The Role of Cross-Linguistic Formal Similarity in Hungarian-German Bilingual Learners of English as a Foreign Language

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von

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To explore the relationships between cognitive development and language development is to enter a very dark forest indeed! It is not so much a question of not being able to see the wood for the trees: one cannot even see the trees. Accordingly, the best advice one might offer to, say, a graduate student would be "Danger, keep off". For those with more leisure and securer positions it is perhaps possible to make an occasional foray without becoming entirely lost, but it should be emphasized that what is both desirable and possible in the study of language development at the present time is more facts, more flower-picking natural history. However, it is sometimes useful to make the attempt at a larger enterprise, if only as a source of ideas about where to look for new flowers.

Campbell (1986: 30)

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Deutsche Zusammenfassung

Thema

Das Thema dieser Arbeit sind kognitive Aspekte interlingualer lexikalischer Prozesse beim Fremdsprachenerwerb von Bilingualen. Die Dissertation beinhaltet eine hypothesengeleitete Analyse von empirischen Daten mit ungarischen bzw. deutschen monolingualen und ungarndeutschen bilingualen Lernenden der Englischen Sprache als Fremdsprache.

Zielsetzung

Die allgemeine Zielsetzung der Dissertation ist die Untersuchung von lexikalischen Interferenzerscheinungen bei fremdsprachlichen Wortverarbeitungsprozessen bei mono- und bilingualen Lernenden. Hierbei wurden kognitive Theorien zur Sprachverarbeitung bei Erst- und Zweitsprache mit Prozessen beim Fremdsprachenerwerb verknüpft. Die Rolle formaler Ähnlichkeit in etymologisch verwandten Sprachen (Deutsch und Englisch) wurde aus kognitiver, psycholinguistischer Sicht untersucht und definiert, insbesondere in Hinblick auf der Verarbeitung zwischensprachlicher Homophone (*cross-linguistic homophones*). Das Experiment lieferte empirische Daten in Bezug auf den Zugriff Bilingualer auf lexikalische L3 Einträge bei mündlicher Produktion mit L1 bzw. L2 Stimuli und den Zugriff Monolingualer auf L2 Einträge mit L1 Stimuli. Das Verhalten der Bilingualen wurde mit demjenigen von Monolingualen verglichen, wobei vor allem a) Genauigkeit, b) Antwortzeiten und c) die phonologischen Eigenschaften der fremdsprachlichen Sprachproduktion bei unterschiedlichem Sprachhintergrund berücksichtigt wurden. Anschließend wurden die Resultate der quantitativen und qualitativen Analyse im Rahmen eines mehrsprachigen interaktiven Netzwerkmodells interpretiert.

Das Experiment

Das Experiment fand in Ungarn und in Deutschland statt. Die Versuchspersonen in Ungarn waren ungarndeutsche bilinguale Schüler (im Alter von 15–17) in einem ungarisch-deutsch zweisprachigen Gymnasium. Zum Testzeitpunkt hatten sie 2–3 Jahre Unterricht in Englisch als Fremdsprache erhalten. Die Sprachproduktion dieser bilingualen Gruppe in Hinblick auf lexikalische Interferenz zwischen der Zweitsprache (Deutsch) und der Fremdsprache (Englisch) ist der zentrale Aspekt der Untersuchung. Als Vergleichsgruppen wurden eine ungarische monolinguale Gruppe (ebenfalls Gymnasialschüler im Alter von 15–17 mit 2–3 Jahren Englischunterricht) und eine Gruppe von deutschen Monolingualen (im Alter von 13–14 und mit 2-3 Jahren Englischunterricht) untersucht. Ihre Sprachproduktion wurde mit derjenigen von Bilingualen verglichen.

Folgende zwei Haupttests wurden für die Datenerhebung eingesetzt[1]:

- Auditory Lexical Decision (ALD)
- Oral Word Translation (OWT)

Auditory Lexical Decision

ALD ist eine Standardtechnik für die Messung von Antwortzeiten auf dargebotene akustische Stimuli. Den VPs wurden auditiv Stimuli jeweils in der Muttersprache oder in der Zweitsprache präsentiert. Die Stimuli waren zwanzig in der Muttersprache/Zweitsprache existierende Wörter und zwanzig nicht existierende Pseudo-Wörter. Die VPs mussten sich entscheiden, ob die dargebotenen Stimuli echte deutsche Wörter waren oder nicht.

Oral Word Translation

Die "mündliche Wortübersetzung" ist ebenfalls eine häufig verwendete Technik zur Untersuchung lexikalischer Prozessmechanismen in zwei Sprachen. Die VPs hören ein Wort in ihrer Muttersprache/Zweitsprache und sind aufgefordert, dieses Wort in seinem fremdsprachlichen Äquivalent auszusprechen. Die Stimuli waren 50 Einzelwörter. Die Wörter wurden unter Berücksichtigung folgender Faktoren ausgewählt: Formale Ähnlichkeit zwischen Input und Übersetzungsäquivalent, Grad der Abstraktheit, Grad der Familiarität. Hinsichtlich formaler Ähnlichkeit unterschieden sich *true cognates*, d. h. Wörter mit formaler Ähnlichkeit und derselben Bedeutung in zwei Sprachen; *false cognates*, d. h. Wörter mit formaler Ähnlichkeit aber nicht übereinstimmender Bedeutung und *noncognates*, d. h. Übersetzungsäquivalente ohne formale Ähnlichkeit.

[1] Zusätzlich wurden drei weitere Aktivitäten mit den beteiligten Schülern durchgeführt, die in erster Linie als Experimente zur Bestimmung der *Baseline* dienten.

Datenanalyse

Reaktionszeiten und Genauigkeit der gegebenen Antworten wurden quantitativ ausgewertet und *between-* und *within-Group* Unterschiede verglichen.

Hypothesen

Nullhypothese: Es gibt keinen Unterschied in der Art und Weise, in der Monolinguale und Bilinguale lexikalische Femdspracheninformationen verarbeiten.

Alternative Hypothese: Die Wortverarbeitungsprozesse unterscheiden sich in Mono- und Bilingualen mit unterschiedlichem Sprachhintergrund infolge deutsch-englischer lexikalischer Interferenz. Als Beleg hierfür sollten die Genauigkeitsanalyse und die Reaktionszeitanalyse signifikante Unterschiede zwischen der nichtdeutschsprachingen Gruppe (-Deutsch) und den deutschsprachigen Gruppen (+Deutsch) einerseits und innerhalb der +Deutsch Gruppen bzgl. der *cognate* Kategorien andererseits ergeben.

Hypothesen über die Genauigkeit der Antworten: Die +Deutsch Gruppen werden eine signifikant höhere Genauigkeitsrate haben als die -Deutsch Gruppe. In Bezug auf *cognate status* werden *true cognates* eine signifikant höhere Genauigkeitsrate haben als *noncognates* und die Genauigkeit der Antworten wird in *false cognates* signifikant niedriger sein als in *noncognates*.

Hypothese über die Reaktionszeiten: *True cognates* werden geringere mittlere Antwortzeiten haben als *noncognates*. Die Reaktionszeit für *false cognates* bei richtigen Antworten wird höher sein als bei *noncognates*.

Ergebnisse

Generell unterstützen die Ergebnisse der Genauigkeitsanalyse die Hypothese, daß Erstsprachinformation ein wichtiger Faktor beim fremdsprachlichen Wortverarbeitungsprozeß ist. Die Kenntnis einer etymologisch verwandten Sprache führt zu einer allgemein höheren Genauigkeit, wie der Vergleich der +Deutsch und -Deutsch Gruppen zeigt. Die nichtsignifikante Differenz in den Genauigkeiten Bilingualer (mit ungarischem und deutschem Input) stützt die Hypothese, daß bei ihnen beide Lexika (L1 und L2) am lexikalischen Verarbeitungsprozeß von L3 beteiligt sind.

Die *within-Group* Unterschiede belegen, daß bereits erworbene Kenntnisse einer etymologisch verwandten Sprache den Zugriff auf Übersetzungsäquivalente erleichtern, falls die Lerner die formalen Ähnlichkeiten zwischen Input und Zielwort wahrnehmen. Die VPs zeigen hohe Genauigkeit in der *true cognate* Bedingung und eine niedrige Genauigkeit in der *false cognate* Bedingung. Dies unterstützt die Hypothese, daß formal ähnliche Wörter ohne vollständige semantische Äquivalenz ausgewählt werden können. Allerdings ist die Art der *false cognates* von Bedeutung. *False cognates* ohne semantischen Überlapp (z. B. Rock – rock) werden *nicht* als Übersetzungsäquivalente betrachtet. Die Lerner betrachten *false cognates* als Übersetzungsäquivalente nur dann, wenn die zwei Wörter nicht nur formal ähnlich sind, sondern auch gemeinsame semantische Komponenten aufweisen (z. B. Frieden – freedom, Land – land). Es gibt keine signifikante Interferenz bei formal ähnlichen Wörtern ohne semantischen Überlapp.

Die Analyse der Reaktionszeiten unterstützte die Alternativhypothese nur in einer Hinsicht. Die bilinguale Gruppe mit L2 (Deutsch) als Input unterschied sich signifikant von allen anderen Gruppen, die L1 (Deutsch oder Ungarisch) als Input verarbeiteten. Die übrigen drei Gruppen zeigten keine signifikanten Reaktionszeitunterschiede.

Die Analyse ergab jedoch eine Interaktion zwischen Geschwindigkeit und Genauigkeit der Antworten. Zwischensprachliche formale Ähnlichkeit erleichterte die Aktivierung von Übersetzungsäquivalenten (in der *true cognate* Bedingung), erschwerte aber die korrekte Artikulation. Es wird daher angenommen, daß die korrekte Artikulation akustisch ähnlicher Zielwörter die Suppression der in L1/L2 aktivierten Form verlangt, die in subartikulatorische Überwachungsprozesse involviert sein kann. Der Vergleich der Latenzzeiten von phonologisch richtigen und falschen Antworten unterstützt die Hypothese, daß die Produktion phonologisch korrekter Antworten auf Kosten der Schnelligkeit erfolgt.

Das multilinguale Netzwerkmodell

Die Art der hier vorgeschlagenen Modellierung der mentalen Repräsentation bilingualer Lernender einer Fremdsprache basiert auf den monolingualen und bilingualen interaktiven Netzwerkmodellen von Stemberger (1992); Dell (1988); Roelofs (1999); Paradis (1997); Green (1993). Im hier beschriebenen multilingualen Netzwerkmodell werden Wörter in unterschiedlichen Sprachen (in diesem Fall lexikalische Einträge von L1, L2 und L3) durch Einträge im lexikalischen Gedächtnis repräsentiert, die bidirektional miteinander verknüpft sind. Die sprachspezifischen Lexika formen miteinander ebenfalls bidirektional verbundene Sub-Netze im Sprachsystem. Die nichtverbale Information wird im konzeptuellen Gedächtnis gespeichert. Die Einträge beider Sprachen der Bilingualen und der Eintrag von L3 können grundsätzlich auf zwei unterschiedlichen Pfaden miteinander verbunden sein: 1) mit dem Konzept als Mediator (*concept mediation*) oder 2) durch direkte Wortassoziation (*direct word association*); siehe de Groot et al.

(1994); Chen and Leung (1989). Der Zugriffsprozess auf die lexikalischen Einträge basiert hierbei auf dem Kohortenmodell (*Cohort Model*) von Marslen-Wilson (1989a).

Fazit

Die vorliegende Arbeit (insbesondere die Analyse von Genauigkeit und phonologischer Interferenz) liefert empirische Evidenz für die Bedeutung bereits erworbener Sprachkenntnisse beim Erwerb einer etymologisch verwandten Sprache. Formale Ähnlichkeit des Inputs und Outputs erleichtert den Zugriff auf das Zielwort auf der lexikalischen Ebene, erschwert aber gleichzeitig dessen korrekte Artikulation durch phonologische Interferenz. Diese Befunde wurden im Rahmen eines multilingualen Netzwerkmodells interpretiert. Zukünftige Forschung mit einer Implementation dieses Modells könnte es erlauben, die dynamischen Vorgänge bei der Verarbeitung fremdsprachlicher Wörter zu simulieren.

Chapter 1

Introduction

> ”. . . mastering the vocabulary of most European languages means simply learning to recognize a number of old friends under slight disguises, and making a certain effort to learn a residue of irrecognizable words, which, however, offer less difficulty than they otherwise would through being imbedded in a context of familiar words. . . ”
>
> (Sweet, 1899: 66)

1.1 Language learning with different language background

Henry Sweet, in his well-known, frequently cited early study of languages writes about the ease with which speakers of European languages learn other European languages, a topic ever since at the heart of second and foreign language acquisition research. Nevertheless, not every European language is so easily acquirable. As Harold Palmer points out:

> The problem to be faced by a Frenchman about to learn Italian has a very different character from that encountered by an Englishman setting out to learn Hungarian. (Palmer, 1917: 33).

On the whole, whether it is a Frenchman learning Italian, an Englishman coping with Hungarian or vice versa, one thing remains indisputable: During the acquisition of the foreign language, the learning process will be strongly influenced by the nature of the native language. When hearing a foreigner speaking our language, we can quite often identify his nationality, by his accent and by the kind of errors he makes. The foreign language has a ’parasitic’ nature, it feeds on what it finds available. In more scientific terms: Learners of a foreign language rely upon their prior linguistic knowledge in the acquisition process. Similarities and dissimilarities in word form, along with similarities and dissimilarities in word meanings, play a major role in how quickly and successfully a particular foreign language may be learned by speakers of another language. The primary language can facilitate the learning process: It is easier to recognize and to learn target words that are similar to words in the native language. For example, a native speaker of German does not have much problem understanding or producing the lexical items in the following English sentences:

The weather was stormy this summer.
Das Wetter war stürmisch in diesem Sommer.

She has a book in her hand.
Sie hat ein Buch in der Hand.

It is cold: you must give me a pullover or a jacket.
Es ist kalt, du musst mir einen Pullover oder eine Jacke geben.

The primary language, however, does not always facilitate the learning process. In certain cases, the perceived formal similarity may be misleading: A similar sounding word that actually has a different meaning in the native language can be an 'unwanted intruder' in the learner's interlanguage which he cannot easily get rid of. The following examples are meant to illustrate the intrusion of knowledge from the primary language. They were taken from the written and oral production of learners of English with prior knowledge of German:

This room is quite **hell*.	(Instead of This room is quite *bright*.) In German: Dieses Zimmer ist ganz *hell*.
Please, leave your coat **on the floor*.	(Instead of Please, leave your coat *in the corridor*.) In German: Bitte lass deinen Mantel *auf dem Flur*.
He is **even so* clever as his father.	(Instead of He is *just* as clever as his father.) In German: Er ist *ebenso* klug wie sein Vater.
I * *will not that* you do it.	(Instead of I *do not want you* to do it.) In German: Ich *will nicht, dass* du es tust.
How long did they **laugh*?	(Instead of How long did they *run*?) In German: Wie lange sind sie *gelaufen*?
Balaton is the biggest **sea* in Hungary.	(Instead of Balaton is the biggest *lake* in Hungary.) In German: Der Balaton/Plattensee ist der größte *See* in Ungarn.
I **noticed* what I wanted to buy.	(Instead of I wrote *down* what I wanted to buy.) In German: Ich habe *notiert*, was ich kaufen wollte.

In these cases, the lexical items in the source language and in the target language share many formal characteristics, but they share no (or very few) features of meaning. Similarity of spelling or sound shape in these cases is actually an obstacle; the L1 lexical knowledge hinders proper use of words in the target language and it may also hinder ultimate correct attainment of the L2 if the learner does not notice the difference between his incorrect lexical use and that of native speakers. Thus, formal similarity between lexical items in two languages would appear to produce a facilitating effect if the formally similar words also share their meaning and it results in interference if the two lexical items do not share their semantic features. But, does facilitation really result in easily acquired, correct language usage? Let us consider the following examples that were taken from the same group of language learners with knowledge of German.

That he is *so nervous*, disturbs me. In German: Dass er *so nervös* ist, stört mich.	[nervøːz] instead of [nəːvəs]
Her *hair* was brown. In German: Ihr *Haar* war braun.	[haːr] instead of [heə]
I know *this man*. In German: Ich kenne *diesen Mann*.	[dɪːz man] instead of [ɗis mæn]
I told him *persönlich*. In German: Ich habe ihn *persönlich* gesprochen.	[perˈzøːnliç] instead of [ˈpəːsnəlɪ]
It is very *interessant*. In German: Es ist sehr *interessant*.	[intereˈsant] instead of [ˈɪntrɪstɪŋ]

In these cases, the learners did not make lexical errors (unlike in the previous examples where they used target language items that were semantically inappropriate). In the above sentences, the errors appeared at the phonological level. The learners used a word that existed in the target language, nevertheless the interlanguage phonology showed clear signs of interference from prior lexical knowledge of German. In these examples, the German and the English words shared not only their meaning but also many of their phonological features. However, since similarity does not mean sameness, formal resemblance can also be a source of difficulty for language learners that manifests itself primarily in pronunciation and spelling errors. In this way, in the case of similar lexical forms, facilitation and interference seem to be inseparable.

The above examples come from a specific group of language learners. They are Hungarian-German bilinguals who learn English as a foreign language in a secondary grammar school in Hungary. As a teacher of English in this school, I observed that the interlanguage of these bilingual learners differed in many respects from the target language use of Hungarian monolinguals learning English. They made certain characteristic errors which seem to be caused by their knowledge of German (see appendix A and the examples listed above). Furthermore, the bilingual groups in this school seemed to be quite successful learners of English making remarkable headway in the foreign language, especially in the initial phases of learning. This led me to the following observations:

1. In the learning process, these bilinguals rely on their second language more than on their mother tongue and owing to this, they enjoy advantages over

the monolingual Hungarians due to their knowledge of German (since German and English share a great number of similar lexical forms). Furthermore, the bilinguals may be advantaged over the monolinguals in foreign language learning in general, due to differences in cognitive skills in monolinguals and bilinguals, since the bilinguals have acquired two languages at an early age and are proficient speakers of two languages.

2. With respect to pronunciation, learners without prior knowledge of German produce fewer pronunciation errors in their oral production. Once they have learned the pronunciation of words, they tend to use them correctly, unlike German speakers in the case of similar sounding but not identical words. Thus, phonological interference appears to be a problem for speakers of an etymologically related language more than for speakers of an unrelated language, meaning that regarding the phonological accuracy in the target language, Hungarian monolinguals may be advantaged over German-speaking learners.

These observations that result from three years of teaching experience and subsequent empirical data collection led to the following questions:

1. Do bilinguals rely upon their second language lexical knowledge more than upon the first language if they perceive more formal similarity between the second language and the third (target) language than between the native language and the target language?

2. Is it generally an advantage to be bilingual when learning a foreign language?

3. Is phonological interference indeed an unavoidable concomitant of cross-linguistic lexical similarity and is it really hard to overcome?

To try to find an answer to these questions, a series of experiments were conducted to provide us with empirical data concerning the lexico-semantic and phonological properties of the interlanguage of learners of English from different language backgrounds. In the experiments, Hungarian-German bilinguals, Hungarian monolinguals and German monolinguals were tested in oral production. The analysis of the data is based on psycholinguistic aspects of the processing of foreign language lexical information in monolingual and bilingual language learners. I shall discuss cognitive aspects of the manifestation of positive and negative transfer, the role of cognate status and multilingual competence. For the description of the underlying cognitive processes, a multiple language network model will be used that is based on models and empirical findings describing monolingual and multilingual mental representations and processing mechanisms.

1.2 The Hungarian-German bilinguals - An historical and sociolinguistic overview

The Hungarian-German bilinguals are the main group to be studied in the experiments. I will now clarify what I mean by *Hungarian-German bilinguals*, addressing such questions as: the extent to which I can talk about bilingualism in Hungary, where the Hungarian-German bilinguals are situated, how much they have preserved of their national identity and, most importantly, under which circumstances the German ethnic minority can learn and use German in Hungary. The following historical overview is largely based on information taken from an extensive study by Paikert (1967) on the German populations in Hungary and neighboring countries.

1.2.1 Historical overview of the German nationality in Hungary

The first wave of Germans came to Hungary in the eleventh century at the invitation of King St. Stephen who, on the advice of his Bavarian born wife Gisela, encouraged German monks, preachers, knights, traders and craftsmen to settle down there. The next organized immigration of Germans occurred during the twelfth century under King Geza II, who invited Germans from the Mosel region to the Transylvaniean boundaries of Hungary in order to fortify the border zone with reliable western manpower. The third and by far the greatest wave of German immigration to Hungary, known as the *great Swabian migration*, began in the eighteenth century immediately after the liberation of Hungary from Turkish rule, and was completed in the first half of the nineteenth century. Many Germans were brought to Hungary, mainly from the southwestern part of the 'Germanies' (Paikert, 1967) and the hereditary lands of the Habsburgs. The chief areas of settlement were in south Hungary, where, throughout the eighteenth and nineteenth centuries a chain of villages with a high percentage of German population, the so-called *Swabian Basin* gradually took shape. In the twentieth century, between the two world wars, the total number of Germans in Hungary was around half a million. After the second world war, the Soviet troops marsched in and Hungary got under the political and economic influence of the Soviet Union. The socialist era behind the 'iron curtain' began. Germans became a despised and unwanted minority in Hungary because of their role in the second world war, and they also became political enemies because of the political system in West-Germany. In order to "eliminate once and for all the possibility of German interference in Hungarian domestic affairs through the pretext of protecting a German minority" (Paikert, 1967: 203), the Soviet Union ordered the deportation of the Danube Swabians.

Altogether some 200,000 Swabians were transferred from Hungary to Germany. The number of ethnically German Hungarians decreased radically. Moreover, those who remained, disguised their ethnic origin; they did not dare to claim to be German. According to official statistics, in 1949 only 22,453 persons gave German as their mother tongue. The situation of the German nationality improved gradually around the end of the sixties, as the political conflict eased up between 'the East' and 'the West'. As a result, the isolation of Hungary from the western world due to its location behind the Iron Curtain has eased a great deal, and since then there has been regular contact between the Swabians remaining in Hungary and their relatives who fled or were expelled to Germany. In the eighties, the situation of the German nationalities improved further, most of all due to political changes in Hungary; the socialist system having failed, democratic changes started with the first free elections in 1989, when a democratic party was elected. Political changes in Germany (the unification of East- and West-Germany) had an effect, too. Minority education has improved a lot and there has been an ever growing demand to use German and to preserve cultural traditions. The statistical data in Table 1.1 show the effects of the negative and positive changes on the German population in South Hungary, in county Baranya[1].

Year	German ethnic minority status	German mother tongue, Hungarian nationality	Speakers of German (other than a native or ethnic language
1941	69287	97545	30501
1949	312	5446	47274
1960	1621	17271	-
1980	3367	11756	28875
1990	10524	14055	28813

Table 1.1: Changes in the German and German-speaking population in Baranya county, Hungary. The statistical data is taken from Hoóz (1993: 16).

It is obvious that the number of persons who claim to be of German origin has grown dramatically from the beginning of this decade. At the same time, the number of those who can speak German, but not as a native or an ethnic minority language has decreased. This odd shift in numbers can be explained by the hypothesis that many of those who claimed to be mere speakers of German before 1990, declared themselves as native speakers of German or as members of the German minority in 1990. In 1990, ethnic Germans in Baranya county made up 34% of the German ethnic population in Hungary. Consequently, the census

[1]The statistics to be presented describe the situation of the German nationality in the county where the experiment was conducted. The majority of the bilingual subjects come from this area and live in the villages or towns that are involved in the statistics.

data reveals Baranya county to have a heavy concentration of ethnic Germans, a factor relatable to minority language maintenance (the statistical data are taken from Hoóz (1993: 16-20).

1.2.2 Minority language education

Before describing minority education, it is useful to give a brief description of the Hungarian educational system. Traditionally, all children attend a nursery school between the ages 3 and 6. They go to primary school at 6 and finish primary education at 14. Secondary education starts at the age of 14 and lasts 3 or 4 years, depending on the type of school the child is attending. Children who attend secondary school for 4 years and take a final examination can do further studies at college or university.

Ethnic minorities in Hungary have the chance to use both the official state language and their minority language from nursery to secondary school. In Baranya county, for example, the German language is taught in nursery schools, primary and secondary schools and at university. In 1992, a total of 3300 children learnt German in 57 nursery schools. 7327 children learnt German as an ethnic minority language in altogether 50 primary schools (Hoóz, 1993: 16-20). At the secondary level, there are 3 schools where German is taught as a minority language. One of these schools is the Leőwey Klára Secondary Grammar School, which has had a German *nationality* section since the academic year 1956-57. In 1980-81, the school had 124 ethnically German students, the number of learners in 1990-91 amounted to 317 persons. Instruction by language is organised as follows: 50% of the classes are in the 'majority language' (Hungarian), the other 50% are in the minority language (the statistical data come from the offical yearly statistics of the secondary school). The following subjects are taught in German: German language and literature, history, biology and geography. Weekly, there is one class-meeting with the form master that is also held in German and there are several extra-curricular activities (afternoon programs, exchange programs with German and Austrian schools, etc.), where the German language is used. During their studies, most of these bilingual learners take a Goethe Institute proficiency exam (*Deutsches Sprachdiplom*).

Chapter 2

Theoretical considerations

2.1 The mental lexicon

The mental lexicon is "a vast compendium of information" in the human brain, a mental dictionary in which our knowledge of language (words and their relationships) is stored (Kess, 1992: 80). There are some similarities between a written dictionary and the human mental lexicon. A written dictionary and the mental lexicon are both organized along certain principles, such as the orthographic, phonological and semantic characteristics that the words share. If we look for a word in the dictionary, we need to start the search with the initial letter, to find words beginning with that letter and then to narrow down the possibilities by going on with the following letters always in alphabetic order until in the end we find the right 'entry'. It gives us access to all the semantic, morphosyntactic and pragmatic information related to the lexical item we have looked up. Words in our mind are supposed to be stored 'behind' entries in a similar fashion. The storage of lexical information and the processing mechanisms through which we have access to the stored knowledge in memory have some similar underlying principles. Nevertheless, the complexity of the storage and access of representations in the mental lexicon makes any analogy with a dictionary (or a library, or a storehouse) untenable. Books in a library or entries in a written lexicon are static and unchanging, whereas lexical knowledge in the human mind is dynamic; on the one hand, the languages themselves change over the time, on the other hand, no native speaker has perfect knowledge of the native language. The mental representations in the mind change in that new word forms or new instances of meaning can be added and representations that are never used can cease to be accessible. Books and electronic databases do not have this dynamic character. The accessibility of the stored information also differs in a written lexicon and in the human mind. In a book, all information is equally accessible, whereas in the mental lexicon entries differ in their degree of accessability. This difference is determined by certain factors like frequency of use or imageability of a word (to be discussed later). Moreover, books can only operate with verbal information, that is, with orthographic/phonetic forms and verbalized meaning. The mental lexicon, on the contrary, is built up of verbal *and* nonverbal information, the mental representations of words provide access to linguistic as well as nonlinguistic knowledge (Schreuder and Flores d'Arcais, 1989). A word in the mental lexicon has, besides its lexical properties, nonverbal percepts, conceptual representations and images that are derived from 'real-life experience' and are stored in episodic memory. We infer the meanings of words from the contexts in which they are embedded in real-life situations and through our senses we receive the information necessary to establish the mental images and our knowledge about the world. As Bakhtin expresses it, "Every word smells of the context (. . .) in which it has lived its intense social life" (Bakhtin cited in Gass and Selinker, 1994: 276). This characteristic feature of the mental lexicon, namely that it is an inventory of verbal (linguistic) and nonverbal (conceptual) information, which makes it basically differ from books and computers, causes difficulties in defining and describing linguistic and nonlinguistic mental representations in the human mind. But before discussing the topic of lexical and conceptual representations, let us consider the following questions: How is our knowledge of language stored in mental representations and how are these representations organized in the mental lexicon?

The description of the mental lexicon and the processing mechanisms that will be presented here basically follows a cognitive psychological approach of speech processing (referred to as the connectionist or spreading activation approach) which in certain aspects stands in contrast to that linguistic tradition which postulates modular computational processes and describes the language structure in terms of a system of rules (see section 2.1.1). Rumelhart and McClelland (1987) summarize the basic differences in the two approaches and at the same time they emphasize the importance of both in our attempt to come to a better understanding of the language system. They posit that many aspects of human behavior are governed by rules. The ability to speak natural languages appears to be a rule-governed behavior too, since we are able to speak and write in an acquired language correctly and we can judge the grammaticality of given utterances fairly well. The advocates of linguistic theory (see Chomsky, 1986) have proposed an abstract description of the language faculty and of the nature of language acquisition. Cognitive psychologists and psycholinguists, however, seek an answer to some questions in terms of the actual processing mechanisms in the human brain, formulated by Rummelhart and McClelland in the following way:

> "But what of the actual representations and procedures used in language processing and language learning? Do the processing mech-

> anisms actually consult a set of rules, and do the acquisition mechanisms actually formulate, evaluate, and/or modify members of the set?" (Rumelhart and McClelland, 1987: 195)

In their answer to these questions, Rummelhart and his colleague outline the main principles of the new approach which are as follows:

> "We take the view that the answer may be "no". We suggest instead that implicit knowledge of language may be stored in connections among simple processing units organized into networks. While the behavior of such networks may be describable (at least approximately) as conforming to some system of rules, we suggest that an account of the fine structure of the phenomena of language use and language acquisition can best be formulated in models that make reference to the characteristics of the underlying networks.
>
> In our network models, the mechanisms that process language are constructed in such a way that there are no rules anywhere in them. Acquisition occurs by a simple process of adjusting connections between units. The behavior of the models is lawful (as lawful, we would argue, as the human behavior it simulates), but is not based on the formulation or consultation of rules." (Rumelhart and McClelland, 1987: 196)

They claim that similar phenomena occur very frequently in nature and refer to an example that they take from Bates (1979). This example is the formation of honeycomb which 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." (Rumelhart and McClelland, 1987: 196)

However, it must be added here that the structure of the network models that will be described here in detail and that serve as a basis for the particular multilingual network model through which the results of the experiments I conducted will be demonstrated are motivated to a large extent by linguistic theory. Many models that follow the psychological tradition attempt to combine (neuro)psychological findings with linguistic theory and to give an account of the kind of data that each emphasizes (see Dell, 1988; Stemberger, 1985). The approach based on the findings of neuropsychology, referred to as the connectionist approach

> "allows the interactions among information sources that were the focus of the psychological tradition to be placed within a system of linguistic knowledge. Specifically, much of what is emphasized in

> the linguistic tradition will be present in the structure of the network, in its units and the connections among them. The effects associated with the psychological tradition will then emerge from the spreading-activation process." (Dell, 1988: 127).

The purpose of these models is at the first place to describe human information processing by concentrating on the demonstration of certain significant *effects* rather than developing and testing predictions from linguistic theory (Dell, 1988: 128). Many cognitive psychologists and psycholinguists emphasize the importance of a compromise between connectionist network implimentations of processing and principles of symbolic representations, for example McShane (1991), discussing the advantages of the McClelland & Rummelhart model in McClelland and Rumelhart (1981) or Stevick, drawing the attention to some shortcomings in terms of a rule-governed behavior (Stevick, 1996: 71). The goal of researchers using network models for the description of lexical processing is to attempt to give an account of the computational function of the brain as a subtle network of interconnected units. Cognitive psychologists and psycholinguists are still far from reaching this ultimate goal, but with the help of the interactive network models we can learn a great deal about the actual functioning of the human brain and about information processing in the language system.

In the following, a contrastive description of the modular computational and the connectionist theory will be given here, highlighting their strengths and weaknesses. After a general discussion of the two theories, some influencial models of both approaches will be presented with particular respect to the aspects of lexical processing they can best account for.

2.1.1 The modularity theory

The origin of modularity theory dates back to the 18th century when a German anatomist (Franz Josef Gall) developed the view that intellectual and behavioural attributes are controlled by a specific location in the human brain (Singleton, 1999: 111). The theory became the most influencial cognitive perspective in the late sixties, posing a challenge to the behaviorist view. The most important advocate of modularity theory is Fodor (1983, 1989), who proposed special-purpose perceptual processors that he called *modules*. These modules are autonomously fuctioning operating systems within the language system, meaning that each module processes a certain aspect of language information independently of the other operating systems. From a neurolinguistic point of view, the modularity theory is based on the hypothesis that there is a specific neural architecture responsible for the processing of linguistic information. Based upon this postulate, some principle claims of the fodorian modularity are that linguistic information processing is *domain-specific*, that is, independent of other, nonlinguistic cognitive processes, and that the operating systems are *informationally encapsulated* (see Fodor, 1983), meaning that the modules can process only certain information and do not utilize other information available in the cognitive system as a whole. One of the most disputed aspects of modularity is this information encapsulation. Different terrains of psychology and psycholinguistics provide evidence that contrasts this hypothesis. It is beyond the scope of the present thesis to describe the counterevidence in detail, thus suffice it to present here only evidence that is most relevant to lexical processing, namely empirical findings of experiments that involve reduced-redundancy procedures such as cloze tests. In cloze tests, subjects are required to fill in missing words in a continuous text, imbedded in context. Results of cloze tests show that the more predictable the target items through contextual cues, the more successful the performance of the subjects attempting to guess the missing words (see Weir, 1988). These results indicate that subjects actually make use of different kind of information available in the cognitive system at the same time (e.g. semantic, syntactic cues). As Singleton formulates, these tests provide evidence for effects of "cognitive penetration" during processing (Singleton, 1999: 115–116). Fodor's response to this critique is that what might appear as contextual effect, might also be viewed as a matter of "interlexical excitation" (Fodor, 1983: 80). He claims,

> ...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)

His description of a possible account of the above effect shows some evident similarities with some postulates of spreading activation theory (an interesting aspect I will come back to in the discussion of serial search models vs. spreading activation models).

2.1.2 The connectionist theory

The connectionist view describes human information processing in terms of the strength of connections between units in a network rather than in terms of governing rules. The theory origins in the 1940s, when McCulloch and Pitts proposed the first mathematical model describing the functioning of a neuron (McCulloch and Pitts, 1943). Nevertheless, the first attempts were followed by a long period of silence until the 70s and 80s, when the first really influencial connectionist models were proposed.

Network models describe lexical processing through activation spreading along a network of interconnected units. Multiple candidates are processed simultaneously. There are two main approaches within the connectionist view: *local connectionism*, in which units are symbolic in nature and have a functional value (e. g. the expression cat corresponds to a node that represents a lexeme, the sound /t/ corresponds to a node representing a phoneme); and *distributed connectionism*, where units do not have functional values, lexical information (phonemes, lexemes) is represented through the co-activation of several units in the network (see Stemberger, 1992). Since most researchers describing processing mechanisms in the language system use local connectionist models ((McClelland and Rumelhart, 1981; Stemberger, 1985, 1992; Dell, 1988; Dell and O'Seaghdha, 1993; Roelofs, 1992, 1999), the discussion will center around some characteristics of the local connectionist approach that will serve as a basis in my multilingual network model.

