BIA model assumes that the language nodes operate in a manner akin to language tags because they indicate to which language a given word representation belongs. In the revised BIA+ model (Dijkstra and Van Heuven 2002) the language membership function of the language nodes is preserved: the language nodes are directly linked to lexical form representations (however, top-down inhibition from the language nodes to the word nodes has been discarded). As was the case in the BIA, the incorporation of language nodes is meant to reflect the observation that mature language users know to which language a particular word belongs (Dijkstra and Van Heuven 2002: 177, 186). A similar rationale was followed in the Multilingual Interactive Activation (MIA) model (Dijkstra 2003) which is an extension of the BIA model to speakers of more than two languages. In the case of a trilingual speaker, its architecture is conceived to be analogous to the one depicted in Figure 8 with the sole exception that in an extended lexicon words from three languages are integrated, and the language node contains language tags for all the trilingual's languages (Dijkstra 2003: 17). The BIA, the BIA+ and the MIA models are similar in that, basing on studies of bilingual and trilingual visual word recognition, they assume that language membership information becomes available only after word identification has taken place (e.g. Dijkstra and Van Heuven 2002: 186; Dijkstra 2003: 24). I tend to agree that in visual word processing the information about which language a word belongs to cannot precede the word recognition stage, but I would like to argue that is it not necessary to postulate the existence of separate language nodes (and/or language tags) to specify language membership. Such a solution appears quite complex to model visual word processing, particularly in the case of speakers of more than three languages. I concur with Grosjean (2008: 207) that there is no empirical evidence that such nodes exists, nor do we know how they are created when new languages are learned. Therefore, I would like to postulate that, at least as regards visual word processing in trilingual translation recognition, a combination of excitatory and inhibitory links within the language-specific subsets appears sufficient to ensure the bottom-up activation of the relevant semantic/conceptual representations.

From the point of view of translation production, it is also essential to ascertain how trilingual speakers determine language membership information, and how they resolve the question of language choice. Let us consider the usefulness of mechanisms meant to specify language membership information (and thereby determine language choice) that were incorporated into bilingual and trilingual models of language production. Some models include a language-specific tagging mechanism in addition to specifying the language choice in the conceptualisation stage. Thus, language membership is specified twice: locally at the lemma level (tags) and globally (language cue). For instance, Poulisse and Bongaerts (1994) assume that lexical representations from two languages are stored in a single network and may be distinguished by means of 'language tags' at the lemma level.[46] During conceptualisation, the language cue in the preverbal message is said to activate the lemmas of the intended language. It is conceivable to assume that also in the case of a trilingual speaker the lexical items from the three languages are tagged and stored in a single network. In so doing, however, all items with the one type of tag can still be considered as forming quasi subsets similarly to the guiding framework envisaged in Section 2.3. Further to that, the idea of a shared conceptual system adopted here may be related to Poulisse and Bongaerts' proposal that concepts consist of different meaning elements which can be shared by within-language synonyms or translation equivalents. There are also models in which language cues of different strength value suffice to indicate language membership. When the language cue specifies a particular language, all the words belonging to that lan-

[46] Poulisse and Bongaerts based their model on Levelt's Blueprint model (1989) in which lemmas contained semantic information.

guage are activated, and the words belonging to the other language are deactivated (De Bot and Schreuder 1993). According to this account, language users can speak one language or mix different languages by making appropriate language choices in the preverbal message (cf. Levelt 1989). A related proposal stipulates that the language cue in the preverbal message contains all conceptual, affective and pragmatic characteristics necessary to retrieve a word that accomplishes a given communicative goal (La Heij 2005). In this view, the language cue suffices to ensure that words in the intended language reach a higher level of activation than those in the competitor language. Therefore, no additional activation or inhibition processes are necessary at the lexical level. In accordance with the principle of "complex access, simple selection", the following assumptions have been made as regards bilingual production (La Heij 2005: 304): "(a) because of the language cue, semantically related words in the intended language become more strongly activated than semantically related words in the non-intended language; (b) words spread activation to associatively related words within the lexicon (…); and (c) activated words return to a somewhat higher baseline level of activation (…), [so that] the repeated retrieval of words in one language will ultimately result in relatively high activation levels of the words within that language." This reasoning makes it possible to account for the erroneous selection of words related in meaning or in form to the intended word not only within but also across languages. In the latter case it is reasonable to suppose that when a trilingual speaker is asked to produce a translation equivalent in a language which is used less frequently, the elements of that language which are associated either in form or in meaning to the language used more frequently may also become activated and interfere with the production of the correct translation equivalent. With regard to trilingual translation production, this supposition is supported by De Bot's (2004) Multilingual Processing Model (cf. Figure 9).

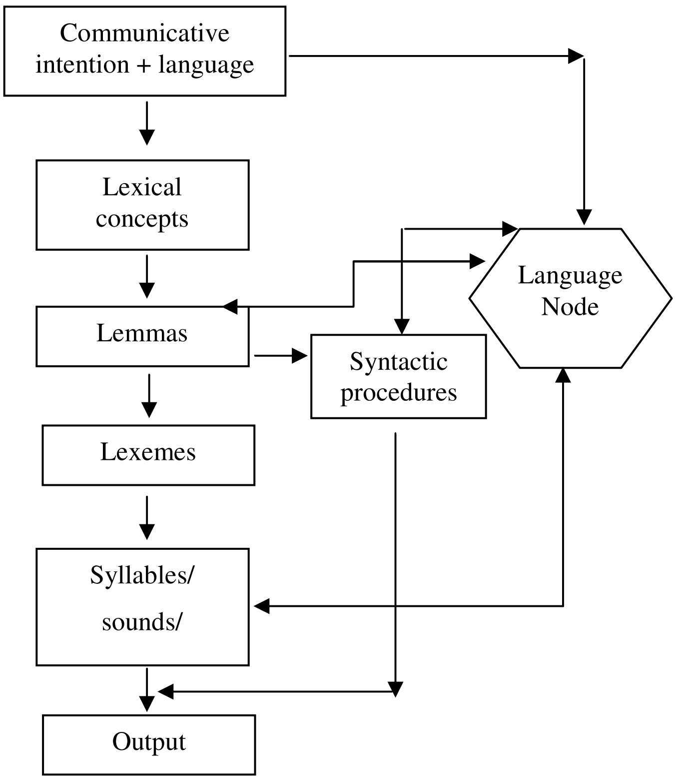

Figure 9: The Multilingual Processing Model (after De Bot 2004: 29).[47]

As already mentioned, in De Bot's Multilingual Processing Model language membership information is specified by means of subsets at the conceptual, syntactic and form levels. The subsets can have different activation levels depending on how frequently a given language is used. "In selection the elements from a given language/subset are preferred, but the elements from other languages are not completely blocked out" (De Bot 2004: 30). Language choice in this model is made in the following manner: the communicative intention to use a specific language activates lexical concepts comprising bundles of semantic and conceptual features, while an external language node controls individual speech processing components, i.e. the syntactic and form levels. As a result, the activation of a specific language subset proceeds both through the lexical concepts and the language node. The Multilingual Processing Model may thus be used in this study to account for cross-lingual activation of closely related lemma and lexeme representations in trilingual translation production, as the information about the activation of a specific language subset will be

[47] This model is based on Levelt's 1993 version of the Speaking Model because that particular version was concerned not only with language production but also with perception.

passed to the remaining language subsets provided that the representations featured in those subsets are strongly associated.

It is apparent from the above discussion that the trilingual speaker's communicative intention will be crucial to specify language choice in translation tasks. Having entertained various mechanisms (language cues, language nodes, language tags) put forward to account for the manner in which words from the intended language are selected in translation contexts, I would like to argue that the idea of having language-specific subsets (De Bot 2004, Paradis 2004) ensures a greater degree of parsimony in modelling lexical processing than that of having a large multilingual lexical network (Poulisse and Bongaerts 1994). No language tags need to be postulated to specify language membership information in translation if the position of a given element within the subset is determined by the type and strength of connections to its immediate and more distant neighbours. In fact, by postulating a tagging system the existence of language-specific subsets is, in a sense, already implied. The language node may be a useful construct to control linguistic processing by modulating the levels of activation across various language subsets, but it is also largely superfluous on the assumption that the speaker's intention already lowers the activation threshold of the language subset to be used. Any instances of intra- or cross-lingual activation of unintended representations in trilingual translation recognition or translation production can be accounted for in terms of failures to suppress the spread of activation via associative connections both within and across subsets.

2.3.3. Control of processing

We have thus arrived at the question of how control of lexical processing is effected in the case of trilingual speakers. I agree that "[a]ny model involving an imperfectly partitioned multilingual lexicon must include control mechanisms, since fluency depends on controlling interference" (Setton 2003: 147). So far we have advanced the idea of global control according to which three languages are stored in strongly interconnected subsets which can be activated or inhibited independently of one another depending on the speaker's intention. In this perspective, when a trilingual speaker decides to use one language, the activation thresholds of the remaining languages will be raised automatically so as to avoid interference (cf. Paradis 2004: 28). In this section this and related proposals will be examined with a view to resolving the problem of how trilinguals speakers are able to control lexical processing in translation recognition and in translation production.

One way of explaining how trilingual speakers are able to keep their languages separate in translation contexts is based on the idea of different levels of activation. For example Green (1986, 1993) put forward that languages can be characterised by one of the following discrete levels of activation: ‘selected’, ‘active’, and ‘dormant’. The selected language is used in production and controls the output. The active language acts in parallel to the selected language but has no access to the output channel and may produce interference. The dormant language is stored in the long-term memory, and does not play an active role in processing. Grosjean (1997, 2001, 2008) also suggested three different levels of language activation but, crucially to the present investigation, all three languages may be activated to varying degrees during the speaking process. According to his Language Mode (LM) framework, the level of activation of a trilingual’s languages in comprehension and in production is highly sensitive to various factors, such as situational variables or task type. Therefore, he claims, it is important to ensure that the language mode be controlled when participants are being subjected to experimental tests. In this dissertation I decided to adopt Grosjean’s rather than Green’s terminology when referring to the levels of language activation because the notion of ‘language mode’ provides more flexibility in the context of translation tasks performed by trilingual speakers. Following Grosjean’s (2008) suggestions, adequate steps have been taken to ensure that those participating in the translation experiments are in a bilingual mode (the two languages needed for comprehension and production ought to be quite active but the remaining language should receive very little activation) rather than in a trilingual mode (cf. Chapter 5 for details concerning the exact procedures applied). The above measures notwithstanding, the remaining language is still expected to exert a certain influence on the translation performance, particularly in case of insufficient attentional resources to inhibit irrelevant information in processing.

Various investigators have pointed out that adequate mental resources are a prerequisite to control in lexical processing, particularly in translation or interpreting situations. Whenever inhibitory resources are insufficient, for instance due to stress or fatigue, slips are likely to appear in the output channel (Green 1986, 1993). The idea of resources is related to the concept of working memory: in the absence of sufficient attentional resources, the central executive is not longer able to adequately monitor the output, which brings about various forms of cross-linguistic interaction (Baddeley 1999: 45-69; cf. Cowan 2000/2001). Green's resources are also conceptually close to Gile's (1995, 1999) Effort Models and the related Tightrope Hypothesis which posit that if the total available processing capacity is exceeded at any stage of linguistic processing, errors or omissions are very likely to occur. Given the fact that the cognitive load is usually very close to saturation in interpreting situations, any processing capacity deficits are likely to lead to faulty lexical selection or omissions. For instance, errors may occur with relatively easy source segments, if more processing capacity was required to process a more difficult upstream segment (Gile 1999).

In the light of the above, the following question had to be considered prior to designing experiments involving trilingual translation recognition and production, and namely that of how control is in fact exercised in translation itself, i.e. exactly in what way are the appropriate language items activated, accessed and retrieved for comprehension and production purposes while the competing language items are being simultaneously suppressed. Green (1986, 1993) suggested that two conditions were necessary for language speakers to be able to control their language production: explicit intention and language tags. Additionally, Green postulated the existence of a 'specifier' regulating how the system must be controlled in order to speak a given language, or to translate. When a person is speaking in one language, the specifier needs to suppress externally the words of the other language. In L1 -> L2 translation, Green suggested that, while both languages are active, the output of one of them needs to be suppressed internally by the specifier whose role consists in boosting the activation of appropriately tagged words in the lexicon, and then in inhibiting the L1 words which are inappropriately tagged. Green (1986) also dealt with control in L1 -> L2 translation in the case of trilingual speakers. His explanation is, however, rather complex as he proposed that L1 -> L2 translation involved an internal suppression of the L1 and an external suppression of the L3 by the L2. If Green's line of reasoning were to be extended to L1 -> L3 translation production explored here in Experiment 2, the internal suppression of naming in the L1 would have to occur in combination with the external suppression of the L2 by the L3, so that translation would be effected into the L3 instead of into the L2. On top of the complex nature of the above reasoning, there was also the question of how the control operations effected by the conceptual/intentional system and the specifier were to be related to the execution of a given task type (e.g. translation as opposed to spontaneous speech production). Therefore, I decided to consider what intuitively seemed to be a simpler idea, namely that of task schemas which were incorporated into Green's (1998) Inhibitory Control (IC) model and the already mentioned BIA+ model (Dijkstra and Van Heuven 2002). I thought that professional conference interpreters could have developed some translation schemas during their interpreting practice which enable them to control and monitor their output more efficiently, particularly in the directionalities they use the most frequently.

In the IC model (Green 1998) language task schemas are understood as action schemas linking input to and output from the lexico-semantic system to responses. The Supervisory Attentional System (SAS) is an executive control locus responsible for activating these schemas which compete to control the output.[48] The third locus of control is at the lemma level, i.e. within the lexico-semantic system (cf. Figure 10).

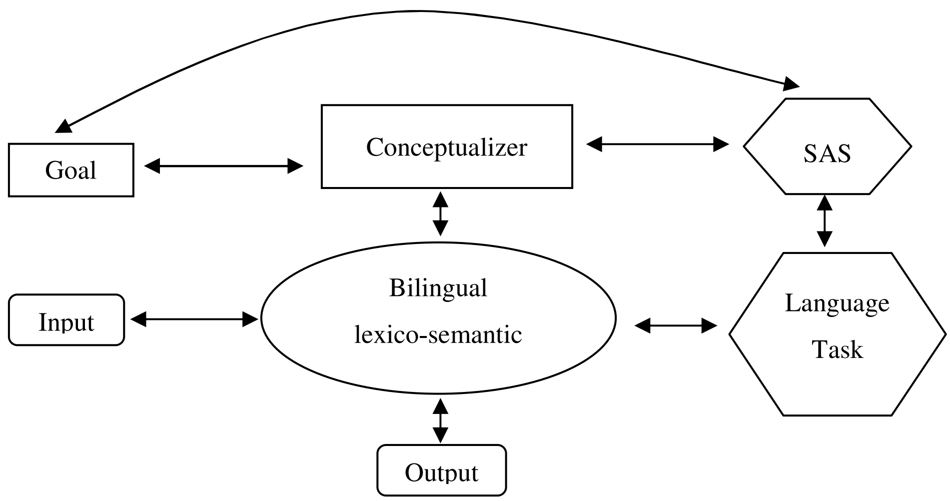

Figure 10. The Inhibitory Control model (after Green 1998: 69).

Language task schemas can be organised into 'functional control circuits' such as translation schemas or word production schemas. Schemas control the activation and inhibition of language tags at the lemma level. For instance, L1 -> L2 translation is operated by a for-

[48] Green's task schemas and the supervisory attention system can be traced to Norman and Shallice's (1986) model designed for the control of actions. Green's SAS also operates quite similarly to Gile's coordination effort (Gile 1995, cf. also Gile 1997).

ward task schema. This schema sets L1 as the input, and L2 as the output. It also inhibits the schema for naming the input in the L1 (cf. Price et al. 1999). Control is thus exerted proactively by balancing the global activation levels of the language systems, and reactively by inhibiting locally any inappropriate output from the lexico-semantic system. I agree with De Groot and Christoffels (2006: 191-192), however, that it is unclear how 'external' and 'internal' control (Green 1986) maps onto proactive and reactive control (Green 1998). Language task schemas, although presented by Green (1998) as relatively permanent structures, are moreover often established ad hoc depending on current task requirements. In case of a translation task exploiting a directionality which is not in customary use in regular interpreting practice, it is conceivable that certain modifications will have to be made to the schemas present in the minds of those participating in the experiments. Therefore, Green's IC framework (1998) is in fact quite complex owing to the nature of the control mechanisms which are supposed to govern the selective activation or inhibition of language tags at the lemma level. It is not absolutely necessary to postulate the existence of the central executive while task schemas may well be established on a case-by-case basis. As pointed out in the previous section, any form of language-specific tagging at lemma level seems largely superfluous if one assumes that languages are stored in strongly interconnected subsets where language membership is determined by the unique position of a given representation or pair of representations in the lexicosemantic network. For instance, links between translation equivalents or within- and between-language synonyms should be strengthened every time those representations co-occur in actual language use (Francis 2005; De Groot and Christoffels 2006). In translation production, the speaker's intention should suffice to inhibit elements from the non-intended language (i.e. raise their activation thresholds) provided attentional resources have not been depleted (e.g. Paradis 1994, 2004, 2009; Gile 1995, 1999; Grosjean 2001). This stance on control in language production, including translation, is well represented by the following quote:

> The process that alternately inhibits one or the other language subsystem during speech follows the general laws of excitation and inhibition between neural phenomena of any type (…); it is automatically driven by the activation threshold levels. These thresholds are modulated by the mental set induced by the particular situation (unilingual or bilingual mode), as a blanket increase in activation threshold up to a given degree can be imposed on an entire language subsystem (Paradis 2009: 165).

In keeping with Paradis' ATH (2004), cross-linguistic interference in translation will be prevented automatically by raising the activation thresholds of the lexical representations from the unintended language (although trilingual participants may produce an unintended word if its activation threshold happens to be lower than that of the intended word). There is evidence from neuroimaging studies which suggests that such inhibition is possible due to the existence of mutually inhibitory connections between items which regularly compete for selection, such as the lemmas of frequently encountered translation equivalents (Abutalebi and Green 2007: 265). The idea of there being strong mutually inhibitory connections between frequently encountered translation equivalents is quite plausible, particularly in case of professional conference interpreters. A further point to note concerning translation production involves the direction of translation. In keeping with Green's IC framework (1998) and Paradis' ATH (2004), languages with a high default level of activation should be more difficult to suppress or inhibit and, by the same token, more difficult to activate once they have been deactivated.[49] Therefore, it is reasonable to suppose that language combinations that are used frequently in interpreting situations will have lower activation thresholds than language combinations used less frequently or never. If I ask the participants to translate in a direction they use less frequently or never (such as A -> C), they may find it difficult to suppress the activation of translation equivalents in the language combinations they use more frequently (such as A -> B). It follows that A -> C translation production may be quite taxing in terms of inhibitory control, as the participants will have to suppress the activation of translation equivalents in their B-language (i.e. English) while simultaneously activating the translation equivalents in their C-language (i.e. German). If the German translation of a Polish source word happens to be cognate with its English counterpart, the participants will have to inhibit quite well the competing English representations while producing the translation of the said Polish word into German.

Translation recognition, as we already established (cf. Section 2.3.2.), involves a strong bottom-up processing component. Let us consider how control can be effected in this task. Given the fact that the words to be processed are presented visually, irrelevant form and meaning representations should be inhibited until a decision is made as to

[49] The results obtained by Allport et al. (1994), Meuter and Allport (1999), and Costa and Santesteban (2004) indicate that it is quite difficult to suppress the activation of the unintended language in performance if that language is stronger (i.e. used more frequently, like the mother tongue) than the intended language.

whether or not a given pair of words comprises translation equivalents. I believe that the architecture of the BIA+ model (Dijkstra and Van Heuven 2002) is able to explain the manner in which lexical processing is controlled in translation recognition until that final decision stage.

The BIA+ model (cf. Figure 11) comprises an identification system and a task schema. The identification system provides information about the activated representations from different languages for use by the decision and response selection mechanism operating in the task schema. In this respect, the BIA+ model adopted the ideas of task schemas and control implemented in the Green's IC framework (1998). The word identification system features lexical phonological and semantic representations besides the orthographic ones.[50] Thanks to the distinction between the word identification system and the task/decision system in the task schema, the BIA+ is able to differentiate between non-linguistic context effects (i.e. the language of instruction, stimulus list composition) and linguistic context effects (i.e. lexical context) on word recognition performance. While the linguistic context effects influence the word identification system directly, the non-linguistic context ones affect the task/decision system. Task demands are thus believed to act as factor capable of modifying the output of the word identification system. The information flow in visual word processing proceeds from the word identification system to the task/decision system (purely bottom-up activation of lexemes), so that the task/decision system has no direct influence on the activation state of individual words.

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[50] Phonological codes were also found to be active during word recognition (e.g. Brysbaert et al. 1999).

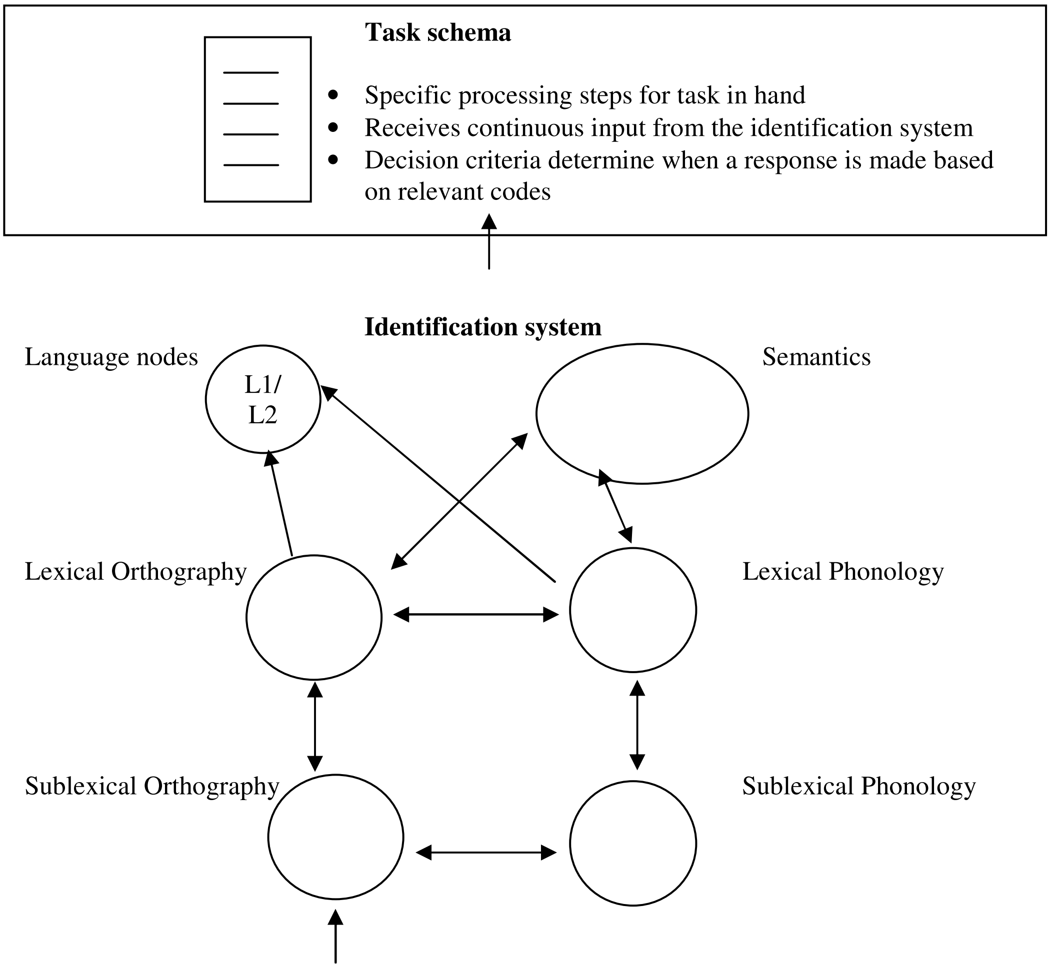

Figure 11. The BIA+ model (after Dijkstra and Van Heuven 2002: 182).

For the purpose of my investigation, it is pertinent to note that the bottom-up processing of the visual input is combined in the BIA+ with the lateral inhibition of irrelevant representations. The final decision with regard to translation accuracy is made in the task/decision system. Whenever attentional control of the output from the word identification system is insufficient (e.g. due to the fatigue of a participant), incorrect decisions are likely to be made in translation recognition. Therefore, it is reasonable to suppose that if insufficient mental resources are allocated to lateral inhibition, representations related in form or in meaning to the intended output will also be activated. If their activation thresholds will be lower than those of the intended output, slips are likely to appear. At the same time, it is plausible to assume that the participants will establish some ad hoc task schemata during their translation recognition performance to streamline the process of concurrent activation and inhibition of relevant interlingual links. A further assumption concerns the direction of translation. To the extent that the translation directions in the recognition task will coincide with the directionalities used in interpreting situations, the performance of professional conference interpreters is likely to be superior in terms of inhibitory control relative to that of the remaining groups of participants. Further assumptions concerning the translation directions to be investigated in the recognition task will be made in Chapter 3.

2.4. Conclusions

In this chapter we have established what processes and mechanisms are indispensable in the case of trilingual speakers to activate and process lexicosemantic information in translation recognition and in translation production tasks.

IA models can provide a suitable framework for understanding the manner in which trilingual speakers activate and process lexicosemantic information in translation recognition, with the caveat that separate language nodes (even language tags) do not necessarily have to be postulated if we assume that a combination of excitatory and inhibitory links within language-specific subsets already ensures that relevant lexical and semantic/conceptual representations are activated (cf. Section 2.3.2.). The MIA model (Dijkstra 2003), an extension of the BIA model (Van Heuven et al. 1998) to multilingual speakers, is based on the principle of non-selective bottom-up processing and language-specific top-down processing of lexical information. The BIA+ model (Dijkstra and Van Heuven 2002) predicts that the task/decision system has no direct influence on the activation state of individual words. Thus, IA models assume that, particularly in case of proficient trilingual speakers, words related in form and in meaning to the intended word (i.e. both intra- and interlingual neighbours) will compete simultaneously for activation in visual processing. Basing on visual word recognition studies which found a double and even triple cognate effects in the performance of participants set in the monolingual mode (Van Hell and Dijkstra 2002; Lemhöfer et al. 2004), it is likely that in the translation recognition experiment the participants may indeed find it hard to suppress the activation of lexical representations which will be related in form or in meaning to the correct translation equivalent.

De Bot's (2004) model, an extension of his earlier Bilingual Production Model (1992) based on Levelt's Blueprint for the Speaker (1989), provides a good working framework for understanding the manner in which trilingual speakers activate and process their languages in translation production. Basing on Paradis' (2004) ATH and Grosjean's (2001) LM framework, De Bot's (2004) model assumes that the activation of a given language subset may be passed to the remaining language subsets and produce cross-linguistic competition, provided that the representations featured in those subsets are strongly associated. In this perspective, frequently used languages (and, by the same token, also language combinations) will have a higher default level of activation compared to languages (or language combinations) used less frequently (cf. Gile 1995; Setton 2003). It follows that it may be quite difficult to suppress the activation of lexical items from languages with a high default level of activation. In keeping with the view of cognate representation and processing presented in Section 2.3.1., Polish words whose translation equivalents in German are cognate with their English counterparts may spread some amount of activation to the latter representations despite deliberate attempts to deactivate the participants' B-language in the translation production experiment (cf. Grosjean 2008).