A common feature of connectionist models is that they present an analogy of the human brain and the connection of neurons. They are also referred to as interactive network models, since there are bidirectional connections between levels (or layers) of representation allowing interaction between them. These network models attempt in an abstract way to model the computational behavior of the neural network during information processing in the human brain. A great advantage of these models over any serial search model is that they can account for the enormous complexity of the information processing in the brain (since the brain consists of 10^{11} neurons, 10^{15} connections among neurons altogether and 10^4 connections per unit). Spreading activation models handle multiple activated items simultaneously, as opposed to modularity theory that assumes a serial comparator that handles one item at a time (see below). This postulate imposes a severe capacity limitation on serial search models. However, network models also face critisism for being too vague and underspecified (see Lively, 1994). Fodor and Pylshyn (1988) and Pinker and Prince (1988) argue that connectionist models are fundamentally inadequate to the task of modelling linguistic abilities since they cannot give an account of syntactic and semantic aspects of language processing. At the present stand of research, network models appear to work well at the word level, that is, for the description of word recognition, but they fail to describe processing mechanisms at the syntactic and message level.

There are several influencial connectionist models describing auditory or visual word recognition (see McClelland and Rumelhart, 1981; Marslen-Wilson, 1987; Luce and Pisoni, 1998), but there are hardly any really influencial connectionist models accounting for discourse processing and syntactic analysis. Thus, one conclusion one might draw from the above arguments against connectionism is that "some amalgam of the symbolic and subsymbolic approaches is necessary" (Garnham, 1994: 1140). Garnham claims that interactive activation models like the TRACE model (see below) can be thought of as hybrid models, since the units in these systems represent features, letters and words. Whether new approaches in a kind of "symbolic connectionism" will have a significant contribution, remains an open question.

Let us now consider some influencial models in both paradigms with particular respect to their way of decribing processing mechanisms in auditory word recognition.

2.2 Models of lexical processing mechanisms

There are two basic ways of describing the access and retrieval of stored lexical information: 1) as serial search in a modular system (Forster, 1976; Paap et al., 1982), 2) as parallel activation of nodes in a network (McClelland and Rumelhart, 1981; Dell, 1988; Stemberger, 1992; Roelofs, 1999; Paradis, 1997).

2.2.1 Serial search models

Serial search models claim that lexical activation and word recognition take place in real time by scanning lexical items as input strings sequentially. The best known and most influencial example of a serial search model is Forster's autonomous search model (Forster, 1976). In this model, there are access files which resemble catalog entries in a library or word entries in a written dictionary. Forster distinguishes three major access files, an orthographic, a phonological and a semantic/syntactic file referred to as the General Problem Solver. These files are processing modules encoding autonomous representations, that is, they are discrete operating subsystems that process different kinds of linguistic information, independently of each other. The modules process lexical information in a serial order. The phonological acces file is responsible for the processing of acoustic-phonetic input. During auditory word recognition, the incoming speech signal is matched to lexical representations in the phonological access file by a single comparator. After the right entry is found, information processing continues in the General Problem Solver (GPS). The GPS collects the output from each processor, and integrates the incoming information. It also serves as a mechanism that controls the operations in the whole processing system. An important characteristic of the model is that words in the orthographic and phonological file are arranged in a number of separate bins in a descending order of frequency so that high frequency words are searched and matched with the acoustic string prior to low frequency words. This is one of the most important strengths of the model, namely that it can account for frequency effects in word recognition, a factor that has been supported by a substantial body of evidence from lexical decision tasks (see Section 2.7).

However, the model cannot give an account of form-based priming effects (that is, the role of similarity neighborhood, see also Section 2.7). Furthermore, the model still faces the problem of capacity limitations due to the fact that only one entry is searched and matched with the input at a time. On the basis of the above limitations, and as an answer to the critisism in terms of the limitations of serial search, the search model underwent extensive changes (see Forster, 1989). In the revised model, Forster proposed a separate comparator for each lexical entry. This multiple comparator system solved the problem of limited capacity. However, this revision actually transformed the model from a search-based model to an activation-based model. A second change in the model was that Forster in the revised version postulated different levels of activity among lexical entries. This modification, similarly to the previous one, indicates that the model adapted some of the basic principles of the spreading activation theory and made the contrast between modularity theory and connectionism less salient.

2.2.2 Spreading activation models

A principle assumption of connectionist (or spreading activation) models is that the mental lexicon consists of a collection of units that can have varying degrees of activation. In local connectionist models, the system operates at distinct levels of representation where the same kind of linguistic information corresponds to the units, such as acoustic features, phonemes (or phonological segments) and lexical units. At the feature level, nodes represent parts of phonemes; at the phoneme level nodes represent parts of lexical items (words) and at the lexical level nodes represent words (e. g. Stemberger, 1992; Dell, 1988; Roelofs, 1999). The units are bidirectionally connected to other units in the network at different levels (see Figure 2.1). Each connection has a certain *weight* or strength. When a node is activated, it passes activation to the nodes it is connected to according to the strength of those connections. This activation can be either excitatory (it causes connected nodes to become more active) or inhibitory (it causes connected nodes to become less active). Accordingly, nodes have varying degrees of activation. If a node receives a sufficient amount of excitatory impulses, it is selected for further processing. The amount of excitation necessary for the selection of a node is determined by the activation threshold of the node. Nodes representing frequently or recently used words need a lower amount of excitatory impulses to be selected than nodes corresponding to low frequency words. After a node has been selected, its activation decays gradually. These units have, thus, a high resting activation level and they need a smaller amount of excitation to be reactivated. Therefore, lexical information that is often processed (e. g. frequently used words) is more easily retrievable than information fragments that are not frequently processed (e. g. rarely used words). During information processing, several nodes receive activation simultaneously, but only one node is selected for further processing. When one unit is selected, it fires (that is, it passes activation to units at higher levels) and at the same time all the other candidates receive inhibitory impulses that lower their activation level. The processes are bidirectional, units can pass activation back to a lower level in a top-down fashion too, for example lexical items send feedback activation to the phonological representations, or higher level (nonverbal conceptual) representations to the lexical units (see Stemberger, 1992; Roelofs, 1999).

After this brief outline of the important operating principles in connectionist models, three monolingual network models of lexical processing will be described to highlight some important issues in speech recognition. In the description of the models, those aspects will stand in the center that will serve as a basis for the multiple language network model that describes the processes in the Hungarian and German mono- and bilingual foreign language learners.

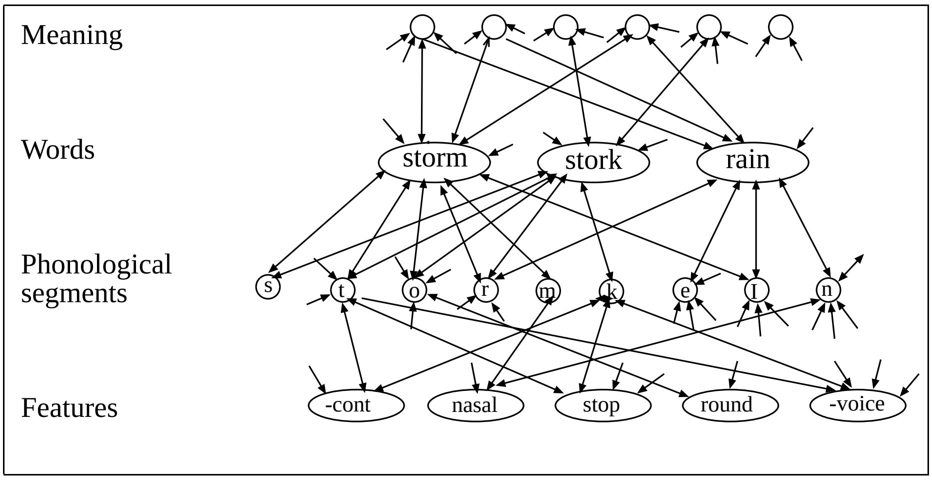

Figure 2.1: Bidirectional connections between units at different levels and the simultaneous activation of lexical units sharing phonological and/or semantic features. Based on Stemberger's connectionist model (Stemberger, 1992: 169)

The TRACE Model

The TRACE model of speech perception (McClelland and Elman, 1986) is a basic example of models that are meant to represent the functioning of neurons in the human brain. The model distinguishes three levels: feature, phoneme, and word level. The units in the model are bidirectionally connected and information processing occurs through excitatory and inhibitory impulses that determine the activation level of the competing units. Word recognition is realized through the processing of acoustic features and phonological segments. Features activate phonemes which activate lexical units. The activation of some units can inhibit other units at the same level. Another important characteristic of the model is that activation of higher level units results in the activation of lower-lever units, for example if a phoneme is activated, its acoustic-phonetic features receive parallel activation. Thus, there is a spread of activation between the layers as well as between the units in the same layer. Connections between levels are facilitory (that is, they send positive impulses only) and connections within levels are inhibitory. As excitation and inhibition are passed among the network, a pattern of activation (referred to as a *trace*) is formed which represents the sum of impulses. The selection of a candidate for recognition is governed by R. D. Luce's (1959) biased choice rule. The choice rule considers the activation level of a candidate relative to the activaton levels of all other candidates in the set (Lively, 1994: 294). An important aspect of the TRACE model is that it provides a description of the time course of spoken word recognition. Another appealing property of the model is the use of bidirectional connections between levels of representation, since this allows interaction between data-driven and concept-driven processes. The model has nevertheless some weaknesses. It has an unrealistic treatment of time (Lively, 1994: 287), since phonemes are assumed to have the same duration. This assumption ignores the temporal variability of speech. The other problem with the TRACE model is that it works with a relatively small lexicon restricted to monosyllabic words.

The Cohort Model

This model of auditory word recognition, developed by Marslen-Wilson and his colleagues (Marslen-Wilson, 1987), describes word recognition in terms of two stages of processing where the left-to-right fashion of processing and the categorical nature of phoneme recognition are emphasized. At the first stage, the acoustic-phonetic information at the beginning of a target word activates all words in memory that share this information. For example, if the acoustic signal corresponds to the word <u>storm</u>, then words beginning with [s] will be activated. They form the *word-initial cohort*, which is a set of activated lexical items. At the next stage of processing, the candidates will be progressively eliminated as the remaining input acoustic string is processed incrementally. Higher-level sources of information (that is, semantic and morphological cues) contribute to the elimination of candidates inconsistent with the already available semantic and morphological information. Word recognition is achieved when a single candidate remains in the cohort (Marslen-Wilson, 1989a: 7). Figure 2.2 illustrates the gradual unfolding of the input word <u>storm</u> from the word initial cohort to the selection of the candidate whose formal features are the best match of the input acoustic string. In evaluating the cohort theory, an important aspect is that it is explicit concerning the time course of spoken word recognition. The model acknowledges the importance of the beginnings of words and the left-to-right nature of processing auditory input (Lively, 1994: 285). Nevertheless, the importance of word-initial imformation is one of the most disputed aspects of the model, since while some empirical evidence supports the significant role of word-initial information in auditory word recognition, others contradict it (see Connine et al., 1993: 206-207).

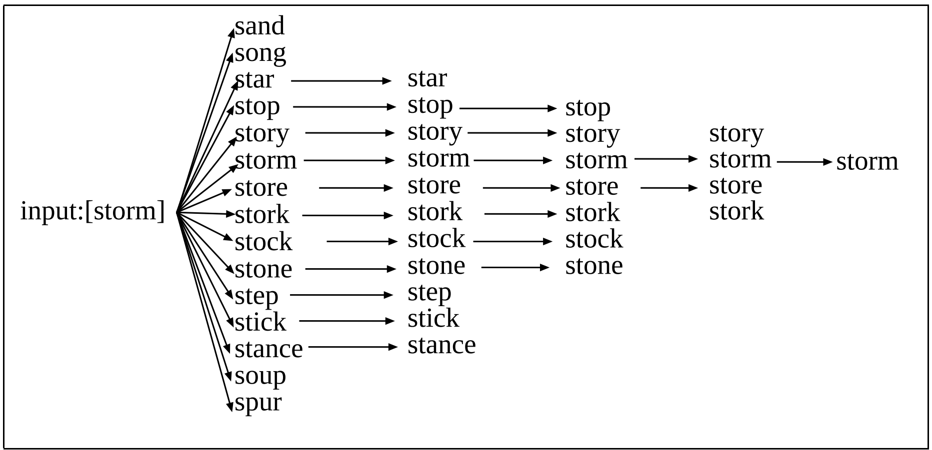

Figure 2.2: Left-to-right processing of lexical units via acoustic stimuli. Based on the Cohort Model of (Marslen-Wilson, 1987).

The Neighborhood Activation Model (NAM)

Another model that describes the processing of isolated words is the *Neighborhood Activation Model* of Luce and Pisoni (1998). Central issues in this model are the size of similarity neighborhood and the function of decision units. The model assumes that a set of similar acoustic-phonetic patterns is activated in memory on the basis of stimulus input. Words emerge in NAM when a system of word decision units tuned to the acoustic-phonetic patterns are activated (Luce and Pisoni, 1998: 27). Once activated, the decision units monitor a number of sources of information. The first source of information is the activation of the acoustic-phonetic patterns, which have previously served to activate the decision units themselves. The word decision units also monitor the overall level of activity in the decision system itself, much like certain processing units monitor the net activity level of the system in the TRACE model of speech perception. NAM is realized as a system of parallel processing units and an important claim of the model is that

> the nature and number of items activated in memory influence the accuracy as well as the speed of recognition. This prediction stems from

> the claim that the word decision units are sensitive to the overall level of activity in the decision system and are, therefore, influenced by the number and nature of competing items. (Luce and Pisoni, 1998: 29)

NAM is in many respects similar to the cohort model. Both are initially data-driven, bottom-up models where the acoustic-phonetic information of the input speech signal determines the initial access to the lexicon. An appealing characteristic of the NAM is that it explicitely considers the size and density of similarity neighborhoods (Lively, 1994: 288). However, determining the actual size and density of acoustic similarity neighborhoods in a language is a rather difficult task. As a result, the model can work with a relatively restricted database only.

In this section, some basic operating principles of network models were introduced in particular with respect to the auditory processing of single words in monolingual settings. The most important characteristics that will be applied in the model for the description of the empirical data in my experiment are the following. Units in the network are bidirectionally connected and form three levels: feature, phonological segment and word level. Lexical access starts with the bottom-up, left-to-right gradual processing of acoustic information. During processing, several competing candidates are activated in a similarity neighborhood; if the number of formally similar units is high, it slows down the activation process. In parallel with the selection of the entry whose activation level reaches activation threshold, the other competing candidates will get inhibited.

2.3 Models of semantic memory

The previous aspects of information storage and processing centerred around verbal (linguistic) representations that are stored in the mental lexicon. In this section, the issue of nonverbal conceptual representations will be examined with respect to the storage of conceptual features and their retrieval from memory. Just as lexical items can be represented as sequences of phonological segments that are instantiated as co-occurring acoustic features, nonverbal concepts can also be expressed as a subnet of co-occurring conceptual features (Collins and Loftus, 1975). A major question and a much debated issue in psycholinguistics is how meaning is represented in our semantic memory. Schreuder and Flores d'Arcais claim, "there is as yet no principled way to determine what kind of information should be called lexical semantic information and what kind of information should be called knowledge of the world." (Schreuder and Flores d'Arcais, 1989: 411). It is difficult to determine the boundary between linguistic representations stored in the mental lexicon and nonlinguistic conceptual representations. Minimally, conceptual representations are postulated to form a separate net that is often referred to as conceptual memory and that is independent of the formal (linguistic) representations of the lexical items (Levelt, 1993; Paradis, 1997). In terms of nonverbal conceptual and verbal lexicosemantic representations, many researchers postulate a distinction between language-specific lexicosemantic features, also referred to as *lemmas*, and nonverbal conceptual features (Levelt, 1993; Grainger and Dijkstra, 1992; Grosjean, 1982; Paradis, 1997; Green, 1993; de Bot, 1992).

An appealing way of describing the mental representations of lexical units and the underlying concepts is as a set of elements bearing some relations to one another and whose underlying representations are organized in semantic memory in a kind of *associative network*. Let us consider now three basic approaches to the formalization of associative network models of semantic organization in the mental lexicon, namely, the hierarchical network model, the semantic feature approach and the spreading activation approach.

2.3.1 Hierarchical network models

Our memory for word concepts can be concieved of as a system of interconnected elements. In hierarchical network models, some of the elements stand above or below other members of the network. The best example of this approach is the Collins and Quillian model (Collins and Quillian, 1969; Collins and Loftus, 1975). A key assumption made by these researchers deals with the concept of *cognitive economy*; information that can conceivably be stored in more than one place would be stored only at the highest possible level to save some space in the semantic memory. For example, the information that birds can breathe is stored in the category ANIMAL since all animals can breathe. The information that a canary has wings is stored at the level of the category BIRDS, since all birds have wings, etc. In sum, this model works with individual words that are represented as discrete units. In the retrieval of semantic information, a search of categories takes place from the more general concepts to the more specific.

2.3.2 The componential approach

Whereas in the Collins and Quillian model, words have individual semantic representations, in the *semantic feature view* (e. g. Smith et al., 1974), the mental representation of a word is a bundle of separate semantic features. This kind of approach, also referred to as the *componential approach*, asserts that we can decompose words into a set of primitive semantic elements. Thus, words that are similar in meaning, share some of their semantic features, but differ in some others. In this approach, a necessary and sufficient condition of understanding a word is to have access to its *defining features*. However, words in this model also have features that are not necessary for category membership, but are nevertheless typically associated to the word. These are the *characteristic features*. For example, two defining features for birds are that they are animals and that they have feathers, whereas a characteristic feature is that they can sing. Characteristic attributes often seem to hold for so-called prototypical members of the set of possible referents for a given word, where the *prototypes* are the category instances that appear to be the *best instances* of that category. Prototypes are supposed to be privileged in the semantic memory, as we are more adept at retrieving prototypes than other members of a category (Rosch, 1975). An attractive aspect of this model is that word meaning is seen to be acquired feature by feature. This provides a possible explanation for errors children make during the acquisition of word meaning (e. g. a characteristic feature can be taken as a defining feature and can result in errors in decisions about category membership, like collies, cats and cows being called *dog* by small children since they all have four legs and are running around the house). The problem with this model is the relativity of defining and characteristic features. The model uses them as absolute categories even though they are subjective and usually depend on individual knowledge of the world (Schreuder and Flores d'Arcais, 1989). On this account, not only children, but also adults would have different judgements on category membership if we indeed only operated on a simple dichotomy like the one offered in this approach.

2.3.3 Spreading activation models

Spreading activation models (e. g. Collins and Loftus, 1975) also assume that semantic features are represented in the mental lexicon within a network of relationships, but not in a hierarchical fashion. This model describes a web of interconnected nodes where the distance between nodes is determined by both structural characteristics such as categorical relations and functional considerations such as typicality and the degree of association between various concepts. The process of the retrieval of the semantic information in this model differs from the process in the hierarchical network model. Collins and Loftus argue that retrieval occurs by activation spreading from one unit to another throughout the network in parallel. The spread of activation is similar to the effect we have when we drop a stone into still water. The disturbance spreads out in all directions, its extension is determined by certain factors, like the intensity with which the stone was dropped. The various concept nodes in this model form a *semantic network*, organized in terms of *semantic similarity* (e.g. <u>storm</u>, <u>rain</u>, <u>tornado</u>, <u>wind</u>). This semantic network is distinguished from the *lexical network* where the *lexical* information related to the concepts is represented, which is organized in terms of *phonetic similarity* (e. g. <u>storm</u>, <u>stork</u>, <u>store</u>, <u>stone</u>). This model offers a more comprehensive, more subtle approach to the storage and access of semantic information than the hierarchical model. The spreading activation metaphor has been most strongly supported by the semantic priming paradigm where subjects are presented a target word and a prime which is semantically related to it (see Balota, 1994: 337-340). If there is semantic priming, it means that there is a tendency for a word to activate the other word associated in meaning (thus, for example, chair primes table, doctor primes nurse). These experiments support the idea of an automatic spreading activation mechanism in the processing of semantic components of words in the conceptual memory.

The above models of speech perception and production represented monolingual systems. However, in today's world, bilingualism is rather the rule than the exception. De Bot goes as far as to suggest that "the basic model should be concerned with bilingualism, with an option to have a unilingual version" (de Bot, 1992: 2). Before giving an overview of the mental representations and information processing in bilinguals, I shall discuss the following questions: Who are considered to be bilinguals?, and, What type of bilinguals can we distinguish on the basis of age and context of acquisition and the degree of achieved proficiency?

2.4 Bilingualism

2.4.1 Who are bilinguals?

Bilingualism can be defined as "having a choice of two available languages for conversation" (Harris, 1992: 299). Fluent bilinguals may be equally (or almost equally) comfortable in both languages, nonfluent bilinguals communicate in one language more easily and automatically than in the other. Regarding the question of fluency and ultimate attainment (that is, a native speaker's competence), one can use a narrower and a more encompassing definition of bilingualism. In the narrower definition, bilinguals are those individuals who have acquired two languages simultaneously or right after each other in early childhood and have a "native-like control of two languages" (Bloomfield, 1933: 56). In other words, they possess two first languages, or they have a native language and a second language that they speak almost as well as the first language. Speakers of two languages who are not fluent in both languages and who started to acquire the second language in a later age are considered as monolinguals who learn a foreign (or a second) language. In this way, we can distinguish bilinguals and second language learners (see Grosjean, 1982). In the research literature, however, bilinguals are often defined as those individuals who have some basic compentence in one of the four skills (listening, reading, speaking, writing) in a second language (Macnamara, 1967). Language learners at any level and in any age can be considered to be bilinguals (or multilinguals), since they have mental representations of two (or more) languages. Accordingly, beginning language learners are sometimes referred to as *novice* or *nonfluent* bilinguals, proficient speakers of two languages are called *proficient* or *fluent* bilinguals (see de Groot and Kroll, 1997: 170).

In this dissertation, when I use the term *bilingual*, I apply it in the narrower sense, since the Hungarian-German bilinguals studied here started acquiring the German language in early childhood, right after the first language (around age 3-6); they have regular contact with native speakers, and they have almost native-like proficiency in the second language. Furthermore, all the subjects in the experiment were learners of a foreign language. Thus, calling the bilinguals 'second language learners' would be very confusing, since we could not distinguish them form the monolingual subjects learning English as a second language. Therefore, I will refer to (German and Hungarian) monolingual and (Hungarian-German) bilingual learners of English as a foreign language.

2.4.2 Types of bilingualism

Bilingualism was first examined from a linguistic perspective in the 1940s and 1950s (see Weinreich, 1953). Weinreich distinguished between three basic types of bilingual linguistic systems, based on assumptions about potential effects of the learning context on the nature of the acquired systems. These were the coexistent, merged and super-subordinate systems. *Coexistent/coordinate systems* are said to result typically from the simultaneous acquisition of the two languages in different contexts. When two languages are acquired in different contexts, each through interaction with specific groups of native speakers (e.g. one language in the home, the other in the school where it is the language of all communication), the linguistic competence in both languages is hypothesized to be the same as those of native speakers of each language. A *merged/compound system* is said to result when both of the languages are acquired simultaneously in the same context (e.g. in the home through parents speaking different languages), because in such cases different word forms are used for the same referents. When the two languages are acquired through interaction with speakers who use both languages interchangeably in all contexts, it was assumed that the two languages would merge and that they would show bidirectional interference. *Super-subordinate systems* are hypothesized to be the results of language learning in a formal setting. When a second language is learned through translation in a first language environment, such as by studying a foreign language in school, the second language system will develop via the forms of lexemes in the first language. In addition to the compound and coordinate distinction, researchers distinguish *balanced* and *dominant* bilinguals. Balanced bilinguals are equally proficient in both languages, dominant bilinguals have a higher proficiency in one of the two languages.

2.4.3 Cognitive skills in bilinguals vs. monolinguals

Another central topic in the study of mono- and multilinguals is, whether they have different cognitive skills. In other words, do bilinguals have better cognitive abilities and do monolinguals have a cognitive deficit? Or on the contrary, do bilinguals/multilinguals suffer a linguistic loss since they speak many languages but might not have full competence in any of them?

In previous centuries, many researchers considered bilinguals to be at a disadvantage; as Cattell put it in 1887, bilinguals might pay a cognitive price for being able to communicate in two languages. He claimed that ”foreign languages take up much time even after they have been learned, and may lead us once more to weigh the gain and loss of a polyglot mental life” (Cattell, 1887: 70). In the second half of the 20th century, bilinguals have been compared to monolinguals with respect to their cognitive abilities in several psycholinguistic and neuropsychological experiments. Albert and Obler (1978) summarize the results of some of these experiments and conclude that

> bilinguals function differently from monolinguals on a variety of cognitive tasks. Although it might appear that bilinguals have better performance scores than monolinguals on a greater number of the tests (...), it would probably be incorrect to speak of a cognitive advantage of bilinguals over monolinguals. Rather, it seems to us more appropriate to speak of differences in cognitive style between bilinguals and monolinguals. (Albert and Obler, 1978: 205)

Some research reports (see Albert and Obler, 1978: 206–210) imply that bilinguals mature linguistically and perhaps also cognitively earlier than monolinguals (for example, bilingual children develop quite early a sense of the relativity of referencial expressions, since they have two signs for many referents and they also seem to develop the ability of linguistic abstraction earlier than monolinguals). Albert and Obler (1978) add that in adulthood, bilinguals may continue to have better verbal skills than monolinguals. Ringbom goes on to suggest that bilinguals may be more successful learners of a *foreign* language than monolinguals, since they have “a wider perspective on language” and “a greater awareness of language variation and the possibilities of expressing the same idea by different linguistic means” (Ringbom, 1987: 112).

2.4.4 The bilingual mental lexicon

Psycholinguistic research on bilingualism in the 19th century and in the first half of the 20th century was still basically speculative in nature. In the second half of the 20th century, the use of computer-aided technology made possible the systematic and sophisticated exploration of mental processes. Since the 1960s (that is, since the beginning of extensive psycholinguistic research on bilingual mental representations), the focus of many studies on bilingual language production has been the question whether two languages are represented in our mind as one mixed system or as two separate systems. Weinreich's compound-coordinate distinction was the first statement of the shared and separate store hypotheses of bilingual memory which provided the basis for the following research in bilingual memory. In 1966, Kolers linked the models of the organization of bilingual memory to models of the nature of representation. He described what was Weinreich's merged system and called it the *shared-store* model (Kolers, 1966). In this model, all lexical knowledge is stored in one lexicon, concepts are represented in some sort of non-linguistic, abstract form. He described what was essentially the coexistent/coordinate system and called this the *separate store* model. Here, the bilingual's representations of words encoded in a specific language are stored in a form that in some way is specific to that language. By linking the separate and shared models to questions about the actual nature of representations, Kolers' schema could not propose that both forms of bilingualism exist in one individual (which was an alternative in Weinreich's categorization). Rather they became conflicting models of the same phenomena, where a crucial aspect is the representation of linguistic and nonlinguistic information.

Much contemporary modeling of bilingual memory distinguishes between two levels of representations, namely the *lexical*, storing word forms, and the *conceptual*, storing meanings (see Potter et al., 1984; de Groot and Nas, 1991; Chen and Leung, 1989; Kroll and Curley, 1988; Kroll, 1993). Paivio, for example, in his *dual-coding model* of bilingual memory asserts that word representations in different languages are in different and separate memory stores which can function independently (Paivio, 1986). In normal processing, the word meanings are derived from interconnections between representations within and across separate memory systems. In bilingual memory, there are connections between representations across language systems, especially between translation equivalents. Representations of translation equivalent words are expected to have connections to the same conceptual representations which provide indirect links between the separate language systems (Paivio and Desrochers, 1980; Paivio, 1986).

The *three-store hypothesis*, on the contrary, considers word meanings as well as word form to be part of the lexical representation along with a third, conceptual, level of representation independent of languages. Two lexicons are postulated, one for each language, as well as a single separate conceptual store, irrespective of the number of languages (Paradis, 1997). Paradis' *Subset Hypothesis* connects the idea of shared and separate representations, since there is one common language system, in which the bilingual's two languages are represented as two subsystems (Paradis, 1981).In this model, a word can be conceived of "as a multidimensional matrix of interconnected phonological, syntactic, morphological and semantic features" (Paradis, 1997: 335). Paradis adds, "inasmuch as no two translation equivalents embody all of the same semantic constraints, not to mention phonological, morphosyntactic, and graphemic properties, the lexicon must necessarily be language-specific, that is, have separate entries for each word and its translation equivalent – including meaning." (Paradis, 1997: 336). Conceptual features are stored in this model as a set of nonverbal mental representations that are "philogenetically and ontogenetically anterior to the development of the lexicon and that continue to grow with experience" (Paradis, 1997: 337).

2.4.5 Representation of meaning in bilingual memory

The question of the semantic vs. conceptual dichotomy is at the heart of studies on bilingual memory. As discussed above, word forms appear to be stored in lexical entries, but meanings seem to have (verbal) lexicosemantic as well as nonverbal conceptual features and thus cannot be readily circumscribed. 'Knowledge of the world' is not language specific per se; speakers of different languages live in and experience the same 'world'. Nevertheless, there are frequently differences in the way speakers of different languages verbalize this experience. As a result, lexical items in two languages often do not share all their meaning features. For example, in Hungarian there are two distinct words for two different shades of the color red; piros meaning red that is not very dark and vörös meaning dark red. Thus, in Hungarian we say vörös vér/red blood, but piros alma/red apple. In most other colors, the semantic component 'the darkness of a color' is not included in the meaning of the word, the same way as it is not included in most English or in German color words. Distinguishing between semantic specifications that are part of the lexical memory and conceptual features that are integrated in conceptual memory is especially important in bilingual language systems and it brings us to the question: Where and how are the L1 and L2 word meanings stored? Should they be considered as lexicosemantic information that is part of separate lexical representations, or are they more likely to be integrated in a shared conceptual memory? Both views have supporters. On the one hand, translation equivalents in different languages have fundamentally different formal representations, but almost identical meaning is attributed to them, so the meanings of words appear to be language independent. On the other hand, a few aspects of meaning can be found only in certain languages (e. g. the verbal distinction between body parts like foot and leg or finger and toe that some languages express, whereas others, for example the Hungarian language, do not; or the three-way system of spacial reference, aquí, ahí and allí, in Spanish - see de Bot, 1992), so they must be language specific. Paradis (1997) argues that a considerable number of words in two languages are not at all one-to-one translation equivalents. They share some, or many but very rarely all of their meaning components. As a consequence, each language must have lexicosemantic constraints that determine which features of the corresponding concepts will be chosen for activation. Paradis claims that "lexical semantic constraints impose restrictions on (and thereby determine) the contents of the mental representation evoked by the word." (Paradis, 1997: 357). He found evidence for the distinction between a nonverbal-conceptual and a verbal-semantic store in the study of aphasic patients. He asserts that, whereas the lexical meaning of words is vulnerable to aphasia, the conceptual system is not. This cognitive system remains available for aphasic patients (Paradis, 1997: 336).

Based on the results of other empirical methods with normal subjects (such as cross-linguistic semantic priming vs. repetition priming tasks and word translation vs. picture naming tasks), many researchers claim that lexical forms are stored in language-specific lexicons, whereas word meanings, that is, the semantic information is stored completely or partially at the level of common conceptual representations, not excluding the possibility of the storage of certain semantic properties as part of the specific lexicons (Potter et al., 1984; Snodgrass, 1984). An increasing number of researchers explicitly or implicitly endorse models which distinguish between the semantic and the conceptual (Grainger and Dijkstra, 1992; Grosjean, 1982; de Bot, 1997; Green, 1993; Paradis, 1997).

De Bot (1992) and Dell and O'Seaghdha (1993), working in the connectionist paradigm, claim that in a model of spreading activation where several nodes are activated and interrelated at the same time, the crucial question is not whether there are language-specific lexicons or only one common store. The central issue, they say, is based much more on the following questions: How, to what extent and under what circumstances are the nodes within and between languages interconnected? What factors determine the interactions of linguistic and nonlinguistic information in the storage system? In Dell's connectionist model, there are phoneme nodes, word nodes and lemma nodes which are interconnected; the activation spreads in both a top-down and a bottom-up fashion so that many words and phonemes are simultaneously activated and contribute to the retrieval process until finally the most highly activated nodes belonging to a certain lexical item reach the necessary activation threshold. As soon as that happens, that word is selected for production and the activation of the other nodes is temporarily inhibited. Right after the retrieval of the selected item, the activation level of the corresponding nodes is set at a resting level, thus enabling the activation and retrieval of other items. Which nodes are involved in a spreading activation, depends on certain factors like word frequency, neighborhood size, etc.

2.4.6 Language choice in bilinguals

A spreading activation model in a multiple language system raises another problem. If we do not distinguish separate stores of lexical information, how is the bilingual able to judge which language the lexical items belong to? How is he able to keep the languages apart and to consciously switch from one language to another? Grainger and Dijkstra in the version of the language network model they call *Bilingual Interactive Activation* claim that all the words belonging to a particular language are connected to a certain node: to the language node of the corresponding language (Grainger and Dijkstra, 1992: 208). In the bidirectional or interactive version of this model, the target word activates the language node, which spreads the activation on to the level of word representations. From here the activation can spread in different directions. The activation of lexical items belonging to the other lexicon is not excluded, either. If words of another language are activated, the connection to the corresponding language node is also triggered. In this way, words belonging to different languages can be simultaneously activated, but thanks to the language node their 'affiliation' is always labeled. A different explanation for the choice of language is proposed by Poulisse and Bongaerts (see Poulisse and Bongaerts, 1994), largely based on Levelt's production model (see Levelt, 1992). They hypothesize that lemmas are tagged with a language label, so that *language* is a feature stored within the meaning representations. Their model is similar to that of Grainger and Dijkstra (1992) in that words belonging to different languages can be activated at the same time, for example an activated lemma with an L1 tag can spread activation down to semantic or phonological *neighbors* with an L2 tag or visa versa. Somewhat different from this theory and a kind of intermediary model between the language specific system and the language independent system are the models offered by Green (1993); Grosjean (1997); Paradis (1981, 1997). Here, within one extended system, there are language subsystems formed by all the elements belonging to that certain language. Because elements of each language normally appear only in different contexts, they form separate networks of connections, within the language system. A subset is activated as a whole when the language is chosen for production. Green, in his model which he calls *Inhibitory Control Model*, goes on to suggest that the subsystems can achieve different levels of activation: they are the most activated when they are *selected*, that is, when they are currently being spoken. They are less activated, but still *active*, when they are used regularly (e. g. in the case of compound bilinguals), but are not spoken at the moment, and they are not, or only slightly active if they are in a *dormant* state, that is, if they are not in regular use. Thus, languages in regular use are active and the stored lexical information of these languages is simultaneously accessible (Green, 1993: 263-264). Green developed this model to give an account of bilingual speakers' ability to speak in one of the two languages, to switch between the two languages and to translate from one language to the other. An important feature of the model is the role of inhibitory connections; at the moment a lexical item belonging to one of the active language becomes selected, nodes in the other language will be suppressed through inhibition. Just as the other network models described here, it also postulates language tags that determine which language the lexical items belong to. However, with respect to the control of language choice, Paradis claims that there is no need to postulate a specific functional organization. He asserts that "the ability to switch languages appropriately is part of a general set-switching ability" which "every speaker possesses and which allows him, among other things, to switch registers within the same language" (Paradis, 1997: 91). Otherwise, Green's model postulates a similar kind of interactive spreading activation in a network where the emphasis is on the *strength of connections* and not specifically on the question where lexical knowledge is stored.

Mixed language processing

The strength of within- and between-language connections is a particularly interesting question in the study of *mixed language processing*. Bilinguals (especially compound bilinguals) have the ability to switch from one language to another and back at any time. However, empirical evidence reveals that bilinguals typically need more time processing mixed-language sentences composed of words from both languages than in processing sentences in which all the words are in the same language (de Groot and Kroll, 1997: 158). The same findings are reported for individual word recognition (de Groot and Kroll, 1997: 158). It seems likely that "there is some cost involved in activation of two lexicons as compared to activation of a single lexicon" (de Groot and Kroll, 1997: 157), a finding which suggests that the lexical processing of bilinguals is generally slower than the processing of monolinguals.

In this section, certain issues in the mental representations and lexical processing of bilinguals were considered that are related to my multiple language network model used in the discussion of my experimental data. The following characteristics of bilingual network models will serve as a basis in my network model: The two lexicons of the bilinguals are represented in two interrelated subsets in an extended language system. The subsets in lexical memory include lexical units and their language-specific phonological and lexico-semantic features. The conceptual features are stored in the language-independent conceptual memory. During lexical processing, both lexicons are activated, but only one language is selected; the nodes in that subnet (most commonly the input language) receive higher amount of activation.

2.5 Language transfer in foreign language learning

The previous research basically dealt with highly knowledgeable, highly proficient users of two languages who have fairly rapid and automatic access to lexical knowledge in these two languages where the within- and (in case of compound bilinguals) the between-language connections are firmly established. In this research, a central topic is the representation and processing of the already acquired lexical knowledge. A related issue of considerable interest in psycholinguistics is language learning, that is, the process of establishing lexical knowledge in a foreign language. An obvious question arises: How do bilinguals come to have the representations that they do, and access them the way they do? A second question concerns foreign language learners: To what extent do their lexical representations mirror those of bilinguals and monolinguals? How much do the between-language lexical connections resemble those described in the bilingual models of lexical access and retrieval?

2.5.1 The age question

Many researchers agree that at an early age, that is, before a certain critical period (see Lenneberg, 1967), second language acquisition resembles the acquisition of the native language, especially if it takes place in a natural environment (Oyama, 1978; Johnson and Newport, 1989; Seliger et al., 1975; Patkowski, 1980). If the second language is acquired shortly after the native language, a high level of proficiency is achieved in many cases, but the level of proficiency gets more restricted with the increase of the age of onset. Oyama et al. (1978) and Patkowski (1980) found evidence for an age-related decline in long-term second language outcomes. According to some researchers, there seems to be a more or less well-shaped boundary around the onset of puberty (around age 10-11) beyond which the acquisition of new languages is significantly more difficult and follows cognitive strategies other than those in primary language acquisition. MacWhinney also considers the onset of puberty to mark the end of the critical period for language learning. In neuropsychological terms, infants have a ‘fresh, uncommitted neural hardware’. During first language acquisition “certain cortical areas become committed” and they began “to accept input data that lead toward a fine-tuning of the activation weights governing processing” (MacWhinney, 1997: 136). As MacWhinney claims, at the start of L2 acquisition, there is already a pre-existing, subtle neural structure involved in the processing of lexical information in the native language. He argues that the increased automatization of the first language system is the main reason why (especially adult) learners face difficulty in learning a foreign language. “The more automatized a system becomes, the less it is available for restructuring” (MacWhinney, 1992: 383). He argues, for those bilinguals and multilinguals who acquire all of their major languages simultaneously during childhood, there is "no need to go through a process of undoing the initial connections" that are formed within the lexicons and between lexical knowledge and conceptual representations, which language learners do if the onset of learning is in a later age (MacWhinney, 1997: 113–120).

The exactness of this demarcation line is nevertheless questionable. Long (1990) and Flege and Davidian (1984) claim that an onset prior to age 6 may be necessary for a native-like or almost native-like competence in the second language. Hyltenstam, based on empirical results, also claims that an onset for acquisition after age 7 may lead to incomplete acquisition of a second language in the field of syntax and lexis (Hyltenstam, 1992: 364). The most proper suggestion seems to be the prediction of a gradual decline in flexibility instead of a specific demarcation line (Harley and Wang, 1997: 44). Without going into the complexity of the age question, I will concentrate here on one aspect only, namely the role of age in the underlying cognitive strategies that determine the gradual building up of a foreign language lexicon. This issue is of great importance, if one assumes that the learner's incomplete foreign language lexicon basically differs from the already well established first and second language lexicons of proficient bilinguals. However, when we claim that these bilinguals are almost equally competent in both languages, this should not necessarily lead us to the conclusion that the competence of a bilingual speaker does not differ from the competence of a monolingual (see Grosjean, 1989). A substantial body of evidence supports the distinction between monolingual and bilingual norms (Mägiste, 1986; Mack, 1984; Hyltenstam, 1992).

The important issue here is that the proficient bilinguals have two firmly established lexicons with automatically retrievable lexical items and with strong connections between the encoded word forms and their conceptual representations in both languages (de Groot, 1993; de Groot and Poot, 1997; Potter et al., 1984). Language learners who started to learn the foreign language after the above mentioned critical or sensitive period, that is, around age 6-11 or later, do not usually achieve the proficiency that early bilinguals have in their second language. The learning process seems to be gradually governed by cognitive processes other than those in young children, and there appears to be a certain loss of flexibility and sensitivity towards the exposure to the language. In short, the implicit, unconscious child language acquisition is gradually replaced by an explicit learning process with general problem-solving procedures (Harley and Wang, 1997).

2.5.2 Language transfer – the role of prior linguistic knowledge

Many language teachers and linguists agree that similarities and dissimilarities in word forms, word meanings, morphological properties and syntactic structure in two languages play a major role in how quickly and accurately a foreign language will be learned by speakers of another language (Ringbom, 1987; Holmes and Ramos, 1995). Already at the end of the 19th century, Sweet asserted that most European languages (at least Germanic and Romance languages) are easier to learn for Europeans, than, for example some Oriental languages, because of the much greater formal similarity (Sweet, 1899: 54). Almost a century later, Ringbom (based on the examination of lexical knowledge and lexical acquisition of foreign language learners with different prior linguistic knowledge) summarized the experience of several language learners and linguists in a similar way. He asserted, "L2 learners who have widely different mother tongues behave in widely different ways when learning a common target language" (Ringbom, 1987: 185). An important question and a starting point in the study of language transfer is the way L1 (or in more general terms, the prior linguistic knowledge) affects the learning process. But before examining the role of already acquired language knowledge, I shall clarify what is meant under *language transfer* or *cross-linguistic influence* in psycholinguistics.

According to Odlin, "transfer is the influence resulting from the similarities and the differences between the target language and any other language that has been previously (and perhaps imperfectly) acquired" (Odlin, 1989: 27). Language transfer is also referred to as "cross-linguistic influence" (e. g. Ringbom, 1987: 44), since the knowledge of a language already acquired influences (either in a positive or in a negative way) the acquisition of another language. Kellerman and Sharwood Smith find *cross-linguistic influence* the more appropriate term, since it "is theory-neutral, allowing one to subsume under one heading such phenomena as 'transfer', 'interference', 'avoidance', 'borrowing' and L2-related aspects of language loss and thus permitting discussion of the similarities and differences between these phenomena" (in Kellerman and Sharwood Smith, 1986: 1).

Forms of cross-linguistic influence in production

Cross-linguistic influence is a complex and still largely unexplained phenomenon. Nevertheless, many researchers, following behaviourist traditions and Lado's (1957) influencial work, agree that it has two basic manifestations that can be labelled the following way. If prior linguistic knowledge facilitates the acquisition and correct use of the foreign language, it is referred to as *positive transfer* or *facilitation*. If it hinders the learning process and leads to erroneous use of the target language, it is called *negative transfer* or *interference*. Most studies of language transfer have zeroed in on the analysis of interference cases, since it is much easier to detect negative transfer than positive transfer. Negative transfer manifests itself in errors and the source of interference can often be pinpointed in the L1 (or generally, in the prior language knowledge). The effects of positive transfer, however, can only be determined by comparing the accuracy in the production of language groups with different native languages (see Odlin, 1989).

Cross-linguistic influence can exhibit different realizations in the course of production. The main distinction in Ringbom's categorization of transfer cases is based on whether or not similarity is perceived by the learner (Ringbom, 1987: 50–51). Accordingly, he distinguishes between *overt* and *covert* cross-linguistic influence. In case of overt influence, similarity perceived by the learner affects language learning. Here, Ringbom distinguishes between *transfer* and *borrowing*. In case of *transfer* Ringbom suggests a similarity of pattern between L1 and L2. He claims, transfer is a knowledge-based procedure that is used to fill gaps of knowledge in the L2. If the learner cannot retrieve a lexical item in the foreign language, he may consciously substitute it with an L1 item. *Borrowing* in Ringbom's definition is a result of similarity in L1 and L2 lexical form, it is assumed to reflect a lack of control in L2 use. Borrowing occurs only in the domain of lexis. In its purest form, it manifests itself in complete language shift, but there are "intermediate forms between transfer and borrowing", when an L1 item (or an item from another acquired language) is "modified by L2-procedures" (Ringbom, 1987: 52). In this way, transfer of lexical items can have different manifestations, such as complete shifts, hybrids, blends and relexifications (see Table 2.1).

Ringbom claims, "the difference between transfer and borrowing refers to end-points on a continuum" (Ringbom, 1987: 52). *Covert cross-linguistic influence* is postulated when there is no perceived similarity that could facilitate the L2 usage. A typical manifestation of this type of interference is the *avoidance strategy*. Avoidance strategy can be defined as the nonuse of already acquired target language forms that are not present in the native language. In this sense, avoidance strategy is often nothing else but the overuse of an inadequate L1 form which substitutes a target language form if that target form is incompletely acquired and not automatically available for the learner (see Dechert and Raupach, 1989: 23–24).

The role of prior linguistic knowledge – empirical evidence

In the last decades, much research has been conducted to test cross-linguistic influence between different languages (see Odlin, 1989). Ard and Homburg, for example, compared the performances of ESL learners speaking two different native languages; Arabic and Spanish (Ard and Homburg, 1983). In these experiments, Spanish native speakers were considerably more successful in answering

lexical transfer	**borrowing**
loan translations semantic properties of one item transferred in form of a combination, e. g. *child wagon* (Swedish: *barnvagn*=pram)	complete shifts L1 item is used in L2 without modification, e. g. I'm usually very *pigg* (Swedish: *pigg*=refreshed)
semantic extension semantic properties extended to L2-word, e. g. he bit himself in the *language* (Finnish: *kieli*=both language and tongue)	hybrids, blends morphological modification of an item, e. g. I was *piggy* (Swedish: *pigg*=refreshed)
false cognates formal cross-linguistic similarity between items with no or partial semantic overlap, e. g. he works in a *fabric* (Swedish: *fabric*=factory)	relexifications forming new, non-existing items on the basis of an L1 word, e. g. let it *smelt* (Swedish: *smälta*=melt)

Table 2.1: Overt cross-linguistic influence in production [adapted from material in Ringbom, 1987].

vocabulary questions than native speakers of Arabic (e. g. providing the English word exiled, whose Spanish equivalent is exilado, that is, a formally similar word, whereas the Arabic word did not resemble the English target). Ard and Homburg claimed that Spanish speakers could rely upon their native language much more than Arabic speakers since there was much more lexical similarity between Spanish and English than between Arabic and English, the first two languages being etymologically more closely related and thus sharing a higher number of similar lexical forms (for the role of formal similarity see also Chapter 2.7). Ard and Homburg also observed that Spanish-speaking students did especially well on lexical items whose spelling was almost identical in Spanish and English (e. g. the above mentioned example). They concluded that Spanish speakers might have an advantage over the Arabic speakers in learning English also because they have more time to concentrate on unfamiliar vocabulary.

Empirical evidence from multilingual settings

In terms of language transfer, the best examined cases are monolinguals learning a foreign language. However, language learners may already have acquired another language besides the mother tongue. There are many bilinguals all over the world who are proficient speakers of two languages and learners of a third, foreign language. This group of language learners has been at the center of psycholinguistic studies in the past few decades. Experiments with multilinguals provide us with useful empirical data concerning the role of language distance in cross-linguistic influence, since very often the language learners are proficient speakers of an etymologically related and an unrelated language. However, it must be added here that researchers face some difficulties in their attempt to detect positive and negative transfer or generally to classify different kinds of interference cases in multilingual settings. The range of possible explanations for errors is greater if the learner speaks another language (or more than one language) in addition to the native language (Vildomec, 1963). Nevertheless, multilingual cases reveal some new, important aspects of the question of transfer. One of the most interesting observations concerning transfer in multilingual settings is the role of language distance and the perception of similarity. Language distance is not an easily definable phenomenon because of the relativity of the notions *distance* and *similarity*. Odlin, for example, defines language distance as "the relative degree of similarity between two languages" (Odlin, 1989: 166). According to this definition, English and German can be judged as *distant languages* if we compare the distance to the one between Dutch and German, but they can be judged as *similar languages* if the basis of comparison is the language distance between, for example, Hungarian and German. There is much more lexical similarity between English and German than between Hungarian and German (or Hungarian and English), since English and German are both West-Germanic languages and due to their etymological relatedness they share a great number of similar lexical forms, whereas Hungarian belongs to the Finno-Ugric branch of the Uralic language family and is etymologically very distant from the West-Germanic languages. However, the etymological relatedness is even greater between German and Dutch and these two languages share an even greater number of similar lexical items. Nevertheless, even though etymology offers us an objective estimation of language distance, this estimation can be misleading if we try to judge potential transfer purely on the basis of etymological relatedness (Odlin, 1989). As Odlin claims, "in some cases, the subjective estimation of distance by learners can override an objective measure. In any learner's attempt to acquire a new language, language distance is ultimately in the eye of the beholder." (Odlin, 1989: 142). Research indicates that transfer will likely result from a learner's (conscious or unconscious) judgement whether or not particular structures and lexical items in the target language and in a previously acquired language are alike. On this account, when talking about the role of formal similarity in language transfer, it should be in terms of similarity *perceived* by the language learners (Odlin, 1989: 141).

There is some evidence of transfer found in multilingual settings supporting the importance of perceived similarity. Todd describes a trilingual group in West Africa speaking Igbo (an African language), French and English (see Odlin, 1989: 141). The speakers' use of English (the L3) is often influenced by their knowledge of French (their L2). Todd notes, for example, that the sentence At the bottom he is a naughty somebody probably reflects influences from French, since the expression at the bottom has a translation equivalent in French (au fond) that could be used in the above context in French. Ahukanna and her collagues (see Ahukanna et al., 1981: 281-287) found the same kind of evidence in a grammaticality judgement task (in a task where subjects have to decide whether sentences in the foreign language are correct or not) with a similar group of trilinguals in West Africa. The judgements that the students gave indicated that English (their L2) had a considerable influence on their acquisition of French (the L3). This influence appeared to be much greater than the influence of Igbo, their L1.

A comprehensive study on the role of language distance and perceived similarity in bilingual learners of a foreign language has been made by Ringbom (1984). In studying the production of Finnish-Swedish bilinguals learning English as a foreign language, he concludes that knowledge of a related L2 facilitates language learning and that positive transfer of L2 knowledge manifests itself most of all in the area of lexis and much less in grammar and phonology. At the end of his exhaustive study on the role of prior linguistic knowledge in multilingual settings, Ringbom concludes that the consistent ways in which Finnish learners of English differ from Finnish-Swedish learners provided empirical evidence of how central a place prior linguistic knowledge occupies in the process of foreign language learning (Ringbom, 1987: 144). However, he draws our attention to the importance of studying the different *variables* which interact and determine the facilitating and hindering effects of prior language knowledge. Such variables are (in terms of lexical acquisition and processing) among others cognate status, the size of similarity neighborhood, word familiarity and imageability. In the following, I will discuss the importance of these factors in the analysis of empirical data with respect to bilingual/ multilingual knowledge representations and processing mechanisms.

2.6 Cognates – cross-linguistic similarity neighbors

2.6.1 The definition of cognates

In the study of mental representations in polyglots, a topic of considerable interest is the storage and retrieval of cognates. From a psycholinguistic point of view, they are particularly interesting lexical items, since they present a certain paradox in the learning process; cognate-pairs can facilitate and hinder lexical learning at the same time. But, before discussing the role of cognate status in a multilingual system, I shall define the term *cognate*.

The traditional definition of cognates comes from historical linguistics. Cognates are lexical units (words) in two languages that are "part of a relation defined in terms of direct descent from a common word (or morpheme) belonging to a given shared ancestral language" (Carroll, 1992: 100). Thus, in the traditional linguistic view, cognate-pairs are found in etymologically related languages; they are lexical items bearing formal resemblance (which can be explained in terms of regular phonological change in each language) and having (more or less) the same meaning (e. g. German Bett and English bed, German singen and English sing, German blau and English blue, etc.). Cognate pairs are very important in historic linguistics, since, given the above mentioned assumption, by comparing the pronunciation of these etymologically related words, linguists can postulate tendencies in the change of the phonological properties of words from the common ancestor language to the present-day languages of the language family.

The linguistic definition of cognates, however, is unsatisfactory if we consider the phenomenon from the point of view of language acquisition. Many researchers agree that cognates are a prime example of lexical transfer (Carroll, 1992; de Groot, 1992b; Meara, 1993; Holmes and Ramos, 1995). Due to the similarity of form, language learners can recognize unknown words in a foreign language if the word and its translation equivalent in the native language of the learner share many orthographic and/or phonological properties. In this way, etymologically related languages appear to be easier to learn than unrelated languages, due to the facilitating effect of formal similarity of their words (see Ringbom, 1987; Holmes and Ramos, 1995). Thus, lexical items that are both formally and semantically similar facilitate the acquisition of a foreign language. This is, however, not always the case with etymologically related words, since the formally similar words are often no longer full translation equivalents (for example the German Land and the English land or the German Spur and the English spur). In spite of the missing semantic overlap, these words appear to be connected in our mind due to the similarity of form; learners of a foreign language suffer from the interference (or negative transfer) of similar lexical forms without a semantic equivalency. In addition, there are lexical items that share most of their formal features but none of their semantic properties. These words appear to be a source of interference sometimes, since in some cases language learners judge them as being identical (e. g. the German word Rock meaning skirt and the English word rock , the German Hose meaning trousers and the English (garden) hose or the Hungarian orr meaning nose and the German Ohr meaning ear). In these cognate-pairs known in psycholinguistics as *false cognates* or *faux amis*, etymological relatedness is irrelevant.

2.6.2 Cognate-pairing as a psycholinguistic phenomenon

The above examples show that cognate-pairs are a prototype, a concept with core exemplars but many individual counterexamples. If we consider cognate-pairing from a psycholinguistic point of view, that is, how and why language learners identify words as being the 'same' in two languages, etymological relatedness is neither a sufficient, nor a necessary condition (Carroll, 1992: 102). From a psycholinguistic point of view, this information is probably not part of the information encoded in the lexical representation of a word in our mind. Metalinguistic information, like the linguistic history of a word, is postulated to be represented in memory separate from lexical knowledge and is not supposed to be "part of the automatic processing of structural information in word activation" (Carroll, 1992: 103). Cognate pairing can be described as a form of automatic cross-linguistic activation of lexical addresses that have the same or similar formal properties in two languages. As described in section 2.1, during lexical processing several units can get activated simultaneously in the mental lexicon. These lexical items are referred to as *similarity neighbors* (see subsection 2.2.2). In bilinguals, formally similar lexical items in two languages can receive parallel activation (Grainger and Dijkstra, 1992: 210). Thus, cognates can be considered as simply cross-linguistic orthographic and/or phonological neighbors. In the same way as formally similar words in one language (e. g. stay, steak, stage) can prime each other (that is, they make each other more easily accessible), cognate-pairs seem to prime each other between languages (e. g. singen – sing; Land – land; Rock – rock).

2.6.3 Types of cognates

Cognate-pairs can be a source of positive as well as negative transfer, since formally similar word-pairs differ from each other concerning the degree of overlap in meaning. Based on Nash (1976), Gallegos constructed a typology with the following four basic types of cognate status (Gallegos, 1983: 8).

True cognates are words which are etymologically related and whose semantic properties completely or almost completely overlap (e. g. German Buch and English book; German braun and English brown).

Deceptive cognates are words which are etymologically related and whose semantic properties partially overlap. These cognates are either no longer translation equivalents, or only in certain contexts), but they still share some features of meaning. (e. g. German aktuell and English actual; German See and English sea).

False cognates are words which are etymologically related and whose semantic features no longer overlap (e. g. German Gymnasium and English gymnasium; German pregnant and English pregnant or German dezent and English decent).

Accidental cognates are words which have no obvious etymological relationship and do not share any features of meaning, but which nevertheless bear much formal resemblance (e. g. German List, meaning trick and English list, German Rock meaning skirt and English rock)[1]

In the above categorization, etymological relationship, or the lack of it, is still a fundamental aspect in the definition of cognate types. In cognitive psycholinguistics, however, the historical relatedness of words is not taken into account and the differences in the mental representations of formally similar words and the nature and degree of formal resemblance determine the type of the cognate pairing. Accordingly, we can distinguish cross-linguistic homophones/homographs and cross-linguistic parophones/parographs with complete, partial or no semantic overlap.

Cross-linguistic *homographs/parographs* are cognate-pairs that have identical or almost identical *orthographic* properties in two languages (e. g. German Lust and English lust; German Land and English land; German Milch and English milk; German Sturm and English storm). Cross-linguistic *homophones/parophones* are cognate-pairs that have almost identical *phonological* properties[2] (e. g. German Sturm [ʃtʊrm] and English storm [stɔrm], German weiss [vaɪs] and English white [waɪt]). The distinction between homographs and parographs as well as between homophones and parophones is not so crucial in psycholinguistic studies, since lexical items in two languages do not need to be completely identical in form for neighborhood activation. Cross-linguistic neighbors do not overlap in all of their formal features (see cross-linguistic priming effects in chapter 2.7). On this account, research most often reports on *homophones* or *homographs*, simply, both meaning formally identical or almost identical words in two languages (see Beauvillain and Grainger, 1987; Gerard and Scarborough, 1989).

Distinguishing between homophones and homographs is especially important in language pairs where one of the languages has a *shallow orthography* (meaning that the spelling-sound correspondence is direct, letters are pronounced in the same way, independently of their position in the letter string, e. g. Spanish or Hungarian), whereas the other has a *deep orthography* (meaning that the spelling-sound correspondence is more arbitrary, the pronunciation of the letters depends

[1] The examples that were presented here were not taken from Gallegos. The original examples were replaced by German-English cognate pairs.

[2] They are hardly ever completely identical, since phonemes often have different phonetic realizations in two languages, e. g. in the German Bild [bɪlt] and English build [bɪld].

on their positions in the word and often illustrates morphological relatedness; see Smith, 1997: 161). English is a typical example of a language with deep orthography, whereas German is a language with shallow orthography. Thus, there are German-English homographs that are not homophones (e. g. Lust [lʊst] and lust [lʌst] or Land [lant] and land [lænd]) and there are German-English homophones that are not at all homographs (e. g. Igel [ɪːgl] meaning hedgehog and eagle [ɪːgl]).

In sum, we can distinguish between cross-lexical homophones/homographs that share most of their semantic components and can be attributed to the same concept (in the experiments to be described later I will refer to them as *true cognates*), and cross-lexical homophones/homographs that share no or only a few semantic components and thus are not attributable to the same concept in most contexts (I will call them *false cognates*). False cognates will be divided into two further groups in terms of the degree of semantic overlap. Cognate-pairs that share some meaning properties and can in certain context be considered as translation equivalents, but not in their prototypical meaning instance (e. g. German Land and English land or German Frieden and English freedom) will be called *deceptive false cognates*, whereas word-pairs that share no semantic features and cannot be translation equivalents in any context will be referred to as *accidental (or formally determined) false cognates*.

2.6.4 The cognate strategy

The formal similarity of cross-linguistic homographs/homophones provides means for language learners to connect L2 and L1 lexical forms and thus to process the higher level representations (concepts, mental images) through the L1 word form and not directly from the L2 lexical representation in word recognition. Similarly, language learners can activate L2 lexical forms through the L1 similarity neighbor in word production. This *cognate strategy* appears to facilitate word recognition and production in the early stages of language learning (de Groot and Poot, 1997; Hancin-Bhatt and Nagy, 1994; Meara, 1993). However, Meara claims that this strategy has only short-term benefits, since similar lexical forms can be false cognates, not only true cognates, which makes cognate strategy inefficient sometimes. If language learners consequently relied upon the strategy of identifying words only on a formal basis, they would very often produce erroneous utterances, but they actually do not (Meara, 1993). Nevertheless, Hammer draws our attention to the fact that in most cognate languages the number of true cognates is much greater than the number of false cognates (Hammer, 1976). Hammer compared English and French and concluded that the ratio of true cognates to false cognates was approximately eleven to one. Meara claims that a facilitating effect of cognates is characteristic in languages that share a great number of cognate-pairs, that is, in etymologically closely related languages. A very important condition for the facilitating effect of cognates is that foreign language learners *perceive* the formal similarity between words in two languages. If the languages have only a restricted number of formally similar words, then the learners might not be aware of the formal relation at all (Meara, 1993: 283).

Meara distinguishes "four main patterns of cognacy" (Meara, 1993: 285). In the first case, there are only a very few cognates and formal similarity does not mean any facilitation in lexical learning. Such language pairs are Finnish and Swedish, Turkish and Arabic (or Hungarian and English). The second case is where the bulk of the vocabulary of the two languages are cognate-pairs, like Italian and Spanish, Danish and Swedish. Here, formal similarity ought to considerably facilitate lexical learning. The third case is a *mixed case*, typified by English and the Germanic languages. In this case, a very large proportion of the basic vocabulary of the L2 is cognate with the L1, but the less frequent items in the L2 are noncognate with the L1. In the case, for example, of a German speaker learning English, initial learning "ought to be relatively straightforward, but the acquisition of less frequent vocabulary will cause problems simply because the learner may not have experienced any difficulty with the basic vocabulary, and may not have developed effective strategies for acquiring new words" (Meara, 1993: 285). The other *mixed case* is found where the use of cognate words is restricted to certain domains or to certain registers only. This is the case of Romance speakers learning English. Romance words in the English language tend to be low frequency words used most of all in formal and technical English. Meara concludes that each of these cases produces its own pattern of difficulty (Meara, 1993: 285).

In language acquisition, an important aspect is the role of prior linguistic knowledge, since the learners rely strongly on their native language or on a second language if they perceive enough similarity between the two languages. Facilitation and interference are phenomena that influence *lexical* processing in particular, since similarities in the formal properties of words belonging to two languages can lead to the parallel activation of lexical items that are part of a *cross-linguistic similarity neighborhood*. In this thesis, the influence of a related second language (German) and an unrelated native language (Hungarian) will be examined in the retrieval of target language (English) lexical items by L1 or L2 stimuli in bilinguals and by L1 (German or Hungarian) stimuli in monolinguals. Before describing the experiments with these language learners, a brief summary of research methods and findings will be presented that are related to my experiments, and the role of some other factors in the access and retrieval of lexical items will be discussed. Based on empirical findings and models of lexical processing in bilinguals and language learners, a multiple language network model will be introduced to describe the mental representations and processing mechanisms of the bilingual foreign language learners in the experiment.

2.7 Research methods and empirical findings

2.7.1 Lexical decision tasks

Monolingual lexical decision tasks

> A fundamental problem in the study of human spoken word recognition concerns the structural relations among the sound patterns of words in memory and the effects these relations have on spoken word recognition. (Luce and Pisoni, 1998: 1)

There are different methods to test the above effects in word recognition, such as phoneme monitoring, gating and lexical decision.

The *lexical decision task* is a frequently used experimental method to test the accessing of isolated words. It has two basic modalities, the visual and the auditory lexical decision. The auditory version of this experimental method "entails speeded classification of spoken words and nonwords" (Grosjean and Frauenfelder, 1997: 559). The paradigm is used in the first place to study the nature of lexical representations in the mental lexicon (e. g. phonetic, phonological, morphological and semantic representations), process mechanisms in word recognition, and the effect of certain factors, such as word frequency and neighborhood effects. Furthermore, it is commonly used to measure priming effects in monolinguals as well as in bilinguals. The paradigm has been used by many researchers to test the role of the above factors (see Havens and Foote, 1963; Grosjean and Itzler, 1984; Marslen-Wilson, 1984; Luce et al., 1990; for a research survey see Luce and Pisoni, 1998: 1-4). In the following, empirical evidence will be presented from Luce and Pisoni's study in which the role of similarity neighborhood structure in spoken word recognition was examined (Luce and Pisoni, 1998).

The goal in their experiment was to examine the effects of the number and nature of words activated in memory on auditory word recognition. In their study, they provided an estimated similarity neighborhood structure by computing an online lexicon that contained approximately 20,000 entries. Each entry contained an orthographic representation, a phonetic transcription, a subjective familiarity rating and a frequency count (based on the Kucera and Francis corpus, see Kucera and Francis, 1967). They computed a similarity neighborhood structure for the lexical items based on the number and degree of confusability of formally (acoustically) similar words and their frequencies. The major hypothesis in the auditory lexical decision task was that "words are recognized in the context of other words in memory. More precisely, it is predicted that the number of words that must be discriminated among in memory will affect the accuracy and time-course of word recognition." (Luce and Pisoni, 1998: 5). In the experiment, approximately six hundred monosyllabic lexical items (half of the stimuli real words, the other half nonwords) were presented to the subjects for recognition. Accuracy scores were obtained for the words and the processing time was measured. The results of the experiment revealed a main effect of neighborhood density; both real words and nonwords in dense neighborhoods were classified more slowly than the input items in low density neighborhoods. Shorter reaction times sometimes led to erroneous categorizations, which suggested speed-accuracy trade-off (that is, when answers are either faster and less accurate or slower and more accurate; see also the reaction time analysis in 4.3.2). In sum, the analysis provided evidence for the hypothesis that neighborhood structure affects the accuracy and the time course of word recognition and supported the postulate of the Neighborhood Activation Model that "the process of word identification involves discriminating among lexical items in memory that are activated on the basis of stimulus input" (Luce and Pisoni, 1998: 12).

Bilingual lexical decision tasks

Besides the above described study of Luce and Pisoni, a substantial body of evidence with monolingual subjects reveals that the time to recognize a word is influenced by the characteristics of words that are formally similar to the stimulus (see Grainger and Dijkstra, 1992; Grainger, 1990; Connine et al., 1990). An important question rises as to the role of formal similarity in bilingual systems, that is, whether orthographic/phonological similarity across languages can affect word recognition performance in bilinguals. Gerard and Scarborough (1989) conducted a visual lexical decision task with proficient English-Spanish bilinguals whose dominant language was English. The input set consisted of Spanish or English lexical items that were noncognates in the two languages (e. g. dog – perro), or cognates (e. g. actual – actual, having the same meaning),or homographic noncognates (e. g. red – red, meaning net in English). The input stimuli (single words) were presented in two different conditions; 1) as Spanish items, 2) as English items. The results of the test showed that bilinguals generally processed L2 (Spanish) information slower than L1 (English) lexical items, but otherwise there were no effects of formal similarity; the bilinguals appeared to be functioning like monolinguals. However, repetition of the same orthographic pattern across languages produced facilitation for cognates as well as for homographic noncognates. They explained these results claiming that "the cross-language repetition effect appears to be a general effect of encoding the same orthographic pattern" (Gerard and Scarborough, 1989: 312). Similar cognate advantage was found in lexical decision tasks with bilinguals by Cristoffanini et al. (Cristoffanini et al., 1986). They found a 100-ms advantage for cognates in English-target lexical decisions with Spanish-dominant bilinguals. A possible explanation of the cognate advantage is that both the English and Spanish lexical entries of a cognate are activated. Given that lexical access is faster in the bilingual's dominant language, the lexical entry in that lexicon will be accessed first and will prime the corresponding lexical entry in the other language lexicon (Cristoffanini et al., 1986; Potter et al., 1984). As to homographic noncognates, an interesting result was presented by Beauvillain and Grainger (1987) . They used English-French homographic noncognates in a task in which a (French) prime word was followed by a test stimulus in English requiring a lexical decision (e. g. the test stimulus was the French word four meaning oven in English, the prime word was the English word five). They found priming effects on such trials and concluded that the homographic test stimuli were processed in both languages. Nevertheless, it is important to mention that in this experiment, the subjects were forced to use both of their languages, which might have largely contributed to the cross-lexical priming effect (Gerard and Scarborough, 1989; Grainger and Dijkstra, 1992).

In sum, lexical decision tasks in both monolingual and bilingual conditions provide empirical evidence that the density of similarity neighborhood is an important factor in the access of single words. In bilingual systems, both lexicons might be initially activated, an extended cross-lexical search appears to be conducted on the basis of the formal features of the input (Smith, 1997).

2.7.2 Word translation tasks

Another frequently used task in the study of bilingualism and language acquisition is word translation. There are two basic forms of this experimental method, namely *translation recognition* and *translation production*. In translation recognition, the participants are presented with two input words (an L1 word and an L2 word) on the computer screen. Their task is to decide, whether or not the two words are translation equivalents in the two languages. In a translation production task, the participants are presented with a word (either visually or auditorily) in one of their languages and have to produce its translation equivalent in the other language, in most cases by uttering the word. In *forward translation*, participants translate from the native language into the second language, in *backward translation* from the second into the native language. From a cognitive point of view, translation recognition tasks are data-driven, bottom up processes, since the participant has to gradually process the input stimuli from the formal features to the conceptual repesentations. After the decoding of the formal features of the input, the corresponding two lexical nodes in the two languages are selected and the conceptual features are processed. If there is a(n almost) one-to-one correspondence at the conceptual level, the subjects ought to judge the two items as translation equivalents.

Since the main task in the experiment that will be presented in this dissertation was an oral forward translation production task, a brief description of word translation with acoustic stimuli will be given here and the hypothesized lexical processing mechanisms during translation will be demonstrated. An oral translation production task has three basic steps: input recognition, target retrieval and response execution (see Chen and Leung, 1989: 316). The first step is the bottom-up, data driven processing of the stimulus from the acoustic features of the input L1 word to its conceptual features. The second step is the top-down, concept driven processing of the translation equivalent from the conceptual features to the articulatory features in the target language. That is, after the corresponding conceptual features of the input word are processed, they pass activation to lexical nodes in the target language. The lexical item that shares enough conceptual features with the input word to be judged as translation equivalent is selected and its formal properties (phonological segments and the corresponding articulatory features) get activated. Finally, a motor program is executed, that is, the translation equivalent is spoken out .