Throughout our discussion it became apparent that the questions of word frequency and neighbourhood are related. It is pertinent to note that in studies which combined the effects of word neighbourhood and frequency, high-frequency neighbours proved to be stronger competitors in comparison to low-frequency neighbours (e.g. Grainger 1990; Grainger and Segui 1990; cf. Balota 1994: 328-330 and Balota et al. 2006: 317-319 for an overview). For example, Van Heuven et al. (1998) demonstrated that bilingual performance in word identification and word naming tasks was sensitive to the number of within- and between-language neighbours (neighbourhood density) and to their relative frequency (cf. Grainger and Dijkstra 1992). In accordance with the predictions of PDP models, it appears that low-frequency words from large neighbourhoods tend to be recognised faster than words with high-frequency neighbours, while high-frequency words are not affected by neighbourhood size. I conclude that it is important to control the word frequency in experiments such as those carried out here which presuppose the occurrence of intra- and crosslingual activation of competing lexical representations in the visual modality (cf. Section 4.8.).

With regard to the issue of control of processing, I believe that it is not necessary to postulate the existence of a central executive or tags at the lemma level (cf. Section 2.3.3.). It is reasonable to suppose that task schemas will be established on a case-by-case basis in translation tasks, particularly if they investigate lexical processing in language combinations used less frequently or never in regular CI practice. I therefore agree that researchers "should be extremely reluctant in assuming underspecified control mechanisms that, in combination with convenient tags or flags at convenient places, solve major problems (…) these mechanisms often induce more problems than they seem to solve" (La Heij 2005: 305). It has been argued that control of processing critically depends on the activation thresholds of relevant items in the linguistic structure which are continually readjusted to reflect changes in memory associations. I thus support the interactionist/connectionist view of lexical processing according to which memory associations are established "by contiguity of the elements in the environment (and possibly by mental contiguity, that is, by the co-occurrence of words in thought)" (De Groot and Christoffels 2006: 192). It is quite likely that inhibitory connections are established between lexical representations that regularly compete for selection (cf. Abulatebi and Green 2007). Given the importance of maintaining a clear separation between languages in translation (e.g. De Bot 2000), we have postulated that the speaker's intention to speak a given language not only lowers the activation thresholds of the relevant subsets in the intended language but also raises the activation thresholds of the irrelevant language subsets (cf. Paradis 2004, 2009). The speaker's intention notwithstanding, items from the non-intended language may occasionally be selected if their activation level is higher than that of items from the intended language.

It is evident from the foregoing discussion that few researchers attempted to move from bilingual to multilingual processing models (Dijkstra 2003; De Bot 2004). Current models assume that multilingual speech processing relies on similar mechanisms that are operative for two languages. De Angelis (2007: 16, 67-71, 75) argues that this assumption, to which she refers as the 'bilingual bias', still remains to be tested given the current paucity of experimental evidence capable of substantiating an automatic extrapolation of the known processing models valid for the bilingual speakers to include also the multilingual ones.[51] I do not support that opinion. In the present thesis it is argued that, in the absence of sufficient experimental evidence enabling a definite rejection of the current practice of applying views of bilingual processing to trilingual speakers, the bilingual bias is a necessary

[51] Similarly, Grosjean spoke about the monolingual prejudice or the monolingual (or fractional) view of bilingualism, i.e. the practice of treating bilingual linguistic competence as the sum of two monolingual competencies (1985 [2008], 1992).

and useful procedure to be followed. There should be no fundamental differences between the cognitive functioning of bilinguals and trilinguals in terms of the processing and control mechanism required in visual word recognition and speech production. Both groups of speakers store their linguistic knowledge is closely interconnected and dynamic networks of links and nodes organised into subsets that can be activated or inhibited independently by virtue of the close associations existing between its elements (cf. Section 2.3.). At the same time it is pertinent to note that the potential for activation spreading to related form- and meaning-representations in tasks such as translation recognition or translation production is likely to be higher in case of a trilingual speaker than a bilingual speaker, and even higher in case of a trilingual speaker whose foreign languages are related than a trilingual speaker whose foreign languages are unrelated. This and related ideas will be explored in the following chapter.

Chapter 3: Key proposals and models

3.1. Introduction

In the foregoing discussion the trilingual mental lexicon has been conceived as a dynamic network of lexical and semantic/conceptual links of differing strengths which are organised into language-specific yet interconnected subsets subserved by a shared conceptual system. It is in this conceptual framework that I will formulate proposals about the speed and accuracy of lexical processing in translation tasks carried out by professional conference interpreters, CI trainees, and trilingual speakers without CI training whose foreign languages are related.

The proposals will be divided into two main categories: (1) those which are devised with regard to professional and trainee trilingual interpreters, and (2) those which are designed for the control group. The discussion will focus on two major factors and their likely interplay in the participants' translation performance: differences in the type and amount of CI experience, and the degree of lexical relatedness existing between English and German. Two models of the trilingual mental lexicon will be proposed to illustrate the preliminary hypotheses made in this chapter: one model will be concerned with speakers with CI experience, the other will be concerned with speakers without CI experience. Basing on those models, the choice of translation directions investigated in the recognition and production experiments will be justified.

3.2. The effect of CI experience

We have argued (mainly in Section 2.2.1.) that routine CI experience leads to more efficient lexical processing, particularly in the frequently used directionalities. In support of this argument, we discussed the dynamics of the Gravitational Model of lexical availability in conference interpreters (Gile 1995). We also mentioned briefly the idea that the organisation of the mental lexicon undergoes a number of cognitive changes during CI training and practice which are meant to ensure high conceptual and linguistic availability in a given directionality (Setton 2003). In this section I lend coherence to this argument by proposing that the differences between the professional and trainee conference interpreters as regards the type and amount of CI experience will be discernible in the speed and accuracy of their lexical processing skills. Thus, the key proposal here is that prolonged CI practice influences the patterns of trilingual connectivity of direct lexical and semantic/conceptual links to support efficient processing in the most frequently used directionalities.

Underlying that proposal are the following data about the type and amount of daily interpreting practice of the professional and trainee conference interpreters in question. Both groups of participants interpreted either from their B- or C-language into their mother tongue, or they worked in retour.[52] The twelve professional interpreters who took part in this study lived in Brussels and worked for the European Commission and the European Parliament as staff or freelance interpreters. In the language experience questionnaire completed prior to the study, they reported to work into English 9.9% of their time per day (*SD* = 5.5). For instance, they provided 'relay' in their B language in multilingual meetings. In addition, before coming to Brussels, all of them reported to have worked in their home markets where bidirectionality is the 'norm'. They also reported having been trained in

[52] According to AIIC's term glossary, the B language is a language "other than the interpreter's native language, of which she or he has a perfect command and into which she or he works from one or more of her or his other languages", while the C language is a language "of which the interpreter has a complete understanding and from which she or he works."

retour interpretation.[53] With regard to the amount of interpreting done from German to Polish, the majority said that they exploited this directionality quite rarely on a daily basis (about 2.7% of their time, *SD* = 3.0). As regards the twelve CI trainees, they also had some retour and C->A interpretation training: the total ratio of B -> A interpretation vs. A -> B interpretation vs. C -> A interpretation during the four-semester Programme is as follows: 1: 1: .36. The average experience of the conference interpreters who agreed to participate in my experiments was 7.8 years (*SD* = 3.4), out of which the experience of working in EU institutions amounted to 4.5 years (*SD* = 1.2). The CI trainees were tested in the final semester of an intensive two-year CI training programme at the School of English, AMU, where they received about 1400 hours of instruction.

Based on those data, I would like to claim that the translation performance of the professional conference interpreters will show a lexicosemantic processing advantage, particularly as regards the routine directionalities in CI. Thanks to prolonged practice, the professional conference interpreters are assumed to preside over a better-organised and consolidated system of intra- and interlingual links which enable efficient lexicosemantic processing in routine CI contexts. In addition, the professionals are claimed to have more associative links among concepts, and a deeper semantic processing ability than their trainee counterparts. Therefore, the professional interpreters will be able to retrieve declaratively stored information about the form and meaning of lexical items faster and more accurately (thanks to efficient monitoring strategies) than the CI students, that particular effect becoming apparent already in online translation tasks.

The validity of my claims is substantiated by observations from studies investigating the nature of cognitive performance differences between experts and novices (e.g. Sternberg 1999; Ericsson et al. 2006). Their general findings have been fairly uniform across various domains and may be summarised as follows: (1) experts tend to favour deeper processing (i.e. at the level of meaning), while novices tend to remain structure-

[53] The fact that the professional interpreters reported to work from English into Polish more frequently than from Polish into English may be taken to reflect a preference traditionally adhered to in the so-called western tradition of conference interpreting. AIIC, for instance, still recommends that conference interpreters work into their native language rather than their B-language because it is only the interpretation into one's native language that is instinctive, spontaneous and idiomatic. Despite recurring concerns about interpretation quality, retour interpretation is increasingly gaining acceptance in EU institutions, particularly after the accession of new member states in 2004 (Newmark 1988: 3; Dejean LeFéal 2000: 11; Minns 2002: 30; Pöchhacker 2004: 21).

focused (i.e. at the level of form); (2) in contrast to novices, experts tend to store knowledge representations based on associative links, which ultimately leads to relatively fast and error-free retrieval operations from LTM; and (3) experts are known to monitor and control their cognitive processes to succeed in performing a given task (cf. Chi 2006, Feltovich et al. 2006). T&I scholars have made similar observations of professional and trainee performance differences predicated on the claim that the progression to expertise involves changes in the nature of cognitive organisation and processing (e.g. Hoffman 1997; Liu 2008). To provide but one example, in a dichotic listening task professional interpreters detected significantly more semantic errors while student interpreters significantly more syntactic ones (Fabbro et al. 1991). The most crucial declarative and procedural knowledge differences claimed to exist between experts and novices in translation and interpreting performance are as follows (Moser-Mercer 1997b: 257-259):

1) *factual knowledge*: experts' factual knowledge is better organised than that of the novices: experts reveal more associative links among concepts and more domain connections, which leads to faster access to declarative knowledge;
2) *semantic knowledge*: as opposed to novices, experts' semantic knowledge is deeper and almost always embedded in the context of a text or speech;
3) *monitoring strategies*:[54] professional interpreters constantly compare the input against the output at various levels, including the level of the lexicon and overall meaning;
4) *workload management strategies*: experienced interpreters use their processing resources optimally, although they are not always conscious of the exact mechanisms they employ to ensure smooth delivery.

Thus, the lexicosemantic processing advantage proposed to exist in the case of the professional conference interpreters under investigation has been attributed to their ability of organising knowledge representations in meaningful ways to streamline the process of lexical activation and retrieval in routine interpreting situations. The final aspect of my claims

[54] Moser-Mercer (1997b: 258) adopted Künzli's (1995) definition of the term 'strategy' as "the use of declarative or procedural knowledge (…) to a conscious or unconscious problem situation." Here we propose to define 'strategy' as "a potentially conscious procedure for the solution of a problem which an individual is faced with when translating a text segment from one language to another" (Lörscher 1991:76; cf. also Kearns 2009: 282).

which requires clarification is the manner in which prolonged CI practice produces long-term changes in trilingual cognitive organisation. I concur in this case with the proponents of the so-called deliberate practice approach according to which deliberate and prolonged practice is required in order to attain expertise (Ericsson 2006; cf. also Ericsson and Charness 1994).[55] In the course of the interpreting practice, the professional interpreters in my study are claimed to have developed methods for storing information in LTM in accessible form. I thus agree with the central idea behind the long-term working memory (LT-WM) theory that as experience in a given domain increases, retrieval structures (i.e. stable sets of retrieval cues in STM) are established to allow efficient storage and retrieval of information from LTM (Ericsson and Kintsch 1995: 216). With regard to lexical retrieval, I am of the opinion that the principles governing the LT-WM theory are not a far cry from the interactionist/connectionist perspective on trilingual lexical processing outlined in the previous chapter, according to which associations are established in LTM based on the contiguity of given lexical items in the environment, and possibly by mental contiguity as well (cf. De Groot and Christoffels 2006: 192). Results of the translation experiments (cf. Sections 5.3.4. and 5.4.4.ff.) largely agree with the above claims regarding the effect of CI experience on the lexical processing skills of the professional conference interpreters. However, it will be seen that the statistical data obtained did not always allow me to corroborate the hypotheses formulated for this group of participants (cf. Sections 5.3.1. and 5.4.1.).

Let us presently relate the key proposal made at the outset of this section to the case of the trainee interpreters. So far I have advanced the claim that the speed and accuracy of lexical retrieval increase with growing experience as a result of strengthening of interlingual connections between frequently occurring translation equivalents. Support for this claim may be found in the field of T&I studies, where CI students are believed to undergo the following stages of skill acquisition (Kurz 1996: 73-75; Moser-Mercer et al. 2000: 109-111; cf. Anderson 1983, Moser-Mercer 2008):

[55] Critics of the deliberate practice theory (e.g. Sternberg 1998) point out that Ericsson and colleagues place too much importance on hard work and focused effort while not paying due heed to such factors as individual predisposition or talent. For pragmatic reasons these reservations were disregarded in our study. Moreover, we agree with Ericsson (2003: 117) that even the most gifted individuals need to engage in deliberate and prolonged practice to acquire expertise.

(i) a cognitive stage, also called the interpretive or cognitive stage,

(ii) an associative stage, also called the compiled stage, and

(iii) an autonomous stage, also called the automatic or procedural stage.

In the first stage, performance is relatively slow and error-prone, it involves controlled processing and requires considerable allocation of attentional resources. The second stage entails a mixture of controlled and automatic processing as associations are formed and the strain on declarative memory and working memory is gradually lessened. Attentional resources are nonetheless still required for control. In the final stage, the processing of declaratively stored knowledge representations becomes more automatic and less dependent on attentional resources. It follows from the above that speed and accuracy are two essential aspects of lexical processing which may be trained during interpreting practice. Therefore, my initial assumption has been that the trainees will be reasonably advanced in the processing of lexicosemantic information after the 1400 hours of training. Consequently, they will be able to outperform the control group as regards the speed and accuracy of lexical retrieval, particularly in the routine CI directions. Results of two lexical processing studies (e.g. Bajo et al. 2000; Kujałowicz et al. 2008) carried out with bilingual conference interpreting students and their respective control groups suggest that CI students have more efficient lexicosemantic processing skills even after a year of intensive training.[56] However, I found it difficult to relate directly the above results to the case of trilingual CI trainees because I suspected that, on top of having three languages at their disposal, the close lexical affinity between their foreign languages would provide an additional hindrance to efficient cognitive organisation (cf. Section 3.3.). Therefore, I came to consider the possibility of an alternative scenario which predicts that the trainees will show a certain deceleration in identifying and producing correct translations as opposed to the control group. Underlying this scenario is the assumption that the CI students are still in the process of reorganising the interlingual links in the lexicon so as to be able to process lexical information more efficiently in the translation directions they practice regularly. That assumption stems from

[56] The former study was concerned with lexical decision making and semantic categorisation , while in the latter the participants were asked to translate words in a word-final position appearing on the computer screen following a high or low sentence context constraint.

second language acquisition (SLA) studies which found that learners' performance tends to deteriorate as they reorganise their internal knowledge representations:

> (…) increased practice can lead to improvement in performance as subskills become automated, but it is also possible for increased practice to create conditions for restructuring with attendant decrements in performance as learners reorganize their internal representational framework. In the second case, performance may follow a U-shaped curve, (...) declining as more complex internal representations replace less complex ones, and increasing again as skill becomes expertise (McLaughlin 1994: 115; cf. also Moser-Mercer et al. 2000: 110).

I have thus assumed that during CI training a similar reorganisation process takes place, aimed at streamlining the process of accessing and retrieving form- and meaning-information from the lexicon. In the course of CI training, some links become stronger, while other links become weaker, thereby leading to a gradual but major reshuffling or reorganisation of lexicosemantic knowledge in the lexicon. It will be seen (cf. Sections 5.3.4. and 5.4.4.), however, that although the arguments presented above tend to favour the second scenario, the actual results obtained for the CI trainees have been mixed. Although some data point to the effect of CI training on their translation performance, overall results tend to lend credence to the claim that in the case of the CI trainees the mental reorganisation process has not yet been completed.

Presently I would like to address certain epistemological and pragmatic issues and challenges which emerged in the course of formulating my proposals concerning the influence of CI experience.

As pointed out by Kussmaul (1995: 9), professionalism is a relative quality. Therefore, it is not surprising to find discrepancies among T&I scholars as regards the attributes of expert and novice status, not to mention the issue of defining the features of translation and interpreting expertise (cf. Pym 1998). For example Moser-Mercer (1997b: 255, cf. Moser-Mercer et al. 2000: 108) defines an expert as "someone who has attained a high level of performance in a given domain as a result of years of experience", and a novice as someone with "little or no experience in a particular domain", although she notes that both categories allow for some degree of variation. Indeed, there are scholars who have made more fine-grained distinctions along the expert-novice continuum (e.g. Hoffman 1997: 199). I agree in this respect with Hild (2007: 106) who asserts that expertise has been defined rather loosely in T&I research. Therefore, I had to ascertain in how far the expert-novice performance differences drawn from 'expertise studies' could be related to the case of professional and trainee conference interpreters in this study.

One solution has been to base the sampling criteria on the amount of CI experience. Drawing on cognitive studies of expertise in various domains, Hoffman (1997; cf. Dillinger 1994) suggested that about 9000 hours of time-on-task or a period of ten years are necessary to reach the performance level of a master interpreter. Another proposal has been to differentiate between expertise and competence as distinct terms pertaining to professional and expert performance respectively. In this view, "[t]ranslation graduates may exhibit varying levels of translation competence but not translation expertise" while not all long-time translators in a given domain will exhibit superior performance (Shreve 2000: 154, 160). In other words,

> merely accumulating cognitive resources (…) is not sufficient to become an expert (…) the differences between novices and experts or experienced non-experts and experts is not simply a matter of cognitive resources (…) but a difference in the quality and composition of those resources (…) how those things are cognitively arranged, represented, and stored in or retrieved from long-term memory (Shreve 2000: 161).

Also Hild (2007) has insisted that "consistency needs to be exercised in distinguishing between experts and experienced professionals in research and theoretical writing." She suggests pre-experimental tests of performance be carried out to decrease participant withdrawal rates on account of poor performance.

For pragmatic reasons, it proved impossible to observe those suggestions in this study. The sampling strategy adopted here consisted in approaching conference interpreters with the required language combination who worked either for the European Commission or the European Parliament, and asking them to take part in the study after they completed a short questionnaire eliciting, among other information, data about the type and amount of their CI experience. Thus, no special sampling procedures were used to distinguish experts from among the experienced conference interpreters. Likewise, none of the professional conference interpreters had surpassed the critical '10-year' marker at the time their performance was investigated. However, it was not my aim to establish objective, falsifiable criteria for identifying and measuring the translation performance of professional and trainee conference interpreters, but rather to register a sizeable difference in their lexical processing skills which would demonstrate the professional interpreters' lexical processing superiority, at least as regards the directionalities used in routine CI practice. In addition, I would like to claim that the pleas for distinguishing between experts and experienced professionals are of more direct relevance to studies investigating CI performance proper. As pointed out by Liu (2008: 160),

> [o]wing to the lack of clearly defined objectives and consistently reliable measuring devices for performance, research in Interpreting Studies has often opted to compare expert and novice performance in order to determine if there are observable differences in behaviors or abilities that can be attributed to different stages of expertise development (…). However, we have to note that expertise defined through this contrastive approach is rather relative (…). This relativity (…) is another factor underlying the difficulty in comparing the results of different studies on interpreting expertise and in making generalizations across studies. However, this relative approach can illuminate our understanding of how experts become the way they are (…).

For the purpose of comparing the online translation performance of two groups of trilingual participants with varying degrees of CI experience, the selection criteria adopted here (specified in detail in Section 5.2.) are deemed sufficient. In fact, the procedure of comparing the performance of more and less experienced individuals is considered useful not only in cognitive studies but also in T&I research. For example Christoffels and De Groot (2005: 469) state that "[b]y comparing novices and professionals on tasks that are supposed to tap into possibly relevant subskills, we can gain more insight into what cognitive subskills are in fact important for SI." Gile (1998: 8) has expressed a similar opinion: "Studies in which professional interpreters and students, amateurs and other subjects are given the same tasks (…) are (…) useful insofar as they provide data on comparability (or lack of comparability) in the performance of various categories of subjects." Further methodological issues will be presented and discussed in Chapter 4.

3.3. The effect of lexical similarity

An important argument made in Chapter 1 has been that the impact of close lexical similarity existing between the participants' foreign languages should not be underestimated. We have pointed out that where the L2 and the L3 are typologically related, the third language is likely to retain a number of resilient lexical connections to the L2, particularly when both languages feature a substantial degree of lexicosemantic similarity (e.g. Hall and Ecke 2003; Goral et al. 2006; Meara 2006). In this section I substantiate and reinforce this argument by proposing that the three groups of participants will show some CLIN in online translation tasks, albeit to varying degrees.

I would like to propose that the effect of lexical similarity on the speed and accuracy of lexical retrieval will be the least prominent in the case of the professional conference interpreters thanks to the efficient monitoring strategies they have developed in the course of the interpreting practice. The caveat here is that the monitoring strategies will be the most successful when applied in the translation directions the professionals use regularly.

With regard to the conference interpreting trainees, my claim is that they are likely to be outperformed not only by their professional counterparts but also by the control group on the assumption that they have not managed to reorganise their trilingual mental lexicon to support efficient lexical processing in interpreting contexts. Thus, the effect of lexical similarity is assumed to exacerbate any potential lexical retrieval problems on the part of the trainees.

The effect of lexical similarity on the translation performance of the control group is claimed to be the most pronounced. They are expected to have retained the closest lexical links between related English and German representations. As a consequence of not being trained in CI, they are claimed to have the least efficient monitoring skills to prevent them from falling prey to interfering form- and meaning-based representations in online translation.

TLA studies provide ample support for the claims made with regard to the likelihood of CLIN to occur in trilingual translation performance. In accordance with De Angelis's (2007: 95) assertion that "the stronger the association between memory stores, the higher the chance of non-native lexical influence to occur as its path may be consequently eased", CLIN has been found to "occur in any one of a constellation of directions, such as from L1 to L2, from L2 to L3, from L1 to L3, from L3 to L1, from L2 to L1, and so forth" (Jarvis and Pavlenko 2008: 21). Therefore, it needs to be ascertained what factors are most likely to trigger CLIN when trilingual speakers with differing amounts of CI experience perform translation tasks in directions involving languages which are close in terms of lexical similarity. Having examined carefully the CLIN-inducing factors found in SLA and TLA research work (e.g. Kellerman 1983; Faerch and Kasper 1987: 120-126; Ellis 1994: 319ff; Jarvis and Pavlenko 2008: 175ff), I would like to argue that the following factors will have the most influence on the translation performance of the participants in this study:

1) linguistic and psycholinguistic factors (language distance and psychotypology);
2) language experience and knowledge factors (proficiency and the order of acquisition).

With regard to linguistic and psycholinguistic factors, the combined influence of language distance and psychotypology is argued to be the fundamental trigger of CLIN in the participants' translation performance. Language distance is understood here as referring to a degree of formal similarity or congruence between languages which tend to be genetically related, while psychotypology is conceived in terms of individual perception of language distance (e.g. Cenoz et al. 2001, 2003). I base this argument on a large number of studies of bilingual and trilingual performance in which CLIN was obtained when languages were closely related to one another. For instance, Spanish L1 speakers with prior knowledge of Basque relied more extensively on Spanish than on Basque when learning their L3 English (Spanish and English are Indo-European languages as opposed to Basque) (Cenoz 2001). In another study, English L3 learners were more influenced by Swedish than Finnish regardless of whether Swedish was the L1 or the L2 (Swedish and English are Germanic languages while Finnish belongs to the Finno-Ugric language family) (Ringbom 1987). With regard to these and related studies of CLIN, several terminological clarifications are necessary. First or all, although some SLA and TLA researchers noted that cross-linguistic similarities tend to be perceived in comprehension while in production they are usually assumed, it is difficult to maintain this distinction in the present study because comprehension and production processes in translation can hardly be separated (cf. Ringbom 2007: 24-26ff.; Jarvis and Pavlenko 2008: 179). For this reason, no attempt will be made to differentiate between those two notions. Secondly, no distinction will be made between the terms 'genetic relatedness' and 'formal similarity' because individual perception of typological proximity most probably correlates with genetic relatedness in the case of English and German (cf. De Angelis 2007: 26-27).

As regards language experience and knowledge, I would like to claim that proficiency will constitute another important factor determining the likelihood of CLIN in translation performance. Its influence is claimed to be so strong as to be able to override the effect of language distance and (psycho-)typology. This idea is derived from several SLA and

TLA studies of lexical processing in translation tasks which found differing amounts of form- and meaning-based transfer depending on the level of proficiency of the participants. Specifically, meaning-based processing tended to occur either in translation into the native language or into a language in which the speaker achieved near-native proficiency. In contrast, transfer of form tended to take place when the speaker's proficiency in the non-native language was not very high in comparison to the native language. If proficiency in the foreign language was close to that of the native language, the combined effect of language distance and (psycho-)typology was frequently attenuated. However, certain types of transfer, such as cognate vocabulary use, could occur even in very proficient language speakers (Ringbom 1987, 2001, 2007; Odlin 1989; Kroll and Tokowicz 2001, 2005; Kroll and Dussias 2004). Basing on these studies, I concluded that it was important for all participants to have relatively high levels of proficiency in both of their foreign languages. Generally speaking, the trilingual speakers under my investigation were more proficient (and in the present context also more dominant) in their L2/B language (roughly equivalent to CEFR level C2, i.e. Mastery') than in their L3/C language (roughly equivalent to CEFR level C1, i.e. 'Effective Operational Proficiency').[57]

Apart from proficiency, the participants' language profiles have been matched on the variable of 'order of acquisition' because the order in which a speaker's languages were acquired has also been found to determine the type and amount of CLIN in TL production. Let us consider briefly a study of lexical inventions of Dutch learners of French and English (Dewaele 1998) because its results emphasise the importance of order of acquisition in experimental investigations of multilingual processing. In that study, one group comprised subjects with French (L2) and English (L3), while the other included subjects with English (L2) and French (L3). The learners from the first group tended to rely more on Dutch than on English in French word production, while the learners from the second group tended to rely more on English than on Dutch. Thus, for both French L2 and French L3 learners the source of lexical borrowing was based in their individual active languages (learned before the target language), i.e. their L1 and L2 respectively. As a result, one potential student

[57] While it is tempting to say that the C2 level is equivalent to that of an educated native speaker of a language, the CEFR (i.e. Common European Framework of Reference for Languages) document explicitly eschews such an interpretation (2001: 36): "[l]evel C2, whilst it has been termed 'Mastery', is not intended to imply native-speaker or near native-speaker competence. What is intended is to characterise the degree of precision, appropriateness and ease with the language which typifies the speech of those who have been highly successful learners."

participant who indicated in the language experience and proficiency questionnaire that he had acquired German prior to English had to be excluded from my investigation despite the fact that he claimed to have been more dominant in English than in German.