2.7.3 Empirical findings in translation tasks

Accuracy analyses

Translation as a research method has been used most extensively in the study of lexicosemantic representations of bilinguals and language learners, most of all concerning the organization of form and meaning in the L1 and the L2 and to test the speed and accuracy of lexical processing in a second or foreign language (Chen and Leung, 1989; de Groot, 1992a; de Groot et al., 1994; Kroll and Curley, 1988; Kroll and Stewart, 1994; Potter et al., 1984). The accuracy analysis is especially applicable in "translation production" tasks (de Groot and Comijs, 1995: 473), that is, in experiments where the participants have to produce the translation equivalents themselves. In translation recognition tasks (where the participants only have to decide, whether two words are translations of one another or not), even weakly established connections between translation-pairs can lead to accurate responses, since data-driven lexical processing (that is, the processing of stored knowledge from external input stimuli) is an easier task than the spontaneous concept-driven activation of a lexical unit in the mental lexicon in a translation production task (Paradis, 1997: 342). Omissions (that is, when the input stimulus does not evoke a response) and erroneous responses occur more frequently in a translation production task. However, omissions and errors do not necessarily imply that the elicited knowledge is absent from the memory. As de Groot claims, this knowledge may be stored (or at least partially stored) in the mental lexicon, but is not retrievable in a concept-driven, top-down process (de Groot and Comijs, 1995: 472). Thus, in translation production tasks accuracy analysis is an important means of examining the *retrievability* of translation equivalents from the incomplete lexicon of language learners, whereas in translation recognition tasks most research tests reaction times to examine the *automaticity* of processing mechanisms.

Reaction time analyses

The first reaction time studies in word translation were conducted in 1887 by Cattell, an experimental psychologist (Cattell, 1887). He compared processing times in forward and backward translations and naming objects in the L1 and L2. He found that more time was needed to name objects in the second than in the first language and that translation in both directions took more time than object naming. His pioneer reaction time studies in language processing found followers only in the second half of the twentieth century. Until then, bilingualism and language learning was treated as an educational and purely linguistic issue only (as in Weinreich, 1953). Thus, reaction time analyses in L2 began in earnest only after the 1950s. In 1973, Oller and Tullius compared processing times of native and non-native (but fluent) speakers of English in reading English text (Oller and Tullius, 1973). They found that non-native speakers were slower than native speakers in this task and concluded that bilinguals process symbols more slowly in their second language than in the native language. Another issue psycholinguists addressed was the question whether bilinguals are also slower in their first language than monolinguals. Mägiste (1986) conducted experiments in which she tested monolinguals, bilinguals and trilinguals on naming and reading tasks in L1 and L2 . According to the results, monolinguals were the fastest, bilinguals were slower and trilinguals were the slowest. Mägiste concluded that bilinguals experience interference from competing language systems. Ransdell and Fischler (1987) tested monolinguals and bilinguals in their first language. They did not find such significant differences as Mägiste, nevertheless in word recognition and lexical decision tasks the bilinguals were somewhat slower than monolinguals showing that the L1 information processing in bilinguals took more time than monolingual native language processing. This can be interpreted as the result of a more extensive process in bilinguals who have mental representations of two languages and might simultaneously access lexical items in both lexicons.

2.7.4 The role of cognate status in translation tasks

One source of evidence that suggests that language learners in early stages rely upon the cross-lexical connections between the L1 and L2 lexical items when translating words comes from experimental research on cross-linguistic transfer of cognates. As de Groot and Kroll argue, “because cognates are relatively transparent at the lexical level, they provide a means for less fluent bilinguals to use the second language prior to the ability to conceptually access the meanings of L2 words" (de Groot and Kroll, 1997: 173). They go on to suggest that the degree of transfer from L1 to L2 depends on the similarity of phonetic features in the learner's two languages. In languages in which words are similar in their phonetic properties (e. g. German and Dutch, Spanish and Italian), there appears to be a greater amount of lexical transfer. Dufour and Kroll (1995) examined the role of cognate status in the translation performance of less and more fluent English-French bilinguals. The results showed that all bilinguals translated cognates more rapidly than noncognates, nevertheless the advantage for cognates was greater for the less than for the more fluent bilinguals, suggesting that less fluent bilinguals relied more upon this strategy. These results replicated previous findings of a facilitating effect of cognates status leading to faster response latencies (e. g. de Groot, 1992b; de Groot et al., 1994; Kroll and Stewart, 1994, see de Groot and Kroll, 1997: 173).

In terms of reaction time measurements in translation production tasks, de Groot and Comijs (1995) draw the attention to an obvious shortcoming. They claim that in translation production, the subjects have to process the conceptual representation of the input word, select the appropriate lexical item in the target lexicon, access the corresponding phonological features and, finally, utter the selected word. In such a complex task, it is hard to pinpoint the processing stage where a certain effect may or may not occur (e. g. whether a long reaction time is due to a lack of full conceptual overlap, weak connections between the conceptual and the lexical level or from the lexical to the phonologial representations, or difficulties in the articulation). In word recognition, we can disregard the latter two possibilities and in this way it is also easier to test the effect of certain factors in the reaction time data (de Groot and Comijs, 1995: 473). Nevertheless, de Groot and Comijs also claim that processing in word recognition may be 'shallower' than in word production, since "it is plausible that translation recognition addresses more superficial information in conceptual memory than does translation production" (de Groot and Comijs, 1995: 474), meaning that in word recognition tasks we can only test the bottom-up processing of L1 and L2 lexical items by external input, whereas in a translation production task we can examine the concept-driven, top-down processing of L2 lexical items in the target lexicon. In addition, production tasks offer a better chance to examine cross-lexical phonological and semantic interferences.

2.7.5 The word association and the concept mediation models

On the basis of empirical results concerning the facilitating effect of formal similarity in translation tasks, de Groot claims that the translation of cognates is influenced more by lexical factors (that is, formal resemblance of input word and target word) than by conceptual factors (that is, the overlap of conceptual features), whereas the translation of noncognates is largely determined by the correspondence of the conceptual features of input and target word (de Groot, 1992a: 1015). She claims that if two lexical items are similar in their form, they can be directly connected to each other at the lexical level. If they also share some of their conceptual features, language learners tend to judge them as being translation equivalents, even if they overlap only in a few conceptual properties. As opposed to this, noncognates are not directly connected to each other at the lexical level, and the conceptual features have a greater weight in judgement of translation equivalency. Based on these assumptions, many current bilingual models subscribe to the view that there are two ways of accessing lexical and conceptual information: via *word association* and via *concept mediation* (de Groot, 1992a, 1993; de Groot et al., 1994; Kroll and Curley, 1988; Kroll and Sholl, 1992; Chen and Leung, 1989).

Word association and concept mediation in an oral forward translation task can be modeled in the following way. *Word association* occurs, if there is formal similarity between the input word and a lexical item in the target lexicon. In this case, translation can come about via direct activation between lexical representations within lexical memory. The same way as similarity neighbors receive parallel activation in a monolingual lexicon during word recognition, in the bilingual lexicon the cross-linguistic similarity neighbors might be simultaneously activated due to formal resemblance. In this way, an L1 input stimulus might prime its L2 translation equivalent if the two words share enough formal features (see Figure 2.3).

Word translation in a forward translation task is postulated to occur via *concept mediation* if there is no formal similarity between input and expected output. In that case, the input word is processed in a bottom-up fashion from the acoustic features to the conceptual representations of the stimulus word and the translation equivalent is processed in a top-down manner, that is from the conceptual representations of the L1 input to the articulatory features of the corresponding lexical unit in the target lexicon, followed by response execution (see Figure 2.4).

Applications of word association and concept mediation in a multiple language network model

The above two hypothesized processing pathways (word association and concept mediation) will serve as a basis in the interpretation of the empirical data to be presented in this thesis. The *multiple language network model* to be introduced here is based largely on monolingual and bilingual network models of lexical processing mechanisms (see Stemberger, 1992; Dell, 1988; McClelland and Elman, 1986; Paradis, 1981, 1997; de Bot, 1992; Grosjean, 1982, 1989, 1997). The results of the experiment are going to be interpreted in the framework of this multilingual

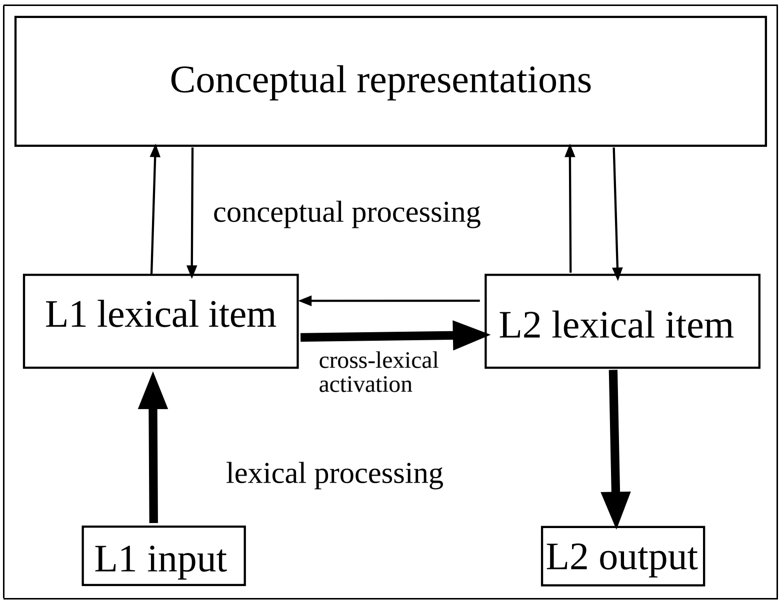

Figure 2.3: An interactive activation model of word association.

model in which the language-specific phonological and lexicosemantic information is stored in lexical memory and the common nonverbal conceptual representations are stored in a separate conceptual memory. The bilinguals' two languages, as well as the third, incompletely acquired language are stored in form of separate subsets, one for each language. These subsets are enclosed in a larger set, the language system (see Paradis, 1997). During lexical process, all the lexicons are active, the language of the input (the *base* or source language) as well as the target lexicon and the third lexicon (the *guest* language - see Grosjean, 1989). Thus, when bilinguals process lexical information in one language, the other languages come to be activated in parallel (see Figure 5.1). Lexical memory is structured in three layers (representing phonological segments, lexemes and lemmas). These layers can be conceived of as three subsystems of homogeneous nodes (see Stemberger, 1992; Roelofs, 1999; for a detailed description of the model see section 5).

The access and retrieval of translation equivalents is a complex process that depends on a number of influencing factors. Some variables that appear to play an important role in this process are the level of proficiency in the second language, the role of formal similarity in cognate-pairs, concreteness of the input word, frequency of the input and familiarity with the expected target word. The model will attempt to account for the influence of these factors in the access and retrieval of translation equivalents in mono- and bilingual learners of a foreign language with particular attention to the role of prior language knowledge and cross-linguistic

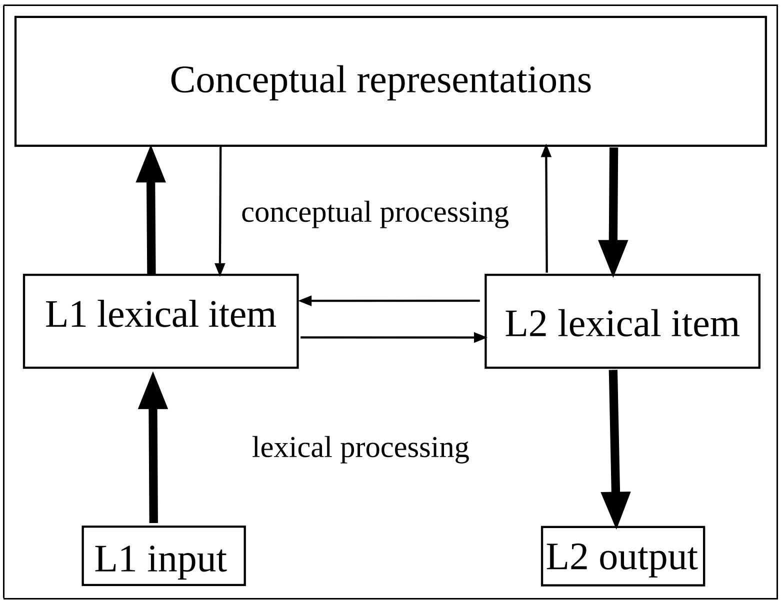

Figure 2.4: An interactive activation model of concept mediation.

neighborhood effects in formally similar words.

Chapter 3

Description of the experiment

3.1 The participants

The experiment was conducted in Hungary and in Germany; the subjects were recruited from three schools (one school in Germany, two in Hungary). All 85 participants were school-age learners of English at pre-intermediate level (mean age in Hungary: 15.5 years; in Germany: 13.5 years). At the time of testing they had been school-trained in English for about 2.5 years, 3 hours per week on average. The 69 participants in Hungary had been trained from the same course material. At the time of the experiment, they had finished approximately the same units in the course material. The 16 subjects in Germany had been taught from a different course book. Passive and active vocabulary knowledge of the selected participants in all three schools was tested to control for potential differences in prior exposure. Results of a pre-test on vocabulary knowledge showed that students had comparable knowledge of English.

The subjects were divided into four groups based on two criteria: 1) language background, 2) the language of the input stimuli. Regarding the language background, German speakers (henceforth: +German) and non-German speakers (henceforth: -German) were distinguished. The -German speakers were all Hungarian monolinguals. The +German speakers were either German monolinguals or Hungarian-German bilinguals. The latter were all compound bilinguals with Hungarian as the first and dominant language and German as the second language they started to acquire in early childhood. At the time of testing, they were intensively learning German in an ethnic minority class in secondary school. The experiment was conducted with the German monolinguals in Germany, and with the rest of the participants in Hungary. The input stimuli were Hungarian for the Hungarian monolingual group (henceforth MonHu) and German for the German monolingual group (henceforth MonGe). The Hungarian-German bilinguals were divided randomly into two groups: one group received the input stimuli in Hungarian (henceforth: BilHu), the other group heard the input in German (henceforth: BilGe).

Summarizing, the participants in groups MonHu and MonGe were *monolinguals*, whereas the participants in groups BilHu and BilGe were *bilinguals*. Groups BilHu, BilGe and MonGe were +*German* speakers, whereas group MonHu consisted of -*German* speakers.The experiment was conducted *in Hungary* with groups MonHu, BilHu and BilGe and *in Germany* with group MonGe. (For an overview, see Table 3.1)

Group Name	Number of subjects	Bilingual Status	Home country – place of the experiment	Language condition in the experiment	Knowledge of Geman
MonHu	23	monolingual	Hungary	Hungarian	-German
BilHu	23	bilingual	Germany	Hungarian	+German
MonGe	16	monolingual	Hungary	German	+German
BilGe	23	bilingual	Hungary	German	+German

Table 3.1: An overview of the groups in the experiment.

3.2 A brief description of the Hungarian language

The participants of the experiments were, as noted, native speakers of Hungarian or German, learning English. Since a central issue in my study is the role of prior linguistic knowledge and formal similarity during foreign language learning, and since Hungarian does not belong to the most widely spoken languages of the world, a brief descriptive sketch of its major features will be presented here, in particular phonological characteristics, since these are of considerable importance in some of the subsequent analyses of experimental data.

Hungarian is the most widely spoken Uralic language, with some thirteen million speakers in Hungary and neighboring countries and roughly one million scattered all over the world, most of all in America. Typologically the most closely related languages are Khanty and Mansi. Some more well-known related languages are Finnish and Estonian. Hungarian has been assigned to the eastern branch of the Finno-Ugric family, called the Ugric branch. In pre-Christian times, the ancestors of present-day Hungarians inhabited an area in Central Asia. Subsequent migrations brought them to the area north of the Black Sea, where they entered into close contact with Turkic peoples. Around 800 A. D., the Hungarians entered the Carpathian basin and settled down (for a detailed historical overview in English see Abondolo, 1998: 428–456).

Hungarian is an agglutinative language which means that several suffixes can be attached to the word stem. Accordingly, it has an elaborate set of case suffixes and an extensive system of aspect markers. Some important characteristic features of the Hungarian language are a fairly free word order, vowel harmony and fixed stress pattern. Since it is beyond the scope of the present study to give a detailed description of the Hungarian language, only some phonological characteristics of the Hungarian language will be mentioned here that are considered to be necessary for a better understanding of native language (Hungarian) phonetic/phonological influence in the qualitative analysis of learners' errors. The information that is provided here is taken from Samu and Szathmári (1967) and Tompa (1970)[1].

The Hungarian language has a rich sound system. It consist of 22 consonants and 7 vowels, each of the vowels and consonants have a short and a long realization (for a description of the Hungarian sound system see Table 3.2 and Table 3.3).

		Labial	Labio-dental	Alveolo-dental	Alveolo-palatal	Palatal	Velar	Glottal
stop	voiceless voiced	p [p] b [b]		t [t] d [d]		ty [c] gy [ɟ]	k[k] g[g]	
fricative	voiceless voiced		f [f] v[v]	sz [s] z [z]	s [ʃ] zs [ʒ]			
affricate	voiceless voiced			c [ts] dz[dz]	cs [tʃ] dzs[dʒ]			
glides	voiceless voiced			 l [l]		 j, ly[j]		h[h]
trills	voiceless voiced	 m[m]		r [r] n [n]		 ny [ɲ]		

Table 3.2: The inventory of Hungarian consonants.

	Back				Central		Front			
	Rounded		Unrounded				Rounded		Unrounded	
	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long
High	u[ʊ]	ú[uː]					ü[ʏ]	ű[ʏː]	i [ɪ]	í [ɪː]
High Mid										é[eː]
Mid	o[ɔ]	ó[oː]					ö[ ]	ő[ɵː]		e[e]
Low Mid				á[a]						
Low					a[ʌ]				e[ɛ]	

Table 3.3: The inventory of Hungarian vowels.

[1]For more information on the Hungarian language and the above mentioned phonetic/phonological characteristics (with particular respect to vowel harmony and assimilation rules) see The Sound Patterns of Hungarian by Vago (1980)

An important feature of the Hungarian vowel system is that vowels can be long or short, but they are not reduced. Unlike German and English, but like French, Hungarian is a syllable-timed language, in keeping with the fixed position of stress on the initial syllable of the prosodic word. Unstressed syllables are therefore not reduced (e.g. képen/in the picture [keːpen] in Hungarian as opposed to Leben/life [leːbən] or [leːbm] in German and taken [teikən] in English).

Hungarian belongs to the languages of the world that have a fixed stress pattern. Primary stress always falls on the first syllable, without any exception. Loan words that come from languages with a different stress pattern are nativized to conform to this rule (e. g. appartment is pronounced as [ˈʌpʌrtmʌn], hotel became [ˈhɔtel] and television [ˈtelevɪːzɪoː]). In many syllabic words, however, a secondary stress is allowed which often falls on a long vowel (e. g. [ˈteleˌvɪːzɪoː]).

3.3 The tasks

The experiment consisted of the following activities:

- Pilot study
- Vocabulary test and questionnaire on bilingual status
- Lexical decision task
- Oral word translation
- Reading task

3.3.1 Pilot study

Prior to the testing period, a pilot study was carried out, to test the input stimuli selected for the main experiment as well as the experimental procedure. The piloting took place in Hungary in both language conditions, with 15 bilingual and monolingual learners. The learners in the pilot study had received different training in English; it varied between 1 year and 6 years of school training. Learners with approximately 2-3 years of English training appeared to perform best on the experiment. Learners with 1 year of English appeared to have a restricted active vocabulary and to lack the skills necessary for a restricted time oral word translation task. Learners with 5-6 years of English education had a fairly high command of English and were able to access and retrieve the translation equivalents of the input set rapidly and with a very high accuracy.

The number of input items (50 words) and the duration of the translation session (approximately 7 minutes, instructions included) were acceptable in that no learner appeared to suffer from fatigue. The nature of the experimental materials, namely tape-recorded stimuli and the nature of the tasks, immediate oral translation of auditory input words, gave me reason to expect anxiety or frustration to be a factor that might have a negative effect on the production. For this reason, I decided to start the experiment with two very easy items. In this way, the first two words served as ’warm-up’ items. They will be excluded from the data analysis.

A further purpose of the pilot study was to try out the method chosen for the recording. As noted, subjects heard tape-recorded input stimuli. Their answers were recorded on tape, too, using a Philips cassette recorder. The recorded data was then converted from analog to digital representation at a 44.1 kHz sampling frequency with 8-bit accuracy and stored on a computer hard disk. For the conversion, I used the program Sound Edit 16 on an Apple Macintosh computer. The converted data proved to be suitable for the further computer-based analysis of reaction time and for the analysis of the phonological properties of the output.

3.3.2 Pre-testing I: Written vocabulary test

Prior to the main testing, about 100 learners (aged 14 – 18), who volunteered to take part in the experiment, were given a written test on active and passive English vocabulary, both in Germany and in Hungary. In this pre-testing task, I did not use a standardized language test. Instead, a vocabulary test was constructed based upon the following considerations: 1) The majority of the activities were to be creative tasks where the application of the acquired lexical knowledge was tested. 2) The results of the test, besides serving as baseline data for the selection of participants, were to provide empirical data that could contribute to the description of lexical processes in learners of a foreign language (e. g. within-language similarity neighborhood effects in the mental lexicon). 3) Due to the fact that the majority of the participants used the same course book (*Headway Pre-Intermediate*), it was possible to use the material of that course book as primary source for the written test. Based on the test results of this written pretest and consultations with the teachers of English in the schools where testing took place, participants were selected for the further tasks. In order to have homogenous groups, the outstandingly good or noticeably poor learners were filtered out. It appeared to be important to exclude learners with exceptionally good results in the pre-test, since they might have had exposure to English outside of the school classes. It also appeared to be important not to choose learners who scored very low in the pre-test, since the poor results might indicate that their active lexical knowledge in English was well under the level expected after the amount of exposure to the language in the classes of English. The pre-test reflected the active vocabulary of the participants, since in the test they had to recall words (see task description below). In the selection of groups for further activities, the active vocabulary of the participants was compared to the lexical items they learned from the course book. Participants who used only such words that appear regularly in the course book, and/or who wrote very few words within the given time were filtered out, as well as participants who used several words that were not included in the course material.

Each participant received a copy of the test paper with the exercises on two pages (see Appendix B). In most of the groups, each subject received the same test (the 'A' version). However, in small classrooms where students sat close to each other, two different versions were used. The vocabulary test consisted of two types of tasks testing active and passive vocabulary knowledge. Two tasks tested the active vocabulary of the participants through association. In the first one, learners were instructed to write down words that come to their mind in connection to a given word. In this task (known as *continuous free association*), the retrievability of semantically related words from the target lexicon was tested. In the second task, the participants were instructed to write a certain number of words a) beginning with a given letter, b) ending with a given letter. In these two activities (known as *continuous controlled association task*), the retrievability of target words on the basis of (a certain amount of) formal resemblance was tested. The second type of task assessed the passive vocabulary of the learners. Here, the participants were instructed to find the odd word in groups of words, consisting of 4 items (an *odd one out* task). They were asked to concentrate on the semantic irrelevance of one of the items in each group. They were instructed to underline the odd one and give a brief explanation in their native language. The participants were given 30 minutes to fill in the vocabulary test. The instructions on the test were presented in two languages. Native speakers of Hungarians read the instructions in English and Hungarian, German native speakers were presented with the instructions in English and German. It was important to present the instructions in the native language of the participants, to exclude possible misinterpretation of the tasks due to comprehension difficulties in the L2, which is always a risk in testing in a foreign language. Since the English knowledge of the subjects had been assessed to be at pre-intermediate level, they might have had difficulties understanding the instruction if these had been presented only in the target language.

The vocabulary test, besides helping in the selection of the four groups for the main testing, provided me with useful empirical data concerning the role of formal resemblance and neighborhood size in the access and retrieval of lexical items in the target lexicon (see 4.1).

3.3.3 Pre-testing II: Questionnaire

In order to assess the language background of the bilinguals, the approximately 60 bilingual participants of the pre-test were asked to fill in an additional questionnaire on bilingual status and knowledge of German. The questions were formulated in German and the participants were instructed to answer in German. In the questionnaire, they were asked when and under what circumstances they acquired their first words in German (e. g. at home, from bilingual members of the family), how long they had been school-trained in German and how often they had contact with native speakers of German. They were also asked to assess their German knowledge relative to their Hungarian knowledge (e. g. whether it is better, worse, or at an equal level) and they were asked if they considered themselves bilingual (see Appendix C). In order to make sure that in the bilingual condition an unsatisfactory knowledge of the second language was not a factor which might modify the results, the learners who had been school-trained in German for less than 8 years and/or had had no regular contact with native speakers of German were not included in the groups that took part in the main testing.

Participants were selected for the experiment on the basis of the questionnaire. They had a mean of 10.7 years of school training in German; the mean age of starting to learn the language was 5.3 years. 55.5% of the learners considered themselves to be bilinguals; 24% could not make a decision. 10.9% of the participants judged their Hungarian and German knowledge to be equal; 50% judged their German knowledge to be almost as good as their knowledge of Hungarian; 34.8% of the subjects considered their Hungarian knowledge noticeably better; 1 subject judged her German better than her Hungarian[2], and 1 subject considered the German language as a foreign language that she does not speak well[3]. 71% of the participants had some knowledge of German before primary school. 85% had regular contact with native speakers (most of all with family members in Germany/Austria, with friends and with school-age pals from German/Austrian exchange programs). In this way, all the bilingual participants selected for further testing were judged to be compound Hungarian-German bilinguals with Hungarian as the first and dominant language and German as the second language that they learned continuously and used regularly with native speakers from their early childhood.

[2]A conversation with this participant convinced me that her Hungarian knowledge did not differ in any aspect from the language use of Hungarian native speakers in everyday life situations. She did not appear to be a bilingual with German language dominance; she seemed to have acquired two languages approximately equally well. The teacher of German also supported this observation.

[3]Here I must note that according to the teacher of German, this participant belonged to the best learners of German with very thorough and reliable language knowledge. I was encouraged not to leave this subject out of the experiment because of her idiosyncratic assessment of her knowledge of German.

3.3.4 Pre-testing III: Auditory lexical decision (ALD)

Prior to the main testing, the four selected groups took part in an auditory lexical decision task. The lexical decision paradigm has a wide applicability in the study of processes in word recognition and helps one to find out about the nature of the mental lexicon in monolinguals and in bilinguals (e. g. the nature of phonological representations; cross-linguistic interference in bilinguals), as well as certain factors that affect lexical processing (e. g. frequency , similarity neighborhood). In a lexical decision task, subjects are presented with lexical items that are either real words (that is, words that exist in the language) or nonwords/nonce forms (usually pseudo forms of existing words). The subjects, after hearing a lexical item, must decide as quickly as possible whether the given stimulus item is a word or a nonword.

The input words were presented as auditory stimuli in Hungarian or in German, respectively. Groups MonHu and BilHu heard the stimuli in Hungarian, groups MonGe and BilGe were presented with the input in German. Before the experiment started, the participants received instructions that were presented on audiotape. Instructions were in the same language as the following input stimuli. They were asked to answer after hearing each stimulus word with 'yes' or 'no' (in German or in Hungarian, respectively) as quickly as possible and were instructed to answer 'yes' only if they were sure that the input word really existed in that language. This precision was found necessary to reduce possible guessing in the bilingual condition with L2 stimuli. The instructions were followed by 5 practice items (3 real words and two nonwords) prior to the actual test material. In the practice set, the participants received feedback on the correctness of their answers. After the practice set, the participants were informed about the start of the experiment and of the tape-recording. The input items followed each other at approximately 3 second intervals; real words and nonwords were ordered randomly. The presentation of the input set was continuous, the participants were expected to answer within the three seconds and were not given more time for consideratio. The duration of the auditory lexical decision (henceforth: ALD) was about 5 minutes, of which the instructions and the practice took up 2 minutes, the recorded session was about 3 minutes per participants.

The input set in this task consisted of 40 lexical items: 20 real words (all of them nouns) and 20 nonwords. (See Appendix E). The 20 real words of the input set were translation equivalents in German and in Hungarian. The 20 nonwords complied with the phonology of both input languages. Concerning phonological forms, they were nearly identical auditory stimuli in German and Hungarian (that is, they were pseudo-forms of existing Hungarian words and of existing German words at the same time), but they were pronounced according to the phonological constraints of the corresponding language. The Hungarian words and nonwords were produced by a Hungarian native speaker, the German words and nonwords were presented by a German native speaker. The nonwords were constructed in the following way: They were 1) derived from existing words on the basis of phoneme substitution in any position 2) derived on the basis of phoneme addition or deletion (see Luce and Pisoni, 1998) [4]. The following factors were also considered to influence production: 1. *Concreteness*. Since concrete words are hypothesized to be processed faster than abstract words (see de Groot, 1992b), this factor was controlled for in the experiment: The set of real words consisted of 10 concrete nouns and 10 abstract nouns. 2. *Word length*. The length of the input items is an important factor in the testing of response latencies (Grosjean, 1997). In the case of longer input stimuli, it is important to control the uniqueness point, that is, the point where the input item becomes identifiable, where there is only one candidate remaining for selection (see Marslen-Wilson, 1989b). This, however, may differ from word to word. Moreover, it was hard to control for this factor in two languages in parallel. Thus, I chose exclusively one- and two-syllabic lexical items in both language conditions. In this way, I had a set of one-syllabic input words and a set of two-syllabic input items and it was possible to work with the response latencies between input offset and output onset. (This variable will be called *RT-offset* in the analysis.) 3. *Similarity neighborhood*. Since most models of word recognition hypothesize that word recognition is to a great degree a process of discriminating among competing lexical items (see Luce and Pisoni, 1998), it appeared to be important to control the *neighborhood density* of the selected items. Neighborhood density or similarity neighborhood can be defined as ”a collection of words that are phonetically similar to a given stimulus word” (Luce and Pisoni, 1998: 3). It basically refers to the number and the degree of confusability of the real word’s neighbors, or , in the case of nonwords, the number of real words it resembles and the form and degree of deviation from these real words. Accordingly, higher density neighborhoods (with a relatively high number of phonologically similar words, like <u>mat</u>, <u>map</u>, <u>mad</u>, <u>man</u>, <u>men</u>, <u>ment</u>, etc.) are different from lower density neighborhoods (with a smaller number of similar-sounding neighbors, like <u>owl</u>, <u>our</u>, <u>are</u>). Nevertheless, it must be added here, that this variable differed in the two language conditions.. In the lexical decision task, I wanted to compare the lexical processes particularly in the monolingual condition with L1 (German) input and in the bilingual condition with L2 (German) input. The main objective of this task was to see whether the bilinguals had a very high command of German and whether they were able to retrieve L2 information automatically. If this is the case, then the accuracy of the bilinguals with L2 input will not be significantly different from that of the German

[4] For example, the nonword stimulus /urt/ was pronounced with an uvular ’r’, meanwhile the Hungarian stimulus /urt/ was pronounced as a trill.

monolinguals. In order to get a valid test result, it was important to have a number of items with a higher degree of confusability and a relatively high neighborhood size. If the subjects in the bilingual group can give accurate decisions for highly confusable words or nonwords within a restricted time (approximately 3 seconds between two input stimuli), this would support the postulate that they will have a fairly automatic access to the input words in the main testing in the German input condition. Then the possibility can be excluded that an inadequate knowledge of the L2 hinders these participants in the translation of words from German into English. In this respect, the results of the lexical decision task were planned to be used as empirical evidence for the high proficiency of the bilingual participants in their L2, a necessary precondition for the comparability of groups in the main testing. In addition, the results of the auditory lexical decision task will also serve as baseline-data for the reaction time analysis of the oral word translation task. Furthermore, through the results of the lexical decision task I hoped to gain insight into differences and similarities in the lexical activation processes of monolinguals and bilinguals in the native language.

3.3.5 Main testing 1: Oral Word Tanslation (OWT)

The main testing (OWT) took place in the same schools and with the same subjects shortly after the base-line data collection was finished.(In Hungary, where three different groups were tested, the ALD started one week after the written pre-testing and the OWT started on average one week after the ALD. In Germany, the ALD with the German monolingual group was conducted two days after the written task and the OWT was carried out one day after the ALD.) The set of stimuli in this task consisted of 50 words (all nouns) presented as auditory input, in German or in Hungarian, respectively. Each subject heard the material in the same language as in the ALD The input was taped so that there was an approximately four-second interval between two stimuli. However, the participants were allowed to take their time. If there was no answer given after 2 seconds, the tape recorder was stopped and the subjects were given approximately 5 more seconds to consider the answer. In this way, I wanted to avoid frustration which could affect results. In case the participants did not give an answer within the additionally given time, or at some point they indicated that they could not answer (e. g. by shaking their head or saying ”I don't know” in English or in their native language), the tape recorder was started again. The recording of the OWT lasted 3-4 minutes on average, the instructions took one minute. Thus, this session of the experiment lasted about 5 minutes per participant. The recording started immediately after the instructions. In this task, no practice items were used, since the task (forward translation of isolated words) was well known to the subjects, there was no need to familiarize them with the task. Nevertheless, the first two words of the 50 input stimuli were two English words with a very high degree of familiarity. They were used in order to raise the self-confidence of the participants and to reduce the initial anxiety, which was found necessary due to the nature of the experiment (tape-recorded oral production). The two practice words, which appear among the most frequently used lexical items in the course book material, were recorded together with the rest of the input, but these two items were not included in the analyses. Thus, the number of words intended for analysis was 48. In the selection of the 48 words the following factors were taken into account : 1) cognate status, 2) concreteness and 3) frequency of occurrence (for an overview, see Table 3.4).

German-English cognate status	Language of the input	Degree of concreteness	Frequency of occurence in the course material
True cognates	Hungarian	Concrete words	Words appearing regularly
Noncognates	German	Abstract words	Words appearing more than 10 times
False cognates			Words appearing less than 10 times
			Words that appear at least once in the course material

Table 3.4: Independent variables in the oral word translation task.

As Table 3.4 shows, the input stimuli were divided into three categories concerning cognate status in the two etymologically related languages (German and English). In this way, the input consisted of a) 18 German-English true cognates (phonologically and semantically identical or almost identical homophones, b) 9 German-English false cognates (phonologically identical or almost identical homophones without any or with only partial semantic overlap), c) 19 German-English noncognates (translation equivalents with no formal resemblance). Two words were excluded from the analysis of the role of German-English cognate status; one of them was a Hungarian-English true cognate (bicikli – bicycle) and the other could be grouped as a German-English true cognate (Ohr – ear) or as a German-Hungarian false cognate (Ohr – orr in Hungarian, meaning nose). The 18 true cognates involved 3 common loan words of greco-latin origin (problem, lamp and vase), they were both German-English and Hungarian-English homophones. Thus, these words were cognates for all the subjects. One of the false cognates (Gymnasium/gimnazium, meaning in English secondary school) also appears in both input languages, and is a false cognate for each group. The other 15 German -English true cognates and 8 German-English false cognates were for the -German speakers (that is, for the Hungarian monolinguals) noncognates (for the input set, see Appendix F).

Another factor, *concreteness* was also taken into consideration in the selection of the input words (see Appendix F). Concreteness can be defined as ”the extent to which the word's referent can be experienced by the senses” (de Groot and Comijs, 1995: 475). Regarding this factor, 32 of the 48 words were concrete words (like armchair, lake, coat) and 16 were abstract words (like wedding, death, answer). Since the degree of concreteness is expected to influence most of all the reaction times, this factor will be considered in the analyses of response latencies.

Another aspect of great importance in the selection of the input was the semantic mapping of the items in the three languages. The input stimuli were selected so that the corresponding German and Hungarian input words in the different input conditions shared most of their basic semantic features, many of them were fully overlapping translation equivalents and they all had a translation equivalent with the same basic semantic components in the English language.

The English translation equivalents were grouped by another factor too, namely by *familiarity*. This factor ”indicates the frequency with which the participants have experienced the word” (de Groot and Comijs, 1995). Word frequency was assessed by the frequency of occurrence of the English words (the translations of the input words) in the course material. The frequently occurring lexical items were expected to have a higher degree of familiarity and to be more easily accessible and retrievable than the rarely occurring words. In order to obtain a classification by frequency , the occurrence of the input words was counted in the course book. The input set was divided into four groups by this criterion in the following way:

Familiarity 1 words that regularly appear in the course material, which means that they occur either in each unit once or more, or in certain units many times);

Familiarity 2 words that appear altogether more than 10 times; that is, words the learners encounter either in many units, or in a few units many times

Familiarity 3 words that appear less than 10 times, that is, relatively rarely and

Familiarity 4 words that appear once or twice, that is, very rarely (see Appendix F).

This classification gives a relatively objective picture of the degree of familiarity for each input word, since the teachers followed the course material and did not often use additional material. However, it must also be added here that word familiarity could be computed only in the 3 groups in Hungary, as they were instructed from the same course book. The monolingual group in Germany was instructed from another course book. As a result, the ranking of word familiarity corresponds only to the input and subjects in Hungary.

The oral word translation was meant to provide empirical data for the description of process mechanisms in polyglots , particularly regarding the role of cross-linguistic formal resemblance and the role of more extended language background (that is, when more than one 'source lexicons' are involved in the access and retrieval of foreign language words).

3.3.6 Main testing 2: Reading task

A central aim of the experiment, besides finding out about foreign language lexical information processing in monolinguals and bilinguals, was to examine the phonological properties of the interlanguage of monolingual and bilingual learners of English. Since the oral word translation gave us data that consisted of isolated lexical items only, I supplemented the translation task with an additional reading task which was meant to provide us with data concerning the segmental and suprasegmental phonological properties of the interlanguages with different prior linguistic knowledge. The reading task was conducted after the word translation. After the translation task was finished, the tape recorder was stopped. The participants were informed about the start of the second task and were given the instructions in the same language as in the first part of the main test. The subjects were instructed to read out aloud a short printed text in English. After the instructions, the participants were informed about the start of the tape recording. The recording lasted approximately one minute. It was part of the methodology not to give the subjects time to get familiar with the text. I wanted to see which words are the most quickly and easily retrievable, which caused the most difficulty and which words showed interference with the background language(s). The text was a short extract (7 sentences) from a simplified adaptation of O. Henry's *The Last Leaf*, taken from an *Easy Reading Selection* in English at pre-intermediate/intermediate level (see Appendix G). The selection included letter combinations with marked phonological features in the target language for both Hungarian and German native speakers (e. g. *th* both in word initial and in intervocalic position), and of consonant clusters that are unmarked in both native languages, but have different rules of pronunciation (e. g. *ng* in word final position, *br* in word initial position, etc.). The text also included loan words (usually of Latin origin) that can be found in both native languages and are, thus, cognate words (e. g. section, apartment, hotel) and the proper nouns in the text also appear in all the three languages (since the original names, Sue and Johnsy were replaced by the names Mary and Arthur). With the reading task, I wanted to examine the phonological differences in the English interlanguage of monolinguals with different first languages and the phonological interlanguage features of bilinguals, particularly the role a second language plays in the forming of a third language phonological approximative system at a relatively early stage of language acquisition.

Chapter 4

Data analysis

4.1 Analysis of the association tasks in the written vocabulary test

The vocabulary test served first as baseline data for the selection of participants in the subsequent activities. However, the tasks in this written test also provided me with some interesting findings concerning the processing of foreign language lexical items, particularly with respect to the role of similarity neighborhood in a foreign language lexicon. In this section, I will examine the written production of the language learners on the association task where they were required to write words beginning and ending with given letters (for the tasks in the written vocabulary test, see section 3.3 and Appendix D).

4.1.1 Association tasks in a native language

An association task in its simplest form implies the presentation of a word to the subject asking him or her to answer with the first word that comes to his mind. In a *continuous free association task*, the subject must answer the stimulus word with as many words as possible, often within a given time. In a *controlled association task*, there are some restrictions concerning the relation between input word and possible associations. In associations provided by adult native speakers, the most characteristic way of recalling words is by semantic proximity, that is, by similarities in the meaning of the words (e. g. synonyms, antonyms, taxonomic relations such as words denoting kinship, days of the week, etc.). Purely formal structuring by native speakers (that is, when the associated words share their orthographic and/or phonological properties, but not their semantic features, is very rare, at least in normal adults. Formal, sonorous associations can be found in certain pathological cases or in infants (see Slama-Cazacu, 1973: 329–339). In normal adults, formal similarities appear sometimes as morphological variations, that is, when different derivational and inflectional affixes are added to the same stem (e. g. *paint*, *painter*, *painting*).

4.1.2 Association tasks in a foreign language

The above findings apply to native speakers' production in recall tasks. In my experiment, in the written vocabulary test, however, the nonnative language proficiency of the participants was tested. The first two tasks were continuous association tasks, but, while the first task was free association, in the second one the range of possible answers was restricted formally. Nevertheless, the subjects did not have to write words that bear much formal resemblance, neither were they required to recall words based on semantic similarities. Thus, they were free to write words that began/ended with the same letter but were otherwise neither formally nor semantically related to each other (e. g. *park* – *pick* – *politician*, etc.). Some empirical data suggest that nonfluent speakers of a foreign language tend to connect words on a formal rather than on a semantic basis (see Chen and Leung, 1989). Meara (1978)) investigated lexical associations made by learners of French. He found that language learners (unlike native speakers) gave responses on the basis of phonological similarity, such as *profond* – *plafond*, or *profond* – *professeur* (Meara, 1978: 192–211). In terms of lexical processing, this result supports the assumption that nonproficient foreign language learners do not have strong links between lexical forms in the incomplete foreign lexicon and the corresponding conceptual representations. A native speaker (or proficient bilingual), in contrast, can automatically process the conceptual features of lexical items (Chen and Leung, 1989; de Groot and Kroll, 1997). A language learner, however, might be able to retrieve a word and its similarity neighbors in the target lexicon without processing the meanings of the recalled words (e. g. *paint* – *pain* – *pay*). In psycholinguistic terms, it can be interpreted in a network model by the automatic activation of the within-language similarity neighbors in the target lexicon without a subsequent automatic activation of the conceptual features of the corresponding lexical items. In later stages of learning, as a lexical item in the foreign lexicon "becomes more integrated into the internalized system", it gradually passes "from a more phonological to a more semantic profile" (Singleton, 1999: 136).

4.1.3 Qualitative analysis of the controlled association task

A question of considerable interest in the qualitative analysis of the controlled association task was whether there were tendencies of clustering words on a formal basis (that is, words sharing their orthographic and/or phonological features), on a semantic basis (that is, synonyms, antonyms, taxonomic relations), or on a morphological basis (that is, derived forms of a stem). In case subjects write sequences of words that are formally similar, another question of interest is, whether the words share their orthographic or phonological properties, or both of them. In the written production of the subjects in this particular task, I found a considerable number of word sequences that shared many of their formal similarities (see Appendix D for a collection of form-based associations from the written test). The formally similar words formed approximately 30% of all the words listed by the subjects[1] Most of the lexical items in a sequence shared both their orthographic and phonological properties (e. g. hammer – ham, hurry – hurrican, held – helmet, plan – plant, price – prize, pill – pillow, play – plate – place, banana – bank – band, etc.), but there were also some groups of words which were only orthographically similar (e. g. price – prince, pub – put ,house – horse – hours, bridge – bride, shark – shadow, etc.) and there were also sequences which shared only their phonological features (e. g. people – pupil, high – how, high – height – heart, basket – biscuit, skull – sculpture, etc.). The considerable amount of form-based clustering suggests that the subjects retrieved similarity neighbors from their foreign language lexicon. The high number of words sharing both their phonological and orthographic features and the low number of words that were only orthographically similar show that even in a written task where subjects only needed the orthographical properties of the target words, they nevertheless used phonological cues too, which indicates that sound similarities play an important role in the organization of similarity neighborhood in the target lexicon. In other words, similar sounding words primed each other, even though the subjects did not hear words in English, neither did they speak words out loud.

Another finding of considerable interest is that most of the lexical items in the students' production are one or two syllabic words, especially in the task where the participants wrote words that ended with the given letter. The selection of short words also indicates that the subjects were probably searching through similarity neighborhoods, since longer (three- or more syllabic) words are bound to have a more restricted similarity neighborhood. With respect to the word-final letter condition, another important observation was made. There were several word sequences in which not only the word-final consonant was identical, but also the word-initial (e. g. *wild* – *wood* – *word*, *had* – *hand* – *helped* – *head*, *children* – *chicken*, *clean* – *can*, *better* – *bear* – *beer* – *bar*, *litter* – *letter*, etc., for more examples see Appendix D). Even when subjects had to concentrate on *word-final* letters, they frequently retrieved words that shared their *initial* letter, too. This finding provides empirical evidence for the importance of word initial informa-

[1] All examples of clustering presented in the analysis and those in the Appendix were extracted from sequences of lexical items (10-12 words in each sequence) that the subjects wrote. It should be emphasized here that not all items in the sequences formed clusters (e. g. been – bean – boring – board – become – believe – behind – begin – brother – black – bit).

tion in the access and retrieval of words (see Marslen-Wilson's Cohort Model in section 2.2.2).

4.1.4 Conclusions

The lexical items listed by the participants in the controlled association task indicate that nonfluent language learners show a tendency to associate words in the target language lexicon that share their orthographic/phonological features. This can be interpreted in terms of the hypothesis that lexical entries are organized into *similarity neighborhoods*, which, in turn, are defined by the left-to-right linear order of decoding during lexical processing. Even in a foreign lexicon, lexical items appear to be organized into such similarity neighborhoods, words in the target lexicon are retrievable on the basis of formal similarity with another target word without any semantic relatedness between the two words, a kind of within-language priming that is less typical in proficient speakers of a language. This indicates that in nonproficient language learners, in contrast to fluent speakers of the language, there may be stronger connections at the lexical level than between the lexicon and the higher-level conceptual representations.

4.2 Analysis of the auditory lexical decision (ALD)

The lexical decision task, similarly to the vocabulary test, was used as a pre-test in the selection of the participants of the main testing and at the same time as empirical data in the analysis of lexical processing in monolinguals and bilinguals. In the subsequent analyses, the level of proficiency of the bilingual participant in the second language (German) will be compared to the native language proficiency of the monolinguals. The role of various factors in the processing of L1 and L2 lexical information (such as similarity neighborhood size, concreteness effect) will also be subjected to quantitative analysis.

Hypotheses:

H_0 The null hypothesis claims that there will be no differences between bilinguals and monolinguals and between the groups processing L1 and L2 input, and that there will be no within-group differences between the processing of existing and non-existing words.

H_A The alternative hypothesis is that there will be between-group differences due to bilingual status and input condition. The processing of L2 words will be significantly slower than the processing of L1 lexical items and bilinguals will be significantly slower than monolinguals in both input conditions. The alternative hypothesis also claims that there will be within-group reaction time differences in each group, concerning the following factors: word status, concreteness and neighborhood size. The processing of real words will be significantly faster than the processing of nonwords; concrete words will also be processed significantly faster than abstract words. The size of similarity neighborhood will affect the speed of processing too; words in a denser neighborhood will have a higher reaction time than lexical items in a sparser neighborhood.

The above differences, however, are expected to be significant only for reaction time data and not for the rate of accurate responses. In the accuracy analysis, the bilingual participants are expected to have a very high accuracy rate in L2 as well as in L1, since they are proficient speakers of both languages.

4.2.1 Analysis of accuracy

In the accuracy analysis, the following variables were used:

Independent variables:	- input condition	- Hungarian
		- German
	- bilingual status	- monolinguals
		- bilinguals
Dependent variable:	- rate of accurate responses	

In lexical decision tasks, the accuracy rate is not usually tested, unless the groups differ in their proficiency level. In the experiment to be presented here, one of the four groups was tested on L2 lexical input, whereas the other 3 groups processed L1 input. Thus, it is a crucial question in the accuracy analysis whether there are between-group differences, more concretely, whether or not the bilingual group with L2 input has a significantly lower rate of accuracy. If the accuracy in the bilingual group with L2 input significantly differs from the accuracy in the other three groups processing native language input, then bilinguals do not have an almost native-like competence in their second language. In that case, the rate of accuracy in the main testing (Oral Word Translation) in groups processing L1 and L2 input will not be comparable, since inaccurate responses or omissions (the lack of response) might be the result of inadequate knowledge of the input language (L2). Thus, prior to the reaction time analysis, the rate of accurate responses in the four groups was tested and compared. Figure 4.1 a displays the between-group differences in accuracy.

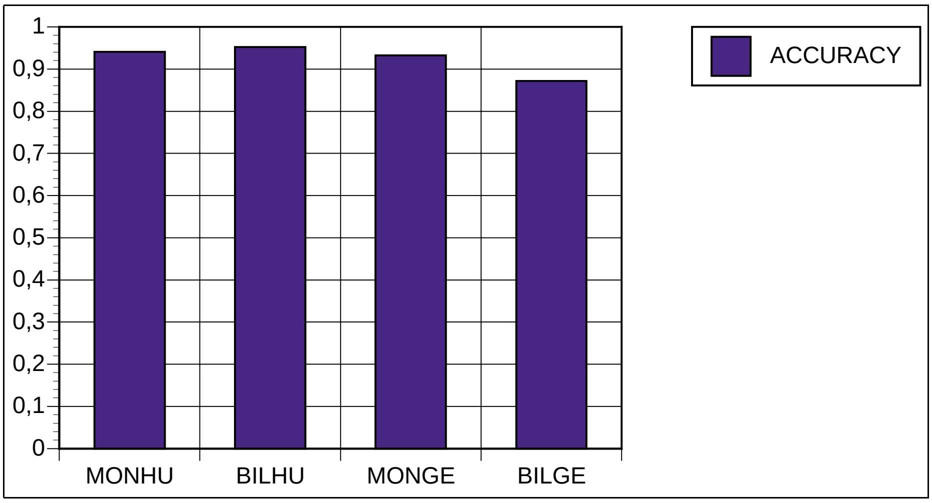

Figure 4.1: Accuracies in groups in the ALD.

Each of the four groups has a very high accuracy, nevertheless the rate of accurate responses is the lowest in Group 4 (that is, in the bilingual group with L2 input stimuli). The data were subjected to a multivariate analysis of variance (MANOVA), to test the within- and between-group differences in accuracy for a possible main effect of input condition. The analysis did not reveal significant differences. A follow-up Mann-Whitney U-test was performed on the accuracy of the bilingual group with L2 input and the native language accuracy of the German monolingual group. The result of the U-test was complimentary with the MANOVA analysis, the difference between the two groups was not significant ($p>.05$). In terms of accuracy, the analysis supported the null hypothesis; there are no significant within- and between-group differences in the rate of accurate responses in the four groups.

The result shows that in the ALD, the bilingual group with L2 input is comparable with the groups that process native language information. This finding is of great importance concerning the main testing, the oral word translation task.

Since in the ALD, the L2 proficiency of the bilingual group does not differ significantly from the L1 proficiency of the other groups, I conclude that the subjects will not be hindered by a possible lack of sufficient L2 knowledge in the OWT, either. Thus, in the accuracy analysis of the OWT, the bilingual group with L2 input will be comparable with the other groups receiving L1 input.

4.2.2 Analysis of reaction time

Variables and coding criteria

In the reaction time analysis, the following variables were used:

Independent variables:	– word status	– real words – nonwords
	– concreteness	– concrete words – abstract words
	– similarity neighborhood	– higher density neighborhood – lower density neighborhood
	– input condition	– Hungarian - German
	– bilingual status	– monolinguals - bilinguals
Dependent variable:	– reaction time	

The classification of the similarity neighborhood was partly based on the method used by Luce who constructed a computerized lexicon of acoustic similarity neighborhood of 20,000 English words. In Luce & Pisoni's definition, similarity neighborhood is "a collection of words that are phonetically similar to a given stimulus word" (Luce and Pisoni, 1998). The magnitude of the neighborhood depends on the number and degree of confusability of words in the neighborhood and on the frequencies of the neighbors. In my experiment, however, there was no chance to control the frequency of words, since there is no standard frequency of spoken words in Hungarian comparable to frequencies of German spoken words. Nevertheless, each of the input items that were used in the lexical decision task were relatively frequent words in both languages (for the input items in the ALD see Appendix E.1). Thus, in the analysis, I controlled the neighborhood density of the input items without their frequency. Though the similarity neighborhood used in the data analysis is based on a self-made classification, the criteria that were chosen here are those that are considered to be among the most important ones in the access and retrieval of words by acoustic stimulus and they seem to provide us with a fairly reliable *mental map* of the connections between similar sounding words in the mental lexicon of Hungarian and German native speakers.

The neighborhoods were computed based on the number of close similarity neighbors. In the selection of close neighbors, the following aspects were of interest:

- The closest neighbors have a high degree of confusability, they differ only in the coda, that is, in their last consonant (or consonant cluster). They may also differ in the nucleus, but the difference between the two vowels must be minimal (e. g. the vertical position of the tongue, like in *u* and *o*).
- Further (more distant) neighbors are identical with the input word in their initial features (the word onset) and differ in the rest (due to phoneme substitution, addition or deletion). These more distant neighbors can be longer than the input word, whereas the closest neighbors do not differ in length.

The input items have a *neighborhood with higher density* if they have two or more close neighbors with relatively high confusability and also some more distant neighbors. The input words have a *neighborhood with lower density* if there is only one or no close neighbor with a high degree of confusability and/or if the number of (more distant) neighbors is generally very low.

The response latencies in the lexical decision task were calculated by measuring the time interval between the offset of the input and the onset of the output. In the analysis of response times, significant within- and between-group differences were expected. Preliminary analysis showed that the reaction time data were normally distributed. The between-group comparison of reaction times (mean response latencies and within-group dispersion) displayed in Figure 4.2 shows differences in the four groups, particularly the bilingual group with German input seems to differ from the other three groups.

To see, whether the differences are significant, a multivariate analysis of variance (MANOVA) was performed. The analysis revealed a main effect of group (DF=3, F=51.38, Sig. of F$<$.001). In order to find out whose reaction times showed significant differences, the data were submitted to further analyses where groups were compared in the following conditions: 1) Hungarian input groups (Hungarian monolinguals vs. Hungarian-German bilinguals); 2) German input groups (German monolinguals vs. Hungarian- German bilinguals); 3) Monolingual groups (Hungarian monolinguals vs. German monolinguals); 4) Bilingual

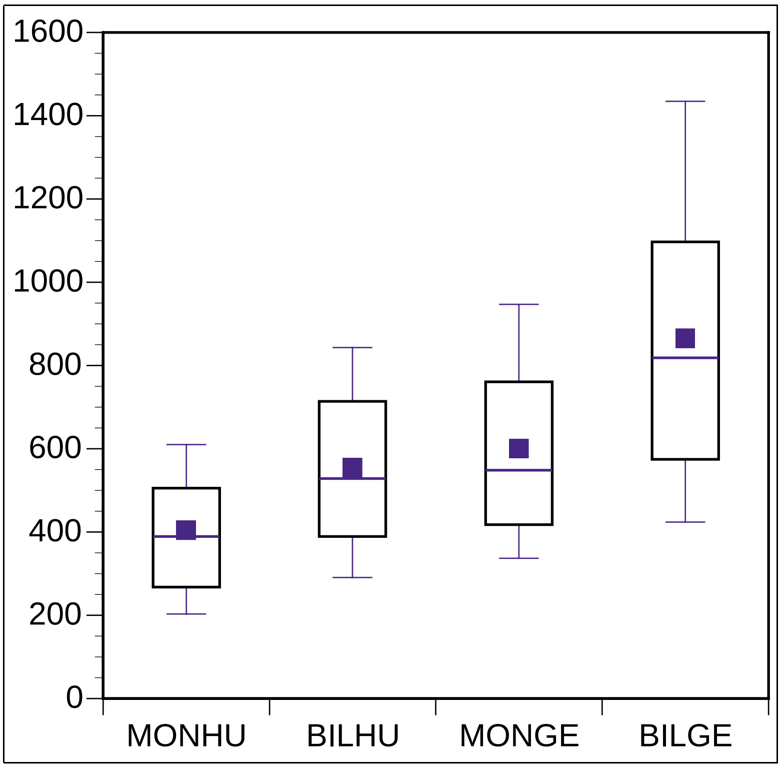

Figure 4.2: Within-group reaction time differences of word status in the four groups.

groups (bilinguals with Hungarian input vs. bilinguals with German input). The results of the comparisons are shown in Table 4.1:

Groups	DF	F	Sig. of F
BilHu – MonHu (Hungarian input)	1	5.19	.028
MonGe – MonHu (monolinguals)	1	13.75	.001
MonGe – BilGe (German input)	1	53.5	.000
BilHu – BilGe (bilinguals)	1	70.33	.000

Table 4.1: Significant between-group RT differences.

The analysis reveals that there were significant between-group differences in all of the above conditions (bilingual status, language of input and nature of input language). BilHu and MonHu differ in bilingual status only, MonGe and MonHu in the language of input, BilGe and BilHu in the language and nature of input, MonGe and BilGe in both bilingual status and nature of input (since BilGe was presented L2 input stimuli).

The results indicate that in the reaction time data, unlike in the accuracy data, the differences in the processing of L1 and L2 input are highly significant. There is a main effect of input condition in two senses: depending on whether the input stimuli were Hungarian or German, and whether the German stimuli were processed as L1 or as L2 information. As can be seen, L2 words are processed more slowly than L1 words and German stimuli also have a significantly higher reaction time than Hungarian stimuli. Bilingual status also results in different reaction times: both bilingual groups are significantly slower than the monolinguals. (However, the bilinguals with German input can also have a lower reaction time because they processed L2 input, but the two groups with Hungarian input differed only in bilingual status, otherwise both of them processed L1 input.)

After the between-group analysis, the within-group differences were tested in order to examine in which way and to what extent different factors contribute to reaction time differences. An important question is whether the processing of real words and nonwords differ significantly. In the lexical decision paradigm, a substantial body of evidence supports the idea that the processing of nonwords requires significantly more time (see section 2.7). Figure 4.3 displays the within-group differences in this condition. To see whether the above differences were significant, the data were submitted to a MANOVA. The analysis revealed a highly significant main effect of word status (DF=1, F=611.43, Sig. of F$<$.001).

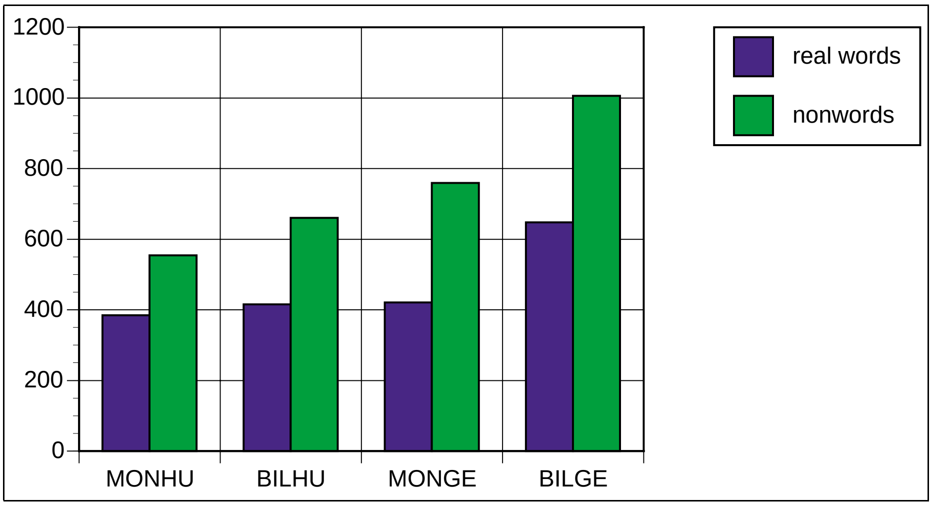

Figure 4.3: Reaction times in groups in the ALD.

The other factor to test was similarity neighborhood. Many researchers agree that neighborhood structure is an important factor in spoken word recognition and that words are recognized in the context of similar words activated in memory (see Luce and Pisoni, 1998). Figure 4.4 shows the reaction time differences between input words in sparser and denser similarity neighborhood in each group.

The data were submitted to a MANOVA, the analysis revealed a main effect of neighborhood density. (DF= 1, F=55.58, Sig. of F<.001).

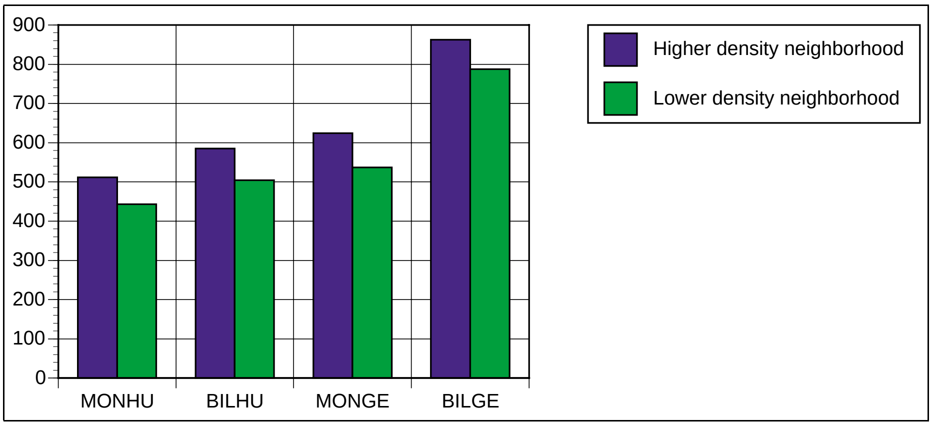

Figure 4.4: Within-group reaction time differences of neighborhood density in the four groups in the ALD.

The two factors examined above (word status and neighborhood density) both contributed to significant within-group differences. The obvious question arises, whether there is an interaction between these two factors. The MANOVA analysis revealed significant (or marginally significant) interaction between word status and neighborhood density in three of the four groups, as seen in Table 4.2.

All groups together	DF=1	F=6.36	Sig. of F=.014
MonHu	DF=1	F=28.17	Sig. of F=.000
BilHu	DF=1	F=6.33	Sig. of F=.014
MonGe	DF=1	F=3.69	Sig. of F=.074
BilGe	DF=1	F=.70	Sig. of F=.413

Table 4.2: Interaction of word status and neighborhood density in the four groups.

Next each group was collapsed into 4 subgroups in order to compare real words and nonwords in denser and sparser neighborhood. The subgroups are as follows:

1. nonwords in a denser neighborhood
2. nonwords in a sparser neighborhood
3. real words in a denser neighborhood
4. real words in a sparser neighborhood

Figure 4.5 shows the within-group differences of similarity neighborhood effects in real words and nonwords, Appendix E.2 displays the means, standard deviations and the 95% confidence intervals. The data indicate that sparse real words require the shortest processing time and dense nonwords take the longest to process. The same tendency can be observed in the monolingual and the bilingual data with respect to these distinctions, supporting the hypothesis that activation processes in bilinguals can be modelled by models originally motivated by research with monolinguals.

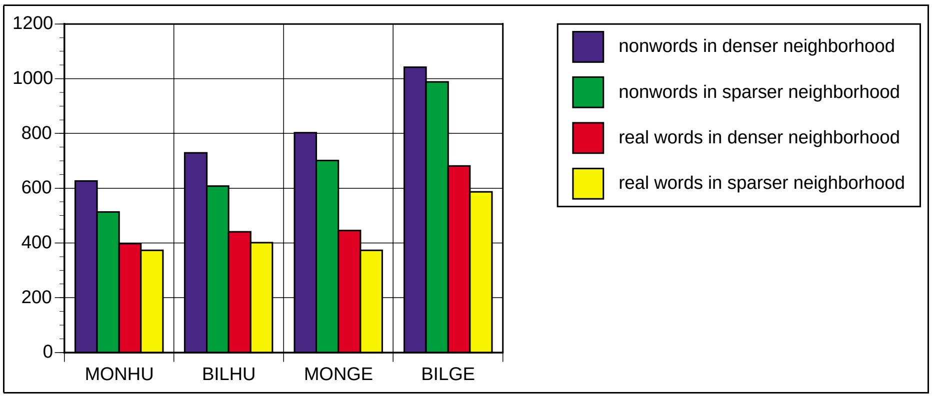

Figure 4.5: Similarity neighborhood effects in real words and nonwords.

In the lexical decision paradigm, a body of evidence supports the significance of another factor, namely the concreteness of the input words. Abstract words appear to have a significantly higher reaction time than concrete words. Figure 4.6 shows the within-group RT differences between concrete and abstract words in the experiment.

As can be seen, the within-group differences in each group show the above mentioned tendency: The reaction time for concrete words is lower than for abstract words. However, the multivariate analysis of variance did not reveal a main effect of concreteness (Sig. of $F>.05$) and the t-tests showed significant differences between reaction times for concrete and abstract words only in group 4 ($p=.024$; in the other groups $p>.05$). This result may be due to an interaction between the previously discussed two factors (word status and neighborhood density) and concreteness. Nevertheless, since the concreteness effect can only be tested in real words, not in nonwords, it appeared very problematic to include this factor in a multivariate analysis of variance and to test within- and between-group interactions in only a subgroup of the data (real words). Thus, suffice it to say here that the comparison of concrete and abstract words shows a tendency towards higher reaction times for abstract words than for concrete words, as shown in Figure 4.6.

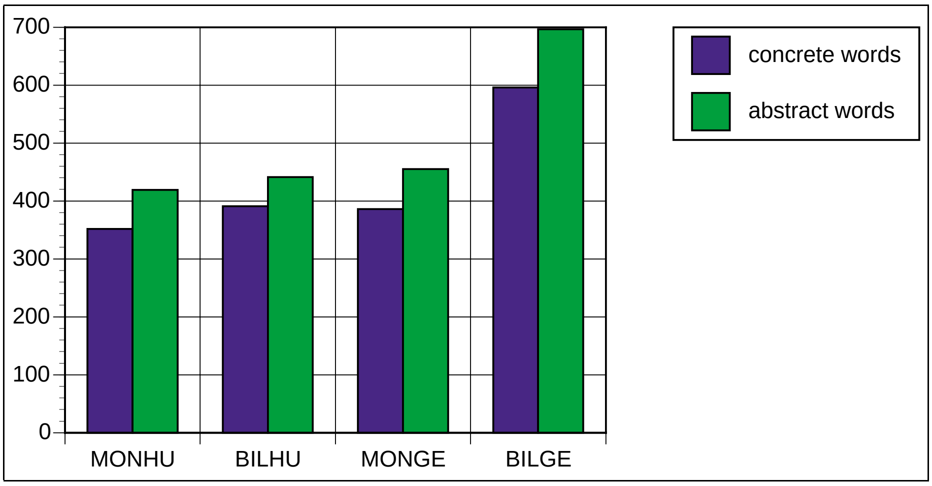

Figure 4.6: Reaction time differences between concrete and abstract real words in the four groups in the ALD.

4.2.3 Discussion, conclusions

The findings in the analysis of reaction times in the auditory lexical decision task basically replicate results from previous experiments on auditory word recognition (see Harris, 1992: 299–317). Real words are processed faster than nonwords, concrete words also have a lower reaction time than abstract words and there is a positive correlation between neighborhood density and reaction time.

In a lexical decision task, real words are expected to be processed faster than nonwords, since the processing of nonwords is hypothised to require a more exhaustive search in the lexicon. The recognition of real words is described in my model in the following way. During the gradual decoding of the acoustic input, several lexical items that share some of their phonological properties receive activation. The process lasts until the candidate is found whose stored phonological features match the acoustic properties of the input. After this lexical item is found, it is selected for further processing and at the same time the rest of the candidates come to be inhibited. In nonwords, however, there is no full-match stored in the mental lexicon, thus, all the near matches have to be checked until the subject comes to the decision (after an extended process) that there is no entry for that lexical item in the mental lexicon. Since the nonwords in my experiment are pseudo-forms of existing words, often with a high degree of confusability, the formally similar lexical items in the mental lexicon can be highly activated. The rejection of these candidates takes longer because of the high formal similarity and also because there is no full-match to be selected. In certain cases, if the nonword is highly confusable with a real word, the positive impulses can reach the activation threshold of the lexical representation of the near match and the input stimulus can be identified with this lexical item. The result is a wrong answer, an incorrect ‘yes’. This occurs seldom, most of all in nonwords where the one-phoneme difference is minimal. (e. g. *korm – Korn or *eder – edel).

The comparison of monolingual and bilingual L1 processing also supports previous findings. Many researchers agree that in word recognition, cross-linguistic phonological neighbors are also involved in the search process. Thus, there are more candidates to process, which, by hypothesis, should result in higher reaction time. The question of bilingual L1 and L2 lexical processing is also a central aspect in previous research on word recognition. The results of my experiment are consistent with findings of other researchers. The access and retrieval of L2 information in the case of bilinguals whose L2 is not the dominant language is usually reported to be slower than the processing of the dominant language (L1). This phenomenon can be described by a difference in the automaticity of the processing of the native language and the second language. Lexical information in the native (and dominant) language is automatically retrievable, since the native language is more frequently used and the connections in the L1 mental lexicon are more firmly established than in the L2 lexicon. The stronger the connections, the lower the activation threshold, the less activation is needed for the selection of the lexical item in the mental lexicon. If the connections are weaker, a higher activation is needed, which can lead to higher response latencies.