In view of the above, I would like to form the following expectations with regard to the likelihood of CLIN to occur in the participants' translation performance. Thanks to their proficiency level, the participants are expected to be more prone to meaning-based than to form-based transfer. Some amount of CLIN may nevertheless originate from a source language which the participants recognise (in objective or subjective terms) as being closely related to the target language. For instance, German -> English translation would appear to be more prone to CLIN than German -> Polish translation, especially in the case of participants without CI experience who are assumed to be less skilled in the application of efficient monitoring strategies (cf. Section 3.2.). Further to that, I expect that some participants may be inclined to use form-based transfer if they encounter a high degree of perceptual similarity between German and English representations. With regard to the processing of cognate representations, I would like to propose that some degree of interference is likely to occur also in the case of participants with CI experience. Thus, in case of translation directions featuring a high degree of formal similarity, lexical retrieval of cognate lexical representations may be facilitated, but more monitoring effort may be required so as to minimise the risk of interlingual interference. Support may be found in Seleskovitch's (1978: 104) claim that while "the young interpreter must consciously strive to resist linguistic interference, this effort becomes second nature to the experienced interpreter" although "[t]he risks of interference are greater with languages which have a common origin." Also Gile (1995) points out that in interpreting situations even professional interpreters sometimes fail to inhibit competing language representations in case of insufficient cognitive resources (e.g. saturation, spillover effects).

Having discussed the CLIN-inducing factors likely to operate in this study, some additional comments and clarifications are appropriate.

I have deliberately decided to exclude from the discussion the issue of frequency and recency of language use. A number of TLA studies found that CLIN in trilingual speakers was affected by frequency of use and the related 'recency effect', i.e. the tendency to transfer more from the foreign language used actively by the speaker than from other languages which are known by the speaker but which he or she used less recently. I would like to argue, however, that the majority of these and related effects identified in L3 performance can be traced to the connectionist account whereby the activation thresholds between interlingual form- and meaning-connections are being continuously readjusted in line with individual language experience. Let us take the example of Williams and Hammarberg (1998; cf. also Hammarberg 2001) who proposed that the combined effect of proficiency, typology, recency and L2 status was responsible for the type and magnitude of CLIN observed in their two-year longitudinal study of oral production of an English-speaking learner of Swedish with prior knowledge of other languages (including near-native proficiency in German). In that study, the language acquired most recently (German) rather than the language used most frequently (English) was found to influence oral production in Swedish. I agree that these results need to be viewed in relation to the participant's high proficiency in German, the small linguistic distance between German and Swedish and, last but not least, the order of acquisition. I disagree with Williams and Hammarberg, however, that CLIN may also be ascribed to the influence of 'L2 status' (also called 'talk foreign' or 'foreign language mode', cf. De Angelis and Selinker 2001) which holds that a non-native language may be the preferred source of transfer over the mother tongue which is suppressed as non-foreign.[58] I also reject other researchers' (Cenoz 2001; Murphy 2003) interpretation of Williams and Hammarberg's results as supportive of the 'last language effect' hypothesis, according to which the most recently acquired language is more available for transfer. In my opinion, it is not necessary to invent a multitude of terms which provide similar explanations of CLIN effects in multilingual production. Williams and Hammarberg's study is a case in point: the last language effect concurs with the already mentioned recency effect and L2 status in influencing transfer in L3 production, which makes it very hard to assess the impact of individual factors. In contrast, the effects of proficiency and order of language acquisition can be determined with relative ease. Further to that, I think that the difficulty inherent in any attempts aimed at disentangling such factors as frequency and recency of use, L2 status, or last language effect stems from the fact that they are traceable to the same underlying processes discussed within the connectionist theory, and namely that the strengthening and weakening of intra- and interlingual links in the mental lexicon (according to the type and intensity of language exposure) leads to the activation of

[58] Hammarberg (2001) claims there are differences in L1 and L2 acquisition mechanisms such that in L3 acquisition learners tend to reactivate mechanisms used successfully when acquiring a prior foreign language rather than the mother tongue.

some language items/systems at the expense of other language items/systems. Undoubtedly, the language used most recently or frequently is more likely to serve as the source of transfer because it is activated more quickly (i.e. it has a lower activation threshold). By analogy, the language combination used most recently or most frequently in CI should have a lower activation threshold than the language combination exploited rarely or not at all in the interpreting practice. MacWhinney's (1997) Competition Model captures the above considerations very successfully. I thoroughly support his view of lexical processing as one involving constant tension and competition for activation between various sets of intra- and interlingual mappings of lexical forms and their semantic/conceptual properties. That model emphasises moreover the role of input (cue validity and strength) in structuring lexical and conceptual mental representations. In the context of this study, input refers to the participants' individual linguistic experience and, as argued in the previous section, it is strongly influenced by the amount of CI practice in a given directionality.

At this point I would like to return to the argument made at the outset of this section pertaining to the likelihood of two genetically and formally related languages to have retained close interconnections in case of similar or overlapping representations even in highly proficient trilingual speakers. According to the LM framework adopted here, the background language with the highest level of activation and thus most likely to influence TL production can be either the L1 or any other language learned later in life depending on the degree of lexical similarity or individual factors related to languages use (Grosjean 2001). However, in a number of TLA studies the third language was shown to have developed a stronger connection with the second language than the native language (e.g. Cenoz et al. 2001, 2003). Therefore, I have claimed that also in the present study this close connection is likely to have persisted in spite of increasing proficiency (especially in the case of cognate representations) owing to the small linguistic distance between the participants' L2 and L3. Nevertheless, an important reservation to this claim should be noted, namely that the TLA studies discussed so far employed 'offline' methodologies.[59] To the best of my knowledge, only one psycholinguistic study investigated the impact of directionality on lexical processing in trilingual participants whose foreign languages were related. In a masked translation priming study (Cieślicka and Kowynia 2008), the strength of interlin-

[59] 'Offline' methodologies focus on analysing subjects' performance, for instance in terms of the number of errors or the amount of transfer, *after* a given task has been completed (cf. Hasson and Giora 2007).

gual lexical connections was investigated in the case of Polish conference interpreting students whose foreign languages were either English (18 students) or German (12 students). Given the fact that the same language combination will be investigated in the present study, it is rather important to note that Cieślicka and Kowynia did not detect any effects of CLIN in either group despite the small distance between the participants' foreign languages. On the contrary, masked L1 translation equivalent primes facilitated subjects' decisions in their L3 irrespective of the language combination. That finding was taken to indicate that in online tasks it is the native language, and not the L2, that has the strongest effect on lexical access and processing into the L3. Of particular relevance to the present study are the results obtained by Cieślicka and Kowynia for students with English (B) and German (C). Although there was no difference in reaction times between L1 -> L2 and L2 -> L1 performance, the priming effect in L3 -> L1 performance was greater than in L1 -> L3 performance. I agree with the Cieślicka and Kowynia's (2008) conclusion that the latter finding may be directly ascribed to the influence of interpreting training (C -> A translation practice). As a consequence, their study not also supports our connectionist-based assumption that CI practice tends to reorganise interlingual connections to enhance lexical processing in everyday interpreting situations, but it also suggests that in online investigations the effects of CLIN may be overruled (at least to some extent) by the effect of intensive CI practice.

The two major conclusions to be drawn from our discussion are as follows. Firstly, the type and amount of CLIN in trilingual performance is affected by a confluence of factors, most of which seem to be related to changes in the strength of mental representations in accord with the connectionist account presented in Chapter 2. Secondly, TLA offline research indicates that the third language may be more closely interconnected at the lexicosemantic level to the second language than to the mother tongue, especially in case of related representations. It remains to be seen whether these findings will be confirmed in the present study based on online research methods.

In the following section I present the working assumptions and preliminary hypotheses made with regard to the speed and accuracy of lexical processing in the case of trilingual speakers with differing amounts of CI experience.

3.4. Models and preliminary hypotheses

The CI professionals and trainees under my investigation interpreted either from their B- or C-language into their mother tongue, or they worked in retour. To add to the complexity, their two foreign languages were closely related in terms of typological and formal similarity. In this section I hypothesise about the manner in which these factors affected the mental organisation of their working languages. I then contrast the mental lexicon of a conference interpreter with an A-B-C language combination with that of a trilingual speaker untrained in CI (the architecture of the proposed models accommodates the impact of cross-linguistic similarity between the two foreign language lexicons).

In view of the participants' linguistic proficiency and CI experience, I have assumed that the languages A, B and C will be strongly tied to the conceptual store. B->A lexical links are supposed to be slightly stronger than A->B lexical links in the case of the professional conference interpreters because they reported to work more into their native language than in retour.[60] In the case of the CI trainees, A->B lexical links are likely to approach B->A lexical links in terms of strength of interlingual form and meaning associations (it may be recalled that the trainees received approximately the same number of hours of instruction in both directionalities). However, the CI trainees are assumed to be developing rather than honing the conceptual and lexical links between their working languages (cf. Section 3.2.). Therefore, I hypothesise that their professional counterparts will be able to outperform them in terms of the speed of lexicosemantic processing and resistance to CLIN, particularly as regards the directionalities used in routine CI practice. Lexicosemantic processing in both groups of CI participants is assumed to be faster and more accurate in C->A interpretation than in the opposite direction.[61] C->A lexical links are

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[60] Although this supposition will not be tested, the likelihood of obtaining the L1-L2 translation asymmetry predicted by the RHM in this study is thought to be negligible because comparable studies of proficient bilingual and trilingual speakers with CI experience have found it to be almost non-existent (e.g. Bajo et al. 2000; Cieślicka and Kowynia 2008; Kujałowicz et al. 2008). In fact, even studies investigating bilingual CI performance have not been conclusive with regard to the influence of directionality on the participants' strategic processing skills or the overall interpretation quality (e.g. Barik 1994; Tommola and Helevä 1996; Bartłomiejczyk 2006; Chang and Shallert 2007; cf. also Gile 2005).

[61] SI and ST performance of Russian-Hebrew-English CI trainees (Phillipov 2007) suggests that they have stronger interlingual connections between the L1 and the L3 as opposed to the L2 and the L3. This assumption is also supported by the earlier cited study of translation priming (Cieślicka and Kowynia 2008) in which a greater priming effect was obtained in L3 -> L1 performance than in L1 -> L3 performance of CI trainees who had the same language combination as the one investigated in the present study.

claimed to be relatively weaker than A->B lexical links because both groups reported that they worked from their passive language relatively rarely. Therefore, I assume that their overall range of linguistic choices in the C language will be slightly more limited than in the B language, which will be reflected by the size of the lexical store. Figure 12 illustrates the proposed view of the mental lexicon of a conference interpreter with an A-B-C language combination.[62]

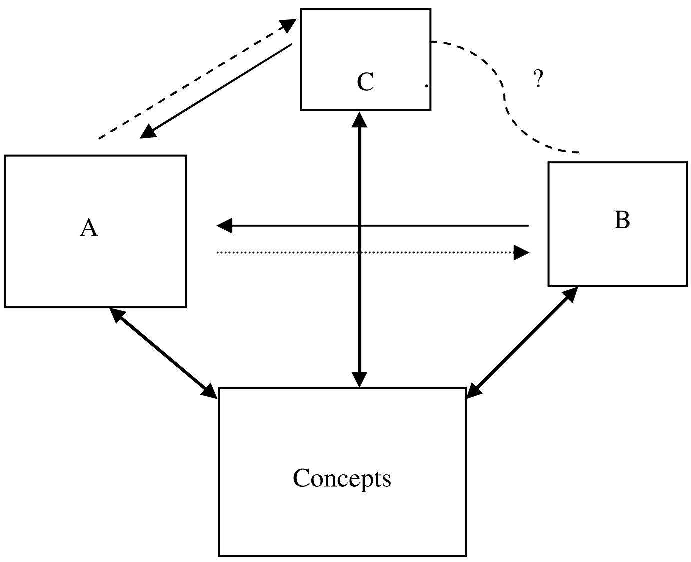

Figure 12. The mental lexicon of a conference interpreter with an A-B-C language combination. The two foreign language lexicons should be interrelated by virtue of typological and formal similarity (i.e. a considerable amount of overlapping lexical representations) but the strength of B-C interlingual links remains to be tested against those customarily employed in the interpreting practice.

The above assumptions and hypotheses concerning the mental lexicon of trilingual conference interpreters with an A-B-C language combination become more complex when two interrelated foreign languages are present in the cognitive makeup. Generally speaking, I assume that varying amounts of form- and meaning-based interference are likely to occur in cases where interlingual links have not been sufficiently strengthened in the course of interpreting practice. This will be the case in the following translation directions: A -> C and B -> C (forward translation), and C -> B (backward translation). Interlingual mediation

[62] Clearly, my schematic conceptualisations do not do justice to the complexity of interlingual relations in the participants' trilingual mental lexicons. However, approximations are a 'necessary evil' and they were solely meant to visualise the rationale behind selecting the translation directions to be explored experimentally.

between the languages B and C can be quite daunting.[63] However, I assume that backward translation into the more proficient language, i.e. C -> B translation, will be less demanding than the reverse direction. Although lexical availability in a C language is even lower than in a B language, in order to investigate the speed and accuracy of lexicosemantic processing it will suffice to explore C -> B translation in a recognition task.[64] From this vantage point, it appears logical to contrast C -> B translation recognition with C -> A translation recognition on the assumption that lexical processing in the latter direction will be faster and less prone to form- or meaning-based interference because it is used in the interpreting practice.[65] In translation production, on the other hand, my intention is to ascertain whether B-based interference will occur from the mother tongue into the passive language. Based on our discussion of cognate representations and their processing (particularly in Section 2.3.1.), it is logical to hypothesise that such interference may manifest itself in case of representations related in both form and meaning between German and English (even if English will not receive direct activation in this task). For these reasons, the participants with CI experience have been asked to perform translation tasks in language directions they use relatively rarely or not at all in their everyday practice.

It was important to include trilingual non-interpreting students in the experimental setup as the control group to distinguish between the effect of general linguistic proficiency and directionality in translation tasks. I assume that both translation recognition and translation production are relatively uncomplicated tasks which can be done readily also by subjects without specialised training (cf. also Chapter 4).[66] While the control group share the basic mental architecture outlined in Figure 12, the crucial difference between the interpreting and the non-interpreting participants is assumed to lie in the strength of interlingual connections. Paraphrasing the words of Paradis (2007a) with regard to the mental lexicons of trilingual speakers with varying degrees of CI experience, one can say that it is not a matter of *what* is represented (the basic mental architecture is assumed to be the same) but *how* it is represented (i.e. how strong the interlingual links are). The foregoing discussion

[63] Interference may arise as a consequence of such factors as task stress or mental fatigue (e.g. Dornič 1978).
[64] Therefore, interpreting from a C into a B is generally avoided because it entails higher risks of saturation (Gile 2009: 238).
[65] Experienced interpreters are capable of selectively enhancing or suppressing the lexical connections so as to make the right decisions (cf. Setton 2003: 159-160).
[66] After Lörscher (1991: 43-45), trilingual speakers are assumed to have a basic ability of mediating between their languages, which will enable them to engage in translation work (cf. also Chapter 4).

about CLIN in TLA research indicates that while the L2 is readily accessed conceptually by trilingual speakers, lexical items in the L3 may be stored in a mixed fashion, i.e. in subordinate, compound, or coordinate representations, reflecting a developmental sequence on the one hand and cross-lingual similarities on the other. My conceptualisation of the mental lexicon of the control group (cf. Figure 13 below) is thus meant to reflect the sequence of language acquisition and the likely impact of cross-linguistic similarity on the preservation of close lexical links between the L2 and the L3.

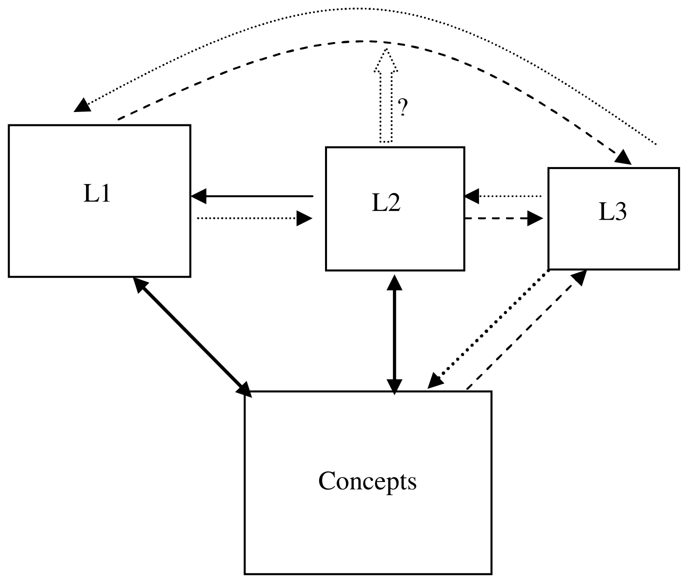

Figure 13. The mental lexicon of a trilingual speaker (L1-L2-L3) without interpreting experience. The schematic arrangement of the three lexicons is meant to reflect the sequence of acquisition and the likely impact of cross-linguistic similarity on the preservation of close lexical links between the L2 and the L3.

In view of the above considerations, I assume that the participants without CI experience will be quite prone to CLIN in lexical processing, particularly between L2 and L3 representations. Thus, more CLIN is hypothesised to occur in L3 -> L2 than in L2 -> L1 translation recognition. In addition, the performance of the control group in L1 -> L3 translation production is likely to be especially prone to L2-influence.

Based on the above models of the mental lexicon of trilingual speakers with and without CI experience, the following preliminary hypotheses have been made to plan my experiments:

1) translation recognition from German into English will be more prone to form- and meaning-based interactions than that from German into Polish;

2) translation production from Polish into German will be vulnerable to cross-linguistic interaction from English when German translations of Polish words share form and meaning connections with their English counterparts.

Between-group differences in the strength of mental representations are likely to be borne out in the speed of lexical access and retrieval (i.e. response times) and the amount of CLIN (i.e. error rates) in both experiments. The trilingual speakers untrained in CI developed their lexicosemantic links between German and Polish solely in language learning situations. Therefore, they are hypothesised to have relatively weaker lexical and conceptual links between German and Polish than the trainee and professional conference interpreters. As a result, the performance of the control group in translation recognition from German into Polish is assumed to be characterised by longer reaction times and lower accuracy scores compared to that of the trilingual speakers trained in CI. As regards translation recognition from German into English, the potential for form- and meaning-based CLIN to occur during processing similar English and German representations is also hypothesised to be higher in the control group than in the groups of participants with CI experience. This is because the former are assumed to have retained stronger lexicosemantic links between their two closely related foreign languages whereas the latter are argued to have reorganised their mental lexicons to support efficient lexicosemantic processing in CI contexts. While this does not necessarily entail that the participants with CI experience will outperform the control group in terms of the speed of processing, I assume that the professional interpreters in particular will be quite adroit in the efficient application of monitoring and control mechanisms to prevent them from making erroneous lexical decisions in this task regardless of directionality. In the translation production experiment, in turn, all participants are hypothesised to find it reasonably difficult to reject the activation of cognate English representations while producing oral translations of Polish words into German. However, I have argued (cf. Section 3.2.) that the greater the amount of CI experience, the better the overall processing of semantic/conceptual information and the more efficient the control/suppression mechanisms. Therefore, the professional conference interpreters are likely to show more resistance to CLIN than the remaining groups of participants also in translation production from Polish into German. It is difficult to hypothesise about the speed and accuracy of lexical processing in the case of the CI trainees. In keeping with the considerations presented in Section 3.2., they are likely to be outperformed by their professional counterparts as regards the overall efficiency of processing semantic/conceptual information in translation, particularly between German and Polish.

3.5. Conclusions

In this chapter two main factors have been claimed to affect the speed and accuracy of lexical processing in the participants' translation performance: the type and amount of CI experience, and the degree of lexical relatedness existing between English and German.

One of the arguments has been that some amount of lexical activation may spread to similar form and meaning representations (both intra- and interlingually) even in case of proficient conference interpreters if they are asked to perform translation tasks in directions they use relatively rarely, particularly when these directions involve languages that are close formally and (psycho-)typologically. In order to verify this and other arguments made in the course of this chapter, we resolved to investigate how fast and how accurately the three groups of participants would reject form- and meaning-related distractors in German -> Polish vs. German -> English translation recognition. We also decided to examine the extent and nature of CLIN in the participants' performance in a Polish -> German translation task in which half of the Polish words to be translated were cognates with their English counterparts.

The translation directions to be investigated have been deliberately selected in order to find out whether close lexical affinity or the type and amount of CI experience have the most impact on the speed and accuracy of lexicosemantic processing. In particular, the study is intended to find out whether:

1) the results obtained in the case of the trilingual control group will point to the German words and the English words being strongly interconnected at the level of form and meaning for similar or overlapping representations, owing to the degree of genetic and formal relatedness existing between these two languages;
2) the data obtained in the case of the professional conference interpreters will rather point to the German words being more strongly connected at the level of form and meaning to the Polish words than to the English words, as that effect is argued to be the result of interpreting training and practice (C ->A only);

3) the above effect will already be discernible in the case of the conference interpreting students who underwent four semesters of intensive CI training.

It is hoped that by contrasting the performance of the CI trainees with that of a control group it will be possible to separate the effect of interpreting training from other effects present in regular trilingual processing. Undoubtedly, also in view of results reported by Christoffels et al. (2006), it would be interesting to investigate whether the professional conference interpreters in our study could outperform proficient language speakers without CI experience but otherwise matched for age, proficiency and language combination.[67] This kind of undertaking proved quite problematic, however, and it had to be relinquished on account of the difficulty of finding a suitable control group for the professional interpreters that would comprise at least twelve people from a language-related profession. Further methodological issues will be discussed in the following chapter.

[67] Having contrasted the word translation performance of professional interpreters and a control group of Dutch teachers of English, Christoffels et al. (2006: 339) suggest that "efficient lexical retrieval is not uniquely relevant for interpreting and may be mediated by general language proficiency."

Chapter 4: Methodological issues

4.1. Introduction

The speed and accuracy of lexicosemantic processing have been investigated in single-word translation tasks performed in a laboratory setting (cf. Flores d'Arcais 1978; Massaro and Shlesinger 1997). In the experiments, the participants decided first whether pairs of words presented to them on the computer screen constitute the correct translation equivalents, and then translated single words (also presented visually on the computer screen) into the microphone.

In view of the fact that "[t]he validity question concerns those methods in which the translation situation is somehow manipulated and subjected to experimental control" (Göpferich and Jääskeläinen 2009: 179), in this chapter some of the key methodological issues and concerns will be addressed regarding the use of online translation tasks. Particular attention will be devoted to the questions of:

(i) validity of carrying out translation experiments based on single decontextualised stimuli to investigate differences in the speed and accuracy of lexicosemantic processing between professional and incipient conference interpreters, and

(ii) applicability of results thus obtained for the psycholinguistically-oriented T&I scholars.

I will argue that online translation paradigms involving single word stimuli offer a simple but straightforward and exact means of exploring the speed and accuracy of lexical processing in case of participants having varying degrees of CI experience.

4.2. Translation recognition

This experiment has been carried out in two consecutive sessions: German -> Polish and German -> English. The participants decided by pressing a key whether the second of the two words presented sequentially on the computer display was a correct translation of the first word (cf. Section 5.3.3. for details concerning the exact procedure). In what follows I address the most important methodological issues which emerged when designing this particular experiment.[68]

The first issue I would like to raise concerns the ordering of translation tasks. In the present work translation recognition has been investigated prior to translation production. The reasons for this decision are twofold. Firstly, translation recognition is generally considered to be easier than translation production (cf. De Groot and Comijs 1995). Secondly, the directionality to be investigated in the production task is not used regularly by the participants. The production task was therefore deemed to be more challenging than the recognition task.

A related question concerns the presentation format of the test stimuli. I judged sequential presentation to be preferable to simultaneous presentation because in this manner "the processing order of the two words within a pair could be controlled" (De Groot and Comijs 1995: 480).[69] Thus, participants first read the prime and then, after it had been replaced by the target, they responded to the target. The pairings of primes and their targets were not be apparent to the participants (cf. McNamara 2005: 70; McDonough and Trofimovich 2009: 91-91).

A certain amount of semantic and form-based priming has been presupposed in translation recognition because, apart from the correct translation pairs, the participants have also been presented with incorrect translations pairs which included form-related distractors (*f*) and meaning-related distractors (*sem*). To provide an example, the word pair *Zwiebel – onion* comprises correct translation equivalents, whereas in the word pair *Zwiebel – garlic* the second word is merely related in meaning to the correct translation. As regards the word pair *Zwiebel – mirror*, the second word is related in form to the German

[68] Translation recognition is sometimes referred to in the literature as 'translation verification' (cf. De Bot 2000).
[69] This presentation format was also used by Ferré et al. (2006).

word to be translated (*Zwiebel* and *Spiegel* ‘mirror’ are perceptually similar but they are not translation equivalents). For the sake of clarity, the sample experimental stimuli are presented in Table 1.

Table 1. Sample stimuli in the translation recognition task.

SL word	True translation		Meaning distractor		Form distractor		similar to GER
	EN	*PL*	*EN*	*PL*	*EN*	*PL*	
Klingel	bell	dzwonek	whistle	gwizdek	blade	ostrze	~Klinge
Zwiebel	onion	cebula	garlic	czosnek	mirror	lustro	~Spiegel
Ohr	ear	ucho	mouth	usta	place	miejsce	~Ort
Teppich	carpet	dywan	blanket	koc	vinegar	ocet	~Essig
Gesicht	face	twarz	back	plecy	poem	wiersz	~Gedicht

Thus, apart from collecting the RT data, this task is aimed to look into the priming effects as they are hypothesised to reflect the fundamental characteristics of processes responsible for how the participants organise their lexicosemantic knowledge, and also for how they are able to retrieve and use that knowledge in translation (cf. Neely 1991; Zwitserlood 1996). In view of the above, care has been taken to select the most appropriate distractor words, as well as the stimulus-onset asynchrony (SOA) between the primes and their targets. We address each of these issues in turn.

As regards the selection of the distractor stimuli, two independent judges have been asked to assess whether the distractors are related in meaning, related in form, or completely unrelated to the SL words. Solely the distractors which the judges thought were related in form and in meaning with at least 80% consistency were included in the first experiment (cf. Appendix B, p. 180).