4.2.4 Implications for the translation task

The lexical decision task was used primarily to provide baseline data for the main experiment (OWT), since the first step in the processing of translation equivalents is the accessing of the (L1 or L2) input stimulus. The lexical decision task provided some insights into this first phase: The retrieval of L2 lexical information in the ALD appeared to be very accurate, but also considerably slower than the processing of the L1. Thus, the bilinguals in the experiment had a very high command of the German language, but their automaticity in processing first and second language information differed significantly, a finding of considerable importance for the subsequent analysis of the Oral Word Translation. Owing to this result, in the translation task higher response latencies will be postulated in the bilingual L2 condition. Moreover, since the reaction time analysis revealed significant differences in monolingual and bilingual L1 processes as well, a significant overall difference between monolingual and bilingual response latencies is to be expected in the oral word translation task.

The tendencies that I found concerning the other two factors (abstractness and neighborhood density of the input) also provided some findings that correspond to the postulates in my model of lexical processing in monolingual and polyglot systems. The lower reaction time for concrete words indicates that they are more easily accessible than abstract words; concrete words might be connected to well-defined mental images, which is not always the case in abstract words (e. g. button or meat have higher imageability than trouble or sense). In relation to the translation task, subjects can be expected to translate concrete words faster, since the conceptual features are less complex and more perceivable through our senses. The similarity neighborhood effects indicate that in the activation process, both between- and within-language phonological neighbors receive activation and that in multistore systems, there must be more candidates for selection which can slow down the information processing and result in a wider range of interference errors. The significant RT difference between the monolingual and the bilingual group with Hungarian input supports this hypothesis. The significant difference between the two monolingual groups, however, may seem striking at the first sight. Though this result also has a plausible explanation that lies in the selection of the Hungarian and German input items. Comparing the neighborhood density of real words and nonwords we notice that the German input items have altogether a higher degree of confusability. They had more similarity neighbors than the Hungarian words. Unfortunately there were too many aspects that had to be taken into consideration in the selection of the input stimuli and it appeared impossible to find words that correspond not only in the other factors that were considered (such as length, semantic correspondence, word class, concreteness), but also in the neighborhood density. In the selection of the input I concentrated on two aspects of neighborhood density: Nonwords were pseudo-forms of real words in both input languages at the same time and real words had at least one near-match that differed in some minimal phonological properties. It was not possible to adjust the number of near-matches in the two languages. Nevertheless, the comparison of monolinguals and bilinguals with the same input language and the within-group comparisons also provided important findings with respect to the expected outcome in the OWT and to my model of monolingual and bilingual L1 and L2 lexical process mechanisms.

4.3 Analysis of the oral word translation (OWT)

The oral word translation is the central test in the experiment, in which groups differing in their prior linguistic knowledge will be compared and the role of certain factors (such as cognate status, word familiarity and concreteness) will be tested based on the following hypotheses:

H_0 The null hypothesis is that there will be no significant differences between monolinguals and bilinguals from different language backgrounds and that formal similarity of input and expected output does not influence the translation process.

H_A The alternative hypothesis claims that there will be significant within- and between-group differences. Knowledge of an etymologically related language will facilitate the translation production in the case of true cognates, whereas it will hinder the production through interference in the case of false cognates. The alternative hypothesis also claims that the bilingual status will influence the translation process in both input conditions: Bilinguals will differ significantly from monolinguals due to facilitating and hindering effects of more extended prior linguistic knowledge.

The following hypotheses will be tested in terms of accuracy and reaction time:

H_1 The rate of accuracy in each German-speaking (hence: +German) group will be significantly higher than the accuracy in the Hungarian monolingual (hence: -German) group.There will be significant within group differences in the accuracy rate in all +German groups due to a main effect of cognate status. Thus, the following rank is expected in the accuracy analysis:

- true cognates (highest accuracy)

- noncognates

- false cognates (lowest accuracy)

H_2 Bilinguals will have significantly higher reaction times than monolinguals due to more extensive search processes. Especially long reaction times are expected in the bilingual group that has to process L2 German input.

H_3 There will be significant within-group differences; the translation of true cognates will be significantly faster than the translation of noncognates. In the false cognate condition, accuracy and reaction time will correlate: Incorrect answers (that is, the production of the cross-linguistic similarity neighbor instead of the translation equivalent of the input) will have a low reaction time just as true cognates do, correct answers (that is, the production of the translation equivalent instead of the formally similar cross-linguistic neighbor) will have a high reaction time like the noncognates do.

4.3.1 Analysis of accuracy

Variables, coding criteria

In the accuracy analysis, the following dependent and independent variables were used:

Independent variables:

I) prior linguistic knowledge:	1) +German speakers 2) -German speakers
II) cognate status of input:	1) true cognates 2a) deceptive false cognates 2b) accidental false cognates 3) noncognates
III) bilingual status of subjects:	1) bilinguals 2) monolinguals
IV) imageability of input:	1) concrete words 2) abstract words
V) familiarity with input:	1) very high (regular encounter in the course book) 2) high (more than ten encounters) 3) low (less than ten encounters) 4) very low (one or two encounters)
Dependent variable:	accuracy of immediate responses[2]

The accuracy rate was calculated by coding the answers as correct or incorrect. In the categorization, the following aspects were taken into account: The answer is coded as correct if there was a given answer and it fulfilled the semantic, grammatical and phonological criteria.

The *semantic criteria* are the following: The answer is coded as *correct* if the input word and the given answer could be considered as translation equivalents in the two languages. In other words, in case the two words share most of their

[2] Many subjects gave more than one answer after hearing the input stimulus. The second answer followed immediately on the first and was often the correction of the first incorrect or phonologically not fully correct word. Since my aim in the experiment was to detect direct phonological activation, only the first answers were analysed.

semantic components and thus the semantic features in both languages could be connected to the same concept in memory (see section 2.3.3). In this way, correct answers are, for example doctor or physician as the translation of the input Arzt/orvos; animal or pet for the input Tier/állat, etc.) The answer is coded as *incorrect* if the input and the output do not share all the semantic components necessary and sufficient for the selection of the same concept (e. g. freedom as the translation of the input stimulus Frieden/béke, wind or thunder as the translation of Sturm/vihar or marriage for the input Hochzeit/esküvő). In these cases, the input word and the given answer share many semantic features, the two semantic networks overlap, but the semantic overlap is not enough to lead to the same concept.

The *grammatical criterion* is as follows: The given answer is coded as *incorrect* if due to a grammatical error (e. g. incorrect suffixation), the answer is no longer a translation equivalent of the input word, since the grammatical inaccuracy resulted in a change in meaning (for example, if a suffix was used where it was not needed: dangerous instead of danger, or a suffix/part of a word was missing where it was needed: police instead of policeman). The answer is coded as *correct* if the grammatical inaccuracy did not result in semantic deviation from the input word. (For example, if the plural form of a noun was used (years instead of year).

The *phonological criteria* are the following: Phonological deviations from the target language forms occurred most frequently in true or false cognates. The deviations are coded as *incorrect* if they resulted in another word that semantically did not overlap with the expected output. (e. g. knickers [ˈnɪkərs] instead of knees, was [woːz] instead of vase or neck [nek] instead of knee, etc.). The deviations are coded as *incorrect* also in case they reached the point where they were no longer identifiable as the expected target word (e. g. [pɔlˈjʊsɪst] instead of policeman, etc.) However, the answers are *not* coded as *incorrect* if the output word is still identifiable with the expected target word (e. g. [ˈʃʊldər], [ˈʃɔltər], [knɪː], [ʃtɔrm], [pɔˈlɪsʃən], etc.). Quite clearly, most of these deviations arre hybrids in which the phonological properties of the German lexical items merge with the phonological features of the target words, nevertheless the correct lexical item seems to be selected in the target lexicon.

The variable *familiarity* codes the number of occurrences of the input words in the course book. The coding criteria are as follows: 1) Words that appear regularly in the course book so that the learners hear them frequently; 2) Words that occur more than ten times in the course book and are, as a result, encountered relatively frequently; 3) Words appearing less than ten times (altogether in very few lessons); 4) Words that occur once or twice in the course book material and are, thus, expected to be used quite rarely.

The input condition

Besides the above listed independent variables, there was one more condition by which the subjects were grouped, namely the language of the input set. Before starting the analyses of between- and within-group differences in the rate of accurate responses, it seemed useful to investigate the role of the input condition. It is an important question, whether or not the language of the input affects significantly the accuracy rate, since the bilingual groups and the monolingual groups are comparable only if the language of the input does not cause a significant difference. In that case, we can disregard the different language conditions and compare groups with different input sets. In order to be able to ignore this condition, the input stimuli were carefully selected, so that the lexical items in the two input conditions were translation equivalents of each other and also of the English target word and all of them were frequently used words both in Hungarian and in German. In the bilingual condition, the language of the input is not expected to have a significant effect on the production (at least not on the rate of accuracy), since both of the bilinguals' languages (the L2 as well as the L1) are hypothesized to be accessible during the access and retrieval of translation equivalents. These two groups did not differ in the other conditions, both groups were bilingual and they had the same language background. They differed in cognate status to the extent that the bilinguals with German input were exposed to direct cognates, whereas the bilinguals with Hungarian input had to process lexical items that were indirect cognates, in case they had access to the German equivalents of the Hungarian input stimuli. If this hypothesis holds, the two bilingual groups will not differ in the rate of accurate responses.

Based on these considerations, a Mann-Whitney U-test was performed to compare the overall accuracy of the two bilingual groups. The test did not reveal significant difference in the accuracy rates of the two groups. ($p > .05$). In a follow-up analysis, the accuracies were compared in the different cognate conditions. This analysis appeared to be necessary, since the role of the input condition might differ in the cognate and noncognate conditions. A U-test was performed at first to test the accuracies in the false cognate and the true cognate conditions. The test did not reach statistical significance in either conditions ($p > .05$). The next question to be answered is whether there is a difference in the processing of noncognates where formal similarity does not play a role, but nevertheless the processing of L3 information by native language and by second language input might result in differences in the accuracy. In our hypothesis, this factor (namely the processing of L1 vs. L2 lexical information) is expected to affect reaction times, but not the rate of accurate responses. The Mann-Whitney analysis supported this hypothesis, the difference in the accuracy of noncognates in the two bilingual groups is not significant at the 5% level.

To conclude, the analysis of accuracy did not show a main effect of the input language for cognates or for noncognates. Based on these results, bilingual groups with Hungarian and German input stimuli are comparable in each cognate condition and the language of the input can be ignored in order to examine which of the other variables (cognate status, bilingual status, prior language knowledge) affect significantly the processing of translation equivalents.

The role of prior language knowledge and cognate status

The main research questions in the present study are centered around the role of prior knowledge of an etymologically related language. All the participants in Hungary were speakers of an etymologically unrelated L1, whereas the subjects in Germany spoke an etymologically related native language. The two bilingual groups acquired German as L2 and achieved a high level of proficiency. The central issues in the analysis of the role of the knowledge of German are whether this factor significantly influences the production of English vocabulary items and whether there is a difference between the influence of German as a native and as a second language. In the first analysis related to this question, the rate of accurate responses was compared in the +German and -German groups.

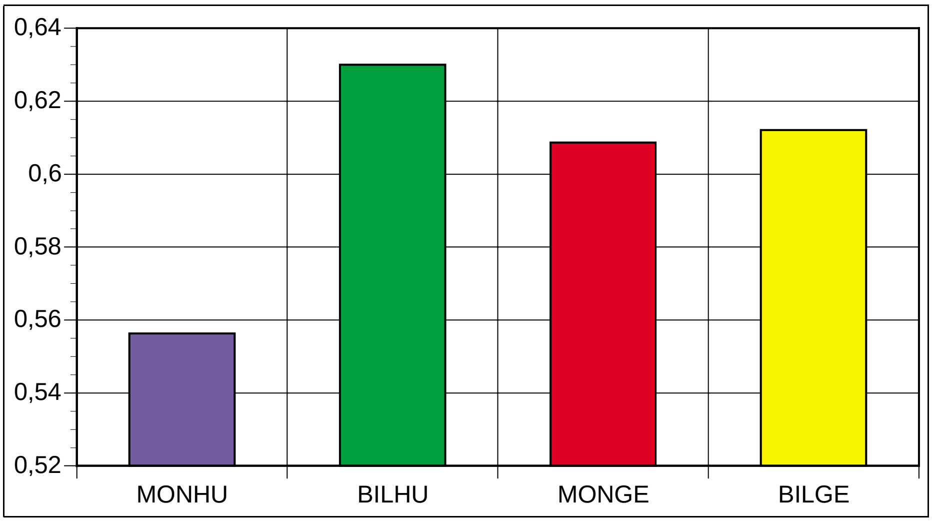

Figure 4.7: Accuracies in groups in the OWT.

Figure 4.7 indicates that there are differences in accuracy between each of the +German groups and the -German (Hungarian monolingual) group, whereas the +German groups have a fairly similar rate of accurate responses. The multivariate analysis of variance did not reveal a significant main effect of group (Sig. of F>.05), but the follow-up U-tests showed highly significant differences in accuracy between each combination of a +German group and the -German group (see Table 4.3). The differences between the +German groups were statistically nonsignificant (p>.05).

Groups	Cases	Mean rank	2-tailed P
MonHu –	1025	999.1	
BilGe	1034	1060.7	.006
MonHu –	1025	988.7	
BilHu	1031	1068.1	.000
MonHu –	1025	852.7	
MonGe	720	901.9	.019

Table 4.3: Mann-Whitney U-tests, accuracy x group.

Since the differences between the +German and -German groups are hypothesized to be a result of the facilitating effect of formal resemblance in the German-English cognate pairs, next the between-group accuracies were compared in the different cognate conditions in the +German groups. Figure 4.8 indicates that there are differences in the rate of accuracy in the three groups; true cognates have the highest rate of accuracy, noncognates the second and false cognates the lowest. This result supports the hypothesis concerning the rank of cognate accuracy in the +German groups. The data were submitted to a multivariate analysis of variance to test the significance of a main effect of cognate status in the three groups. As shown in Table 4.4, the MANOVA yielded a highly significant main effect of cognate status.

Source of Variation	SS	DF	MS	F	Sig. of F
cognate status	1.09	2	.55	30.01	.000
group by cognate status	.07	4	.02	.98	.419

Table 4.4: MANOVA, a main effect of cognate status in the +German groups.

In the next analysis, cognates and noncognates in the four groups were compared in the following way. At first, the 15 input items were selected that were true cognates for +German groups and noncognates for the -German group. The three words of Greco-Latin origin (the input items that are cognates for all the participants) were excluded from this analysis. A multivariate analysis of variance was performed at first including all the four groups, and next including only the +German groups. The MANOVA revealed a significant main effect of group in the first condition (DF=3, F=14,83, Sig. of F<.001), where all groups were included, but

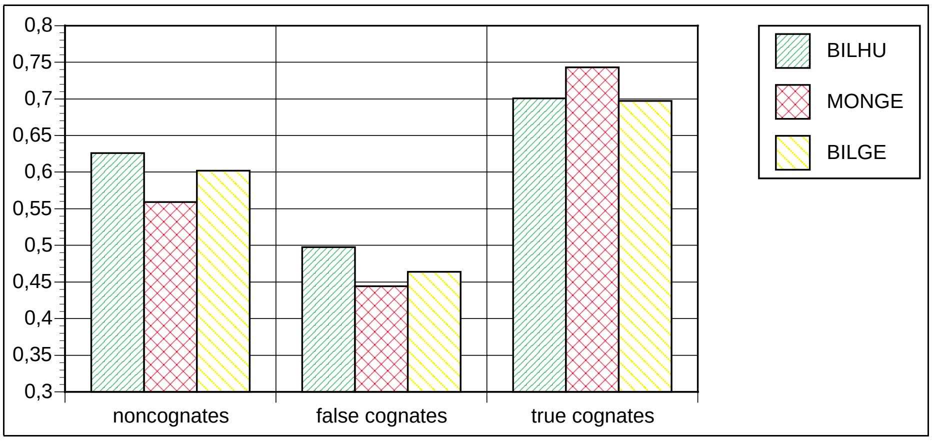

Figure 4.8: Within-group differences in the rate of accurate responses in the three cognate conditions in the OWT.

not in the second condition, where only the +German groups were tested (Sig. of F>.05).

Group	Mean	Std. Dev.	N	95 % confidence interval	
BilHu	.690	.118	23	.639	.741
BilGe	.686	.168	23	.614	.759
MonGe	.775	.106	16	.719	.831
MonHu	.504	.128	23	.449	.560
For entire sample	.655	.164	85	.619	.690

Table 4.5: MANOVA of selected items: True cognates for +German speakers, noncognates for -German speakers.

To see if the differences between +German and -German groups are a result of formal similarity only, the noncognates were also submitted to a MANOVA. The analysis was run under the same conditions as for the true cognates, that is, first all the four groups were included in the MANOVA, then only the +German groups were subjected to analysis. The MANOVA did not show a significant difference in either of the two conditions (Sig. of F>.05).

The above analyses confirmed our hypothesis that the knowledge of an etymologically related language facilitates the translation process if there is formal resemblance between the translation equivalents. The multivariate analysis revealed that the effect of cognate status did not differ in the German-speaking groups. Thus, bilinguals enjoy the same advantages as monolinguals, bilinguals access direct and indirect cognates as well. An additional test, a MANOVA of within and between group cognate status (true cognates vs. noncognates) in the

+German groups also supported this argument with some further evidence: The analysis revealed a highly significant within-subject main effect of cognate status in +German speakers (Sig. of F$<$.001), and the main effect of cognate status did not show significant within-group and between-subject differences (see Table 4.6). The follow-up within-group U-tests also revealed that the rate of accuracy of true cognates tested against the accuracy of noncognates was significantly higher in each of the three +German groups. (See Table 4.7)

Tests involving *Cognate Status* Within-Subject-Effect

Source of variation	SS	DF	MS	F	Sig. of F
Within cells	.62	59	.01		
Cognate status	.44	1	.44	42.56	.000
Group by cognate status	.03	2	.01	1.44	.246

Tests of Between-Subject-Effect

Source of variation	SS	DF	MS	F	Sig. of F
Within cells	1.14	59	.02		
Group	.00	2	.00	.12	.886

Table 4.6: MANOVA of cognate status, true cognates and noncognates in the +German groups.

The above results show that the +German groups outperform the -German group and that true cognates have a significantly higher rate of accuracy than noncognates. The following question remains to be answered at this point: Is there a possibility that the -German group had a significantly lower accuracy not just because of the lack of facilitating effects of formal similarity but also because their command of English was generally at a lower level than that of bilinguals and German monolinguals? The next analyses sought an answer to this question.

In the following test, the 15 true cognates for the +German groups were compared with the same 15 words (all of them noncognates) in the -German group. In parallel, the 19 items that were noncognates for each of the four groups were also selected. Figure 4.9 displays the different rates of accuracy in the four groups in these two selections. U-tests were performed pair-wise in the noncognate condition. The results showed that whereas there were significant differences in the true cognate condition ($p<.01$ in each comparison of +German and -German groups), the accuracies in the noncognate condition did not show significant differences between the -German group and any of the +German groups ($p>.05$ in each case). Thus, the -German group differs significantly from the +German groups only in cognate words. This analysis revealed another interesting finding. The German monolingual group benefitted from the facilitating effect of cognate status sig-

Group 2			
Group	Cases	Mean rank	2-tailed P
Noncognates	433	408.55	.022
True cognates	414	440.15	

Group 4			
Group	Cases	Mean rank	2-tailed P
Noncognates	437	405.78	.004
True cognates	413	446.37	

Group 3			
Group	Cases	Mean rank	2-tailed P
Noncognates	304	270.03	.000
True cognates	288	324.44	

Table 4.7: Within-group comparison of true cognates and noncognates.

nificantly more than the bilingual groups. This can have two reasons: 1) they processed L1 input, meanwhile the bilinguals processed (directly or indirectly) L2 cognates, 2) there is a difference in the degree of familiarity for some cognate words between Hungarian and German native speakers. Unfortunately, the familiarity effect in the German group was not controllable, which makes it impossible to find an answer to this problem. However, the analysis of the familiarity effect revealed some very interesting findings worthy of mention.

The role of familiarity with the target words

In the analysis of familiarity, at first the accuracy rates in the true cognate and noncognate conditions were compared, to see if the accuracy in the four familiarity subcategories reveals significant within-group differences and if there is a difference in familiarity effect between the three groups and between the above two cognate conditions. Let us consider the noncognate condition at first. As Figure 4.10 indicates, the three groups appear to show very similar tendencies. There is no great difference in the accuracy of familiarity 1 and 2 and in the accuracies for familiarity 3 and 4, whereas there is a sudden drop in accuracy between familiarity 2 and 3, that is, between words appearing in the course book more than ten times and less than ten times. This can be interpreted in the following way; subjects need at least ten encounters with the target word to be able to retrieve it from the lexicon at a high rate of accuracy.

Next, the true cognate condition was subject to scrutiny (see Figure 4.11).

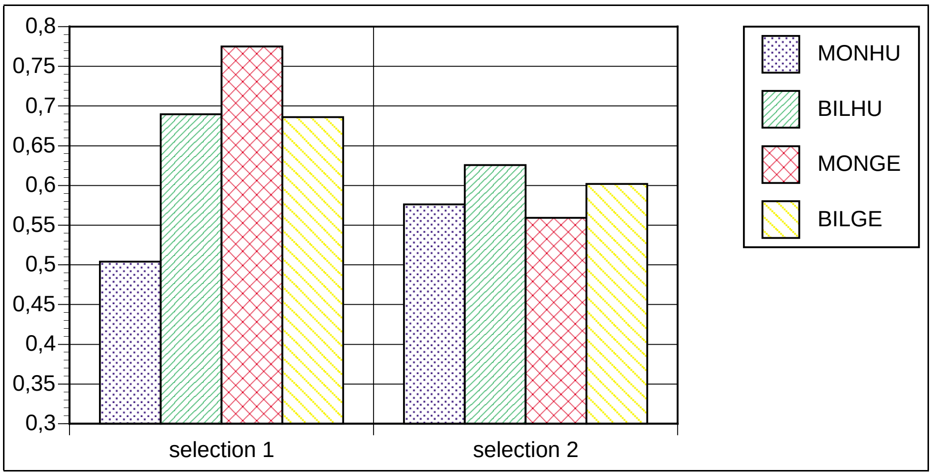

Figure 4.9: Group comparisons of: (left) 15 selected items: true cognates for +German speakers, noncognates for -German speakers. (right) 19 selected items: noncognates for all in the OWT.

Here, the groups did not act as homogenously as in the previous comparison. Nevertheless, some tendencies can be observed here, too. In the monolingual group with Hungarian input (MonHu) a gradual decline can be detected; the less frequently they encountered the target word, the lower the rate of accuracy. In group BilHu, there is a gradual decline in accuracy as well, with a clearly noticeable drop that can be observed in both bilingual groups between familiarity 3 and 4.

To see, whether the observed differences are significant, the data was submitted to pair-wise U-tests. The significant differences are shown in Table 4.8. The results show that the interaction between familiarity and accuracy differs in the two cognate conditions: In the true cognate condition (in the +German groups), fewer encounters are needed to successfully retrieve a word from the target lexicon than in the noncognate condition. This result, again, indicates that formal similarity facilitates the process of translation equivalents. There is a significant difference between MonHu and both of the bilingual groups in *familiarity 3*. Bilinguals have a significantly higher accuracy in this familiarity condition ($p<.05$). This clearly indicates that the very same target words are easier to retrieve for those subjects who can rely upon the phonological resemblance between input words and expected target words.

Accuracy analysis in the false cognate condition

In the analysis of the data, one of the cognate conditions has not yet been considered, namely the false cognates. In the within-group comparisons we could see

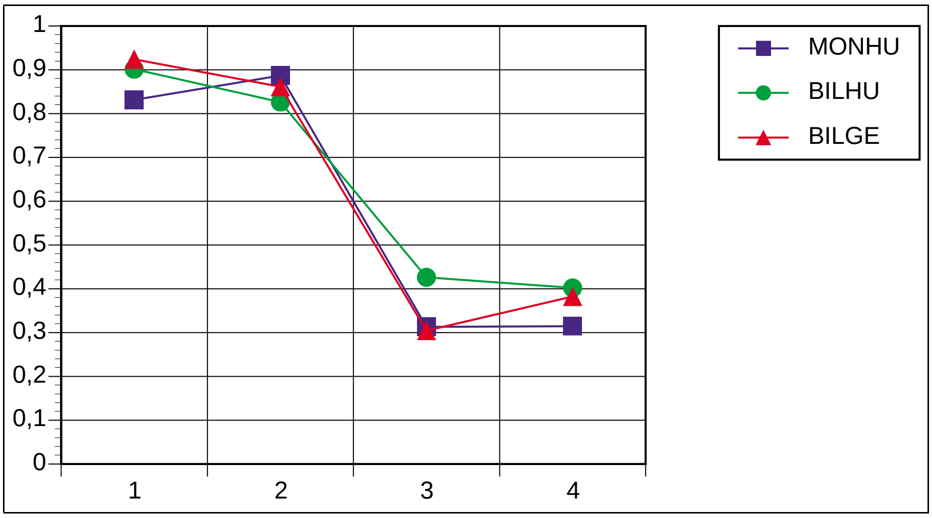

Figure 4.10: Accuracy by familiarity in the noncognate condition (19 selected words, noncognates for all).

that false cognates have the lowest rate of accuracy. However, there are two important factors that have to be taken into account when analyzing false cognates. Firstly, this cognate group differs from the other two cognate conditions in an important aspect. In these lexical items, there is formal resemblance between the input word and a certain target word, but the two formally similar words do not have a enough semantic correspondence to be translation equivalents. As a result, unlike in the true cognate condition, in this group of words the production of the similar sounding target word (the cross-lexical phonological neighbor) results in an *incorrect* answer. In this respect, false cognates differ from true cognates where formal similarity leads to a correct answer. The words that belong to the category called *false cognates* are actually noncognates, since the translation equivalents of these words do not bear formal similarity with the input word (for example: Land – country, Frieden – peace or Rock – skirt). Nonetheless, they differ from the other noncognates, because of the possible interference of the cross-lexical phonological neighbor. The target of examination in the false cognate condition is whether the cross-lexical neighbors really interfere. Secondly, when comparing between-group accuracies of false cognates, it must be taken into account that there are two different groups of false cognates: accidental and deceptive false cognates. The difference between the two categories is that deceptive cognates share some features of meaning (e. g. Land and land or Frieden and freedom), whereas accidental false cognates only sound like a word in the target language. They are homophones that bear no semantic resemblance (e. g. Tier and tear, Rock and rock or Bild and build). Let us start the testing of false cognates with

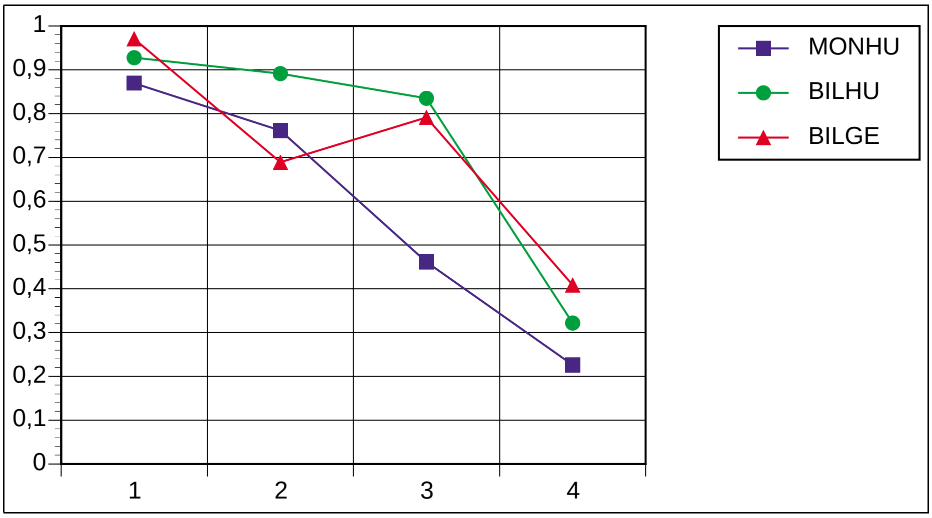

Figure 4.11: Accuracy by familiarity in the true cognate condition (15 selected words, true cognates for +Germans, noncognates for -Germans).

the within-group comparisons.

Figure 4.8 already indicated that false cognates had the lowest value in the cognate accuracy rank. But are there any significant differences? The false cognates and the noncognates were subjected to within group Mann-Whitney U-tests. The analysis did not reveal significant within group differences (in each group $p>.05$). This indicates that formal similarity does not lead to significant interference in the false cognate condition. Nevertheless, this result basically contradicts the findings of some other experiments and also the hypotheses in this work concerning the role of cross-lexical similarity.

On this account, the two different false cognate categories were next submitted to analysis, to see if there is a significant difference in the accuracy of accidental and deceptive cognates . Figure 4.12 indicates that the two false cognate conditions differ remarkably, deceptive cognates appear to have a much lower rate of accuracy ($p<.05$). The U-test analyses supported this observation, in each group there is a significant difference in the accuracy of accidental and deceptive false cognates (see Table 4.9). Accidental false cognates have an accuracy rate similar to that of noncognates, whereas deceptive false cognates have a much lower rate of accurate responses. This indicates that subjects are likely to answer with a cross-lexical homophone if there is some overlap in meaning, but not if the two between-language homophones have totally different semantic representations (see also Section 4.5 and Table 4.14).

Noncognates for all

Group	Familiarity condition	2-tailed P
MonHu	Famil 2 – Famil 3	.000
BilHu	Famil 2 – Famil 3	.000
BilGe	Famil 2 – Famil 3	.000

15 selected items (true cognates for +German, noncognates for -German)

Group	Familiarity condition	2-tailed P
MonHu	Famil 2 – Famil 3	.001
MonHu	Famil 3 – Famil 4	.001
BilHu	Famil 3 – Famil 4	.000
BilGe	Famil 3 – Famil 4	.000

Table 4.8: Accuracy by familiarity, U-tests of within-group differences.

Discussion of results

Overall, the analyses of the accuracy data support the hypothesis that primary language knowledge is an important factor in the access and retrieval of foreign language lexical information. The knowledge of an etymologically related language contributes to a higher overall accuracy, as the group comparisons (+German vs. -German) show. The nonsignificant difference in (or more properly, the very high similarity of) the accuracy rate in the two bilingual groups provided evidence for the hypothesis that both of the bilinguals' lexicons were involved in the lexical process mechanisms. As Green puts it, although one language is selected, another one may also be active (Green, 1993: 269). In the experiment, even in case the source language was Hungarian, the bilinguals could rely upon the indirect facilitating effect of German-English lexical similarity.

The within-group differences clearly support the idea that prior knowledge of an etymologically related language facilitates the access and retrieval of translation equivalents on account of cognate status. The learners perceive formal similarities between input word and target word, in the access and retrieval of cognates, the emphasis is on formal similarity. Subjects have a high accuracy in the true cognate condition and a low accuracy in the false cognate condition, which supports the hypothesis that formally similar words can be selected for production whose conceptual features differ from those of the input words. However, the nature of the false cognate status is also of great importance. The accuracy rate in deceptive false cognates is very low, but the accuracy in the accidental false cognate condition does not show significant differences from accuracy in noncognates. This finding can be attributed to the different conceptual characteristics

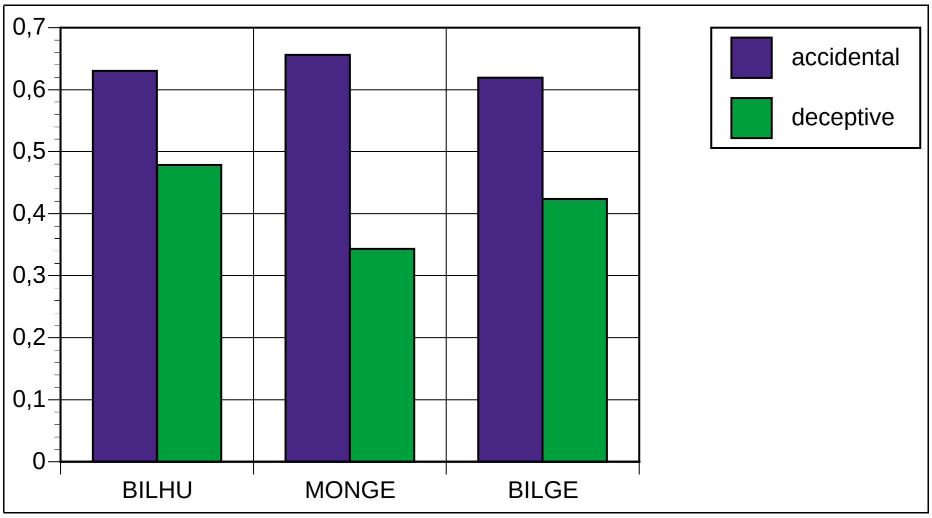

Figure 4.12: Within-group comparisons of accidental and deceptive false cognates in +German groups.

in these two groups of false cognates. Learners are mislead by false cognates if (and, practically, only if) the two words are not only formally similar, but they also share some features of meaning. There is no significant interference in formally similar words with no semantic overlap. (However, individual differences cannot be disregarded here; there are subjects who show clear tendencies in identifying words on formal basis and without semantic overlap. These individual cases will be subject to some subsequent qualitative analyses of errors.)

The familiarity analysis provided strong support for the contention that lexical items in the target lexicon are more easily retrievable after a certain number of exposures to those words during language learning. We saw that the amount of exposure necessary for the retrievability of the lexical items differs in true cognates and noncognates; true cognates can be successfully translated after fewer encounters with the target word. It confirms our claim that in the processing of target language lexical information, formal similarity facilitates the retrieval of target words.

As the above results and interpretations show, the knowledge of an etymologically related language effects the accuracy of the target language in oral word translation. The questions still to be answered are: Does it also influence the speed of processing of the target lexical items and does it affect the phonological properties of the selected target words?

BilHu

Group	Cases	Mean rank	2-tailed P
accidental	92	99.5	0.38
deceptive	92	85.5	

MonGe

Group	Cases	Mean rank	2-tailed P
accidental	64	74.5	0.00
deceptive	64	54.5	

BilGe

Group	Cases	Mean rank	2-tailed P
accidental	92	101.5	0.08
deceptive	92	83.5	

Table 4.9: Comparison of accidental and deceptive false cognates.

4.3.2 Analysis of reaction time

The independent variables used in the reaction time analysis are the same as in the accuracy analysis. The dependent variable is *RT offset*, that is the reaction time between the offset of the input word and the onset of the answer. In the OWT, unlike in the ALD, the subjects were not required to answer within a certain period of time. On the contrary, they were allowed to take as much time as they needed and the tape recorder was stopped when the subjects did not answer after about two seconds. This had the advantage that the subjects were not put under time pressure, which could have forced them to give a quick but incorrect answer. This, however, had the disadvantage that there were some extreme cases in the reaction time data, as a stem-and-leaf analysis revealed. These extreme cases were excluded from the subsequent analyses of response latencies.