As opposed to the form-based distractors, the choice of the meaning-based distractors presented a serious methodological quandary. It had to be ascertained whether or not it was important to avoid associative relations between the primes and their semantically-related distractors. Some researchers have argued that it is possible to distinguish an associative relation among words from a purely semantic relation. For instance, Ferrand and New (2003) maintain that pairs of associatively related words need not share semantic features (e.g. *spider – web*), while pairs of words linked by purely semantic relations are usually category co-ordinates (e.g. *spider – ant*). From this point of view, associative relations between words tend to reflect word use rather than word meaning. In a similar vein, McDonough and Trofimovich (2009) have argued that prime-target pairs based on associative relations (e.g. *grass – green*) are close semantic associates but they are not members of the same semantic category (they give the example of *furniture – table* to illustrate a categorically related pair of words). Lucas (2000) has proved that it is possible to obtain pure semantic priming and, crucially to this study, she found that adding association to a semantic relationship almost doubled the priming effect. Ferrand and New (2003) indeed obtained purely semantic priming (i.e. without association) and purely associative priming (i.e. without semantic relatedness) in a lexical decision task carried out under automatic conditions (the three SOAs tested were 100, 250 and 500ms). On the other hand, McNamara (2005) points out that both semantic (e.g. *goat – dog*) and associative (e.g. *cat – dog*) prime-target relations may involve members of the same categories. He also makes the following assertion:

> Having devoted a fair amount of time perusing free-association norms, I challenge anyone to find two highly associated words that are not semantically related in some plausible way. Under this view, the distinction between purely semantically related words and associatively (and semantically) related words is an artificial categorization of an underlying continuum. This explanation of pure semantic priming and the associative boost could be implemented in all of the models of priming (McNamara 2005:86).

His point, thus, is that the associatively related words share more or stronger semantic relations than the unassociated words. In view of the above considerations, I concluded that it was preferable to avoid strong associative relations between primes and the semantically-related distractors. However, I had to acknowledge that some degree of association between the semantically-related pairs in this study could not be excluded for the reason that semantic influences and associative influences typically co-occur (Balota et al. 2006: 327).

A further methodological issue concerned the choice of SOA to be used in the experiment. McNamara (2005: 72) advises investigators to use SOAs of 200ms or less in order to investigate the automatic component of semantic priming. Semantic priming measured at prime-target intervals longer than 200ms has been found to be subject to controlled processing (McDonough and Trofimovich 2009: 63ff.). In such a case, participants have been found to adopt an expectancy strategy, i.e. after seeing a given prime they started generating a list of possible targets even before they appeared on the screen. As a result, unintended facilitation priming occurred. For that reason, a SOA of 200ms was used in the two pilot studies carried out prior to this experiment. However, the results obtained in the pilot studies have indicated that the 200ms is too short a period for the participants to complete the recognition task. Therefore, a prime-target interval of 300ms has been used in the experiment proper. It might be argued that as a consequence of that choice the experiment no longer investigated the automatic but rather the strategic processing of visually presented stimuli. However, there is not enough data to substantiate this argument in semantic priming studies carried out with trilingual speakers.[70] Therefore, the SOA chosen here is argued to be sufficiently short to investigate automatic processing of form- and meaning-related distractors in trilingual word recognition. Moreover, in a bilingual translation recognition experiment a prime-target interval of 238ms was used based on the claim that the onset asynchrony between the two words within a pair was "far too short for a translation to be generated by the participant before the second word appeared, but long enough for the first word to have been recognised by then" (De Groot and Comijs 1995: 480). The same rationale has been adopted here. In view of the fact, however, that this study concerns translation recognition from the participants' L3, the SOA of 300ms was deemed the most appropriate.

4.3. Translation production

In the experiment the participants have been instructed to produce oral translations of Polish words presented visually on a computer screen into German by using a microphone which activated a voice-operated switch. In this section we address the most important methodological issues which emerged when designing this particular experiment.

We have assumed (cf. Section 4.2.) that the participants would most probably find this task more challenging than translation recognition.[71] Therefore, care has been taken to activate their C-language prior to performing translation production in order to alleviate the possible occurrence of task anxiety (cf. Section 5.4.3. for details). As a result, in keeping

[70] In the case of bilingual speakers, researchers have used intervals of 200-250ms to investigate automatic processing. Cf. McDonough and Trofimovich (2009: 80) for a table summary of SOAs used in bilingual semantic priming studies.

[71] Translation production is also rather challenging from the point of view of data analysis. Not only does it involve more laborious data analysis procedures than those used for translation recognition, but it also requires that the operation of the voice switch be monitored. This is done in order to exclude from the analysis the RTs associated with failures of the voice key to register the participant's response, or with triggering due to the faltering of the participant's voice, or to the interference of external sound sources.

with Grosjean's (2001, 2008) LM framework (cf. Section 2.3.3.), the participants should be in the 'German language mode'. Nevertheless, they are hypothesised to have been influenced by English representations because in this experiment half of the German translations of Polish words were cognates with their English counterparts.

Although we have argued in Section 2.3.1. that B-based influence in C-language production is highly probable (cf. Van Hell and Dijkstra 2002; Lemhöfer et al. 2004), we noted that it was difficult to predict the size of that effect because the processing of cognate representations has never been investigated before in a comparable experimental context. Therefore, in order to determine the magnitude of the cognate effect, a similarity pretest has been conducted (Appendix B, p. 180).[72] The English-German cognates have then been divided into two groups according to the degree of interlingual form similarity: the category B cognates (*CogB*) were less perceptually similar (fewer shared phonemes and letters) than the category A cognates (*CogA*).[73] The number of Polish stimuli whose translations were cognate between English and German was counterbalanced by Polish stimuli whose translations into German had no formal overlap with English. The sample experimental stimuli are presented in Table 2.

Table 2. Sample stimuli in the translation production task.

Cognate A			Cognate B			Control	
source	*transl*	*similar to EN*	*source*	*transl*	*similar to EN*	*source*	*transl*
gwiazda	Stern	star	deszcz	Regen	rain	budzik	Wecker ('alarm clock')
krew	Blut	blood	droga	Weg	way	kwiat	Blume ('flower')
orzech	Nuss	nut	wyspa	Insel	island	lalka	Puppe ('doll')
szczur	Ratte	rat	ziemia	Erde	earth	kogut	Hahn ('rooster')

In this manner, apart from investigating the speed and accuracy of lexical retrieval, this experiment will also look into the extent of English-based influence in L3 translation production. In view of the above, we need to refine the working assumptions and preliminary

[72] Forty students matched for language combination and age with my student participants ranked whether English and German cognate pairs were more or less similar in form to one another (on a scale from 7-very similar to 1-very dissimilar). The difference was significant: $F(2, 13) = 419.41$, $p = .000$. A similar procedure was followed by De Groot and Nas (1991), De Groot et al. (1994), and De Groot and Comijs (1995).
[73] The cognate stimuli were compiled based on Friel and Kennison (2001) and Banta (1981).

hypotheses made so far (cf. Section 3.4.) with regard to the nature of processing in trilingual translation production.

Due to the participants' high proficiency in German, conceptual mediation is assumed to occur in all groups of participants. This assumption is based on word translation studies carried out with trilingual speakers whose L3 proficiency was considerably lower than is the case in the present study (cf. Section 1.6.). Thus, there will be more meaning- than form-based errors in the control condition. As regards the cognate conditions, form-based errors will tend to prevail over meaning-based errors (cf. Section 3.3.). If more form-based CLIN is found in *CogA* than in *CogB*, and if the RT data collected are shorter in the former than in the latter condition, then even a strong cognate effect could be postulated.

Apart from the RT and ER data, the experiment is also assumed to provide valuable information as regards the number of omissions. In keeping with the view of expert/novice differences presented in Chapter 3, the performance of the professionals will probably be characterised by an efficient processing of lexicosemantic information despite the fact that this directionality is never used in the CI practice. Thus, in case of problems with retrieving a given TL word, experienced interpreters are deemed likely to provide an approximate (i.e. semantically close) translation, whereas the remaining groups of participants (the control group in particular) may resort to omissions in that case.[74] Avoidance of omissions will be treated here as a manifestation of strategic processing, and the use of generalisations will be taken to constitute an acquired translation strategy.

4.4. Contrived tasks

For my research purposes, contrived tasks (cf. Chi 2006) are preferable to 'familiar' or 'intrinsic' tasks like SI or ST. The advantage of using contrived tasks such as translation recognition and translation production is that all groups of participants will be able to perform them relatively competently irrespective of the degree of CI experience they have. The reasons for this assertion are twofold. Firstly, it rests on the premise that translation is an innate skill (cf. Harris 1977; Harris and Sherwood 1978). Secondly, it is based on the obser-

[74] Omissions are regarded as an 'emergency strategy' (cf. Riccardi 2005).

vation that trilingual speakers are able to perform translation tasks without much difficulty even in the language directions in which they lack formal training (cf. Section 1.6. for relevant examples). The contention, therefore, is that translation tasks make it possible to investigate trilingual lexical processing in the most interesting directions (cf. Section 3.4.) while being much simpler to perform than simultaneous or sight interpreting.

In support of this contention, let us consider briefly two experiments conducted with bilingual and trilingual speakers respectively. In the first case (Christoffels et al. 2003) untrained participants were required to interpret simultaneously a manipulated text of about 4.2 minutes into their mother tongue. It is doubtful whether the results of that experiment may be related to the case of speakers trained in SI, particularly in view of the fact that the participants' performance was, in fact, rated rather poorly. In the second case (Phillipov 2007) SI and ST were used to investigate the performance of Russian-Hebrew-English CI students in two directionalities: C -> A and C -> B. In both interpreting modes, C -> B translation proved to be more difficult than C -> A translation, which serves to prove that investigations of trilingual interpretation in the former directionality demand substantial allocation of cognitive resources. The resultant mental fatigue may have a negative impact on the translation performance in other tasks or directions under investigation. Moreover, the complex nature of such tasks precludes comparisons with a control group. Therefore, psycholinguistic research methods such as word translation have been judged to provide a simpler means of testing such variables as the speed and accuracy of trilingual lexical processing.

Translation tasks may be taken to constitute a potential disadvantage particularly with regard to experienced conference interpreters because such tasks are not encountered in their everyday working environment. As pointed out by Ericsson and Smith ([1998]: 538), with unfamiliar tasks "we need to consider the possibility that the expert may resort to nonoptimal and unstable strategies that can be rapidly improved even during just a couple of sessions." However, the experimental design adopted in this work is considered unlikely to lead to practice effects: in the recognition task the participants make a total of forty decisions per translation direction, while in the production task they translate sixty Polish words into German. Moreover, even if practice effects occur, the experiments will still be considered successful "as long as the practice effects for the experts remain comparatively small and the performance of the experts remains reliably superior to those for novices" (Ericsson and Smith [1998]: 539). Bajo et al.'s (2000) study comprising lexical decision and semantic categorisation experiments serves to demonstrate that professional interpreters are able to show superior lexical and semantic processing skills in tasks which are not their daily intellectual staple. Therefore, we conclude that translation tasks offer a simple yet direct means of studying trilingual lexical processing in this study.

4.5. Transcoding vs. deverbalisation

It might be claimed that professional conference interpreters are so accustomed to deverbalise that they will be disadvantaged as regards the processing of the so-called 'direct lexical correspondences' in translation tasks. However, it will be argued in this section that professional conference interpreters use both transcoding and deverbalisation in their interpreting practice, and that neither transcoding nor deverbalisation should be viewed as isolable procedures. Both form- and meaning-based processing co-occur in translation and interpreting situations, and both of them contribute to overall performance efficiency.

'Transcoding' is a term which invokes negative associations in T&I studies because traditionally it refers to word-for-word translation procedures which tend to produce interference (cf. Lörscher 1991; Kussmaul 1995; Wilss 1996). In interpreting, "[a]t a phonetic, phonological, morphological, syntactic and semantic level, the two working languages (...) tend to short-circuit, and the overall message is not decoded at a cognitive level" (Fabbro and Gran 1994: 297). In contrast, in deverbalisation "the source language utterance is decoded until a non-linguistic meaning is abstracted, via phonological, morphological, syntactical and lexical semantic analysis. Subsequently, the abstracted non-linguistic meaning is encoded in the target language via lexical semantic, syntactical, morphological, and phonological processing steps" (De Groot and Christoffels 2006: 196; cf. Seleskovitch 1976, 1978; Lederer 2003). Thus, transcoding is traditionally associated with form-based processing while deverbalisation with meaning-based processing. As a rule, conference interpreters are encouraged to use deverbalisation to safeguard themselves against potential syntactic or lexical interference between the working languages (e.g. Gile 2003). Thanks to deverbalisation, interpreters become very adept at processing meaning which enables them to make the most appropriate linguistic choices in the target language (e.g. Schweda-Nicholson 1987).

While meaning- or sense-based translation is generally considered to be superior to transcoding, the present contention is that the latter procedure may have been underestimated by T&I scholars, and that the application of both procedures is justifiable, depending on the interpreting situation (cf. De Groot 1997, 2000; Setton 2003).[75] This train of thought may be traced to Levý's (1967) Minimax Principle (derived from Game Theory) according to which translators tend to keep to the more shallow, bottom-up processing rather than the deeper, top-down processing level so as to keep the cognitive burden as light as possible. In Interpreting Studies, a similar idea may be found. Already Gerver conceived of SI as a parallel online search process for matching linguistic items (i.e. decoding and encoding) across the two languages involved. In his view (Gerver 1976: 198), input has to be translated into some abstract form before restructuring it, but this process may "often be by-passed (…) by selecting frequently occurring surface correspondences." Professional interpreters may thus resort to form-based interpretation. Fabbro and Gran (1994: 297; cf. also Massaro and Shlesinger 1997) list situations in which interpreters are likely to follow this procedure. Similarly Setton (1999, 2003) speaks of 'lexical shortcuts' as an alternative processing route within his cognitive-pragmatic model of the SI process. By using lexical shortcuts, interpreters are able to transpose some SL fragments into TL on the basis of "ready-made lexical equivalents without contextualisation" (Setton 2003: 152). MacWhinney, although he asserts that conceptual structure forms the basis for interpretation, also considers transcoding to be a viable procedure in case of direct interlingual noun correspondences (1997: 230-231). Therefore, it appears that both processing routes are not only available (cf. Paradis 1984, 1994), but they are regularly applied in the interpreting practice.

Experimental support for the co-existence of form- and meaning-based translation procedures is furnished by the presence of the recency of form and cognate effects. Let us consider the following examples. Isham (1994) found that although interpreters recalled fewer sentence forms that bilingual listeners, they still had some information on the sentence form. Thus, no evidence for systematic deverbalisation could be shown.[76] Macizo and

[75] De Groot (1997, 2000) refers to transcoding as 'horizontal processing' (cf. Strategy II, Paradis 1994), and to meaning-based or conceptually mediated translation as 'vertical processing' (cf. Strategy I consisting of linguistic decoding and linguistic encoding, Paradis 1994; cf. also Gerver 1976).

[76] To be exact, the interpreters in Isham's (1994) study showed two different patterns of recall. Type I interpreters were more similar to the bilingual listeners in that they had higher verbatim recall (Isham concluded they followed the 'form-based' approach). Type II interpreters had poor verbatim recall, which led Isham to believe they followed the 'meaning-based' approach.

Bajo (2006) obtained a cognate effect in the performance of proficient Spanish-English translators and bilinguals who read sentences for repetition and for translation. Cognates in sentence-final position facilitated translation performance. A plausible explanation for the occurrence of the recency of form and cognate effects may be found in Christoffels and De Groot (2005). They claim that in meaning-based interpretation the exact form of the input may still reside in the input buffer and so it may influence the target language output, even though no transcoding takes place. Alternatively, while the input is being transcoded, it may also be simultaneously processed at a deeper level up to full comprehension, and thus resemble the comprehension resulting from pure meaning-based interpretation.[77] Either way, it is reasonable to assume that neither transcoding nor deverbalisation constitute distinct processing routes. Both procedures most probably co-occur depending on the situation, and together they contribute to efficient translation and interpreting performance. This assumption is supported by Gile's (2009: 239) observation that "whatever the theory, in their daily practice of interpreting, interpreters use direct lexical correspondences very often (…)." Thus, we conclude that professional conference interpreters need not be disadvantaged as regards the processing of 'translinguistic equivalences' or 'direct lexical correspondences' in translation tasks.

4.6. Single-word translation tasks

In the foregoing discussion we claimed that direct associative links exist in LTM between frequently co-occurring representations (e.g., translation equivalents, cf. Section 2.2.1.ff.). We have also assumed that the better the mental organisation of within-language and between-language representations, the more efficient the processing and retrieval of lexical information in online experiments (Section 3.2.). In this section we address questions related to the validity and applicability of single-word translation tasks to investigate the nature of lexical processing in trilingual speakers with varying degrees of CI experience.

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[77] Christoffels and De Groot (2005) suggest that if semantic and conceptual representations are distinguished, then transcoding need not take place solely at the lexical level. I believe their idea to be very useful but in empirical investigation of translation in a sentence context. As stated in Section 1.2., distinguishing between semantic and conceptual levels of representation is irrelevant in single word translation.

Single-word translation experiments might be criticised on the grounds that decontextualised words are devoid of their language-specific characteristics such as their morphological or syntactic features (Paradis 2007b). Applicability of results yielded by word translation studies might also be questioned based on the assertion that the operation of frequency, concreteness, context availability and imageability effects is likely to be distorted when words are presented out of context (Setton 2003; cf. also Shlesinger 2000b). While such concerns are understandable and valid, I share the view of De Bot (2000) that in translation and interpreting contexts, comprehension and production are basically lexically-driven processes, both of them relying on the speed of accessing and retrieving the relevant lexicosemantic information from the lexicon. Therefore, we concur with those researchers who maintain that single-word translation experiments are indispensable to subsequent investigations of lexical retrieval operations in a sentence context (De Groot 2000; Christoffels et al. 2003; cf. also Van Hell and De Groot 2008). Moreover, although results of word translation experiments cannot be generalised to the representation and processing of language as a system (i.e. the implicit grammatical properties of lexical items which are sustained by procedural memory), such experiments are perfectly legitimate to investigate the declarative (i.e. explicit) memory which stores spoken or written word forms and their default meanings (Paradis 2009: 188). By using RT-based research methods, it will be thus possible to gain an insight into the degree of interconnectivity of lexical and semantic/conceptual links between words in the trilingual mind. Moser-Mercer (1997a: 193-194) also points out that online paradigms are useful because they allow researchers to study the subcomponents of the interpreting process by granting them access to 'the primitive processes' taking place in the interpreter's black box.

While studies investigating the processing of single words tap into their declaratively stored forms and meanings, there are reasons to suppose that implicit processing might also be involved. This point is substantiated by research showing that implicit memory is implicated whenever priming at short stimulus-onset asynchronies (SOA) occurs (Squire and Zola 1996; McNamara 2005: 65-81; McDonough and Trofimovich 2009: 64ff.). Besides, access to explicit memory is automatic, even though the intention to access it is deliberate (Paradis 2004: 42). Therefore, it seems reasonable to assume that the participants will use both their explicit and implicit memory even when asked to process decontextualised words. As a result, the reaction time measurements obtained in the translation experiments will specify the speed of retrieval (implicit linguistic competence) of explicitly stored word forms and word meanings. The RT data will also serve to infer about the mental organisation of lexicosemantic information and the degree of interlingual connectivity in the case of speakers with varying degrees of CI experience. This is supported by Marian's (2008: 22) assertion that "the same behavioral measures (e.g., reaction times) can be used to make inferences about both representation and processing."

4.7. Is 'fast' automatic or controlled?

At this point in the discussion I would like to raise the question to what extent the speed of processing in single-word translation tasks can be related to automatic processing.

We have established (cf. Section 3.2.) that professional interpreting performance can be considered automatic insofar as it involves the application of well-rehearsed procedures and schemes to retrieve the relevant lexical items from LTM, but it is also subject to continuous monitoring and control processes. Thus, professional interpreters are thought to balance both types of processing to achieve the desired performance level. Yet, those considerations pertain to professional performance in a linguistic context wider than that of processing decontextualised words. In case of single-word translation, certain questions remain open. For example, let us suppose that in the translation recognition task some participants provide accurate responses and achieve remarkably short RT scores at the same time. Does it mean that they process lexicosemantic information automatically, i.e. without conscious control? Another issue to be resolved concerns CLIN. For example, let us consider the case of participants producing a target word in Polish -> German translation which is marked by a strong English-based interference of form. Should this effect be attributed to automatic processing (i.e. without attentional control), or should it be treated as an outcome of controlled processing during which a failure of the monitoring system occurred?

There is ample neurolinguistic evidence in favour of maintaining the distinction between the automatic (i.e. involuntary and unconscious) and the speeded-up but controlled (i.e. voluntary, conscious) processing, not the least of which is that both types of processing are sustained by different neural structures (cf. Paradis 2004, 2009).[78] For our purposes, the following arguments are particularly relevant. Firstly, it has been claimed that although automatic processing cannot be avoided, attention can be deployed consciously depending on the subject's intentions (Posner and Snyder 1975). Secondly, it has been suggested that attentional control is a skill which may be developed through practice (Gopher 1993; cf. also Styles 1997). In the Declarative/Procedural model (Paradis 2004, 2009), only controlled processing is attention-demanding, while automatic processes do not require attention. Thus, attention is a variable inherent in the declarative memory. Paradis also points out that application of efficient means of control can create an illusion of automaticity in the performance of a task. However, he argues that controlled processing allows changes of processing velocity to be made, while automatic processing does not.

The above arguments imply that speeded-up/controlled processing rather than automatic processing constitutes the best explanation of the origin of fast yet accurate lexical processing in translation. Therefore, after Paradis (2004, 2009), I regard monitoring and control procedures as referring to the level of attention devoted to the processing of declaratively stored information.[79] Priming, on the other hand, can be explained in a satisfactory manner only by assuming that the procedural memory is involved in that case (e.g. Squire and Zola 1996). Therefore, if a participant makes an incorrect decision in the recognition task (i.e. selects a form- or a meaning-distractor instead of the translation equivalent), it will mean that insufficient attention has been devoted to inhibit the activation of primed but incongruent representations. Likewise, in the case of translation production instances of CLIN will be treated as lapses in attention due to the intellectual strain of the task in hand. Although lexical access itself is automatic, the participants under my investigation are claimed to process the information they access either automatically or in a more controlled manner. Further to that, the retrieval of frequent translation equivalents is claimed not to be very attention-demanding. This claim dovetails with the terms and definitions provided by T&I scholars with regard to frequently encountered translation equivalents: 'automatisms in interlingual lexical access', 'coupled units', 'lexical shortcuts', '(near-)automatic lexical pairings', 'stock equivalents', and 'automation of useful Translinguistic Equivalences'

[78] Cf. Shriffin and Schneider (1977) and Schneider and Shriffin (1977) for a general theory of automatic and controlled processing.
[79] This view is also supported by Cowan's (2000/2001: 117) assertion that WM is as an activated portion of LTM which is the focus of attention and control processes.

(Toury 1995; Setton 2003; Shlesinger 2000a; Moser-Mercer et al. 2000; Chmiel 2004; Gile 2009). Our view is also congruent with the LT-WM theory (cf. Section 3.2.) which holds that the existence of strong links in memory permits automatic lexical retrieval (cf. Ericsson and Kintsch 1995).[80] We conclude that access to lexical representations is automatic, particularly in case of frequent 'direct lexical correspondences'. However, monitoring and control procedures may be applied to the subsequent processing of those representations in the WM.

4.8. Stimuli selection

A critical element in any research design is the selection of experimental stimuli, various characteristics of which could be theoretically manipulated to register a sizeable difference in the participants' translation performance. We concur with De Bot (2000) that word translation studies are best conducted in a laboratory situation where the operation of all sorts of variables and external influences can be controlled. Consequently, in this section the rationale is presented for selecting single content words which were controlled for their length, frequency, concreteness, and the number of translation equivalents.

It is common practice in psycholinguistic research to match experimental stimuli in terms of length and frequency (cf. Balota 1994; Balota et al. 2006). Therefore, in the translation recognition experiment, where predominantly the visual modality was explored, the stimuli have been matched in the number of letters. In the translation production experiment, which required the participants to provide oral renditions of visually presented words, the stimuli have been matched in the number of letters and syllables. The nouns used in both experiments were selected from the corpora of Polish, English and German words. Frequency counts for the Polish nouns were taken from the full online version of the *PWN (Polish Scientific Publishers) Corpus of Polish* consisting of 40 million words.[81] The frequency counts of the British words were taken from the *British National Corpus* consist-

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[80] In order to automatise lexical retrieval in interpreting contexts, some researchers suggest that CI trainees perform word translation tasks (De Groot 2000; Setton 2003).
[81] The reason for choosing the PWN Corpus over *Słownik frekwencyjny polszczyzny współczesnej* [Frequency dictionary of contemporary Polish] (Kurcz et al. 1990) was that solely the former included transcribed spoken texts similarly to the BNC Corpus and the German DWDS Corpus.

ing of 100 million words. Frequency counts for the German words were derived from the DWDS Corpus whose core version contains 100 million words.[82] All those corpora were balanced, synchronic collections of samples of written and spoken language.

It might be argued that frequency counts are an inadequate predictor of lexical availability, particularly in case of experienced conference interpreters whose lexical availability is likely to be "skewed in specialised domains" (Setton 2003: 149). Along similar lines, Gile (2009) maintains that lexical availability may be higher in a B language than in an A language in specific fields in which the interpreter has had more exposure. As a result, investigations of lexical retrieval based on corpus-based estimates would appear to comprise ecological validity. However, the present study is aimed at investigating lexical retrieval in psycholinguistic tasks rather than in interpreting performance *per se* (cf. Gile 1998). Therefore, I have adopted the methodological guidelines followed in psycholinguistic research where the use of corpus-based frequency counts for the purpose of investigating lexical representation and processing has a long history of its own (e.g., Balota and Chumbley 1984). Moreover, I would like to point out that the above-mentioned argument about individual differences in lexical availability might likewise be extended to the case of the trainee conference interpreters and the non-interpreting trilingual speakers. Therefore, basing the frequency estimates on corpora of samples of written and spoken language rather than on corpora of translated or interpreted texts is judged to have been a more satisfactory solution for my purposes.

Concrete words have been used because they correspond to shared meanings across languages, and so they activate the same referents at the conceptual level (cf. Section 1.5.). Moreover, as opposed to abstract words, concrete words tend to have only one translation (cf. Tokowicz et al. 2002). It was important to include stimuli whose translations were unambiguous and straightforward because translation latencies are known to be a function of the number of translation equivalents, longer latencies being evidenced when words in one language correspond to more than one alternative in the other language (Kroll and Dussias 2004). However, selecting words with a single or dominant translation equivalent is not an easy task. De Groot et al.'s (1994) study is the case in point. When Tokowicz and Kroll (2007) examined the experimental stimuli from De Groot's (1994) study, it emerged that

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[82] Given the difference in the size of the corpora, the frequency counts were normed to one million words.

the latter authors did not succeed in eliminating the multiple translation equivalents (approx. 38% of the concrete words used in that study had more than one translation in either one or in both translation directions). Therefore, in order to ensure that the stimuli selected for the translation production experiment had single or clearly dominant translation equivalents, a translation consistency pretest was conducted (Appendix B, p. 180). Twenty second year students recruited from the German Department of the Adam Mickiewicz University (AMU) were asked to translate into German the Polish stimuli whose translations in German were non-cognate with their English counterparts. In the experiment were included only those words which were translated in a consistent manner by at least 80% of the students.

The above considerations notwithstanding, there is evidence suggesting that the impact of ambiguity on the processing of concrete words in translation might not be so straightforward after all. To illustrate this point, let us consider the results of a study devoted to the effects of concreteness and ambiguity in English-Spanish translation of words with single (Exp. 1) and multiple (Exp. 2) translation equivalents (Tokowicz and Kroll 2007). Of particular interest to our discussion are the findings obtained in the second experiment where the ambiguity turned out to influence concrete and abstract words differently: concrete words were quite impervious to ambiguity whereas the ambiguous abstract words were translated more slowly than the unambiguous abstract words. It would appear, therefore, that the concreteness effect is especially robust for words with multiple rather than single translation equivalents, and that concrete words are unaffected by ambiguity in translation.[83] That finding is important because also in the present study, despite the outcome of the pretest referred to above, a few participants did translate some Polish stimuli in the translation production task differently from what had been expected. This was the case with the following four out of sixty words: *umowa – Vertrag* (alternative: *Kontrakt, Vereinbarung*); *liczba – Zahl* (alternative: *Nummer*), *rolnik – Bauer* (alternative: *Farmer, Landwirt*), *wieś – Dorf* (alternative: *Land*). The alternative translations have been accepted as correct even though some of them bear a clear formal resemblance to English and/or Polish words.

[83] From their third experiment (monolingual LDT) it seems that the interaction between concreteness and ambiguity reflects a general property of language processing: the effects of ambiguity were present only for abstract words and the concreteness effect was found only for words with one-meaning in translation (Kroll and Tokowicz 2007).

Finally, in view of the visual presentation of the experimental stimuli, care has been taken to reduce to a minimum the number of stimuli with diacritical marks. With regard to presenting experimental stimuli in the visual modality, Setton (2003) has argued that this procedure is at odds with the predominantly oral input mode in interpreting, and that its use should be discouraged in word translation tasks because it may lead to formal interference. However, I would like to claim that the form-based interference effect will be the least pronounced in the case of the professional conference interpreters. They are assumed to be comparatively impervious to form-based CLIN because they have had the most experience in processing the visually presented information in their interpreting practice (e.g. SI with text or sight translation).

4.9. Conclusions

Having discussed the most important issues related to the validity of online translation experiments based on single words, we conclude that this paradigm constitutes a simple yet viable means of investigating the speed and accuracy of retrieval of lexicosemantic information from the mental lexicon. Our assumption throughout has been that the mental lexicon, akin to a connectionist network, can be trained by a selective weighing of paths and connection strengths. Therefore, we have claimed that differences in the organisation of knowledge representations due to individual linguistic experience will be observed in online translation tasks. This is consistent with Moser-Mercer's (1997b: 257-258) assertion that "[k]nowledge organization does correlate with reaction time, and influences the interpreting process already at the level of word recognition." Also Cowan has pointed out that RT-based research is able to reflect "the speed with which information can be transferred from memory into the focus of attention" (Cowan 2000/2001: 133).

We have argued here and elsewhere (mainly in Chapter 2) that translation recognition and translation production used in combination will make it possible to carry out a thorough examination of the bottom-up and top-down processing of single words. Both experiments are concerned with the processing of words which have only one or a clearly dominant single translation equivalent because we have assumed that their processing will require the activation of relatively direct interlingual form and meaning mappings (e.g. Ericsson and Kintsch 1995).

Although online translation experiments cannot be said to investigate organisation and representation of language as a system, the data from those experiments can be considered legitimate as regards the processing and retrieval of declaratively stored word forms and word meanings. Results of online translation experiments can also provide an insight into the degree of interconnectivity of lexicosemantic information in the mental lexicons of the three participating groups. As has been claimed throughout this work, the strength of associative links between representations within and across the language-specific subsets will vary relative to the amount of CI practice. Likewise, the degree of involvement of controlled processing mechanisms will not only depend on the actual requirements encountered at a given stage of lexical processing, but also on the degree of CI experience.

Thus, the professional conference interpreters are hypothesised to be experts at separating and controlling their languages due to the specific nature of CI practice, while the interpreting students are supposed to be well on the right track to attain proficiency as far as the monitoring of their language output is concerned. Both groups of participants with CI experience are thus likely to outperform the control group with regard to the efficiency of the monitoring mechanisms. The non-interpreting trilingual participants are hypothesised to lack sufficiently strong control mechanisms to prevent the selection of inadvertent output in translation recognition or production, i.e. to suppress competing lexical representations both intra- and interlingually.

E-Prime has been used to furnish data about errors and omissions as well as the exact measurements of the participants' response times (cf. Schneider et al. 2002). In the following chapter the data obtained will be analysed from the point of view of the speed and accuracy of lexical retrieval.

Chapter 5: Trilingual lexical processing in translation tasks

5.1. Introduction

In this chapter the results of investigation of the performance of professional conference interpreters (PRO), conference interpreting students (CIS), and non-interpreting trilingual controls (TRI) will be presented and discussed. These consisted of two experiments concerned with (i) translation recognition (C -> A; C -> B) and (ii) translation production (A -> C).

The experiments were aimed to examine the between-group differences in the speed and accuracy of lexical retrieval for participants with A: Polish, B: English, C: German. In accordance with the predominantly connectionist/dynamic approach to the mental lexicon and processing, interpreting practice, and directionality in particular, was expected to influence the cognitive make-up of PRO (and most probably also CIS) to a greater extent than the close lexical affinity existing between the foreign languages in question. The latter factor was hypothesised to have a significant bearing on the translation performance of TRI.

5.2. Participants

All subjects had normal or corrected-to-normal visual acuity, and were right-handed.[84] Polish was their native language. Of their two foreign languages, English was the first and German was the second strongest and most frequently used language (there were no sig-

[84] This was important because the participants' decisions were recorded with millisecond accuracy and I did not want any participant to be disadvantaged in any way.

nificant between-group differences in the self-rated competence in speaking, listening and reading in those two languages, $p > .05$). In PRO, a few participants reported having learnt another C-language after German, but none of those extra languages was related to German. In CIS, all students reported having some, mostly basic, competence in Dutch which they acquired after German as their fourth or subsequent language.[85] In all groups, a number of participants reported they spoke other languages apart from English and German, but none of them was a Germanic language.

5.2.1. Professional conference interpreters (PRO)

Twelve professional conference interpreters (four female, eight male) took part in the experiments. Among them there were nine staff and three freelance interpreters. Seven interpreters worked only for the European Commission, two interpreters solely for the European Parliament, while the remaining three worked for both those institutions. Their average age was 35.4 ($SD = 3.7$). They started learning English when they were 9 years old (SD 1.9) and German when they were about 16 years old ($\bar{x} = 15.8$ years, $SD = 2.9$). Their competence in German, assessed by means of the *Goethe-Institut German Placement Test*, was equivalent to CEFR level C2 (mean score: 90.6%, $SD = 5.3$).[86] In addition, the interpreters were asked to complete a language experience and proficiency questionnaire (provided in Appendix A, p. 176) in which they reported to interpret from their C-language for about 2.7% of their time ($SD = 3.0$), and to work in retour about 9.9 % of their time ($SD = 5.5$).[87] They were moreover asked to rate their competence in English and in German on a 7-point scale (where 1 indicates a very poor level of competence and 7 a very good one). As expected, they reported being more competent in English (speaking: 6.6, $SD = .4$; listening: 6.9, $SD = .2$; reading: 6.9, $SD = .2$) than in German (speaking: 4, $SD = 1.2$; listening: 6, SD

[85] Their mean self-rated competence in Dutch was quite low: speaking 2.1 ($SD = 1.6$), listening 2 ($SD = 1.1$), reading 3 ($SD = 1.6$).
[86] The test is provided in Appendix A, p. 176.
[87] These are very rough estimates as the interpreters found it difficult to provide average daily statistics.

= .8; reading: 5.6, *SD* = .7).[88] Paired samples tests revealed that difference to be statistically significant ($p < .05$).[89]

5.2.2. Conference interpreting students (CIS)

The twelve conference interpreting students (eleven female, one male) who took part in the experiments were in their final semester of the two-year Conference Interpreting Programme at the School of English, AMU. Their average age was 24.8 (*SD* = 2.7). Their mean age of L2 acquisition was 7 years (*SD* = 2.2) and their mean age of L3 acquisition was 12.9 years (*SD* = 3). Their competence in German was equivalent to CEFR level C1 (mean score: 76.1%, *SD* = 9.4). Based on the syllabus of the conference interpreting programme, it seems that CIS had a substantial amount of retour practice and C->A interpretation training: the total ratio of B -> A interpretation vs. A -> B interpretation vs. C -> A interpretation during the four-semester Programme (about 1400 hours of instruction) is as follows: 1: 1: .36. CIS reported to use German 6.6% of their time (*SD* = 5.4) in all daily activities combined. Three students reported having lived in a German-speaking country (from 5 months to 1 year). CIS also reported being more competent in English (speaking: 6.8, *SD* = .4; listening: 6.8, *SD* = .4; reading: 7, *SD* = .1) than in German (speaking: 4.9, *SD* = .9; listening: 5.3, *SD* = .9; reading: 5.5, *SD* = .9). Paired samples tests revealed that difference to be statistically significant ($p = .000$).

5.2.3. Control group (TRI)

Fourteen trilingual students (ten female, four male) took part in both experiments as the control group.[90] They were all English Philology students at AMU. Their average age was

[88] Participants' self-rated writing competence scores are not reported here because they are deemed irrelevant to the present study.
[89] Due to differences in the type of language experience and time constraints, the questionnaire provided in Appendix B was abridged and slightly altered for the PRO group.
[90] In fact, at the outset of the study the control group consisted of twenty-six trilingual non-interpreting students. However, twelve students (10 female, 2 male) were excluded from the experiment because their accuracy rates in the translation production task were below 80% despite the fact that they achieved relatively high scores in the German proficiency pretest.

25 (*SD* = 3.6). Their mean age of L2 acquisition was 7 years (*SD* 2.9) and their mean age of L3 acquisition was 12.7 years (*SD* = 2.9). Participants' competence in English was not assessed before the experiments because it was assumed that the strict enrolment and evaluation procedures at the School of English, AMU, ensured an advanced L2 proficiency. Their competence in German was equivalent to CEFR level C1 (mean score: 80.2%, *SD* = 9.0). TRI reported to use German 6.8% of their time (*SD* = 4.6) in all daily activities. Fisher's LSD test revealed that TRI did not differ from CIS in this respect ($p > .05$). Two students reported having lived in a German-speaking country (from 3 to 6 months). Similarly to the previous groups, TRI reported to be more competent in English (speaking: 6.7, *SD* = .5; listening: 6.6, *SD* = .7; reading: 6.9, *SD* = .4) than in German (speaking: 4.8, *SD* = 1.1; listening: 5.4, *SD* = 1; reading: 5.4, *SD* = .8). Paired samples tests showed that difference to be statistically significant ($p = .000$). The control group was found not to differ from TRI in any of the factors listed in Table 3.

Table 3. CIS vs. TRI: independent samples test results.

	t	*df*	sig.(2-tailed)	mean difference	*SE* difference	95% CI	
						upper	lower
age	.13	24	.9	.17	1.28	-2.47	2.81
EN_Exp	.12	24	.9	.17	1.36	-2.64	2.98
DE_Exp	.2	24	.85	.37	1.87	-3.48	4.22
DE_Test	1.14	24	.27	1.24	1.09	-1.0	3.48
EN_R	-.90	24	.38	-.1	.11	-.33	.13
EN_S	-.66	24	.52	-.11	.17	-.47	.24
EN_L	-.80	24	.43	-.19	.24	-.68	.3
DE_R	-.19	24	.85	-.07	.34	-.77	.63
DE_S	-.23	24	.82	-.09	.39	-.89	.71
DE_L	.06	24	.95	.02	.38	-.75	.8

Note. EN_Exp = number of years of experience with English, DE_Exp = number of years of experience with German, DE_Test = German proficiency test score, R, S, L = self-assessed proficiency in reading, speaking, listening.

5.3. Experiment 1: translation recognition

We established that translation recognition entails the bottom-up processing of the visual input, the activation of the appropriate translation equivalent (i.e. by selecting the relevant interlingual form- and meaning-representations while inhibiting the irrelevant representations) and, finally, the decision-making stage (cf. the BIA+ and the MIA models). Although no direct phonological activation occurs, there is evidence suggesting that the reading of written words involves the orthographic and the phonological code.[91] Subsequently, the word-form representations of a given pair of words map onto a set of semantic feature nodes (cf. the DFM, Section 1.5.). If considerable semantic overlap is found, then the two words in question presumably constitute the translation equivalents. In contrast, if none or little semantic overlap is found, the said two words most probably are not a translation pair. A positive decision is based on attaining a high level of activation by a given shared set of nodes, a negative decision being determined by a relatively low level of activation of the given set of nodes.

We assume that the participants will establish some ad hoc task schemata (cf. Section 2.3.3.) during their translation recognition performance to streamline the activation and inhibition of relevant interlingual links. In accordance with the connectionist/dynamic view of mental lexicon and processing, we hypothesise the concurrent activation of word forms (i.e. form priming) and word meanings (i.e. semantic priming) which are related to the form or meaning of the true translation equivalent (cf. Neely 1991; Zwitserlood 1996; Forster 1999; McNamara 2005; McDonough and Trofimovich 2009). If the form and meaning distractors are rejected, it means that their activation thresholds are probably higher than the activation thresholds of the true translation equivalents. Automatic suppression of the incongruent form or meaning representations may thus occur already within the language-specific subsets(cf. the ATH, Paradis 2004). Alternatively, the participants can consciously suppress the competing representations at the level of the task/decision system, and thus also direct processing along the right paths (cf. the BIA+; De Bot 2000). If the attentional control of the output from the word identification system is deficient, incorrect decisions are likely to be made in translation recognition.

[91] Grainger et al. (2006) found that phonology influenced lexical processing approx. 250 ms post-target onset.

As opposed to the non-interpreting trilinguals, the participants having CI training and experience are assumed to have a stronger network of interlingual form and meaning connections between German and Polish than between German and English. Thus, they are expected to be able to identify the correct translation pairs in German -> Polish translation recognition more efficiently (faster and more accurately) than TRI. Expertise in CI is moreover assumed to lead to a more efficient processing of meaning information in that particular direction. TRI, as opposed to PRO and CIS, are assumed to have retained stronger interlingual lexicosemantic links between their two foreign languages. As a result, they are expected to find it more troublesome to reject the form- and meaning-distractors in German -> English translation recognition.

5.3.1. Research hypotheses

Hypothesis 1a. PRO will have faster RTs and a lower error rate (ER) in identifying the correct translation pairs (*tr*) in C -> A translation recognition than in C -> B translation recognition;

Hypothesis 1b. PRO will outperform CIS and TRI in terms of speed and accuracy in identifying the correct translation pairs (*tr*) in C -> A translation recognition;

Rationale: Professional interpreters are accustomed to working from German into Polish. They are therefore hypothesised to be able to access and retrieve lexicosemantic information in that direction in an efficient manner (i.e. they will have a directionality advantage). If this is the case, then PRO will identify the correct translation pairs in C -> A translation recognition faster and more accurately than in C -> B translation recognition. PRO are also hypothesised to outperform CIS and TRI as regards the speed and accuracy of identifying the correct translation pairs in translation recognition from German into Polish.

Hypothesis 2. As opposed to TRI, the performance of PRO and CIS in C -> A translation recognition will be faster and more accurate than in C -> B translation recognition across all three conditions investigated (*tr, f, sem*);

Rationale: This hypothesis is based on the argument that CI practice leads to a faster and more accurate processing of lexicosemantic information from German into Polish than could ever be achieved in the ordinary language learning context. Thus, PRO and CIS will be able to identify the correct translation pairs and reject the form- and meaning-related distractors faster and more accurately in C -> A than in C -> B translation recognition. In contrast to PRO and CIS, TRI have developed and strengthened their lexicosemantic links between German and Polish in language learning situations only. Therefore, TRI are hypothesised to perform more slowly and less accurately in C -> A translation recognition than their interpreting counterparts. If *Hypothesis 2* were to be rejected for CIS, one could argue that they have not yet reorganised their interlingual lexical links to attain the ability level indispensable for an efficient recognition of the correct and incorrect translation equivalents from German into Polish.

Hypothesis 3. PRO will reject meaning-related distractors (*sem*) in C -> A translation recognition faster and with greater accuracy than CIS and TRI;

Rationale: Expert conference interpreters, as opposed to CI trainees or individuals without CI experience, are hypothesised to exhibit the most efficient semantic information processing ability.

Hypothesis 4. As opposed to PRO and CIS, TRI will have longer RTs and a higher error rate rejecting the form- and meaning-related distractors (*f* and *sem* respectively) in C -> B translation recognition;

Rationale: TRI are assumed to have retained stronger lexicosemantic links between their foreign languages than PRO and CIS. The participants with CI experience, on the other hand, are argued to have reorganised their mental lexicons so as to support fast and accurate lexical processing in CI contexts. Therefore, PRO and CIS may not necessarily outperform TRI as regards the speed of rejecting the form- and meaning-related distractors in C -> B translation recognition. However, the participants with CI experience are assumed to be quite skilled in the application of efficient control and monitoring mechanisms to suppress the activation of competing form- and meaning representations even regardless of directionality. As a result, the potential for form- and meaning-based CLIN to occur in C -> B translation recognition is hypothesised to be higher in TRI than in PRO or CIS.

5.3.2. Method

In the translation recognition task, the participants were required to decide whether the second of the two words presented sequentially on the computer screen was a correct translation of the SL word. SL words appeared in one out of the three possible conditions: they were followed either by a true translation equivalent (*tr*), or a form-related distractor (*f*), or a meaning-related distractor (*sem*). Additionally, in order to counterbalance the number of incorrect translations, ten correct translation pairs were added as fillers (they bore neither formal nor semantic resemblance to the experimental stimuli employed in the present work). The stimuli in *tr, f* and *sem* conditions were matched in length (letters), frequency and concreteness. The filler items were matched as closely as possible in length and concreteness to the experimental conditions.

Six stimuli lists were created per translation direction. Each list consisted of ten true translation equivalents (*tr*), ten form-related distractors (*f*), ten meaning-related distractors (*sem*), and ten filler items (*flr*). Thus, in each list there were twenty correct translation pairs and twenty incorrect translation pairs. The participants made a total of forty decisions per translation direction. Experimental stimuli were randomised within those lists that were moreover counterbalanced across the participants. As a result, even though all participants were exposed to the same stimuli, they processed them in different conditions and different translation directions.[92] The form and meaning related conditions were compared with the true translation conditions as regards their respective reaction time and accuracy data.

5.3.3. Apparatus and procedure

The translation recognition task was conducted in two separate sessions: from German into Polish (C -> A) and from German into English (C -> B). The order of sessions was coun-

[92]The filler items were uniform across the stimuli lists in a given translation direction.

terbalanced across the participants but translation recognition always preceded translation production.

The participants were tested individually in a dimly lit and sound attenuated room. They were all seated in front of a computer, the viewing distance not being controlled during that experiment. Care was taken to put the subjects into the C-language mode.[93] Throughout the entire experiment all communication took place in German. A native or a native-like speaker of German's task was to ensure that the C language of the participants was activated sufficiently for the purpose of the experiment.[94] The participants read aloud in German the instructions for both experiments that were displayed on the computer screen (the said instructions are provided in Appendix C, p. 182). They were also asked additional questions in German in order to confirm that they had understood the instructions correctly. Apart from activating German, which was crucial to the experiment, the above-mentioned steps were also intended to alleviate the possible occurrence of task anxiety on the part of the participants.

Practice blocks of five trials each were run prior to the commencement of the respective experimental sessions. Within each trial the participants first saw for 500ms a fixation point (a cross) in the centre of the computer screen. Immediately after its offset, a German word was presented. The German word disappeared after 300ms, whereupon a second word appeared in its place.[95] The participants were asked to press '1' when they thought that the second word was a correct translation of the German word, or to press '0' when they thought that the second word was not a correct translation of the German word. The second word was displayed on the screen until a response was provided. If a response was not provided within 4000ms, the next trial was triggered off automatically. Response latencies were measured to the nearest millisecond starting from the appearance of the second word on the screen to the time when the given subject pressed the response key. All

[93] According to Grosjean (2001), the relative activation of languages is very sensitive to participant intentions/expectations and details of the experimenter's instructions. Dijkstra and Van Hell (2003) questioned the language mode framework by claiming that the language mode variations are difficult to observe. However, they only tested language mode in bilingual word association and lexical decision (unlike e.g. Dewaele 2001).

[94] For practical reasons, I was not assisted by a speaker of German in Brussels, but my proficiency in German (CEFR level C2; numerous prolonged stays in German-speaking countries) was sufficient to activate the participants' C-language.

[95] The stimulus-onset asynchrony was thus too short for the translation to be generated by the participants before the second word appeared, but it was long enough for the first word to have been recognised by them (e.g. De Groot and Comijs 1995).

stimuli were presented in white uppercase Courier New font 30 centred on the computer screen against a navy blue background. Stimuli presentation, the recording of reaction times, and the collection of error data were controlled by *E-Prime* Ver. 2.0 (Psychology Software Tools, Inc.), run on a DELL laptop computer. The entire experiment lasted for about 10 minutes.

Experiment 2 (see Section 5.4. for details) was started on the completion of the above described experimental session. After both experiments were completed, the participants were handed over a post-experimental questionnaire designed to determine the extent of their familiarity with the experimental stimuli to which they had just been exposed. The participants were asked to mark (underline or cross out) the words they did not know.[96]

5.3.4. Results

The ANOVA mixed design test was applied for the translation direction (2) and condition (3) as the within-subjects factors, the subject group (3) constituting the between-subjects factor. A series of t-tests was also performed on the data collected in that experiment.

It had to be ascertained beforehand whether significant differences in RTs and ERs were to be found for the individual conditions and translation directions investigated in the present experiment. Mean RTs were calculated for three conditions (i.e. true translation, form-related distractor, meaning-related distractor) in both translation directions (German -> English and German -> Polish). Any and all erroneous responses and outliers (i.e. responses exceeding two standard deviations around the mean) as well as those words which were unfamiliar to the participants were neglected when calculating the said mean values of the RTs. The relevant descriptive statistics are provided in Table 4.

[96]On the basis of the stimuli familiarity post-test, items marked by individual participants' as unknown to them were excluded from further analyses.

Table 4. Descriptive statistics: conditions for both translation directions.

	mean RT	*SD*	*SE* mean
trCA	796.97	233.45	37.87
trCB	868	228.46	37.06
fCA	975.05	300.92	48.82
fCB	1 076.37	333.15	54.04
semCA	1 023.79	292.42	47.44
semCB	1 163.42	353.71	57.38

The data indicate that the mean RTs for the true translation conditions in both directions were shorter than the mean RTs in the form-related conditions, the latter of which being in turn shorter than the mean RTs obtained for the meaning-related conditions. Moreover, mean RTs were found to be always shorter in C -> A translation recognition than in C -> B translation recognition. In order to verify whether these relations were statistically significant, t-tests were conducted on the paired samples. The data obtained are listed in Table 5.

Table 5. T-test results for paired samples: conditions for both translation directions.

	t	*df*	sig.(2-tailed)	mean difference	*SD*	*SE* mean	difference	
							upper	lower
trCA – trCB	-1.4	37	.04	-71.03	205.22	33.29	-138.48	-3.57
fCA – fCB	-2.36	37	.02	-101.32	264.78	42.95	-188.35	-14.29
semCA – semCB	-2.79	37	.01	-139.63	308.97	50.12	-241.19	-38.08

The results presented above indicate that the differences in RTs between the two translation directions across the three conditions were significant. In addition, multivariate tests were conducted. There was a predominant effect of translation direction on the response times, $F(1,37)=12.4$, $p = .001$. There was also a significant effect of condition on the response times, $F(2,36)=46.08$, $p = .000$.

These RT results enabled the following conclusions to be drawn:

1) the true translation condition was the shortest, the form-related condition was longer, and the meaning-related condition was the longest;
2) translation recognition from German into Polish took less time than translation recognition from German into English (cf. Table 7 for details).

Error data analysis yielded the following results: the mean number of errors in both translation direction was very low; in *tr* it amounted to .71 (*SE*= .1), in *f* to 1.21 (*SE*= .09), and in *sem* to 1.41 (*SE*= .14), respectively. The pairwise comparisons of the number of errors across the three conditions investigated showed that the number of errors in *tr* differed from the number of errors in *f* and *sem* (p = .000 and p = .001 respectively). However, the difference in the number of errors across the two translation directions turned out to be insignificant (p = .197).

The analysis of ER results resulted in the following conclusions:

1) the lowest number of errors was found for the true translation condition; more errors were found in case of the form-related condition, while the highest number of errors was noted for the meaning-related condition, $F(2,36)=9.67$, p = .000;
2) the interaction between the number of errors and translation direction failed to reach statistical significance, $F(1,37)=3.53$, p = .068, despite there being more errors in C -> B than C -> A translation recognition performance (cf. Table 8 for details).

Consequently, the RT and error data were analysed separately for each participant group, with due attention to the individual experimental hypotheses put forward in Section 5.3.1.

5.3.4.1. Hypothesis 1

Hypothesis 1 predicted that PRO would outperform the remaining groups (RT and ER) in identifying the correct translation pairs in C -> A than in C -> B translation recognition. RT and ER results for PRO in *trCA* are presented in Table 6.

Table 6. PRO: RT and ER paired samples results in trCA.

		mean	*SD*	*SE* mean	mean difference	*t*	*df*	difference		Sig.
								upper	lower	(2-tailed)
RT	trCA	704.5	77.66	22.42	-	-	-	-	-	-
	trCB	873.5	206.87	59.72	-	-	-	-	-	-
	trCA – trCB	-	164.87	47.59	-169	-3.55	11	-273.75	-64.25	.005
ER	trCA	.25	.45	.13	-	-	-	-	-	-
	trCB	.67	.78	.22	-	-	-	-	-	-
	trCA-trCB	-	.9	.26	-.42	-1.6	11	-.99	.16	.137

From the paired samples test results presented above, it can be seen that PRO had faster RTs in *trCA* than in *trCB* (p = .005). This is in accordance with *Hypothesis 1a.* However, that same hypothesis predicted PRO would also have a lower error rate when identifying the correct translation pairs in C -> A than in C -> B translation recognition. This was not confirmed (p = .137). *Hypothesis 1a* was thus corroborated only with respect to the RT data.

In order to test *Hypothesis 1b*, Fisher's LSD test was conducted. PRO did not outperform CIS in terms of the speed of lexical retrieval in *trCA*, p = .065, *SE* = 93. Still, PRO managed to outperform CIS in terms of accuracy, p =.029, *SE* = .29. However, contrary to what was hypothesised, PRO did not outperform TRI in terms of speed (p = .279, *SE* = 89.87) or accuracy (p = .109, *SE* =.28). *Hypothesis 1b* was thus corroborated for PRO and CIS only, and that exclusively with respect to accuracy scores. Figure 14 illustrates the RTs data for the three subject groups studied in the critical *trCA* condition.