The hypotheses concerning reaction times are, first of all, that groups will show significant differences in mean latencies. In Figure 4.13, the mean reaction times in the four groups are presented. The between-group differences appear to be restricted to differences between group BilGe and the other three groups. The reaction time data was subjected to a multivariate analysis of variance, the MANOVA revealed a highly significant main effect of group (Sig. of $F<.01$). However, the follow-up pair-wise t-tests revealed significant differences only between the bilingual group with German input and each of the other three groups ($p<.01$), whereas in all the other comparisons (that is, in the comparison of the +German groups), the groups did not differ significantly ($p>.05$). This indicates that there is a main effect of input language; L2 stimuli are processed much more slowly than L1 stimuli. Otherwise, the analyses support the null hypothesis; in the reaction time data, there is no main effect of primary knowledge of German or bilingual status.

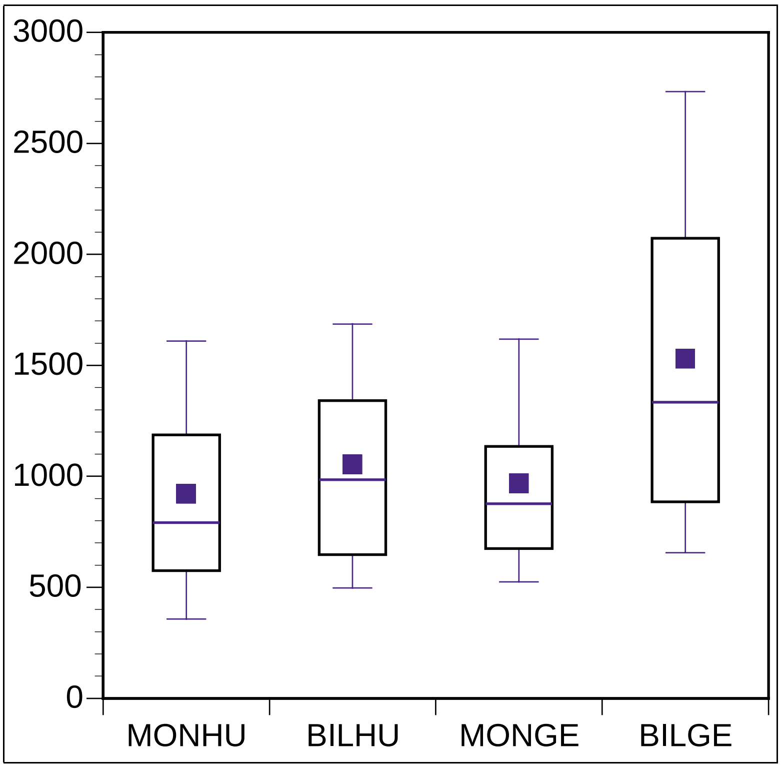

Figure 4.13: Response latencies in the four groups in the OWT.

The above results already indicate that the within-group comparisons will not support the alternative hypothesis either. If there are no differences in the reaction times between +German and -German groups, a main effect of cognate status seems unlikely. Figure 4.14 shows that mean reaction times are higher in noncognates than in true cognates and that false cognates have the highest mean reaction time by accurate responses in the German-speaking groups. Nonetheless, the MANOVA and the t-tests did not yield significant within-group differences in any of the +German groups.

Next, some other factors were subject to tests that might also contribute to reaction time differences, namely concreteness and familiarity. The analysis of concreteness did not reveal significant differences, either (Sig. of F>.05). The familiarity analysis showed negative correlation between familiarity and reaction time (see figures 4.15 to 4.17). Frequently encountered words had shorter response latencies than words with low familiarity. However, the t-tests revealed

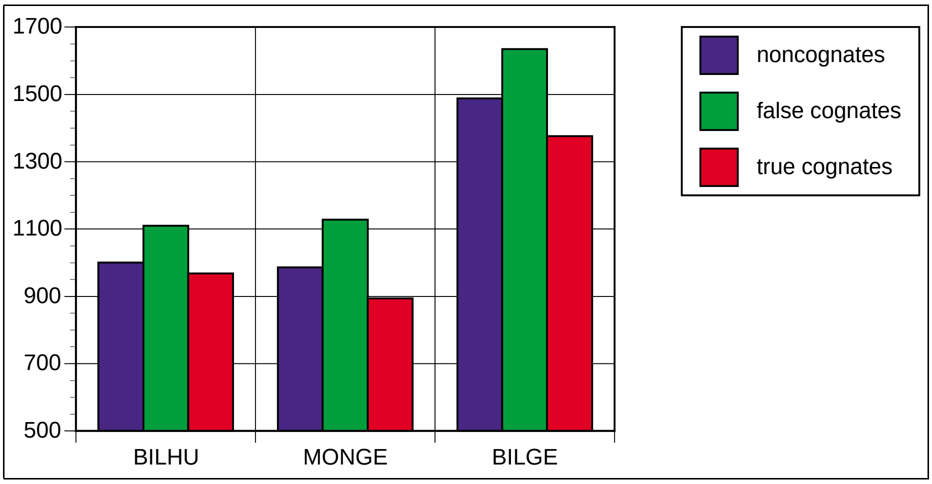

Figure 4.14: Within-group reaction time differences in the three cognate conditions in the four groups.

significant differences in the response latencies only in the noncognate condition between category 2 and 3 (words occurring more than ten times and less than ten times) and only in groups MonHu and BilGe (in both groups $p<.05$).

It should be noted here that the above analyses revealed very high standard deviations in each group and in each cognate condition (see Appendix F.4), which indicates large within-group and within-subject dispersion. In other words, subjects are sometimes fast at translating the input words and sometimes the processing of translation equivalents takes a long time, in each group independently of cognate status. As a result, the expected response latencies cannot be said to be short for true cognates and high familiarity words and significantly longer for noncognates and low familiarity items.

Speed-accuracy trade-off

Besides accuracy and response latency, a third factor to be examined is the manifestation of phonological interference in the learners' approximative systems. This will be the subject of some subsequent qualitative analysis of errors (see Section 4.4). However, the phonological characteristics of the answers in the OWT bring us to an important question related to the reaction time data, namely whether there is an interaction between phonological accuracy and speed of response. In reaction time studies, some researchers postulate the "existence of a tradeoff between dependent variables" (Luce, 1986: 56–57). These dependent variables are reaction time and accuracy. Luce describes the phenomenon that is usually referred to as *speed-accuracy trade-off* in the following way:

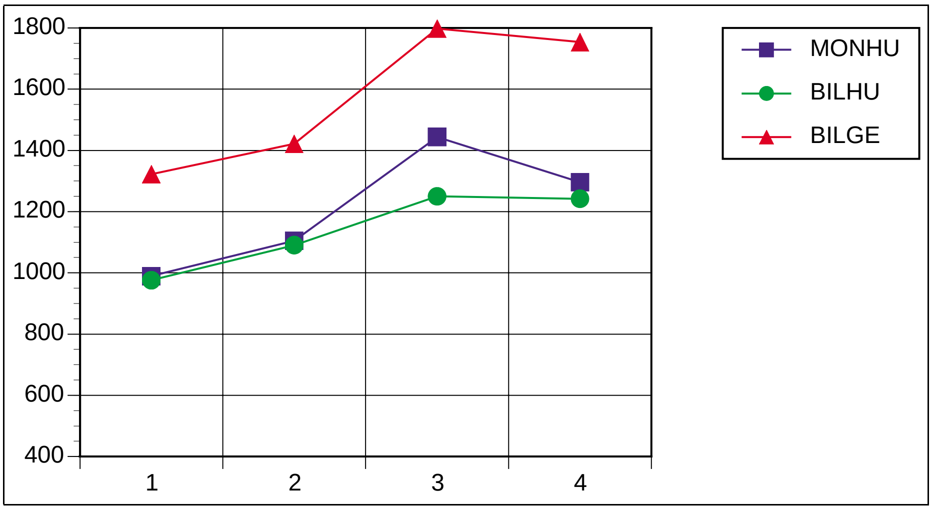

Figure 4.15: Familiarity effect in the three groups in Hungary in the noncognate condition.

> Consider a model of the following character. The physical stimulation undergoes some sort of transduction into an internal representation in the nervous system; it is, of course, a representation that unfolds in time. The brain in some way operates on this information in its attempt to arrive at an 'understanding' of what is transpiring outside the body. (. . .) It seems clear that the brain is in a situation where information is accumulating at some presumably constant average rate, but it varies in quality, and the brain must establish a response criterion that effects a compromise between the level of accuracy and the speed of response. (Luce, 1986: 82–84)

The question of interaction between accuracy and speed is most commonly examined in auditory lexical decision tasks. However, the general idea quoted here seems to be a plausible explanation in the oral word translation, too. In the OWT, the coding criterion for accurate responses was the identifiability of the output with the expected target word. In other words, phonological inaccuracies[3] were tolerated as long as the given answer was identifiable with the intended target word. However, if the hypothesis holds that accurate answers require higher processing time, higher reaction times can be expected in those correct answers where there was no phonological interference and shorter reaction times in answers showing phonological interference.

[3]The term *phonological* should be understood throughout the analysis as referring to both phonetic and phonological properties, allowing for featural and structural differences at the same time.

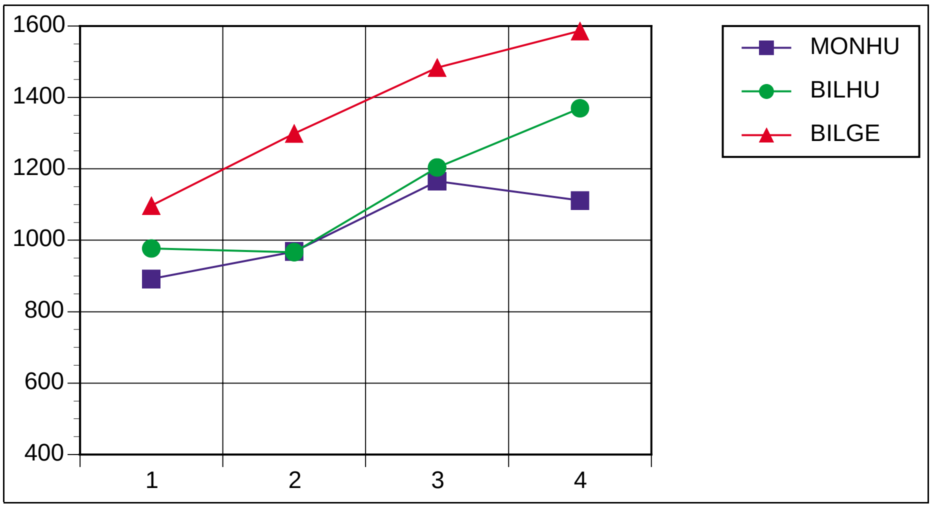

Figure 4.16: Familiarity effect in the three groups in Hungary in the true cognate condition.

In the following analysis, reaction time differences were tested in the true cognate condition in two groups of accurate answers; one group consists of correct answers without phonological inaccuracies and the other group involves accurate responses with phonological interference (e. g. [knɪː] instead of [nɪː], [vaːz] instead of [veɪz] or [prɔbˈleːm] instead of [ˈprɔbləm]. Figure 4.18 shows that accurate answers had a higher reaction time than responses with phonological inaccuracies. Even though the RT differences were not significant in any of the groups, as the t-tests revealed ($p>.05$), the result indicates that there is an interaction between speed and accuracy: the higher the reaction time, the higher the (phonological) correctness of the output.

4.3.3 Discussion of results, conclusions

The reaction time analysis provided clear support for the alternative hypothesis in one aspect only. The bilingual group with L2 German input differed significantly from all the other groups who processed L1 (German or Hungarian) input. This result is complimentary with that from the lexical decision task where the processing in L2 was also significantly slower than native language processing. Translation production was expected to be slower in the L2 condition also because the bilinguals were not trained to translate from their second language into their third language. In other words, there were no strong connections between L2 and L3 words, which was expected to slow down the translation process especially in the noncognate condition.

Concerning between-group differences, significantly lower response latencies

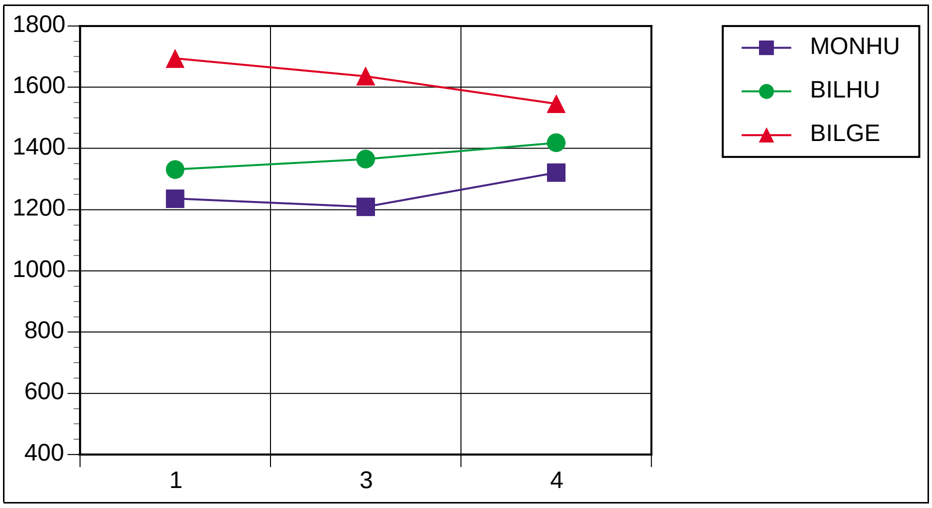

Figure 4.17: Familiarity effect in the three groups in Hungary in the false cognate condition.

were postulated in the true cognate condition than in noncognates. The within group comparisons, however, did not reveal significant RT differences in the cognate conditions. There was no main effect of bilingual status and familiarity, either. Nonetheless, the hypothesized tendencies were clearly recognizable in each analysis. The reaction times were lower in the true cognate than in the noncognate condition and they were the highest in the false cognate condition. It should be emphasized here that, in terms of cognate status, the very same tendency was found in *each* of the German speaking groups. In true cognates, utterances were faster than in noncognates, whereas in the false cognate condition either a fast inaccurate answer was given (like Frieden – freedom, Land – land), or an accurate answer was uttered after longer processing time.

In terms of familiarity, there is a negative correlation between familiarity and reaction time. The higher the number of encounters with the target word, the faster the access and retrieval of the target word, that is, the lower the reaction time. In the +German true cognate condition, there is a gradual growth of reaction time from the high familiarity towards the low familiarity words in each group. In Group MonHu (where the items were all noncognates), a slight RT decline can be observed between familiarity 3 and 4. The same tendency occurred in the +German noncognate condition. MonHu processed noncognates in both conditions and the change in the reaction time showed the same tendency; a slight drop between familiarity 3 and 4. The accuracy in these two groups of input items was very low (between 20-40%). It indicates that the low number of subjects who gave an accurate response already established strong connections to the corresponding target words, thus they retrieved these words relatively automatically. The low rate of

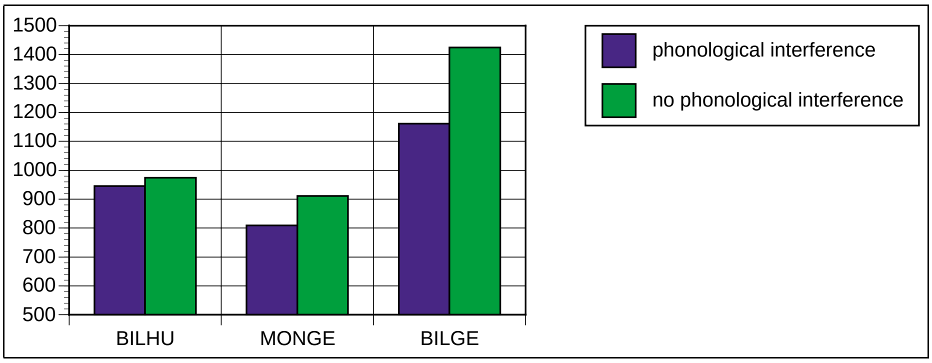

Figure 4.18: Reaction time differences in the true cognate condition in the +German groups: Output with and without cross-lexical phonological interference.

accuracy shows that there was only a small number of learners who had access to target words after a limited number of encounters with those words. In the +German noncognate condition, a stronger increase in reaction time was found between familiarity 2 and 3. In the accuracy analysis, a sudden decline of accurate responses was found between the above two categories. Words that occur less than ten times are retrievable for a smaller number of learners and they require longer time to retrieve, presumable due to weaker connections to the stored target word.

A surprising result in the reaction time analysis was the constantly high reaction time in the true cognate condition in each of the German-speaking groups. The accuracy analysis clearly indicated that formal similarity has a main effect in the translation process, but the response latencies did not support the significant facilitating effect of formal resemblance. However, the lack of within- and between-group significance is explicable if we take into consideration which factors interact in an oral translation task that consists of the following three stages: 1)lexical access of the input word, 2)access and retrieval of the target word, and 3)the articulation of the target word. In each stage, various factors determine the mental processing. In the processing of the input, concreteness, word length, neighborhood size and morphological features of the stimulus word play an important role, as we saw in the analysis of the lexical decision task. In the retrieval of the target word, it is the nature of the cross-lexical connections (word association vs. concept mediation), neighborhood density and familiarity with the target word. In the stage of articulation, it is the pronunceability of the target phonological segments and the degree of similarity between the phonological properties of the input word and its translation equivalent. Besides these factors that effect the lexical processing in the above mentioned stages, another factor is the individual differences in cognitive style. The weight of the above factors can show considerable differences in individuals. In the reaction time data, I found a high within subject dispersion (high standard deviations in each group and in each cognate condition), which supports this assumption. However, I found tendencies in the relation between speed and accuracy of response worthy of mention. Cross-linguistic similarity neighborhood facilitated the processing of the translation equivalent (in the true cognate condition), but hindered the accurate articulation. It is thus hypothesised that the accurate pronunciation of similar sounding target words requires the suppression of the L1/L2 activated form, which might involve some subarticulatory monitoring. The comparison of response latencies in phonologically accurate and inaccurate answers supports this hypothesis, since the production of phonologically correct words is realized at processing costs (see also Section 5).

4.4 Qualitative analysis of phonological interference

The quantitative analysis of accuracy in the oral word translation task provided evidence for the hypothesis that cross-linguistic formal similarity considerably facilitates the retrieval of words from the target lexicon. However, the analysis also revealed that the given responses did not always correspond to the expected target language word. In several cases, the given output was either semantically incorrect, or the correct translation equivalent was not accurately pronounced. The interlanguage use of the subjects indicated within- and between-language phonological and semantic interference which was subject to subsequent qualitative analyses and will be discussed in this section.

4.4.1 Foreign accent and phonological transfer

Many researchers agree that language learners, especially in early stages of learning, appear to rely heavily on their L1 phoneme inventory and the phonotactic characteristics of the native language. The L1 phonetic features and combinatory constraints serve as an initial basis in the foreign language speech production (Weinreich, 1953; Wode, 1977; Hancin-Bhatt and Nagy, 1994; Kroll and Sholl, 1992; Flege, 1992; MacWhinney, 1997). In later stages, language learners gradually modify the articulation of sounds in the target language so that their pronunciation comes closer to the target language norms. However, in most cases language learners do not achieve full attainment of target norms, they produce target language approximations that are neither fully nativelike nor targetlike (Odlin, 1989: 112–122). In terms of phonetic representations, Flege claims that sounds in the second language that differ from native language sounds are very often identified with the first language phonetic category prototypes. This transfer of L1 phonetic categories “may prevent language learners from establishing phonetic categories for certain L2 sounds and thus producing them authentically” (Flege, 1992: 597). Many accounts of developing L2 speech have attempted to explain foreign accent, that is, deficiencies in L2 productions, in terms of structural differences between the sound systems of L2 and L1. In structuralist phonology, a widely held view postulates the systematic substitution of L1 sounds for elements of the L2 system (see James, 1997). However, it has also become evident from research studying and describing real-time processing of spoken language in the past few decades (see James, 1997) that the classic transfer hypothesis is an oversimplified explanation of the phenomenon *foreign accent* in continuous speech. Patterns of L2 pronunciation cannot be accounted for merely in terms of a contrastive analysis of the phoneme inventories of L1 and L2 without considering syllabic templates and prosodic characteristics of the L1 as well as some developmental factors of L2 speech acquisition (see James, 1997). Nevertheless, in general, the notion of L1 structural influence is interpreted by a considerable number of researchers as “a means available to the learner for solving problems in the structuring of the L2 speech data” (Ritchie and Bhatia, 1996: 290). In this way, phonological transfer is often considered as one of the strategic solutions open to learners of an L2 phonological structure (see Ritchie and Bhatia, 1996).

4.4.2 The influence of the native/second language in the OWT

The qualitative analysis to be presented here will describe the influence of the L1/L2 phonological structure in the articulation of single target language items. On this account, the analysis will zero in on characteristics of foreign accent at the segmental level. The target language approximations of the monolinguals and bilinguals will be presented with respect to the influence of the L1 and L2 phonetic segments on target language utterances (e. g. cross-lexical segment substitution) and some phonotactic, combinatory *strategic solutions* (e. g. cluster simplification through elision, regressive assimilation, resyllabification).

In terms of phonological representations, the native language and the target language in both monolinguals and bilinguals appear to form a *super-subordinate system*, the interlanguage of the subjects shows clear influence of the L1. The phonological characteristics of the target-language approximations in the production of the bilingual subjects resemble those of the monolingual Hungarians, but differ from the approximations in the speech production of the monolingual Germans. In other words, the foreign accent of the bilinguals and the monolingual Hungarians does not show noticeable differences. This indicates that the bilinguals rely upon their L1 Hungarian phoneme inventory and the L1 phonotactic constraints in a similar way monolingual Hungarians do, whereas the acoustic-phonetic characteristics of the German language do not interfere in the articulation of the English target words.

In the following, characteristic differences in the acoustic-phonetic features of target language (English) approximations will be presented that systematically occured in the speech production of Hungarian vs. German native speakers in the OWT.

Hungarian native speakers, both bilinguals and monolinguals, frequently substituted the English retroflex /r/ with a trill or a flap, whereas German native speakers typically used a velar/uvular /r/ or a vocalized variant [ɐ] (e. g. teacher [ˈtʰɪːtʃɐ]. In word-intitial and intervocalic positions they tended to substitute /r/ with an approximant [w] (e. g. area [ˈæwɪja]). Most Hungarian monolinguals did not aspirate voiceless plosives in word-initial position (a characteristic feature of Hungarian accent), whereas German native speakers regularly aspirated the word-inital stop consonants (e. g. teacher [ˈtʰɪːtʃɐ]). German monolinguals frequently devoiced word-final and word-initial stops (a characteristic feature of the German foreign accent in English; e. g. dream [tʰwɪːm], thousand [ˈsaɔzənt]), whereas the Hungarian native speakers never showed terminal or initial devoicing. German monolinguals typically substituted the English interdental voiceless fricative [θ] with a labio-dental or apico-alveolar voiceless fricative /f/ or /s/ (e. g. thousand [ˈsaɔzənt] or [ˈfaɔzənt]), whereas Hungarian native speakers pronounced the apico-alveolar voiceless stop [t] (e. g. thousand [ˈtʌʊzend], thief [tɪːf]). The German subjects regularly produced a reduced vowel [ə] in unstressed syllables or omitted the vowel and produced a consonant cluster (e. g. mountain [ˈmaɔntə̥n]), whereas the Hungarian native speakers often pronounced a full vowel [e] (e. g. mountain [ˈmaʊnten]. For more examples see Table 4.10 and for an overall description of phonetic interference in the monolingual and bilingual groups in the translation task, see Appendix H.)

As the examples indicate, native language transfer is characteristic of the interlanguage use of the students in both the monolingual and the bilingual conditions, but we do not find evident instances of second language phonological transfer in the Hungarian-German bilinguals (except for transfer of accentuation, to be discussed later). The reading task reveals the same findings; the interlanguage phonology of monolingual and bilingual Hungarians shows very similar characteristic features, whereas the interlanguage of the bilinguals does not reveal much similarity with that of the German monolinguals.

4.4.3 Phonological interference in the reading task

In the reading task, we can observe the same strong native language influence that results in different foreign accent in the German and the Hungarian native-speaker participants. In the translation task, we saw that the foreign accent of the bilinguals did not differ noticeably from the accent of the monolingual Hungarians,

Target word	Learner's approximation		
	Hungarian monolinguals	German monolinguals	Hungarian-German bilinguals
thousand	[ˈtaʊzend]	[ˈfaɔzənt]	[ˈtaʊzend]
	[ˈtʌʊsənd]	[ˈsaɔzənt]	[ˈtaʊzənd]
year	[jɪːɾ]	[jɪːɐ]	[jɪːɾ]
dream	[dɾɪːm]	[dwɪːm]	[dɾɪːm]
		[tʰwɪːm]	[dʒɾɪːm]
rainbow	[ˈɾeɪnboː]	[ˈweinbɔʊ]	[ˈɾeɪnboː]
		[ˈweinbɔ]	
answer	[ˈaːnsvæɾ]	[ˈaːnzɐ]	[ˈaːnsəɾ]
	[ˈensəɾ]		[ˈaːnsvæɾ]
factory	[ˈfæktʃəɾɪ]	[ˈfæktɔwɪ]	[ˈfaktəɾɪ]
		[ˈfaktʃɔwɪ]	[ˈfæktʃəɾɪ]
teacher	[ˈtɪːtʃəɾ]	[ˈtʰɪːtʃɐ]	[ˈtɪːtʃəɾ]

Table 4.10: Examples of native language – target language phonological transfer.

whereas it differed a lot from the German monolinguals. In the reading task, we can observe similar differences in phonological properties.

German monolinguals very frequently devoiced word-final (and sometimes also word-initial) stops (e. g. old [ɔlt], brick [pwɪk], had [hæt]); they aspirated stops (e. g. top [tʰɔp], people [pʰɪːpl], artists [aːˈtʰɪst]); they often substituted the retroflex /r/ with the bilabial fricative /w/ or in word-final position with the vocalized /r/ (e. g. interest [ɪntəˈwest], brick [pwɪk], other [ˈazəɐ], Arthur [ˈaːsəɐ], their [zeɐ]); the two variants of /th/ were articulated as a voiceless labiodental or apico-alveolodental fricative [f] or [s], or as a voiced apico-alveolodental fricative, [z] (e. g. three [sʀɪː], both [boːs] or [boːf], other [ˈazəɐ], them [zəm]); in word-initial position, the voiceless fricative [s] was sometimes replaced by its voiced counterpart [z] (e. g. section [ˈzektʃən]).

Hungarian native speakers (monolinguals and bilinguals alike), did not devoice or aspirate stops. (Though it must be added that aspirated stops were produced by subjects who did not have a strong foreign accent and this is very likely the result of successful target language approximation, not L2 transfer in bilinguals). Hungarian subjects often substituted for the English /th/ sound an apico-dental voiced or voiceless stop, [d] or [t], or an apico-alveolar affricate [tʃ] (e. g. three [tʃɾɪː] or [tɾɪː], they [deɪ], Arthur [ˈʌɾtuːɾ]). A characteristic feature of Hungarian accent can be observed in both monolinguals and bilinguals, namely the articulation of the letter combination *ng* in word final position. While German native speakers pronounced only the nasal [ŋ], Hungarian native speakers pronounced both the nasal and the stop (e. g. living [ˈlɪvɪŋg], among [əˈmɒŋg]).

The reading task involved some international words and proper names that are used in English, German and Hungarian, as well. Table 4.11 shows the characteristic target language approximations of these words in the bilingual and the two different monolingual conditions.

English Target word	Hungarian monolingual approximations	German monolingual approximations	Hungarian – German bilingual approximations
California	[ˈkalɪfɔrniə]	[kalɪˈfɔːniə]	[ˈkalɪfɔrniə]
	[ˈkʌlɪfɔrniʌ]	[kælɪˈfɔɐnjə]	[kalɪˈfɔrniə]
	[ˈkælɪˌfɔrnjə]		[ˈkælɪˌfɔrnjə]
bohemian	[ˈbɔhemjən]	[bɔˈhemjən]	[bɔˈeːmiən]
	[ˈbɔːmjən]		[ˈbɔhemjən]
	[bɔˈheːm]		[ˈbɔːmjən]
Arthur	[ˈaːsər]	[ˈaːsəɐ]	[ˈaːsər]
	[ˈʌrtuːr]		[ˈʌrtuːr]
apartments	[əˈpærtmənts]	[aˈpaʀtmənz]	[aˈpartments]
	[ˈʌpʌrtmʌnts]	[apaʀtˈmɒnz]	[ˈʌpʌrtmʌnts]
hotel	[ˈhɔtel]	[hɔˈtel]	[ˈhɔtel]
	[ˈhoːtəl]	[hɔtl]	[ˈhoːtəl]
			[hɔˈtel]
			[hɔtl]
artists	[ˈartɪsts]	[aːˈtʰɪsts]	[arˈtɪsts]
	[ˈærtɪsts]		[ˈartɪsts]
			[ˈærtɪsts]
restaurants	[ˈrestʌʊrant]	[ˈʀestˌwant]	[ˈrestʌʊˌrant]
	[ˈrestɔraːnt]	[ˈʀestɔʀaŋ]	[ˈrestɔˌrʌnt]
	[ˈrestɔrʌnt]	[ˈʀestwənt]	[ˈrestɔraːnt]

Table 4.11: Some characteristic target language approximations of proper names and cognates.

As the examples indicate, the target language approximations of the bilingual subjects do not differ from those of Hungarian monolinguals, concerning the phonological features. Nevertheless, in one aspect, namely in terms of word stress, the bilinguals appear to have transferred from the L2 German. Erroneous word-initial accentuation was less salient in Hungarian-German bilinguals than in the Hungarian monolinguals, as seen in the words presented in Table 4.11. (In Hungarian, word stress is always on the first syllable, whereas in German it is not.) On the other hand, bilinguals and German monolinguals produced some erroneous word-final or penultimate stress, probably due to transfer from the German language (e. g. interest [ɪntəˈrest], artist [aːˈtʰɪsts] and interested [ɪntəˈrestɪd]). Thus, it is possible that bilinguals have less difficulty acquiring the stress patterns in English due to their more extended prior language knowledge; the transfer of stress patterns can nevertheless result in another type of erroneous accentuation.

4.4.4 Phoneme substitution errors in the translation task

The target language approximations described so far indicated a clear native language influence. Nevertheless, in the stress patterns we could also detect signs of L2 transfer in the bilingual condition, at least in international words/proper names (Apartment – apartment, California) and in cognate-pairs (Interesse – interest, Artist – artist). If we examine the answers given in the cognate condition in the translation task, we will find even stronger and more evident influence of the German language that manifests itself in a similar way in each German-speaking group. We can observe considerable phonological interference in the German-English cognates, particularly if the target word has a relatively low familiarity, in other words, if the number of encounters with the target word is not very high (see Appendix F.3). Among the given responses in each +German group, there is a considerable number of hybrids, that is, target language approximations in which phonetic segments and segment clusters of the German word merge with those of the English word (e. g. [ʃuldər], [lamp], [ʃtɔrm]; for more examples see Table 4.12, for an overall view see Appendix H). We can also find some complete shifts, that is, cases when the learners transfer the L1/L2 German word without any phonemic modification (e. g. [knɪː], [pʀɔbˈleːm], [zeː], [vaːzə], [huːt]).

German word	English word	Target language approximations
Sturm	storm	[ʃtɔrm]
Polizist	policeman	[ˈpɔlisist]
Schulter	shoulder	[ˈʃoltər], [ˈʃuldər]
Lampe	lamp	[lamp]
Nummer	number	[ˈnamə]
Hut	hat	[hat]
Vase	vase	[vaːz], [veːz]
Musik	music	[ˈmuːzɪk], [mjʊˈzɪːk]
Honig	honey	[ˈhoːnɪ]

Table 4.12: German-English hybrids.

In both of the above mentioned cases (hybrids and complete shifts), the partial overlap of cognate forms appears to be enough to induce learners to establish correspondences between words even if the cognate-pairs differ in some of their phonemes. Nevertheless, these phonemic differences lead to interference errors, since the learners very often transfer some (or all) of the segments of the German lexical item in the production of the English cognate. The high number of multitrial answers (cases where subjects utter a word at two, three or even more trials, e. g. [ʃʊ...ʃe...ʃoldər], [ʃ...ʃtɔrm], [polɪ...pɔˈlɪːsmən], [nʊm...ˈnʌmbər], [na...ne...ˈnambər], [ha...hæt], [hoːn...ˈhanɪ], [ræ...ˈreinboː] also indicate interference with the similar sounding cross-lexical neighbor (for more multitrial answers (see Appendix H). We can notice that the retrieval of the target word phonemes are particularly problematic if the cognate-pair differs in its word-initial phoneme and/or in the nucleus of the first syllable (e. g. Sturm – storm, Knie – knee, Hut – hat). If input and target share most of their phonetic segments (e. g. Tausend – thousand, Musik – music) and particularly if the nonidentical segments are allophonic variations in the two languages (e. g. Gras – grass), the subjects appear to be less confused; the interference is less salient, the utterance is faster and occurs at fewer trials.

The examination of accuracy, processing time and phonological interference in the true cognate condition together brings us to the conclusion that formal resemblance resulted in the selection of the cross-linguistic similarity neighbor at the lexical level (hence the *high* lexical accuracy), but then the subjects experienced the influence of German L1/L2 phonological features which hindered the fast and accurate articulation of the selected lexical item (hence the *high* response latencies and/or the *low* phonological accuracy). In other words, there was positive transfer (facilitation) at the lexical level and negative transfer (interference) at the level of phonological representations or motor articulation.

4.5 Qualitative analysis of semantic interference

In the translation task, when the given answer is not the translation equivalent of the input stimulus, the output and the expected translation equivalent are in several cases still semantically related. The incorrect answers can be divided into three major groups: 1) The expected translation equivalent and the given answer are (closely) related units in a semantic net, they share many of their features, but differ in some others. The given answer is either a semantic extension of the target word (e. g. marriage – wedding, clothes – shirt, hospital – ambulance), or a kind of semantic restriction, that is, the given answer itself can be considered as a meaning component of the target word (e. g. wind – storm), or output and target word are both part of a certain semantic subnet, just like parts of the body (neck – knie, nose – ear, neck -shoulder); numbers (hundred – thousand), professions (professor – teacher, architect – engineer), or fruits (strawberry – cherry). 2)

There is a *syntagmatic relation* between the expected translation equivalent and the given answer, that is, they are collocations; lexical items that tend to occur together in certain contexts in the target language (e. g. ask – question, steal – thief, wedding – funeral[4]) 3) The output is a *clang response*, that is, the given utterance and the expected target word rhyme, they are phonological, not semantic neighbors (e. g. mother – matter [matər], knickers – knie). These answers could be defined as phonologicallly incorrect responses, too. However, I prefer to consider them as semantic interference cases, since the error did not merely occur at the phonological level, the subjects appear to have selected a lexical item which was not the translation equivalent of the input. Nevertheless, it must be added here that the formal similarity, the confusability of the two words is assumed to have largely contributed to the selection of the incorrect target word (see Table 4.13 for more examples of the three types of semantic interference and Appendix I for semantic interference in the four groups).