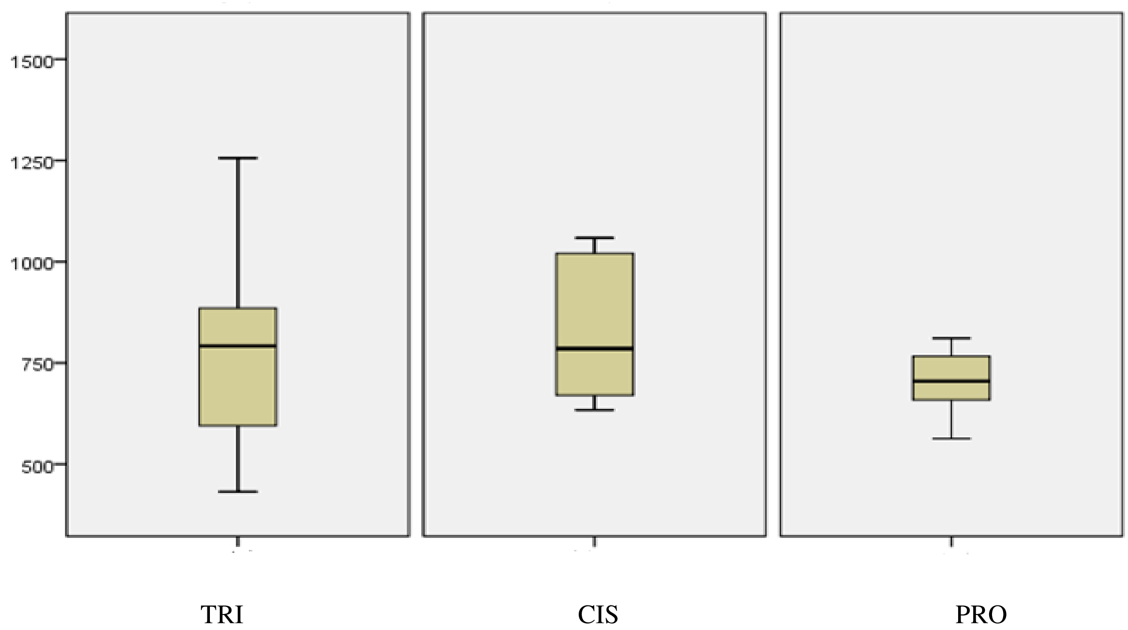

Figure 14. RT data for *trCA* across the three participant groups.

In the box-whisker plots obtained it can be observed that the whiskers for TRI are markedly longer than those for PRO whose RT data are distributed very evenly.[97] This is because there were greater RT disparities in TRI than in the remaining groups of participants. In particular, two female participants in TRI achieved consistently shorter RTs than the rest of their group.[98] In order to check whether their RT data skewed the results of the whole group, a simulation test was conducted in which the data collected from the two participants in question were discarded. However, no significant impact on overall group results was found to exist.[99]

[97]In the box-whisker plots, horizontal lines indicate the medians, boxes indicate the interquartile ranges, and whiskers depict the minimum and maximum values (cf. Myatt 2007: 46-47).

[98]Reaction times were qualified as outliers only when participants' responses to individual stimuli exceeded two standard deviations around the mean.

[99] The two female subjects in TRI either had an exceptionally good day in terms of performance or they generally had very quick computer reflexes. No computer reflex test had been administered prior to the experiment to eliminate the potential influence of that confounding variable.

5.3.4.2. Hypothesis 2

Hypothesis 2 stated that in PRO and CIS, as opposed to TRI, C -> A translation recognition would be faster and more accurate than C -> B translation recognition across all three translation conditions. However, ANOVA results showed the between-group RT differences to be statistically insignificant in either translation direction across all conditions investigated. The relevant data are listed in Table 7.

Table 7. RTs across the participant groups as a function of translation direction and condition.

RT	PRO			CIS			TRI			*df*	*F*	Sig.
	mean	*SD*	*SE*	mean	*SD*	*SE*	mean	*SD*	*SE*			
trCA	704.5	77.67	22.42	882	285.58	82.44	803.36	257.65	68.86			
between groups	-	-	-	-	-	-	-	-	-	2	1.82	.177
trCB	873.5	206.87	59.72	893.42	135.25	39.04	841.5	308.99	82.58			
between groups	-	-	-	-	-	-	-	-	-	2	.16	.849
fCA	939.42	265.68	76.69	971.92	226.65	65.43	1 008.29	390.07	104.25			
between groups	-	-	-	-	-	-	-	-	-	2	.16	.851
fCB	1 101.92	333.22	96.19	1 076.58	311.7	89.98	1 054.29	372.29	99.5			
between groups	-	-	-	-	-	-	-	-	-	2	.06	.939
semCA	966.58	237.67	68.61	1 086.33	321.88	92.92	1 019.21	318.2	85.04			
between groups	-	-	-	-	-	-	-	-	-	2	.49	.616
semCB	1 256.25	273.35	78.91	1 092.58	247.09	71.33	1 144.57	477.74	127.68			
between groups	-	-	-	-	-	-	-	-	-	2	.66	.522

The ANOVA test performed on the error data obtained also did not show any significant between-group ER differences in either condition for both translation directions investigated. A summary of relevant data is given in Table 8.

Table 8. ER across the participant groups as a function of translation direction and condition.

ER	PRO			CIS			TRI			*df*	*F*	Sig.
	mean	*SD*	*SE*	mean	*SD*	*SE*	mean	*SD*	*SE*			
trCA	.25	.45	.13	.92	.9	.26	.71	.73	.19	2	2.74	.079
between groups	-	-	-	-	-	-	-	-	-			
trCB	.67	.78	.22	.67	1.23	.36	1	1.11	.3	2	.44	.649
between groups	-	-	-	-	-	-	-	-	-			
fCA	1.17	.94	.27	.92	.79	.23	1.14	.86	.23	2	.31	.736
between groups	-	-	-	-	-	-	-	-	-			
fCB	1.42	.51	.15	1.25	.45	.13	1.36	1.15	.31	2	.13	.875
between groups	-	-	-	-	-	-	-	-	-			
semCA	1	1.04	.3	1.17	1.27	.37	1.64	1.22	.32	2	1.05	.36
between groups	-	-	-	-	-	-	-	-	-			
semCB	1.08	1	.29	1.33	.65	.19	2.07	1.44	.38	2	2.87	.07
between groups	-	-	-	-	-	-	-	-	-			

On the basis of the data listed in the above Table, *Hypothesis 2* could not be confirmed.

5.3.4.3. Hypothesis 3

Hypothesis 3 predicted that PRO would reject meaning-related distractors in German -> Polish translation recognition (*semCA*) faster and with a greater accuracy than CIS and TRI. This hypothesis could not be confirmed by the RT data (p = .616) and the ER data (p = .36) obtained.

5.3.4.4. Hypothesis 4

Hypothesis 4 stated that, as opposed to PRO and CIS, TRI would have longer RTs and a higher ER in rejecting the form- and meaning-related distractors in C -> B translation recognition. This hypothesis was not confirmed by the data presented in Table 7 and Table 8 above. However, post-hoc analysis of error data (LSD test) revealed that TRI were outperformed by PRO in the meaning-related condition for German -> English translation recognition (*semCB*), *p* = .029, *SE* = .43. This finding partly corroborated *Hypothesis 4*. PRO were thus found to process meaning information with greater accuracy than TRI despite the fact that PRO do not use that directionality in their interpreting practice.

Summing up, *Hypothesis 1a* was partly confirmed: PRO were indeed faster in in German -> Polish than in German -> English translation recognition as regards making decisions in the true translation condition (*p* = .005), but ER differences between the two translation directions were insignificant. *Hypothesis 1b* was also partly confirmed, i.e. as opposed to CIS, PRO were more accurate (but not faster, although *p* = .065 is close to significance) in translation recognition in *trCA* (*p* = .029). Finally, *Hypothesis 4* was confirmed only with respect to accuracy scores when processing meaning-related distractors in German -> English translation recognition, i.e. TRI were found to perform worse than PRO (*p* = .029). On the basis of the data available, the remaining hypotheses could not be upheld since: (i) PRO and CIS were neither faster nor more accurate than TRI across all three conditions investigated (*tr, f, sem*) in C -> A translation recognition as opposed to C -> B translation recognition (*Hypothesis 2*), and (ii) PRO were not more efficient than CIS and TRI when it came to rejecting the meaning-related distractors in German -> Polish translation recognition (*Hypothesis 3*).

5.4. Experiment 2: translation production

We agree with Kroll et al. (2010: 373) that translation production is "an interesting task in the sense that it combines features of word recognition and production, since a word is the event that initiates speech planning." In the foregoing discussion, we established that, in contrast to translation recognition, conceptual memory is directly implicated in translation production. Depending on concept selection, the lexicon of the output language is activated, whereupon the form of an appropriate lexical entry is accessed and passed on to the production stage (cf. the RHM, Section 1.4. and De Bot's Multilingual Processing Model, Section 2.3.3.).

We assumed that, although translation production does not involve such a strong bottom-up processing component as translation recognition, competing form- and meaning-representations may nevertheless be activated if they are strongly associated with a given SL or TL word. In case of insufficient inhibition (either within- or across subsets), errors will occur in the TL output. We hypothesised that A -> C translation production would be quite taxing in terms of inhibitory control, particularly when the German translation of a Polish word would be cognate with its English counterpart.

PRO (and most probably also CIS) are nevertheless hypothesised to be able to retrieve lexical items faster and more accurately than TRI also in A -> C translation production despite the fact that this direction is not actually used in interpreting practice. This is because the subjects having CI training and experience are assumed to be more adept at processing meaning information, and more resistant to B-based interference (by virtue of their efficient inhibition/suppression mechanisms). Due to the sequence of language acquisition and the likely impact of cross-linguistic similarity on the preservation of close lexical links between the L2 and the L3, the control group are assumed to possess stronger lexicosemantic links between English and German than between Polish and German. They are therefore hypothesised to be especially prone to L2-based influence in German translation production. The latter argument is also bolstered by the fact that TRI had not been trained to apply inhibition/suppression mechanisms in translation production to the same extent as their interpreting counterparts.

5.4.1. Research hypotheses

Hypothesis 1a: PRO will outperform CIS in German translation production as regards the speed of reaction times while making the smallest number of errors and omissions (OS) in all experimental conditions (*CogA, CogB* and *ctrl*);

Hypothesis 1b: The translation performance of PRO will surpass that of TRI as regards RT, ER and OS in all experimental conditions (*CogA, CogB* and *ctrl*);

Hypothesis 1c: CIS will perform better than TRI in RT, ER and OS scores in all experimental conditions (*CogA, CogB* and *ctrl*);

Rationale: It is hypothesised that the greater the CI experience, the higher the probability of a faster and more accurate lexical retrieval and the lower the probability of omissions. Avoidance of omissions constitutes probably an acquired translation strategy; therefore, TRI are expected to feature the highest number of omissions in contrast to CIS or PRO. Owing to the differences in the amount of CI experience, PRO are hypothesised to outperform the remaining groups in RT and ER scores. If *Hypothesis 1c* were to be refuted, one could argue that the two-year CI Programme was too short a period for CIS to adequately reorganise their interlingual lexical links so as to be able to effect an efficient lexical retrieval between their C-language and the mother tongue.

Hypothesis 2: In all groups of participants, there will be differences in the degree of involvement of conceptual and lexical mediation, those being reflected by RT data and the type of errors across the three experimental conditions, such that: (*a*) there will be more of the form- than meaning-based errors in *CogA* and in *CogB*, and both cognate conditions will have shorter RTs than the control condition (i.e. a moderate cognate effect), (*b*) there will be more form-based errors in *CogA* than in *CogB*, and there will be shorter RTs in *CogA* than in *CogB* (i.e. a strong cognate effect), (*c*) there will be more meaning- than form-based errors in *ctrl* (i.e. conceptual mediation);

Rationale: It is hypothesised that conceptual mediation will come to the fore because all participants are proficient in German. In addition, either a moderate or a strong cognate effect is hypothesised to occur in the translation production performance of all participants. The cognate effect will be reflected by shorter RTs and more frequent form- than meaning-based errors in the cognate conditions.

Hypothesis 3: There will be more form- than meaning-based errors in TRI, irrespective of the experimental condition;

Rationale: Generally speaking, TRI are hypothesised to show less efficient control/suppression mechanisms than the participants having CI experience. Therefore, TRI will be the least resistant to interference both in form and in meaning, irrespective of the experimental condition. Form-based errors are thought to predominate over meaning-based errors in the performance of TRI because the control group is hypothesised to be less efficient in the processing of semantic/conceptual information than PRO (and also, most probably, than CIS).

Hypothesis 4: In contrast to TRI and CIS, PRO will have the smallest number of both form- and meaning-based errors, irrespective of the experimental condition. In case of lexical retrieval problems, PRO will provide readily a semantically close but acceptable translation equivalent, whereas TRI and CIS are expected in that case to hesitate and produce either semantically related but unacceptable translation equivalents, or altogether fail to provide a correct translation;

Rationale: PRO are hypothesised to have the most efficient control mechanisms enabling them to suppress irrelevant and competing form- and meaning-representations. In contrast to TRI (and most probably CIS as well), PRO will be able to apply efficient strategies of handling lexical retrieval problems, e.g. those involving the use of generalisation.

5.4.2. Method

In the translation production task the participants were instructed to produce oral translations of Polish words presented visually on a computer screen into German by using a microphone which activated a voice-operated switch.

The experimental list comprised sixty Polish words to be translated into German. Half of the German translations of Polish stimuli were cognate with their English counterparts. There were fifteen more similar cognates (*CogA*), e.g. *orzech – Nuss* 'nut', and fifteen less similar cognates (*CogB*), e.g. *miecz – Schwert* 'sword. In order to counterbalance the number of translation pairs whose German translations were cognate with their English equivalents, thirty non-cognate translation pairs were added. Those were fifteen control pairs (*ctrl*), e.g. *lalka – Puppe* 'doll', and fifteen filler pairs (*flr*), e.g. *mydło – Seife* 'soap'. Stimuli in the critical experimental conditions (*CogA, CogB, ctrl*) were matched in length (letters and syllables), frequency and concreteness. The fillers were matched as closely as possible in length and concreteness to the experimental stimuli. Polish words and their German translations in the non-cognate conditions had different onsets and did not rhyme. The presentation of stimuli was randomised across the participants. The participants' performance was examined with respect to the duration of response times, and the number of errors and omissions made in the experimental conditions. The nature of the participants' errors was also assessed, i.e. as either form- or meaning-based errors.

5.4.3. Apparatus and procedure

Prior to commencing this experiment, the participants conversed briefly with a German-speaking interlocutor so as to properly activate their C-language/L3 for production. Both verbal and written instructions for that task were then given in German, and the participants were asked questions in German to confirm that they had understood the instructions correctly (the instructions are provided in Appendix C, p. 182). The participants were instructed to translate words appearing on the computer screen as spontaneously and as accurately as possible. They were asked to speak in a loud and clear manner to avoid the occurrence of triggering failures of the voice switch. For that same reason they were also requested to refrain from smacking their lips prior to articulating the translation, and from making other nonverbal sounds if they happened not to know or remember how to translate a given word into German at given point in time.[100]

Practice blocks of five trials each were run prior to the commencement of the experimental session comprising sixty Polish words. A microphone that activated a voice-operated switch registered the participants' responses. The participants sat in front of the computer screen at a comfortable reading distance. The experimenter sat next to the participants to monitor the accuracy of their responses and to note any failures of the voice key.

Within each trial the participants first saw for 500ms a fixation point (a cross) in the centre of the computer screen. Immediately after its offset, a Polish word was presented for 4000 ms or until the participant made a verbal response. If a response was not made within 4000ms, the next trial started automatically. The Polish stimuli were presented in white uppercase Courier New font 30 centred on the computer screen against a navy blue background. Response latencies were measured in milliseconds (ms) from the onset of stimulus presentation to the onset of articulation. Stimulus presentation was controlled by E-Prime, and the response latencies were measured by means of a voice key. The entire experiment lasted for about 10 minutes.

The participants' responses were transcribed during the experiment to detect errors in the processing of form and meaning representations (F-errors and SEM-errors). The four cases of correct but unintended translations (cf. Section 4.8.) were accepted and analysed

[100] Each participant was requested to drink some water before translation production.

together with the remaining correct translations. Moreover, individual translations which were semantically close to the intended translation response were not considered erroneous but as manifestations of strategic processing (cf. Section 5.4.4. for details).

5.4.4. Results

Two ANOVA tests were conducted. The first ANOVA test was applied for the experimental condition (3) as the within-subjects factor, and the subject group (3) as the between-subjects factor to analyse RT, ER and OS data. Detailed error analysis was done by means of another ANOVA test in which the type of error (2) and the experimental condition (3) were the within-subjects factors, the subject group (3) constituting the between-subjects factor. A series of t-tests was also performed on the data collected in that experiment.

It had to be ascertained beforehand (i) whether significant differences in RT, ER and OS data were to be found for the individual experimental conditions investigated in this experiment, and (ii) whether significant differences existed between the type of error and the said experimental conditions.

Data from the trials during which the voice key failed or verbal dysfluencies occurred (stuttering, utterance repairs, production of nonverbal sounds) were removed from the analyses. These procedures resulted in the exclusion of approx. 2% of the data in each group. Also neglected were the RT data that were erroneous or more than two standard deviations above or below a given participant's mean response in a given experimental condition.[101]

A significant difference was found in RT data between the experimental conditions: $F(2,34) = 21.23$, $p = .000$, but no interaction occurred between those conditions and the individual groups of participants: $F(4,68) = .81$, $p = .525$. This can be seen in Figure 15.

[101] In the post-experimental stimuli familiarity questionnaire, all participants indicated that they were familiar with the Polish words and their German translations.

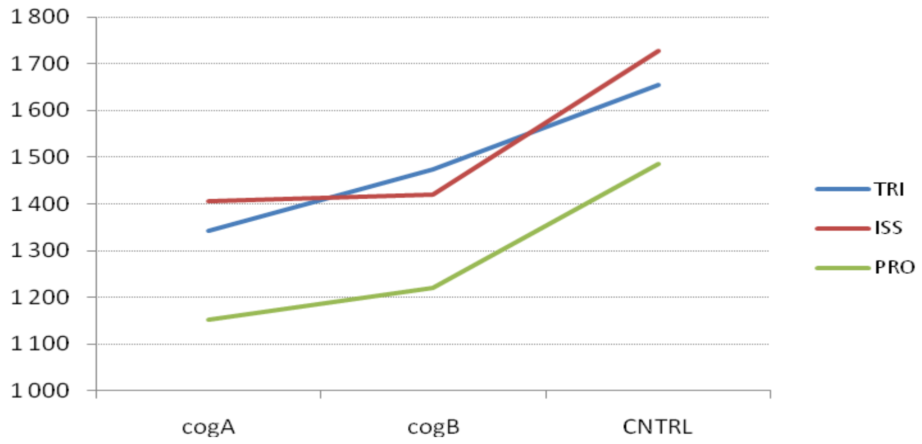

Figure 15. RT data: translation condition as a function of subject group.

As a result, the differences in the RT data available across the participating groups had to be analysed irrespective of the individual experimental conditions.

There was a significant difference in the ER data between the experimental conditions: $F(2,34) = 6.89$, $p = .003$, but there was also no interaction between those conditions and the groups of participants: $F(4,68) = .75$, $p = .564$. This is illustrated in Figure 16.

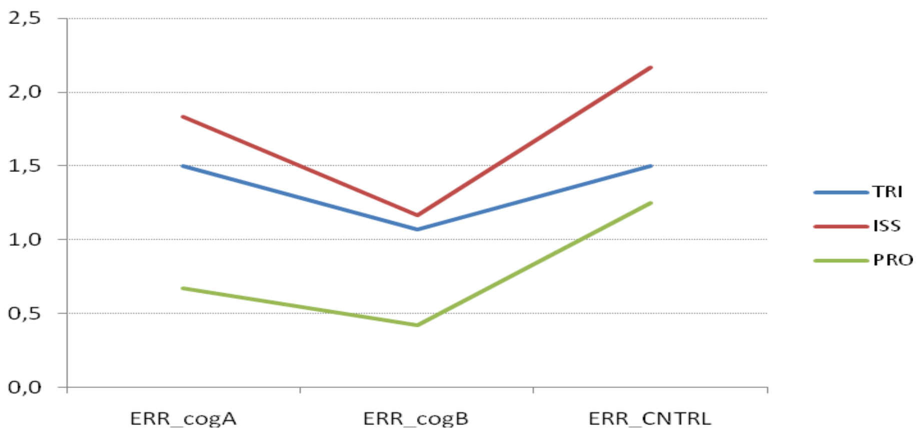

Figure 16. ER data: translation condition as a function of subject group.

Therefore, any and all differences found in ER data across the participating groups also had to be analysed irrespective of the individual experimental conditions.

There was a significant difference in the number of omissions between the participating groups (details are given in Table 9) but there were no significant differences in the number of omissions as a function of experimental conditions: $F(2,34) = 1.39$, $p = .263$, or as a function of the interaction between the experimental conditions and the participating groups: $F(4,68) = .86$, $p = .494$. Thus, only the differences in OS data between the participating groups could be analysed irrespective of the individual experimental conditions.

A significant difference between the type of error and the experimental conditions was found to exist: $F(2,34) = 20.21$, $p = .000$. This is shown in Figure 17. There was also a significant difference between the type of error and the given participating group: $F(2,35) = 3.74$, $p = .034$. However, no interaction was found between the type of error, the experimental condition and the group of participants: $F(4,68) = 1.55$, $p = .197$.

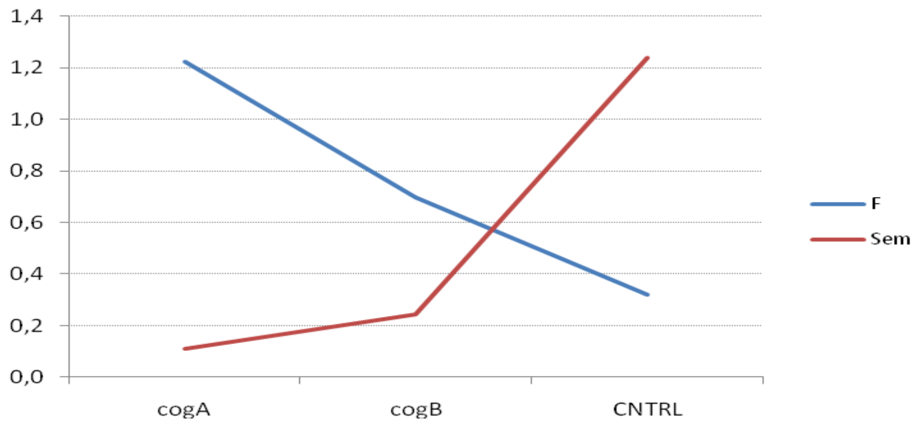

Figure 17. Error data (F: form-based errors, SEM: meaning-based errors) in the experimental conditions employed in the present work.

5.4.4.1. Hypothesis 1

In view of the results presented above, *Hypothesis 1* had to be revised so as to refer to RT and ER data irrespective of the experimental conditions rather than to RT and ER data in the individual experimental conditions.

In accordance with *Hypothesis 1a*, PRO outperformed CIS in the number of errors ($p = .017$). However, PRO did not outperform CIS in the duration of reaction times ($p = .082$) although the mean RTs of PRO were about 230ms shorter than those of CIS. The total number of omissions was very small and almost equal in both groups: $p = 1$. The relevant data are given in Table 9.

Table 9. PRO vs. CIS vs. TRI: RT, ER and OS data.

		mean	*SE*	95% CI lower	95% CI upper	difference	*Sig.*
RT	PRO	1286.64	71.04	1142.41	1430.87	-	-
	CIS	1517.94	71.04	1373.72	1662.17	-	-
	TRI	1490.81	65.77	1357.28	1624.34	-	-
	PRO vs.CIS	-	-	-	-	-231.31	.082
	PRO vs. TRI	-	-	-	-	-204.17	.127
	CIS vs. TRI	-	-	-	-	27.13	1
ER	PRO	.78	.23	.93	1.78	-	-
	CIS	1.72	.23	1.26	2.18	-	-
	TRI	1.36	.21	.32	1.24	-	-
	PRO vs.CIS	-	-	-	-	-.94	.017
	PRO vs. TRI	-	-	-	-	-.58	.21
	CIS vs. TRI	-	-	-	-	.36	.74
OS	PRO	.53	.23	.06	.99	-	-
	CIS	.64	.23	.18	1.1	-	-
	TRI	1.99	.21	1.55	2.4	-	-
	PRO vs.CIS	-	-	-	-	-.11	1
	PRO vs. TRI	-	-	-	-	-1.45	.000
	CIS vs. TRI	-	-	-	-	-1.34	.000

On the basis of the experimental data available, PRO did not outperform TRI in the number of errors ($p = .21$) and in the speed of reaction times ($p = .127$) although the mean RTs of PRO were about 200ms shorter than those of TRI. TRI nevertheless featured a significantly higher number of omissions than PRO: $p = .000$. Therefore, *Hypothesis 1b* was confirmed only with respect to OS data.

Hypothesis 1c had to be rejected based on the RT and ER data obtained. CIS were slower to translate and they made more errors than TRI, although those differences were not statistically significant. CIS managed to outperform TRI only in the number of omissions: $p = .000$.

5.4.4.2. Hypothesis 2

There was sufficient evidence for the occurrence of a moderate cognate effect in the translation performance of all participants: there were indeed more form- than meaning-based errors committed in *CogA* (p = .000) and in *CogB* (p = .002), and shorter RTs were encountered in both cognate conditions than in the control condition (p = .000). Some support for the strong cognate effect was also provided: there were more form-based errors in *CogA* than in *CogB* (p = .007), but there was no significant RT difference between *CogA* and *CogB* (p = .101). It was also found that the SEM-errors outnumbered the F-errors in *ctrl* (p= .000), which suggests that the participants used conceptual mediation in translation production.

5.4.4.3. Hypothesis 3

Hypothesis 3 stated that there would be more form- than meaning-based errors in TRI, irrespective of the translation condition. The findings confirmed that that was indeed the case: the number of the F-errors (M = 2.64, SD = 1.69, SE = .45) was higher than that of the SEM-errors (M = 1.36, SD = 1.34, SE = .36), $t(13)$ = 3.99, p = .002.

5.4.4.4. Hypothesis 4

Hypothesis 4 postulated that PRO would make the smallest number of both form- and meaning-based errors, irrespective of the translation condition. PRO indeed outperformed CIS (p = .002) and TRI (p = .01) in the total number of F-errors. However, the data collected showed that PRO did not commit fewer SEM-errors than CIS (p = .158) or than TRI (p = .962). The relevant data are listed in Table 10.

Table 10. PRO vs. CIS vs. TRI: the number of the form- and meaning-based errors.

error type		mean	*SD*	*SE*	mean lower	mean upper	difference	*Sig.*
F	PRO	1.00	1.13	.33	.28	1.72	-	-
	CIS	3.08	1.73	.5	1.98	4.18	-	-
	TRI	2.64	1.69	.45	1.67	3.62	-	-
	PRO vs.CIS	-	-	-	-	-	-2.08	.002
	PRO vs. TRI	-	-	-	-	-	-1.64	.01
SEM	PRO	1.33	.98	.28	.71	1.96	-	-
	CIS	2.08	1.44	.42	1.17	3	-	-
	TRI	1.36	1.34	.36	.59	2.13	-	-
	PRO vs.CIS	-	-	-	-	-	-.75	.158
	PRO vs. TRI	-	-	-	-	-	-.02	.962

Another finding was that PRO were trying to avoid making omissions. In case of lexical retrieval problems they provided semantically-related translations (mostly semantic extensions). Each case of a semantically-related translation provided by the participants was examined. In the performance of PRO the semantically-related translations were constituted by mostly acceptable renditions of the Polish words. CIS tried to apply the same translation strategy but with varying results. In the case of TRI, any instances of semantically-related translations were found to be rare and mostly incorrect. Examples of semantically-close translations provided by the three groups are listed in Table 11.

Table 11. Examples of semantically-close translations provided by PRO, CIS and TRI.

SL word	type	intended translation	PRO	CIS	TRI
bajka 'fairy-tale'	ctrl	Märchen	*Erzählung* 'narative'	-	-
budzik 'alarm clock'	ctrl	Wecker	*Uhr* 'clock'	-	-
rana 'wound'	CogA	Wunde	*Verletzung* 'injury'	*Verletzung*	-
smok 'dragon'	CogB	-	-	-	**Teufel* 'devil'
walka 'fight'	ctrl	Kampf	*Streit* 'conflict' *Gefecht* 'combat'	*Krieg* 'war' **Schlag* 'punch'	*Krieg*
wieś "Dorf"	ctrl	-	-	**Berg* 'mountain'	**Hof* 'courtyard'

Note. The translations marked by the asterisk (*) were not accepted.

Summing up, the Polish -> German translation production task yielded an interesting set of experimental data. Both interpreting groups had similar OS scores, which would suggest the existence of a distinct, strategic effort aimed at avoiding omissions in translation. TRI were not trained to apply that translation strategy, which resulted in them having the highest number of omissions in their translation performance (p = .000). PRO surpassed CIS only in terms of the ER data obtained, irrespective of the experimental condition (p = .017). CIS did not outperform TRI in either RT or ER scores. In fact, CIS were found to have been slower to translate and they made more errors than TRI, although those differences were not statistically significant. This seems to indicate that the intensive CI training undergone by CIS did not suffice to complete the cognitive reorganisation process in their case. Contrary to all expectations, the RT data collected indicates that PRO were not significantly faster than TRI in the translation production task. PRO also did not commit significantly fewer errors than TRI. Thus, it can be stated that *Hypothesis 1* was partly confirmed by the findings.

Conceptual mediation was indeed found to occur in the control condition (more SEM-errors than F-errors, p= .000). A moderate cognate effect was also present (shorter RTs for cognates than for controls, more F-errors than SEM-errors in both cognate conditions). The said cognate effect was strong enough to manifest itself also by the occurrence of a higher number of F-errors in *CogA* than in *CogB* (p = .007). *Hypothesis 2* was thus mostly confirmed by the findings.

Hypothesis 3, postulating that there would be more F-errors than SEM-errors in the overall translation performance of TRI was verified positively by the experimental data collected (p = .002). That result is thought to be indicative of the fact that TRI had at their disposal less efficient control mechanisms and a weaker ability of processing lexical information than their interpreting counterparts.

Hypothesis 4 was partly confirmed. PRO were found to be quite proficient at controlling their output. They committed significantly fewer F-errors than CIS (p = .002) and TRI (p = .01). The data obtained did not show any significant differences between TRI and PRO and between CIS and PRO as regards the number of SEM-errors. Nevertheless, I observed that PRO were determined to provide a semantically related translation when having problems with retrieving the most suitable equivalent. CIS also showed here a similar tendency which, in their case, did not always yield correct results. TRI were found to produce either semantically close but mostly unacceptable translations, or they failed to translate altogether. The semantically related translations produced by PRO and CIS provide tangible evidence for strategic processing in the translation performance of PRO and CIS.

5.5. Discussion

There is no easy answer to the question of the representativeness of findings in T&I studies (e.g. Gile 1998). A limited number of participants were tested in the experiments, which rendered it a rather challenging task to make far-reaching generalisations. Nonetheless, in what follows some reasons are provided for the nature of the results obtained.

Conference interpreting practice, and directionality in particular, was assumed to influence the cognitive make-up of PRO (and most probably also CIS) to a greater extent than the close lexical similarity existing between English and German. The latter factor was expected to have a significant impact on the translation performance of TRI. PRO were thus hypothesised to be superior at processing semantic/conceptual information (i.e. more associative links among concepts, more domain connections), and to possess more efficient control mechanisms enabling an almost error-free performance in both translation tasks, irrespective of the fact that in most cases the directionalities investigated did not correspond to those used in regular interpreting practice. CIS in turn were assumed to be on the right track to attain a similar level of proficiency as far as the processing of meaning and monitoring their translation performance was concerned. TRI were expected to be less efficient at semantic/conceptual processing, and to lack sufficiently strong control mechanisms to prevent the selection of inadvertent output in translation recognition and production tasks, especially when processing lexical representations which are similar in English and German.

The data obtained in the translation recognition and production experiments did not always confirm earlier predictions directly; some of the data were unexpected but still interpretable. We first discuss the results obtained for individual groups of participants, and then proceed to relate them to the theoretical models and frameworks proposed to account for trilingual lexical processing in translation.

PRO

The professional conference interpreters were indeed found to be able to readily identify correct translation pairs from their passive language into their mother tongue. They recognised correct translation pairs about 170ms faster in German -> Polish than in German -> English translation recognition (p = .005). The fact that PRO did not outperform CIS in the duration of RTs in *trCA* could, in my opinion, be treated as a borderline case (p = .065). Had the sample been greater, that RT difference (about 180ms) could have reached a statistically significant level. As shown in Figure 14 and in Table 7, the RT data collected in *trCA* for TRI were longer than those obtained for PRO (by about 100ms), but as the measurements were quite dispersed in the case of TRI, the said difference did not reach a significance level, too.[102]

The performance of PRO in translation recognition (*tr* and *sem* conditions in particular) was generally characterised by a small number of errors (cf. Table 6). That finding was ascribed to the effective monitoring strategies employed by PRO. That is most probably the reason why no significant differences were found in the number of errors made by PRO in *trCA* and *trCB*. The said low ER scores could have been the result of a ceiling effect, since no significant difference was found to exist between the ER data collected for PRO and TRI in *trCA* (cf. Martin and Bateson 2005: 52-53; McDonough and Trofimovich 2009: 37). As expected, PRO outperformed CIS as regards the number of errors in *trCA* (p = .029). Those results confirm that CI experience contributed to the development of efficient control processes when accessing and retrieving the relevant lexicosemantic information in that particular direction.

PRO were hypothesised to be both faster and more accurate in the processing of meaning information in *semCA* than CIS or TRI. The data obtained allow the conclusion that PRO generally put more emphasis on accuracy than on speed when processing stimuli in conditions requiring the retrieval of relevant semantic/conceptual information, i.e. *tr* and *sem* (cf. Table 8). That may have been the reason why the RT and ER data collected in *semCA* for PRO did not show any significant between-group differences, while PRO out-

[102] Some support for those suppositions may be found in Gile’s (1998) article devoted to observational and experimental studies of CI. Not only does he point out that even powerful statistical methods “cannot overcome the fundamental limitations associated with high variability in small non-random samples”, but he notes that “common sense is paramount, and more important than statistical techniques” (Gile 1998: 9, 10).

performed TRI as regards the number of errors made in *semCB* (p = .029) even though that directionality is not used by them in their interpreting practice. Thus, the overall performance of PRO in the *tr* and *sem* conditions was characterised by an efficient application of monitoring strategies in the processing of lexicosemantic information regardless of the directionality employed. Their characteristic insistence on accuracy was accompanied by a decrease of processing speed.

The performance of PRO in the translation production task was marked not only by their resorting to skilful monitoring processes but also by a strong tendency on their part to avoid omissions. In comparison to the control group, the OS score achieved by PRO was the lowest throughout the entire translation performance (p = .000). PRO also exhibited very little form-based CLIN as they committed the smallest number of F-errors in comparison with CIS (p = .002) and TRI (p = .01). That finding provides a further proof for PRO being very adept at monitoring their output in translation. However, PRO did not outperform TRI or CIS as regards the number of SEM-errors (cf. Table 10). The most likely explanation for there being no significant difference in the number of SEM-errors between PRO and CIS may lie in the fact that the overall number of errors recorded in that task was quite low and, although CIS did commit more SEM-errors than PRO, that difference failed to reach statistical significance. The reason for there being no difference in the number of SEM-errors between PRO and TRI is that TRI resorted to omissions when finding themselves unable to translate a given word into German, while PRO provided semantically-related renditions of SL words. The majority of those semantically-close translations were actually accepted as correct and indicative of their highly pronounced strategic processing abilities (semantic extensions). With regard to RT data, PRO were faster than CIS (by over 230ms) and faster than TRI (by over 200ms) when translating Polish words into German, but that difference failed to reach statistical significance in both cases.

CIS

CIS found the translation recognition task to be clearly more challenging than PRO and TRI. The reason for it may be the fact that CIS have not yet been able to reorganise their lexicosemantic network to an extent enabling them to attain the competence level indispensable for discriminating efficiently between the correct and incorrect translation equivalents. The four semesters of their CI training undoubtedly featured an increased volume of translating practice, but that may have resulted in their distinctly inferior performance, as depicted in the literature by a U-shaped learning curve (cf. McLaughlin 1994). The trainees were thus most probably in the process of readjusting the strength of their interlingual connections in the lexicosemantic representational network while simultaneously developing efficient monitoring strategies, so as to be able to inhibit the occurrence of incorrect decisions in translation. The resultant performance deceleration found in the case of CIS is reflected by the following experimental facts: CIS were outperformed by PRO as regards the number of errors made in *trCA*, and CIS also failed to outperform TRI with respect to both RT and ER translation recognition data.

The validity of the explanation of the reorganisation process (as discussed is Section 3.2.) is substantiated by the trainees' RT and ER scores obtained in the translation production task. CIS were surpassed by PRO as regards the total number of errors made in that experiment ($p = .017$). This shows that the trainees were less skilled than PRO at controlling their TL production. CIS were also over 230ms slower than PRO to translate Polish words into German, although that difference was not found to be significant. There were, furthermore, very slight differences between CIS and TRI as regards the RT and ER scores. Those findings provide tangible evidence that the intensive CI training undergone by the trainees did not suffice to enable them to outperform the control group in terms of speed or accuracy of lexicosemantic processing between their C-language and the mother tongue. The influence of CI training was clearly visible in OS scores, however. Similarly to PRO, CIS produced significantly fewer omissions than TRI ($p = .000$). Further evidence for strategic processing in CIS is constituted by their effort to provide semantically-close translations when having problems with retrieving the most appropriate translation equivalent. That procedure did not always lead to acceptable translations, however. As a result, the influence of CI training in Polish-German translation production manifested itself in CIS using strategies aimed at producing semantically-related translations instead of resorting to omissions.

TRI

In the translation recognition performance of TRI the speed of lexicosemantic processing between German and English was not significantly faster than that between German and Polish. TRI thus proved to be unable to use to their advantage the close lexical affinity between English and German in the short time available to them in that experiment. That finding demonstrates that one should be careful when predicting the character of linguistic processing in RT-based experiments based on offline studies. The offline studies of CLIN which demonstrated the existence of closer interlingual connections between the L2 and the L3 than the L1 and the L3 were obviously devoted to the investigation of the application of strategic processing in L3 learners' performance (cf. Cenoz et al. 2001, 2003; De Angelis 2007). In our previous discussion (cf. Section 3.3.) we acknowledged the fact that some researchers (e.g. Cieślicka and Kowynia 2008) did not obtain CLIN in trilingual speakers' online performance despite the small distance between their foreign languages. In order to throw some more light on this issue, a relatively short SOA (300ms) was used in the translation recognition experiment to preclude (or at least to reduce significantly) the involvement of strategic processing in the participants' performance (cf. McNamara 2005; McDonough and Trofimovich 2009). The results obtained suggest that in online performance the influence of linguistic and psycholinguistic factors (such as cross-linguistic similarity) may indeed be overruled by learning environment factors (i.e. the fact that most trilingual participants learned German in an L1-based environment). A similar conclusion has been reached by Kujałowicz (2007) in a study which investigated the online lexical processing performance of trilingual speakers with different language combinations (including the one investigated here).

Some evidence for the existence of closer lexicosemantic links between English and German than between Polish and German may nevertheless be noticed upon a closer examination of the RT and ER data (cf. Table 7 and Table 8). For instance, TRI had slightly shorter response times in *trCB* and *fCB* than the remaining groups of participants. TRI also committed more errors in *trCB* and in *semCB* than PRO and CIS. Those results suggest that while TRI were faster to make decisions in that particular direction, they also experienced

CLIN in the processing of semantic/conceptual representations. There are also reasons to believe that TRI did not pay as much attention to the accuracy of their decisions in the *sem* condition as PRO or CIS. That would indicate that TRI had at their disposal less efficient means of inhibiting inappropriate meaning representations than their interpreting counterparts. The above mentioned accuracy advantage of PRO over TRI in *semCB* seems to lend credence to this reasoning.

In contrast to PRO and CIS, TRI were found to pay more attention to the form- than meaning-information in Polish -> German translation production. That tendency manifested itself by a higher number of F- than SEM-errors in the translation performance of TRI (p = .002), and also in the rare occurrence of acceptable translations whenever TRI attempted to provide a semantically related equivalent. The fact that TRI often failed to translate altogether when having lexical retrieval problems, is thought to reflect the lack of a strategic effort on their part aimed at deliberately avoiding omissions in translation production. Those findings indicate that TRI had less efficient means of control at their disposal, and a weaker ability to process semantic/conceptual information than their interpreting counterparts, which is in accordance with the considerations presented in Sections 3.2. and 3.3.

After having purposely decided to investigate the translation production from Polish into German to determine whether B-based interference would occur from the mother tongue into the passive language, a moderate cognate effect was found to exist in the case of all participating groups when they processed overlapping representations in German and English. That finding is consistent with the view of cognate processing presented in Section 2.3.1. (cf. also De Bot 2004). To the best of my knowledge, no other study carried out to date was able to show the existence of the cognate effect in the translation performance of trilingual subjects having varying degrees of CI experience in that particular directionality. Results of the translation production experiment demonstrate that the cognate effect in the participants' performance was sufficiently strong so as to manifest itself not only in the predominance of form-based over meaning-based errors in the cognate conditions, but also in faster reaction times found in those cognate conditions than in the control condition. At the same time, all participants duly showed conceptual mediation in their translation performance in the control condition (as evidenced by the larger number of SEM-errors), which is in accordance with research findings obtained in trilingual word translation experiments (e.g. De Groot and Hoeks 1995; Francis and Gallard 2005; Kujałowicz and Zajdler 2009).

We now turn to discuss our findings in relation to the relevant frameworks and models which have been proposed to account for trilingual lexical processing in translation tasks.

At the outset of the study (cf. Section 1.7.) a decision was made to design RHM-inspired models of the trilingual mental lexicon. Consequently, the models proposed in Section 3.4. were aimed to illustrate the assumptions and hypotheses put forward with regard to lexical processing in translation tasks performed by trilingual speakers whose foreign languages were related and who had varying degrees of CI experience. To my knowledge, no similar models exist. Although the proposed models constitute useful approximations for the predominantly connectionist/dynamic view of lexical processing adopted in the present work (cf. Chapter 2), results of both experiments seem to corroborate the assumption that the different language subsystems of a trilingual speaker are separate but interconnected by virtue of associative links whose strength depends on factors related to individual linguistic experience (such as the type and amount of CI practice). Relative to the amount of CI practice, the participants have been found to establish ad hoc task schemata during their translation performance to control the activation and inhibition of relevant interlingual links (cf. Section 2.3.3.). The findings indicate that although lexical access is essentially non-selective in visual word processing, it is still subject to task demands (cf. the BIA+, Dijkstra and Van Heuven 2002) and to inhibition/suppression mechanisms operating at the local and global levels in a dynamic representational network.[103] Recently, the main tenets of the RHM have been questioned in favour of a Revised Distributed Model, and it seems that more attention should be given to the interlingual inhibitory rather than excitatory links in language processing models (cf. Pavlenko 2009; Schoonbaert et al. 2009; Brysbaert and Duyck 2010; Kroll et al. 2010). The experimental data obtained (the ER data in particular) imply that inhibition may hold the key to fast and accurate language control and lexical selection. It would appear that interactive activation models like the

[103] It should be emphasised that non-selectivity is understood here as having to do with "parallel access and sublexical activation that creates resonance among shared features" (Kroll et al. 2010: 374, cf. also Van Heuven et al. 1998), and not as implying an integrated lexicon.

MIA (Dijkstra 2003) do seem to offer a satisfactory explanation for the instances of CLIN found in the translation performance of my participants.

There is also a compelling set of evidence derived from neuroimaging studies which indicates clearly that cognitive control at the lexicosemantic level (understood in terms of competition for selection among language representations) plays a major role in lexical processing and, consequently, also in translation tasks (e.g. Price et al. 1999). For instance, the prefrontal cortex was found to be responsible for decision-making, response selection and inhibition, the anterior cingulate cortex for attention and error detection in linguistic processing, while the basal ganglia were found to play a role in selecting the appropriate language or lexical items (Abutalebi and Green 2007, 2008; Paradis 2009). Results of my experiments dovetail nicely with findings from neurolinguistic studies because cognitive control was also observed to play a central role in the participants' translation performance. An interesting aspect of cognitive control consisted in its being executed in a different manner, depending on the degree of CI experience acquired. PRO were thus found to be the most efficient at accurate processing of semantic/conceptual information in both experiments. They were also the most adept at providing semantically-close translations in case of encountering any lexical retrieval problems. In conjunction with their avoidance of omissions in translation production, that finding leads to the conclusion that PRO possessed a wide network of semantically-related lexical items which they used whenever direct lexical links between the translation equivalents were not readily available for retrieval (cf. Finkbeiner et al.'s network of senses, 2004).

The main tenets of the Activation Threshold Hypothesis (Paradis 2004, 2009) may also be applied to account for the findings obtained. It seems that the speaker's intention to use a given language lowered the activation threshold of the relevant element in the intended language while simultaneously raising the activation thresholds of the irrelevant language elements. The data collected indicate that the professional conference interpreters were capable of appreciably enhancing the functional capacity of their lexicosemantic network by selectively intensifying or suppressing in their interpreting practice the intra- and interlingual connectivity among the individual lexical units. Consistent with that interpretation of the findings are the results obtained in the present dissertation for the conference interpreting trainees. The differences in the cognitive organisation between PRO and CIS were discernible not only with respect to the actual efficacy of the activation/inhibition mechanisms as such, but also to the size and the degree of interconnectivity of the lexicosemantic network. The translation performance of TRI also agrees well with that interpretation. The non-interpreting trilinguals were less proficient at processing semantic/conceptual information, and at applying global and local control mechanism aimed at enhancing the accuracy of their translation performance (e.g. using omissions instead of generalisations).

It has been claimed that the strategies or ‘coping tactics’ developed by the professional conference interpreters in their daily work made it difficult for them to adjust to the requirements of experiments such as these (e.g. Gile 1995; cf. also Riccardi 2005; Chi 2006). That reservation does not stand up to scrutiny however, owing to the fact that the performance rate of professional conference interpreters was quite high, if not significantly higher than that of the remaining groups, in the conditions and directions employed in both translation experiments (cf. Table 7, Table 8, and Table 9).

Finally, the results obtained should also be analysed by taking into account the possible variations in the task performance of individual participants that may have been either due to fatigue, general ill-disposition or stress. The occurrence of such performance fluctuations cannot be prevented (cf. Gile 1998).[104] However, the fluctuations in question could be expected to have a limited bearing on the representativeness of the findings because I tried to minimise the influence thereof by designing 20-minute rather than 40-minute experimental sessions.

Further implications of the findings discussed in this section for trilingual lexical processing studies will be offered in the final part of the dissertation.

[104] A number of the participants in PRO were preparing for their EU accreditation exams, and the majority of them were tested by me during their regular working day.

Conclusions

The present study was based on the assumption that, as opposed to the non-interpreting trilinguals, the participants having CI training and experience would have a stronger network of interlingual form and meaning connections between German and Polish than between German and English (cf. the models in Section 3.4.). In order to test this assumption, I investigated the speed and accuracy of lexicosemantic processing in the translation recognition and the translation production performance of professional conference interpreters (12), conference interpreting trainees (12) and non-interpreting trilingual speakers (14) with Polish (L1/A), English (L2/B), and German (L3/C). The use of those two online research paradigms enabled a thorough examination of the bottom-up and top-down processing of lexical information in the most interesting directionalities: C -> A and C -> B (translation recognition) and A -> C (translation production). Thus, the translation experiments addressed the issue of trilingual lexicosemantic organisation indirectly, by investigating the speed with which declaratively stored information about word forms and word meanings was accessed and retrieved from the mental lexicon during the processing of visually displayed single word stimuli.

The findings show that conference interpreting experience does in fact lead to a distinctly more efficient processing of semantic/conceptual information in terms of accuracy but, contrary to what was expected, not in terms of speed. The professional conference interpreters were found to monitor carefully their performance in the translation recognition experiment, irrespective of the translation direction employed. The conference interpreting trainees also tried to use monitoring strategies with a view to inhibiting the occurrence of incorrect translation decisions. Nevertheless, the experimental data obtained enable the conclusion that the lexicosemantic network of intra- and interlingual representations of CIS did not work as efficiently as that of PRO. Additionally, evidence was found for the application of strategic processing in the translation production performance of PRO and CIS (as exemplified by the use of generalisations and avoidance of omissions). In other words, results of both experiments point to the existence of conscious, strategic processing in the case of both groups of participants with CI experience. The control group were in turn found to use strategic processing to a smaller extent than the interpreting participants. Regardless of directionality, TRI were shown to be less accurate in the processing of semantic/conceptual representations in translation recognition than PRO. TRI were also more influenced by the form- than the meaning-based CLIN in Polish -> German translation performance. In contrast to PRO and CIS, TRI failed to exhibit a strategic effort to avoid omissions in translation. Those findings suggest that TRI possessed less efficient means of controlling their translation performance at the local and global levels.

On the whole, the findings yielded by the experiment point to a general tendency on the part of the professional conference interpreters to pay more attention to the accuracy of their output rather than to its speed. It therefore seems right to conclude that fast lexical processing does not necessarily constitute a prerequisite for an efficient translation performance, a conclusion which may be taken to coincide partly with the RT findings obtained by Christoffels et al. (2006) in the word translation performance of professional conference interpreters and a control group comprising bilingual speakers from a language-related profession. The RT findings obtained are also supported by Gile's (1995) claim that, apart from the professionally relevant sector of their vocabulary, the linguistic availability may actually be lower in interpreters than in educated speakers of the same language. Results of the experiments provide strong evidence for upholding the assertion that expertise in CI is not so much associated with the processing speed as with the efficient application of translation strategies at the local and global levels (concentration on accuracy and on avoidance of omissions) coupled with skilful processing of semantic/conceptual information.

It is felt that a connectionist view of the trilingual mental lexicon (Chapter 1) and lexical processing (Chapter 2) is able to explain the intensity of processing dynamics manifesting itself in the participants' lexical processing skills in translation. In combination with certain elements of the modularity theory, the connectionist perspective appears to provide a satisfactory means of explaining the nature of the findings obtained. The results thus support the view of the mental lexicon as a dynamic and interconnected network of links and nodes whose functioning is governed by a complex pattern of intra- and inter-subset associations at and between the levels of form and meaning. That network of connections is being constantly readjusted in the mental lexicon to reflect the type and amount of individual linguistic experience. The said processing dynamics were found to be subject to a strong influence of cognitive control in the case of the proficient conference interpreters, which points to the necessity of including inhibitory links in any process model intended to account for the processing of form and meaning information in translation or interpreting tasks.

Clearly, the results obtained do not permit any far-reaching conclusions or generalisations, and more research is needed in this area. It may be surprising that the trilingual control group performed better as regards the RT and ER scores in both experiments than the CI trainees who underwent a two-year intensive training course. With regard to this finding, one might consider the question of whether the graduates of 6-month or 12-month CI courses offered by leading T&I centres would be able to outperform a control group comprising proficient language speakers untrained in CI in similar circumstances. However, we would like to suggest that the influence of CI training may be observed in the trainees' performance, particularly as regards the involvement of strategic processing in the translation production task. For instance, CIS produced significantly fewer omissions than TRI. Furthermore, as opposed to the control group, CIS tried to provide semantically-close translations in cases of lexical retrieval problems in the production task.

Finally, it should be noted that the number of participants did not perhaps constitute a large sample in statistical terms. It might therefore be argued that individual differences in translation performance affected the results. However, individual variability appears to be inevitable in T&I research. Interpreting scholars often acknowledge the difficulty of securing an adequate number of linguistically suitable volunteers willing to participate in similar experiments, i.e. persons having both the required experience and the language combination desired. For example Gile (1998: 6) states that "[i]n interpreting, access to data and to subjects is problematic (…), which leads to small, non-random samples, and to the possibility of interference from uncontrolled variables associated with the sampling procedure." Therefore, care was taken to ensure a high level of intra-group homogeneity when the participants were selected (cf. Section 5.2.). Moreover, additional tests were run in cases when noticeable disparities in the collected data were observed (cf. Section 5.3.4.). A partial solution to the problem of small sample sizes in the case of this work and T&I research in general might consist in conducting for different language combinations multiple replications (cf. Gile 1998) of experimental paradigms such as those employed here. Gile (1994: 43) emphasises that "empirical studies, both observational and experimental, need to be plentiful before data can be considered as being representative of more than a limited population of practitioners and of more than a limited range of environmental [interpreting / translation] conditions and tasks." Nevertheless, one should not lose sight of the fact that the above mentioned constraint of finding suitable candidates for such experiments would still be applicable (e.g. Shlesinger 2000b: 13).

In view of the paucity of studies investigating online translation performance of professional and trainee conference interpreters whose foreign languages are related, the obtained findings may be of importance not only to the psycholinguistically-oriented T&I scholars (who are still underrepresented within mainstream T&I research), but also to CI practitioners and trainees, CI trainers and aptitude test designers. Psycholinguistically-oriented researchers have long underscored the importance of comparing the performance of experienced professionals and trainees so as "to observe the process by which connections in the mental lexicon are built and strengthened" (Chmiel 2010: 232). They have also drawn attention to the importance of finding out "which aspects of SI can and should be learned" (Christoffels and De Groot 2005: 471). In Chapter 4 I argued that online translation tasks are well-suited for those research purposes. Consequently, I subscribe to Cowan's (2000/2001: 134) opinion that "[t]he more we learn about retrieval speeds and what processes determine them, the more clues we will have about how to pinpoint the processes contributing to excellent interpreting and to learn how training might be improved."

It remains to be seen whether the results obtained in this study will be reflected in any larger linguistic context, with various language combinations and directionalities. Translation tasks concerning the speed and accuracy of lexical retrieval and conducted in a high and a low sentence context constraint may perhaps prove helpful in this respect (cf. Hoey 2005; Van Hell 2005; Van Hell and De Groot 2008; Kujałowicz et al. 2008). In this way the translation performance of participants having CI experience could be investigated in a more natural setting featuring an abundance of various translation contexts to which conference interpreters are being constantly exposed in their day-to-day interpreting practice. Selected corpora of interpreting texts could also be used for the above mentioned purpose, which would ensure the elaboration of sets of adequate experimental materials also for future studies in that complex field.

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Appendices

Appendix A: Participant pretests

Pretest 1: Language Experience and Proficiency Questionnaire (English version)[105]

(1) List all the languages you know in order of dominance (your native language first):

____

(2) List all the languages you know in order of acquisition (your native language first):

____

(3) List the foreign languages you know in order of most proficient to least proficient. Rate your ability on the following aspects in each language. Please rate according to the following scale (write down the number in the table):

Very poor Poor …Fair ……Functional ….Good ……Very good Native-like

1 _________ 2_________3_________4__________5_________6_________7_________

Language	Reading proficiency	Writing proficiency	Speaking fluency	Listening ability

[105] This pretest was originally modelled on the questionnaires developed by Li et al. (2006) and Marian et al. (2007) but it was adapted for the student populations studied in the present thesis. Professional conference interpreters received a slightly altered version of this questionnaire which solicited only the most relevant data.

(4) If you have ever lived in another country for more than three months, please provide name of country and time of residence (the number of years/months):

____

(5) Specify how old you were when you started to learn English:

____

(6) How did you learn English up to this point? (check all that apply)
   a) Mainly through formal classroom instruction _____
   b) Mainly through interacting with people _____
   c) A mixture of both _____
   d) Other (specify) _____

(7) Specify how old you were when you started to learn German:

____

(8) How did you learn German up to this point? (check all that apply)
   a) Mainly through formal classroom instruction _____
   b) Mainly through interacting with people _____
   c) A mixture of both _____
   d) Other (specify) _____

(9) Estimate, in terms of percentages, how often you use your native language and other languages per day (in all daily activities combined). Total should equal 100%:
   e) Native language _____%
   f) Second language ______%
   g) Third language ______%
   h) Other language: ____________________)

Age (in years):_________________

Sex (circle one): male/female

Pretest 2: Goethe-Institut German Placement Test[106]

Wählen Sie die richtige Lösung. Es gibt nur eine richtige Lösung.

[Choose the correct answer. Only one answer is correct.]

1. Ich habe keine ----, bei dieser Hitze durch die Stadt zu laufen. Bleiben wir doch hier!
   a. Auskunft
   b. Sachen
   c. Liebe
   d. Lust

2. Heute kann ich nicht kommen, weil ----.
   a. ich habe viel zu tun
   b. ich habe zu tun viel
   c. ich viel zu tun habe
   d. viel ich zu tun habe

3. Hans hat bald Geburtstag. Haben Sie auch ---- Einladung bekommen?

[106] This test has 30 questions and it gives an approximate placement in one of the six levels of the Common European Framework.

a. ein
b. eine
c. einen
d. einer

4. Hast Du jetzt ein ---- Auto? Das kenne ich ja noch nicht.

a. ander
b. andere
c. anderer
d. anderes

5. Viele Wohnungen auf dem Land sind nicht so ---- wie man denkt.

a. billig
b. billige
c. billiger
d. billigere

TEXT 1: Was Berufsanfänger wissen sollten: Holen Sie sich so viele Informationen (6) ----

a. auf
b. bei
c. über

Ihre neue Firma wie möglich. Ziehen Sie sich am (7) ----

a. Erste
b. Ersten
c. Erster

Tag schick an. Der erste Eindruck, (8) ----

a. Das
b. den
c. der

die anderen von Ihnen haben, ist wichtig. Kommen Sie nicht zu spät. (9) ----

a. Stell
b. Stelle
c. Stellen

Sie Ihren Wecker so, dass Sie nicht nur pünktlich in der Firma sind, (10) ----

a. außerdem
b. besonders
c. sondern

auch genügend Zeit haben, Ihr zukünftiges Büro zu finden.

TEXT 2: Wie lange kann man Informationen behalten? Was hat (11) ---- Ihre Zahnärztin über Ihre Zähne erzählt?

a. Dir
b. Ihnen
c. Sie

Sie wissen (12) ---- nicht mehr ganz genau? Das ist ganz normal, aber nur dann,

a. er

b. es
c. sie

wenn das Gespräch (13) ---- Ihrer Ärztin schon länger als 24 Stunden zurückliegt.

a. mit
b. über
c. von

Denn die Hälfte aller Informationen, (14) ---- wir hören, werden nach einem Tag vergessen.

a. das
b. der
c. die

Und nach 48 Stunden haben wir nur (15) ---- ein Viertel des Gesprächs im Kopf.

a. noch
b. über
c. weniger

16. Du willst in Berlin arbeiten? Hast Du dich denn schon ---- eine Stelle bemüht?

a. an
b. für
c. so
d. um

17. Leider waren die Ferien schon zu Ende, sonst ---- ich mit den Kindern länger geblieben.

a. hätte
b. wäre
c. werde
d. würde

18. ---- nach Qualität kosten die Jacken Euro 100.- bis Euro 210.-.

a. Entlang
b. Je
c. Jede
d. Mal

19. Trotz ---- Bemühungen des technischen Personals mussten die Fluggäste stundenlang warten.

a. viel
b. viele
c. vieles
d. vieler

20. Die Universitätsgebäude sind zwar hässlich, ---- ist aber das Studienangebot sehr vielfältig.

a. dafür
b. damit
c. dazu
d. hierfür

21. Bei dem neuen Autotyp ist technisch viel verbessert ----- .

a. geworden

b. werden

c. worden

d. wurde

22. Der kleine Junge hatte lange Haare, ---- ihn viele für ein Mädchen hielten.

a. darum

b. deshalb

c. denn

d. weshalb

<u>TEXT 3:</u> Internationale Ledermesse in Offenbach

Die Internationale Ledermesse in Offenbach verzeichnete am Wochenende einen (23) ---- Anfang.

a. befriedigenden
b. befriedigten
c. befriedigter

Schon am Samstag (24) ---- es einen regen Besucherandrang gegeben, teilte die Messeleitung mit.

a. Habe
b. hat
c. hatte

Bei einigen Artikeln, wie etwa (25)---------- Saisonwaren Koffer und Reisegepäck,

a. dem
b. den
c. der

sei der Besucherandrang sogar sehr hoch gewesen. Insgesamt zeigen 403 Aussteller, (26) ----

a. darunter
b. dazwischen
c. unter uns

über 100 Hersteller aus dem Ausland, ihre neuesten Kollektionen an Lederwaren. Bei den ausländischen Ausstellern stellt Indien mit 24 Firmen das stärkste Kontingent, (27) ---- von Holland, Argentinien und Italien.

a. folgend
b. folgende
c. gefolgt

28. Auch Männer haben heute andere Erwartungen ---- die Vereinbarkeit von Familie und Beruf.

a. an

b. für

c. um

d. zu

29. Der Herausforderung der modernen Technik muss man sich in jedem Beruf ----.

a. begegnen

b. entgegnen

c. stellen

d. überwinden

30. Lange Arbeitszeiten bedürfen ----.

   a. geplante Pause
   b. geplanten Pausen
   c. geplanter Pausen
   d. geplantere Pause

Appendix B: Examples taken from stimuli pretests (English version)

Stimuli pretest for Experiment 1: distractors pretest

Decide if the word pairs presented below are related to each other. If you think they are:

completely unrelated to each other	put a cross in the right-hand column	X
related in form	write 'F' in the right-hand column	F
related in meaning	write 'M' in the right-hand column	M

Hemd	Herd	
Ohr	Mund	
Teppich	Decke	
Tropfen	Kette	
Zug	Eimer	
Zwiebel	Spiegel	

Stimuli pretests for Experiment 2: similarity pretest for cognate stimuli

Rate the degree of similarity between the pairs of German and English nouns below according to the following scale:

1. very dissimilar
2. dissimilar
3. somewhat dissimilar
4. neither dissimilar not similar
5. somewhat similar
6. similar
7. very similar

Mond	moon	1	2	3	4	5	6	7
Blut	blood	1	2	3	4	5	6	7
Stein	stone	1	2	3	4	5	6	7
Nachbar	neighbour	1	2	3	4	5	6	7
Blume	flower	1	2	3	4	5	6	7

Dorf	village	1	2	3	4	5	6	7
Schloss	castle	1	2	3	4	5	6	7

Stimuli pretests for Experiment 2: translation consistency pretest for non-cognate stimuli

Translate the following words into German as spontaneously and accurately as possible. Provide only one translation for each word.

budzik: …………………………………..

lalka: ……………………………………..

kogut: ……………………………………

czapka: …………………………………..

Appendix C: Instructions

Experiment 1: translation recognition (same instructions for both language directions):

WILLKOMMEN!

AUF DEM BILDSCHIRM DES COMPUTERS WERDEN SIE WÖRTER SEHEN.

ZUERST KOMMT EIN FIXATIONSPUNKT + UND DANACH EIN DEUTSCHES WORT.

DANN WIRD DAS DEUTSCHE WORT VERSCHWINDEN UND SIE WERDEN EIN ZWEITES WORT SEHEN.

DIE AUFGABE IST, FESTZUSTELLEN, OB DAS ZWEITE WORT EINE KORREKTE ODER FALSCHE ÜBERSETZUNG VOM ERSTEN DEUTSCHEN WORT IST.

DRÜCKEN SIE "1" FÜR EINE KORREKTE ÜBERSETZUNG.

DRUCKEN SIE "0" FÜR EINE FALSCHE ÜBERSETZUNG.

DRÜCKEN SIE BITTE DIE LEERTASTE, UM ANZUFANGEN.

[Welcome! On the computer screen you are going to see words. First you will see a fixation point + and then a German word. Then the German word will disappear and you will see a second word. The task is to determine whether the second word is a correct or a false translation of the first German word. Press 1 for a correct translation. Press 0 for a false translation. Press the spacebar to begin.]

Experiment 2: translation production

AUF DEN BILDSCHIRM DES COMPUTERS WERDEN SIE WÖRTER SEHEN. ZUERST KOMMT EIN FIXATIONSPUNKT '+' UND DANACH EIN POLNISCHES WORT. ÜBERSETZEN SIE BITTE DIE WÖRTER INS DEUTSCHE SO SPONTAN UND GENAU WIE MÖGLICH INS MIKROFON.

[On the computer screen you are going to see words. First you will see a fixation point '+' and then a Polish word. Please translate the Polish words into German as spontaneously and as accurately as possible into the microphone.]

Appendix D: Experimental stimuli lists

List of experimental stimuli in translation recognition C -> B

SL word	True translation		Meaning distractor		Form distractor		similar to GER
	EN	*PL*	*EN*	*PL*	*EN*	*PL*	
Baum	tree	drzewo	root	korzeń	fence	płot	~Zaun
Berg	mountain	góra	valley	dolina	dwarf	karzeł	~Zwerg
Birne	pear	gruszka	plum	śliwka	picture	obraz	~Bild
Boden	floor	podłoga	ceiling	sufit	arch	łuk	~Bogen
Erbse	pea	groch	bean	fasola	heir	dziedzic	~Erbe
Frau	wife	żona	husband	mąż	question	pytanie	~Frage
Gebiet	area	teren	town	miasto	prayer	modlitwa	~Gebet
Gehirn	brain	mózg	skull	czaszka	salary	płaca	~Gehalt
Gipfel	peak	szczyt	slope	zbocze	fork	widelec	~Gabel
Holz	wood	drewno	iron	żelazo	neck	szyja	~Hals
Kerze	candle	świeca	torch	latarka	guy	facet	~Kerl
Kleid	gown	suknia	skirt	spódnica	song	pieśń	~Lied
Klingel	bell	dzwonek	whistle	gwizdek	blade	ostrze	~Klinge
Kopf	head	głowa	stomach	brzuch	button	guzik	~Knopf
Lachs	salmon	łosoś	trout	pstrąg	corpse	trup	~Leiche
Laden	shop	sklep	booth	stoisko	thread	nitka	~Faden
Mantel	coat	płaszcz	trousers	spodnie	edge	róg	~Kante
Ohr	ear	ucho	mouth	usta	place	miejsce	~Ort
Pferd	horse	koń	donkey	osioł	arrow	strzała	~Pfeil
Reifen	tyre	opona	wheel	koło	journey	podróż	~Reise
Stiefel	boots	kozaki	gloves	rękawice	level	poziom	~Stufe
Tanne	fir	jodła	shrub	krzak	aunt	ciotka	~Tante
Ufer	shore	brzeg	beach	plaża	clock	zegar	~Uhr
Vogel	bird	ptak	mammal	ssak	people	naród	~Volk
Wurst	sausage	kiełbasa	cheese	twaróg	throw	rzut	~Wurf
Zehe	toe	palec	thumb	kciuk	marriage	ślub	~Ehe
Zimmer	room	pokój	attic	strych	brick	cegła	~Ziegel
Zug	train	pociąg	bike	rower	stuff	rzeczy	~Zeug
Zunge	tongue	język	throat	gardło	boy	chłopiec	~Junge
Zwiebel	onion	cebula	garlic	czosnek	mirror	lustro	~Spiegel

List of experimental stimuli in translation recognition C -> A

SL word	True translation		Meaning distractor		Form distractor		similar to GER
	EN	*PL*	*EN*	*PL*	*EN*	*PL*	
Amt	office	urząd	church	kościół	velvet	aksamit	~Samt
Auge	eye	oko	lash	rzęsa	owl	sowa	~Eule
Bein	leg	noga	pelvis	miednica	lead	ołów	~Blei
Dusche	shower	prysznic	sink	zlew	smell	zapach	~Duft
Eimer	bucket	wiadro	jug	dzban	oak	dąb	~Eiche
Ente	duck	kaczka	turkey	indyk	harvest	plon	~Ernte
Fenster	window	okno	wall	ściana	design	wzór	~Muster
Ferse	heel	pięta	ankle	kostka	trial	próba	~Versuch
Fluss	river	rzeka	lake	jezioro	corridor	korytarz	~Flur
Gesicht	face	twarz	back	plecy	poem	wiersz	~Gedicht
Getreide	cereal	zboże	hay	siano	beverage	napój	~Getränk
Heft	notebook	zeszyt	newspaper	gazeta	yeast	drożdże	~Hefe
Hemd	shirt	koszula	tie	krawat	cooker	piec	~Herd
Kette	chain	łańcuch	wire	drut	chest	skrzynia	~Kiste
Messer	knife	nóż	spoon	łyżka	fair	targi	~Messe
Schenkel	thigh	udo	hip	biodro	swing	huśtawka	~Schaukel
Schirm	umbrella	parasol	belt	pasek	forehead	czoło	~Stirn
Speise	dish	potrawa	bowl	miska	play	gra	~Spiel
Stuhl	chair	krzesło	armchair	fotel	hour	godzina	~Uhr
Tasche	pocket	kieszeń	sleeve	rękaw	day	dzień	~Tag
Taube	dove	gołąb	eagle	orzeł	diver	nurek	~Taucher
Teppich	carpet	dywan	blanket	koc	vinegar	ocet	~Essig
Tier	animal	zwierzę	plant	roślina	door	drzwi	~Tür
Tropfen	drop	kropla	puddle	kałuża	pot	garnek	~Topfen
Tuch	kerchief	chustka	cuff	mankiet	pond	staw	~Teich
Wagen	vehicle	pojazd	engine	silnik	cheek	policzek	~Wange
Wiese	meadow	łąka	lawn	trawnik	desert	pustynia	~Wüste
Zelt	tent	namiot	camp	obóz	money	forsa	~Geld
Ziege	goat	koza	sheep	owca	witness	świadek	~Zeuge
Zweig	branch	gałąź	trunk	pień	dough	ciasto	~Teig

List of experimental stimuli in translation production

Cat. A cognates		
	PL source	DE transl
1	GWIAZDA	STERN ‘star’
2	KAMIEŃ	STEIN ‘stone’
3	KREW	BLUT ‘blood’
4	KSIĄŻKA	BUCH ‘book’
5	KSIĘŻYC	MOND ‘moon’
6	ŁÓDKA	BOOT ‘boat’
7	ŁÓŻKO	BETT ‘bed’
8	OGRÓD	GARTEN ‘garden’
9	ORZECH	NUSS ‘nut’
10	PSZCZOŁA	BIENE ‘bee’
11	RANA	WUNDE ‘wound’
12	SIEĆ	NETZ ‘net’
13	SŁOWO	WORT ‘word’
14	STOPA	FUß ‘foot’
15	SZCZUR	RATTE ‘rat’

Cat. B cognates		
	PL source	DE transl
1	BROŃ	WAFFE ‘weapon’
2	CÓRKA	TOCHTER ‘daughter’
3	DESZCZ	REGEN ‘rain’
4	DROGA	WEG ‘way’
5	DZIECKO	KIND ‘child’
6	MIECZ	SCHWERT ‘sword’
7	SĄSIAD	NACHBAR ‘neighbour’
8	SMOK	DRACHE ‘dragon’
9	ŚWIAT	WELT ‘world’
10	ULICA	STRAßE ‘street’
11	WĘGIEL	KOHLE ‘coal’
12	WIEŻA	TURM ‘tower’
13	WYSPA	INSEL ‘island’
14	ZIEMIA	ERDE ‘earth’
15	ŻOŁNIERZ	SOLDAT ‘soldier’

Controls		
	PL source	DE transl
1	BAJKA	MÄRCHEN
2	BUDZIK	WECKER
3	CZAPKA	MÜTZE
4	JAJKA	EIER
5	KARTKA	ZETTEL
6	KLUCZ	SCHLÜSSEL
7	KOGUT	HAHN
8	KWIAT	BLUME
9	LALKA	PUPPE
10	LICZBA	ZAHL
11	ROLNIK	BAUER
12	UCZEŃ	SCHÜLER
13	WALKA	KAMPF
14	WIEŚ	DORF
15	ZAMEK	SCHLOSS

Fillers		
	PL source	DE transl
1	BUDYNEK	GEBÄUDE
2	CZŁOWIEK	MENSCH
3	CZYNSZ	MIETE
4	GŁOS	STIMME
5	MYDŁO	SEIFE
6	NACZYNIA	GESCHIRR
7	OGON	SCHWANZ
8	PIANA	SCHAUM
9	POSADA	STELLE
10	ROZDZIAŁ	KAPITEL
11	SĘDZIA	RICHTER
12	SKARB	SCHATZ
13	UMOWA	VERTRAG
14	WIECZÓR	ABEND
15	ZAKUPY	EINKÄUFE

Abstract in English

In this dissertation *E-Prime* is used to examine the nature of lexical processing of single words in the translation performance of twelve professional conference interpreters (PRO), twelve conference interpreting trainees (CIS), and a control group of fourteen non-interpreting trilingual speakers (TRI), all with the following language combination: Polish (A/L1), English (B/L2), German (C/L3). The type (i.e. directionality) and amount of interpreting practice is hypothesised to influence the cognitive make-up of PRO (and probably also CIS) to a greater extent than the close lexical affinity existing between the foreign languages in question. The latter factor is hypothesised to have a significant bearing on the translation performance of TRI. In the experiments, the participants decide first whether pairs of words presented to them on the computer screen constitute the correct translation equivalents, and then translate single words (also presented visually on the computer screen) into the microphone. The speed and accuracy of their performance is investigated in the following translation directions:

(i) German into English (C -> B) and German into Polish (C -> A) in translation recognition, and

(ii) Polish into German (A -> C) in translation production.

Those two experiments are preceded by a review of the most important empirical findings and models of the mental lexicon (Chapter 1) and of lexical processing (Chapter 2) in case of speakers of two and three languages. The said review is aimed at establishing how trilingual speakers carry out and control lexical processing in translation production and in translation recognition. Also discussed is the issue of the influence of the type and amount of conference interpreting (CI) practice on the strength of lexical connections in the mental lexicon, as well as the most likely triggers of cross-linguistic interaction (CLIN) in

the case of proficient trilingual speakers (Chapter 3). In the final part of the discussion, two models of cognitive organisation in case of trilingual speakers are developed, including those with and without CI experience.

Prolonged conference interpreting practice has been shown to influence strongly the organisation of lexicosemantic information in such a way as to support the accuracy but not necessarily the speed of lexical retrieval in translation tasks. The professional conference interpreters have nevertheless been found quite capable of providing skilful and strategic processing of semantic/conceptual information, irrespective of the directionality employed. The results obtained seem to indicate that a two-year CI training period has not been sufficient for the mental reorganisation process to proceed to completion, as the overall translation performance of the conference interpreting students has been worse than that of the control group. The influence of CI training may nevertheless be observed in the trainees' performance, particularly as regards the involvement of strategic processing in the translation production task (i.e. providing semantically-close translations in case of lexical retrieval problems rather than resorting to omissions). The influence of language distance and (psycho-)typology on the translation performance of the non-interpreting trilingual speakers has been found to be largely negligible when performing online tasks. The control group was moreover observed to pay less attention to the questions of both accurate and strategic processing of semantic/conceptual information in translation than the interpreting groups.

The connectionist/dynamic view of the trilingual mental lexicon and processing supplemented by selected aspects of the modularity theory has been found suitable to understand the nature of the findings obtained. Results of both experiments thus corroborate the assumption underlying the two proposed models of the trilingual mental lexicon, and namely that the different language subsystems of a trilingual speaker are separate but interconnected by virtue of associative links whose strength depends on factors related to individual linguistic experience (such as the type and amount of CI practice). Online translation tasks present a promising line of research in the field of Translation and Interpreting Studies in which empirical investigations of lexical processing in case of trilingual speakers with varying degrees of conference interpreting experience constitute a relatively unexplored territory. It is hoped that the results of this research will be of importance not only to the psycholinguistically-oriented T&I scholars, but also to CI practitioners and trainees, CI trainers and aptitude test designers.

Abstract in Polish

W niniejszej rozprawie użyto oprogramowania *E-Prime* celem zbadania istoty przetwarzania leksykalnego podczas tłumaczenia pojedynczych słów przez dwunastu profesjonalnych tłumaczy konferencyjnych (PRO), dwunastu studentów tłumaczenia konferencyjnego (CIS), oraz czternastoosobowej grupy kontrolnej osób trójjęzycznych bez doświadczenia w tłumaczeniu ustnym (TRI), z których wszyscy posiadali następującą kombinację językową: polski (A/L1), angielski (B/L2), niemiecki (C/L3). Postawiono hipotezę, że rodzaj (tj. kierunkowość) oraz długość ustnej praktyki tłumaczeniowej będą miały większy wpływ na strukturę kognitywną PRO (a także prawdopodobnie CIS) niż bliskie podobieństwo leksykalne istniejące pomiędzy obydwoma językami obcymi. W przypadku TRI postawiono hipotezę, że podobieństwo leksykalne będzie miało znaczący wpływ na wyniki tłumaczenia. W trakcie eksperymentów uczestnicy najpierw oceniali, czy pary słów na ekranie komputera stanowią prawidłowe ekwiwalenty tłumaczeniowe, a następnie tłumaczyli pojedyncze słowa (także przedstawione na ekranie komputera) do mikrofonu. Szybkość i dokładność tłumaczenia była badana w następujących kierunkach:

(i) z niemieckiego na angielski (C -> B) i z niemieckiego na polski (C -> A) podczas rozpoznawania prawidłowych par tłumaczeniowych, oraz

(ii) z polskiego na niemiecki (A -> C) podczas ustnego tłumaczenia pojedynczych słów.

Obydwa eksperymenty były poprzedzone przeglądem wyników najważniejszych badań empirycznych oraz modeli słownika umysłowego (Rozdział 1) i przetwarzania leksykalnego (Rozdział 2) w przypadku osób dwu- i trójjęzycznych. Przegląd literatury służył ustaleniu, w jaki sposób osoby trójjęzyczne wykonują i kontrolują przetwarzanie leksykal-

ne w trakcie rozpoznawania par tłumaczeniowych oraz tłumaczenia ustnego pojedynczych słów. W dyskusji podniesiono także kwestię wpływu rodzaju i długości praktyki tłumaczenia konferencyjnego na siłę powiązań leksykalnych w słowniku umysłowym, oraz tego, jakie czynniki mogą przyczynić się do wystąpienia zjawiska interakcji międzyjęzykowej w przypadku osób trójjęzycznych o dużym stopniu zaawansowania w znajomości języków obcych (Rozdział 3). W końcowej części dyskusji opracowano dwa modele organizacji słownika umysłowego w przypadku osób trójjęzycznych, z których pierwszy dotyczy osób mających doświadczenie w tłumaczeniu konferencyjnym, a drugi odnosi się do osób nieposiadających takiego doświadczenia.

Długotrwała praktyka tłumaczeniowa okazała się mieć silny wpływ na organizację informacji leksykosemantycznych w taki sposób, by umożliwić dokładne, ale niekoniecznie szybkie przetwarzanie słów podczas wykonywania zadań tłumaczeniowych. Profesjonalni tłumacze konferencyjni wykazali się umiejętnością zręcznego, strategicznego przetwarzania informacji semantyczno/konceptualnych bez względu na kierunek tłumaczenia. Wyniki uzyskane w grupie studentów tłumaczenia konferencyjnego okazały się być gorsze niż te uzyskane w grupie kontrolnej, co wydaje się wskazywać na to, że okres dwóch lat praktyki tłumaczeniowej nie wystarczył, aby zakończyć proces reorganizacji słownika umysłowego. Wpływ treningu tłumaczeniowego można jednak zauważyć na przykładzie przetwarzania strategicznego podczas tłumaczenia (np. w przypadku trudności w dostępie leksykalnym, studenci woleli podać słowo podobne znaczeniowo do prawidłowego ekwiwalentu tłumaczeniowego zamiast nie tłumaczyć w ogóle). Wpływ dystansu językowego i (psycho-)typologii na wyniki tłumaczenia w grupie kontrolnej był mało zauważalny w paradygmacie online. W badanej grupie dało się także zaobserwować, że w porównaniu do osób posiadających doświadczenie w tłumaczeniu ustnym, osoby trójjęzyczne w grupie kontrolnej poświęcały mniej uwagi kwestii dokładnego i strategicznego przetwarzania informacji semantyczno/konceptualnych w zadaniach tłumaczeniowych.

W zakresie organizacji słownika umysłowego oraz przetwarzania leksykalnego u osób trójjęzycznych, perspektywa koneksjonistyczno-dynamiczna wzbogacona o pewne elementy teorii modularności okazała się odpowiednia, by zrozumieć uzyskane wyniki. W wyniku przeprowadzonych eksperymentów potwierdzono założenie leżące u podstaw dwóch zaproponowanych modeli słownika umysłowego u osób trójjęzycznych, zgodnie z którym poszczególne podsystemy językowe u osób trójjęzycznych są osobne, a równocześnie posiadają powiązania skojarzeniowe, których siła zależy od czynników związanych z indywidualnym doświadczeniem językowym (np. z rodzajem i długością praktyki tłumaczenia konferencyjnego). Paradygmat tłumaczenia online stanowi obiecujący kierunek badawczy w dziedzinie przekładu pisemnego i ustnego, gdzie problematyka badań empirycznych nad przetwarzaniem leksykalnym w przypadku osób trójjęzycznych jest stosunkowo mało znana. Autorka wyraża nadzieję, że wyniki niniejszego badania będą miały znaczenie nie tylko dla badaczy przekładu pisemnego i ustnego w aspekcie psycholingwistycznym, lecz także dla praktyków i studentów tłumaczenia konferencyjnego, oraz dla nauczycieli akademickich prowadzących zajęcia z tej dziedziny i przygotowujących testy predyspozycji do wykonywania tłumaczeń ustnych.