In a considerable number of cases, the semantic and formal confusability is not separable. That is, the subjects tended to give erroneous responses in which they selected a semantically related word which, in addition, shared some phonological properties with the expected target word, too (e. g. neck – knie, head – hat, manufactor – factory).

4.5.1 Cross-lexical semantic interference

The errors discussed above revealed semantic interference within the target language. In a considerable number of cases, however, the semantic interference occurred between input language and target language in the monolingual condition and between one of the two source languages and the target language in the bilingual condition. I will discuss two different manifestations of cross-lexical transfer, in which the selection of the incorrect answer was due to formal similarity between an L1/L2 word and the selected target word.

In the *false cognate* condition, the formal similarity between the L1/L2 German word and an English target word led to a semantically incorrect answer. Nevertheless, as we can see in Table 4.14, formal similarity resulted in the selection of the similarity neighbor almost only in case the two words also shared some semantic features (that is, in the deceptive cognate condition, but not in accidental false cognates).

Another characteristic example of cross-lexical interference can also be found in the data. The given response of the subjects was frequently a semantic neighbor of the expected target word that had a *true cognate* in the German (sometimes

[4]In this last case, *funeral* is assumed to be a collocation, since the subject who gave this response had just seen the film *Four weddings and a funeral,* as she admitted after the testing.

Target word	semantic relation (members of subnets)	syntagmatic relation (collocations)	formal relation (clang responses)
ambulance	hospital, nurse		
grass		grow	glasses, grey
skirt	shirt		skript
shirt	T-shirt, pullover		short
danger	enemy, rescue		stranger
storm	thunder, wind, tornado		
hero			Herkules
problem (matter)			mother, matter
vase			was
question		ask, answer	
bicycle			cycling, circle
knie	neck		knife, knickers
armchair	sofa, couch		
policeman			polish
picture	photo, image		pain
mountain	hill, rock		
vase			was
thief		steal, stole	chief
death			date, deed
ear			hear, hair, air

Table 4.13: Examples of the three types of interference.

also in the Hungarian) lexicon (e. g. input: Mantel / kabát; semantic neighbor: Jacke / dzseki; output: jacket (see Table 4.15 for more examples). In these cases, the L2 (or L1) similarity neighbor might have contributed to the selection of the English word which was in most cases a synonym of the expected target word).

4.5.2 Relexifications – target language approximations

So far the given utterances subject to analysis have been meaningful, existing words in the English language. There are, however, some given answers that are not identifiable with a target English word due to morphological and/or phonological deviations. This type of target language approximations are sometimes referred to as *relexifications* (see Ringbom, 1987). In these examples, the subjects appear to have selected a lexical item in the target language whose formal properties were only partially available, or merged with the formal features of another target word (e. g. [ɪkˈsaɪdənt], possibly accident + excited, [pɔlˈjuːsɪst], possibly Polizist/policeman + pollution). The results are not attested words. Nevertheless, we can also observe that the given responses are not illegal target forms; the

a) deceptive false cognates

German L1/L2 word	English similarity neighbor	N / 62 (N of subjects)
Frieden	Frieden	21
See	sea	26
Gymnasium	(school) gym/gymnasium	33
Land	land	25

b) accidental false cognates

German L1/L2 word	English similarity neighbor	N / 62 (N of subjects)
Rock	rock	5
Bild	build	-
Dieb	[dɪːp]	2
	[tɪːf]	1
Tier	tear	-
Held	held	1
	hold	1

Table 4.14: Cross-lexical transfer in the two false cognate conditions in the +German groups.

learners usually used target language approximations that conformed to the target language morphophonological norms when forming these nonexisting words (e. g. [ˈraʃmərɪ], [pɔlˈjuːsɪst], [ɪkˈsaɪdənt], [ˈgæmblɪərər], [ˈstoːlər], [mæˈdɪʃən], [mædˈnɪʃən]; for more examples see Appendix H). These examples indicate how weak the links might be between certain lexical units and their formal representations in the target lexicon.

Another interesting manifestation of interference is the transfer of L1/L2 words with pronunciation adjusted to the target language norms. These answers can be considered as examples of “reckless guessing”, when the learners judge the L1 or L2 word as having a formally similar equivalent in the target language (e. g. Mantel [mæntl], Fabrik [ˈfæbrɪk], fotel (Hung.) [ˈfoːtəl], Farbe [færb], see Appendix I). The several target approximations of the input words Ambulanz and Gymnasium/gimnázium can also be considered as reckless guessing, since we cannot be sure that the learners were really familiar with the English words ambulance and gymnasium.

Lexical items that are loan words in the source language(s) are often judged by the learners to have a similarity form in the target language. In the true cognate condition, there were three words of greco-latin origin in both the two source languages and the target language: problem (familiarity 2), lamp (familiarity 3) and vase (familiarity 4). If we compare the accuracies in the four groups, we can

Input (L2/L1)	L2/L1 semantic neighbor	given answer (L2/L1 – L3 similarity neighbor)	translation equivalent
Mantel / kabát	Jacke / dzseki [ˈdʒekɪ]	jacket	coat
Dieb / tolvaj	Räuber / rabló [ˈrʌbloː]	robber, rob, *robbler	thief
Lampe	Licht	light	lamp
Fabrik	Industrie	industry [ˈindʊstrɪ]	factory
Gymnasium	Universität	university [ʊnɪˈverzɪtɪ]	secondary school
Lehrer	Professor/professzor	professor	teacher
Land	Staat	state	country

Table 4.15: Examples of cross-lexical (L2/L1 and L3) interference in the bilingual condition.

observe that if the number of encounters was very low (that is, in familiarity 4), the bilinguals had a higher accuracy than the monolinguals (see Figure 4.19).

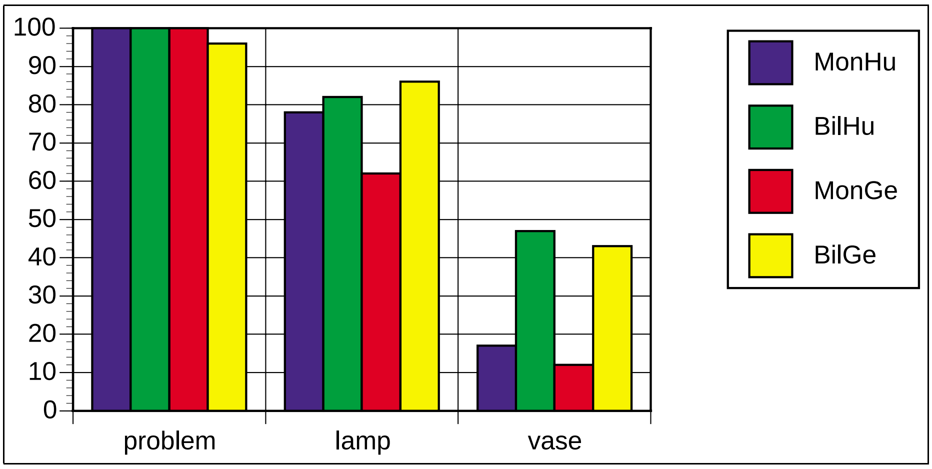

Figure 4.19: Rate of accurate responses in the three loan words of greco-latin origin.

The higher accuracy can be a result of reckless guessing; the fact that these words are (almost) the same in the L1 and the L2 might have led the subjects to the hypothesis that the target language has the same (or nearly the same) lexical form. The considerable phonological interference ([vaːz], [ˈvaːzə], [væːz]) seems to support this assumption. On the other hand, the higher accuracy can also be interpreted by the fact that bilinguals had two sources of positive transfer; the native language as well as the second language could facilitate the selection of the

L3 translation equivalent.

4.5.3 Some interesting single-case errors

Among the given answers I found some interesting single cases of multilingual lexical interference (see Figure 4.20). One participant evidently processed the

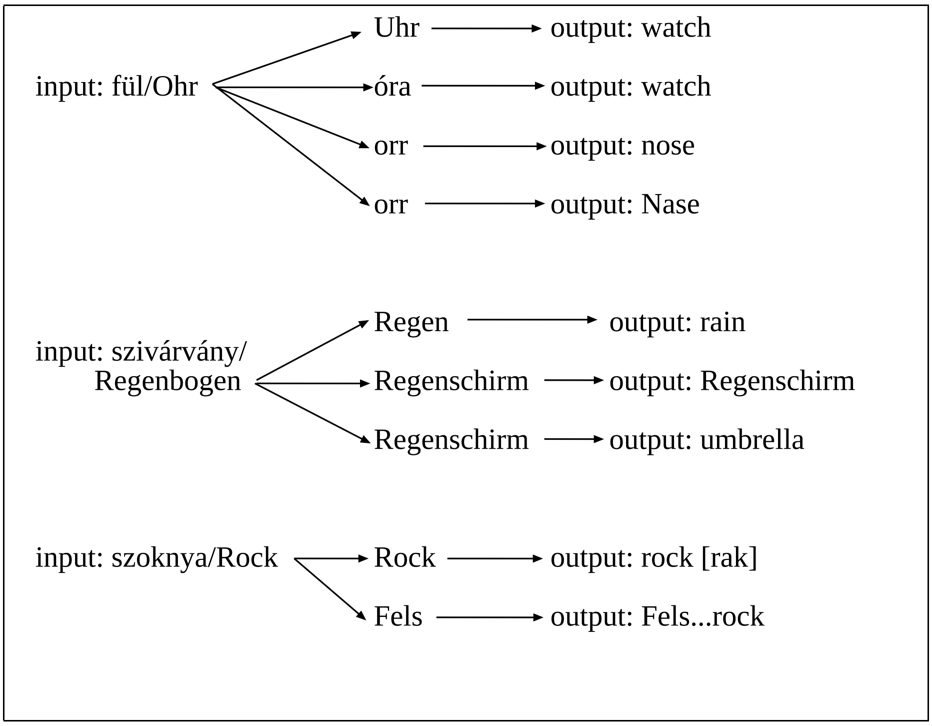

Figure 4.20: Cross-linguistic interference of similarity neighbors in multilingual settings

German input word Rock as if it was an English item and responded to the input with Fels, which is the translation equivalent of the English word in German. After realizing the error, she corrected herself and gave a second answer which was rock (pronounced as [rʌk]). In doing so, she actually gave the English translation of her false (German) answer. Another participant translated the Hungarian input fül into the German equivalent Ohr [ɔɐ] instead of the English translation ear. She also realized the error and gave a second response, which was watch. This answer was the translation equivalent of the Hungarian word óra [ˈoːrʌ], which is evidently a cross-linguistic similarity neighbor of the German word Ohr. Another subject translated the input stimulus fül (ear) into Nase. Here, the participant probably got mixed up with the two similarity forms Ohr in German meaning ear and orr in Hungarian meaning nose in English, Nase in German. A third participant heard the input word Ohr and translated it into Nase, probably also due to the above described high cross-lexical confusability. A similar interference appeared in the compound input Regenbogen (rainbow). One subject produced the output Regenschirm after hearing the input Regenbogen, which is a German word meaning umbrella. Another learner translated the German input word Regenbogen into umbrella. Single cases in which subjects produced a German output were not at all rare (e. g. mozi/Kino – Kino; ing/Hemd – Hemd; cseresznye/Kirsche – Kirsche, esküvő/Hochzeit – Hochzeit). In these cases, the given answers were the equivalents of the Hungarian input (or a simple repetition of the German stimulus). In some other cases, the (German) answers were semantically different from the input and its German equivalent (e. g. orvos/Arzt – Medikament; rendőr/Politzist – Politiker).

Chapter 5

Application of the results: A multiple language network model of word recognition and word retrieval

5.1 Mental representations and lexical processing mechanisms

The model that will be used to describe the processing mechanisms in the monolingual and bilingual learners of a foreign language is a multiple language network model that distinguishes between a lexical memory, where the verbal information is stored and a conceptual memory for the nonlinguistic information. In the monolingual and bilingual learners of a foreign language, each lexicon is represented in memory as an independent subset (see Figure 5.1), that is, the languages form separate networks of connections that are interrelated (see Paradis, 1981, 1997; Grosjean, 1997). Following the *segmental theory* (see Stemberger, 1985, 1992; Dell, 1988; Levelt, 1993; Roelofs, 1999), phonological segments have their own abstract representation in lexical memory. In this view, "a segment recodes a set of features into a representation that refers to the features but that does not contain the features as a proper part" (Roelofs, 1999: 174). These models assume that lexical memory contains segment nodes that are bidirectionally connected to lexeme nodes (or morphemes) and to nodes for the features of the segments (see Section 2.1.2).

In the phonological feature nodes, the distinctive acoustic and articulatory features of phonetic segments are stored. Such distinctive features are, for example, in the phoneme /f/ that it is [+consonant], [+fricative], [-voiced], etc. These features distinguish the phoneme /f/, among others, from the phonemes /v/ or /p/ within the same language. Monolinguals have a set of phonological segments

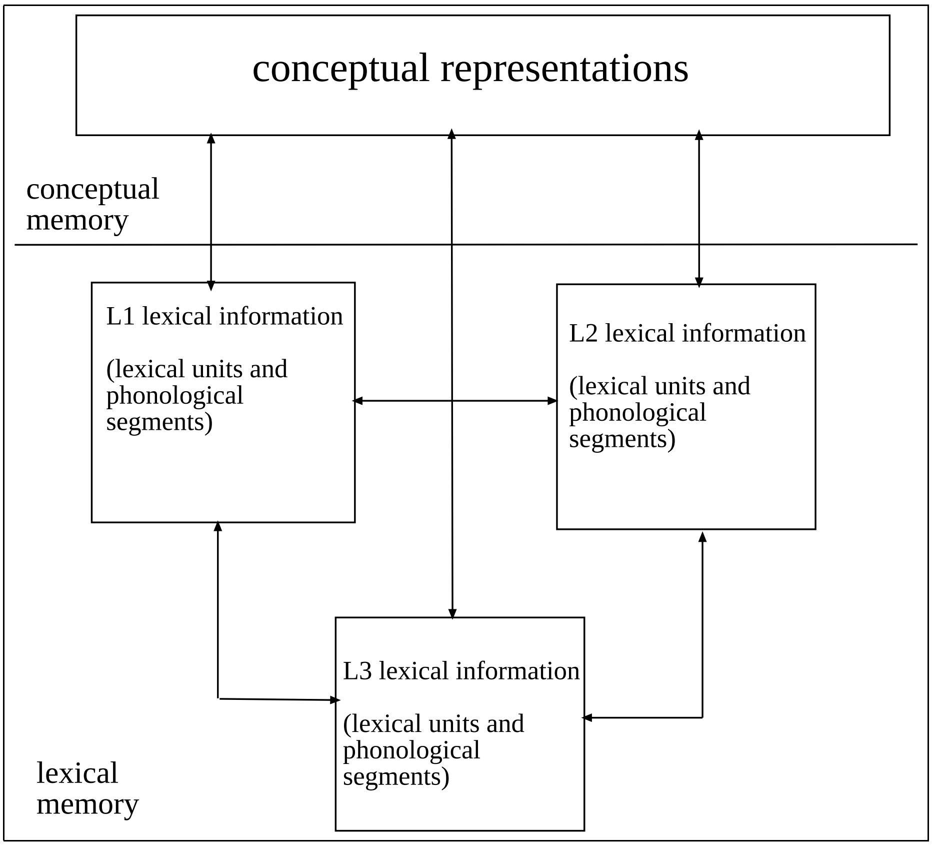

Figure 5.1: Interconnected language subsets in a multilingual system.

with their distinctive features. Learners of a foreign language have a set of L1 segments with their distinctive features and are gradually establishing another set with the auditory and articulatory features of the phonological segments in the foreign language. Thus, in the processing of the nonnative language, the native language acoustic-phonetic information is postulated to serve as a basis; nonfluent speakers of a foreign language are supposed to rely on the encoded native language information, the nonnative language is subordinate to the L1 (see Figure 5.2). The formal representations and the target language phonological norms will gradually be encoded in the nonnative lexicon in the learning process).

A more problematic question is, whether bilinguals, that is, proficient users of two languages, have two independent sets of phonological segments (coexistent systems) or rely upon the native language phonological representations (super-subordinate systems). In the Hungarian-German bilinguals in the experiment, a coexistent system is postulated where both languages have their own phonological representations, however with the restriction that during second language acquisition, the encoding of L2 representations was influenced by the phonological char-

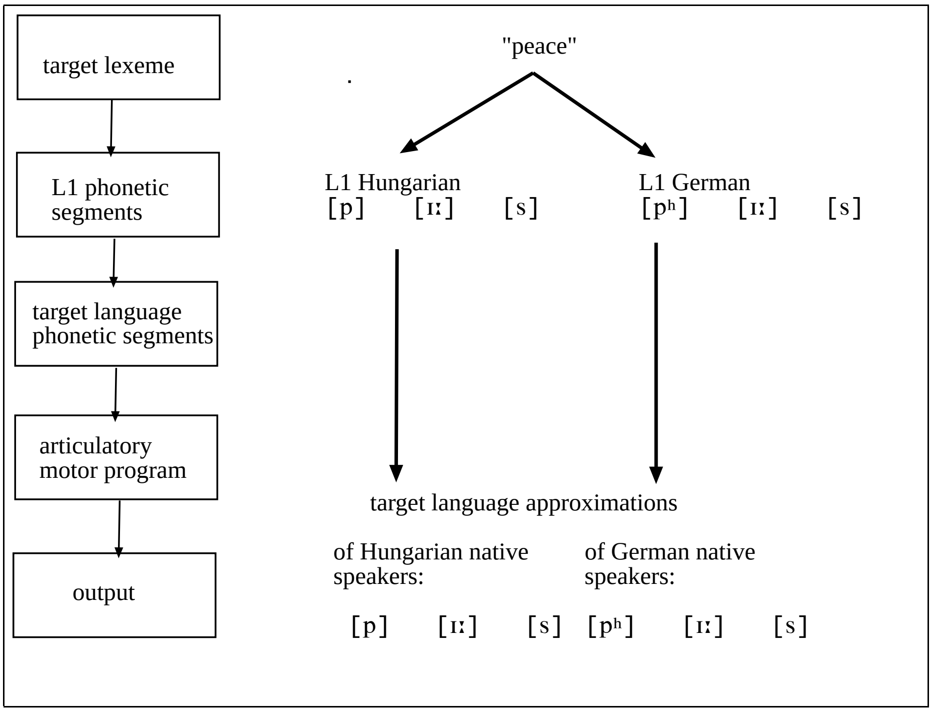

Figure 5.2: A super-subordinate system of phonological representations. The target language utterances of language learners at early stages of learning show evident influence of the phonological characteristics of their native language. Thus, for example, Hungarian native speakers do not aspirate word-inital voiceless stops in English words, whereas German native speakers do (as a result of native language phonological transfer).

acteristics of the native language (the dominant language), since they acquired the second language in a Hungarian language environment. The bilingual subjects are highly proficient speakers of the second language, nevertheless they are unbalanced bilinguals whose dominant language is the native language and who most frequently use the second language in L1 setting (school, family)[1].

5.2 Access and retrieval of translation equivalents by acoustic stimuli

An auditory forward word translation task has three basic processing steps: 1) recognition of the input word, 2) retrieval of the target word and 3) response ex-

[1]Most of the bilinguals who took part in the experiment had a Hungarian accent when speaking German, even though in many cases it was only slightly noticeable.

ecution. In my model, the access and retrieval of translation equivalents in the auditory forward translation task can be described in the following way. The processing is carried out through a spread of activation. The acoustic stimulus spreads activation down to different nodes in the network via preestablished links. The amount of activation sent depends on the weight of links between the connected units and the sum of excitatory and inhibitory impulses a node receives. As soon as one lexical item gets the necessary amount of activation to be selected, the other competing candidates get inhibitory impulses that raise their activation threshold. Thus, the appropriate item comes to be active not only by excitatory impulses, but also by the inhibitory impulses that impede the further activation of the other candidates at the same level.

The auditory input is decoded in a bottom-up fashion. The acoustic speech signal gradually triggers phonological segments in the input lexicon. The segments that receive excitatory impulses spread activation to the lexical level, where several word forms get triggered. The more phonological segments are decoded in the input string, the more restricted the number of possible lexical items that can be chosen for further processing, until a uniqueness point is reached where only one candidate remains who receives an amount of excitation enough to reach the activation threshold (see the Cohort Model in section 2.2.2). The lexicosemantic constraints of this selected item are processed and they spread activation to the conceptual level. If the target word has close phonological neighbors that share most of their acoustic features, the semantic features of these phonological neighbors can also be activated. But in the end only one concept is selected and the other competing candidates are simultaneously suppressed through inhibition.

The bottom-up activation of the concept is followed by the top-down processing of the corresponding translation equivalent in the target language. From the conceptual memory, the activation spreads down to the lexical level in the target language. The lexemes that receive sufficient impulses proceed to spread activation to the corresponding phonemes and their articulatory features. The retrieval process ends with the utterance of the target word (see Figure 5.3). However, the retrieval of a target language word form is successful only if the connections between the activated target language word form and the corresponding phonological representations are established firmly enough. In other words, if there has not been enough exposure to the word in the target language and thus the connections between the lexical unit and the corresponding formal representations are weak, the decoding of the phonological features of the selected lexeme remains incomplete, the target word is not, or only partially available for production.

The retrieval of a target word is especially hindered if the initial phonological information is not available. Language learners often face this problem, also referred to as *tip-of-the-tongue effect*, during language learning, if the target word is not yet automatically retrievable (e. g. when language learners remember learning a certain word, they might also remember the context in which the word occurred and they might be able to recall some segments of the lexical item, but they cannot pronounce the entire word).

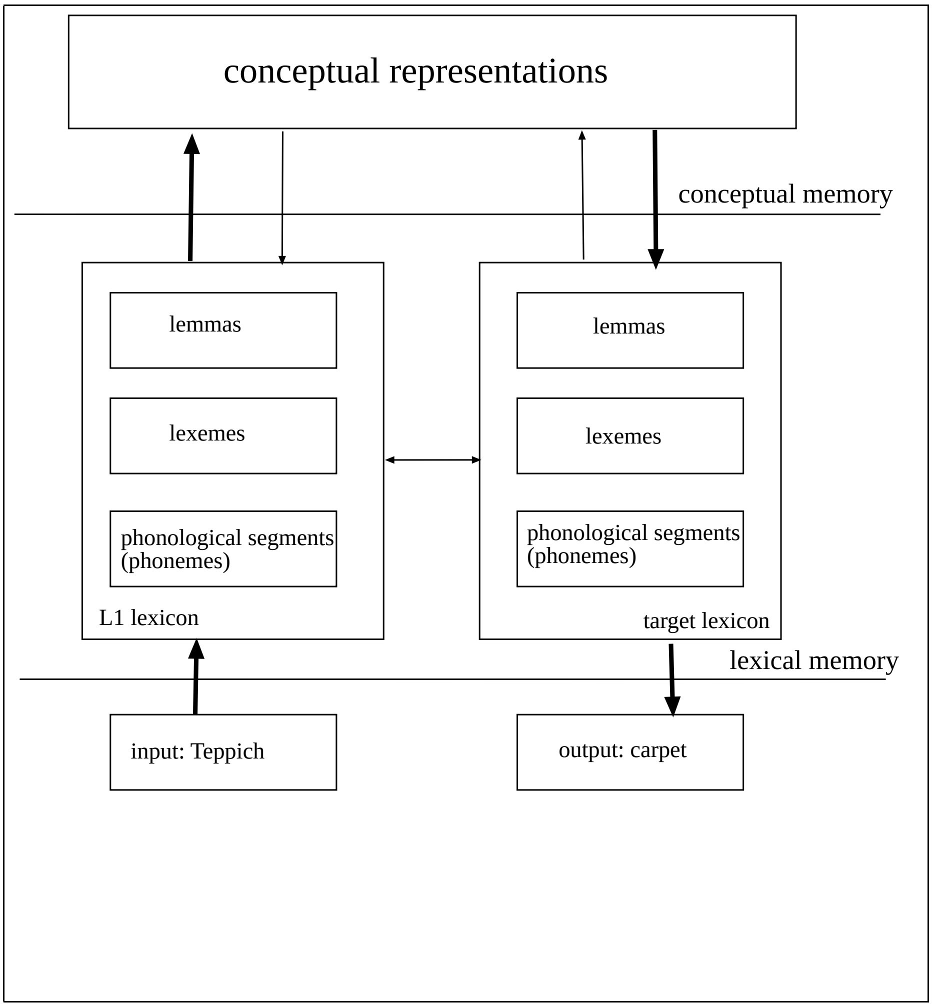

Figure 5.3: Access and retrieval of translation equivalents without formal similarity.

5.3 The processing of true cognates

So far the access and retrieval of translation equivalents was described in cases where input and target bear no formal similarity. This kind of processing referred to as *concept mediation* is characteristic in the foreign language processing of native speakers of an unrelated language (Hungarian), and in the processing of noncognates in the related native/second language (German).

In case the input word and its translation equivalent share many of their formal features, the access and retrieval of the translation equivalent can have a different activation route, that is, instead of concept mediation, the translation equivalent can be processed via direct *word association* at the level of lexical memory (see Figure 5.4).

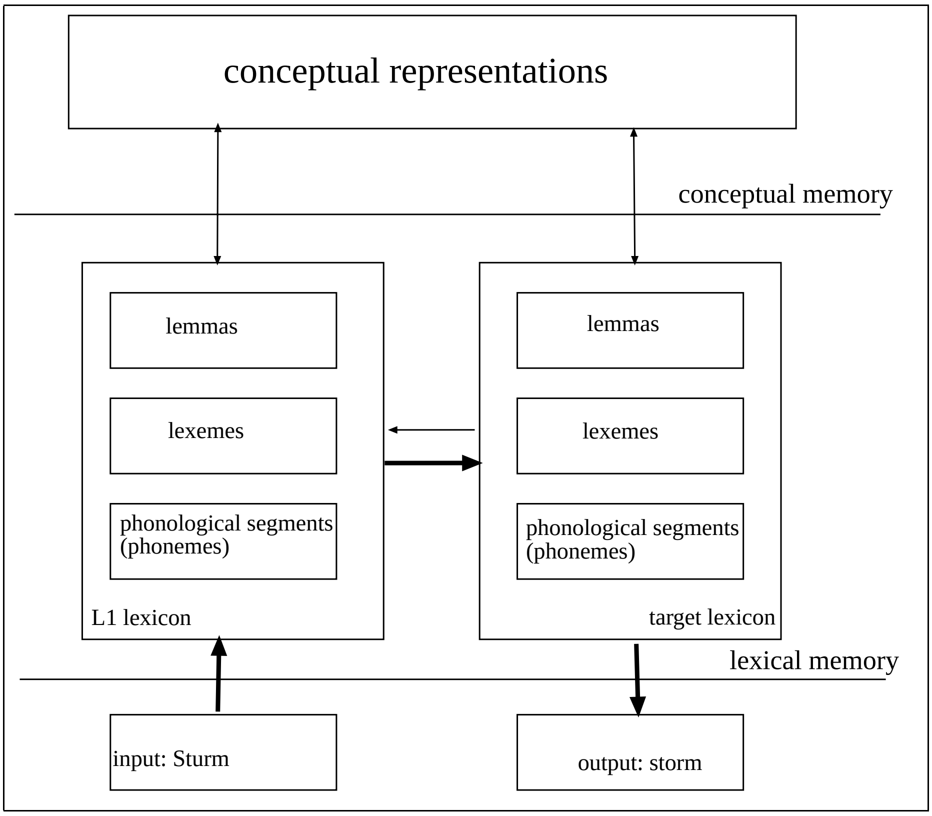

Figure 5.4: Access and retrieval of translation equivalents with formal similarity.

In this case, the auditory input triggers the segments and the corresponding word form in the input lexicon. From here, the activation can spread directly to the target language lexical memory where the cross-lexical similarity neighbor receives activation. For example, if the input word is Sturm, the German lexical form triggers the cross-linguistic similarity neighbor storm in the target lexicon. The corresponding phonological segments and articulatory features of the target lexical unit become selected for the production of the target word. However, as seen in the previous analyses, the given responses show a great scale of phonological interference with the input (e. g. storm pronounced with an initial apico-palatal fricative [ʃ] instead of an apico-dental fricative [s], shoulder pronounced as [ˈʃuldər] or [ˈʃɔltər], knee pronounced as [knɪː], etc.). It appears plausible to postulate the inhibition of the phonetic representations of the target word whose representations are not yet firmly established through those of the input word that are more easily accessible.

The data analysis revealed that cross-linguistic interference occurred frequently in cognates. The more automatically accessible phonological representations of the input might come to be activated and they might simultaneously inhibit the activation of the correct segments in the target word by raising their threshold level. It is particularly probable in target lexical items with low familiarity (that is, in such lexical items where the number of exposure to the word is relatively low), since each exposure to the target word contributes to the encoding of the formal and conceptual representations of the target word and also strengthens the connections between the target lexical unit and the already established phonetic and conceptual representations. The stronger the connections between the target word and its phonetic representations that are already available, the less probable it is that the phonological features of the target lexical item will be inhibited through those of the input word.

In terms of target word familiarity, the analysis of accuracy revealed that in the case of less than ten encounters with the target word, the accuracy in the true cognate condition was significantly higher than in the noncognate condition. In the true cognate condition, the accuracy of the answer does not appear to depend on how regularly the learner heard the input word, since it is enough for the input word to prime the similarity neighbor if the target word already has an entry in the target lexicon. However, there is a sudden decline in accuracy in the true cognate condition as well, between words that occur less than ten times and words that occur once or twice. In terms of my model, words that occur so infrequently might not be represented in the mental lexicon at all. Words that are not yet encoded in the learner's lexicon cannot be accessed and retrieved. This assumption can account for the fall in the accuracy in the true cognate condition. This finding also allows us the assumption that the subjects did not show a tendency to use reckless guessing as a cognitive strategy in the true cognate condition. (For a discussion of reckless quessing see the qualitative analysis in section 4.5.) They retrieved formally similar target words most commonly if they *perceived* the formal similarity.

5.4 The processing of false cognates

False cognates are words that resemble true cognates in that they have a cross-linguistic similarity neighbor and resemble noncognates in that their actual translation equivalents do not bear formal similarity with the input. Thus, the output in the processing of false cognates can be different, depending on whether it is retrieved with or without the involvement of conceptual memory. In the processing of the translation equivalent, the input lexical unit can prime the cross-lexical similarity neighbor at the lexical memory (word association). However, this similarity neighbor shares no, or only a few semantic features with the input word; the input and the target lexical item are not connected to the same conceptual representations. If during the processing of the input, the spread of activation reaches the concept memory in parallel with the activation of the cross-lexical neighbor, the lack of conceptual correspondence may lead to a more extensive feedback activation during which the mismatch at the conceptual level is realized.

The particularly interesting aspect in the processing of false cognates is its complexity. Word association and concept mediation can simultaneously lead to the selection of a target word. Whether the selected word is the translation equivalent or the cross-linguistic similarity neighbor depends on the strength of connections between and within languages and between the lexical level and conceptual memory. If, for example, the input triggers the cross-linguistic neighbor whose connections to the higher level representations are not strong enough, the similarity neighbor may get enough positive impulses to be selected and to simultaneously inhibit the processing of the correct translation equivalent (e. g. input: Rock, output: rock, instead of skirt; input: Frieden, output: freedom, instead of peace). But, if the connections between the lexical and the conceptual are firmly established, the processing of the conceptual features of the input word may result in the selection of the correct translation equivalent and in the simultaneous inhibition of the similarity neighbor in the target lexicon. In that case, false cognates are no longer a source of interference (e. g. input: Rock, output: skirt or input: Frieden, output: freedom). The results of the data analysis showed that in language learners at an early stage, simultaneous activation of the cross-lexical neighbor and the translation equivalent can be postulated, where one of the competing items wins over the other, depending on the strength of connections between the input and the target lexical units and their conceptual representations (see Figures 5.5 and 5.6).

However, it has to be added here that the degree of conceptual overlap between the false cognates appears to play an important role in the processing mechanisms. The significant difference in accuracy between deceptive and accidental false cognates indicated that if input and target share no semantic features at all (for example the German input Rock and the English false cognate rock), chances are greater that the perceived incompatibility of the conceptual features of the input and its cross-linguistic neighbor results in the inhibition of the selection of the false cognate. The possibility is nonetheless not excluded that the similarity neighbor receives such high activation that is enough for lexical selection without the involvement of conceptual memory. In case the two similarity neighbors share

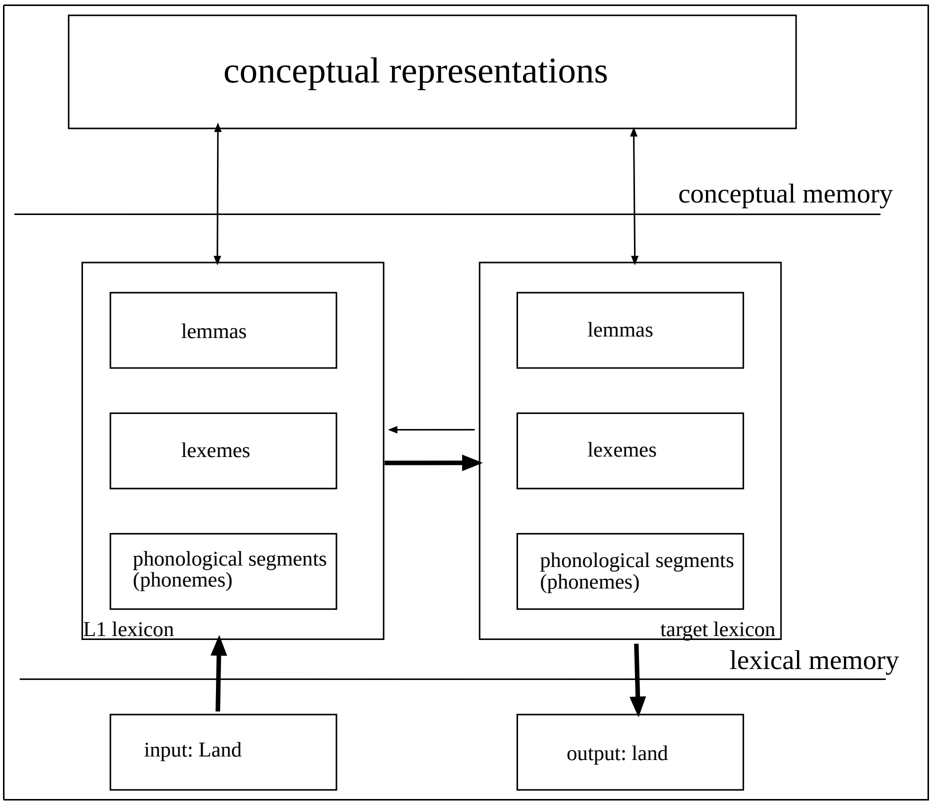

Figure 5.5: Access and retrieval of translation equivalents with formal similarity. False cognate condition, inaccurate responses.

many semantic features (for example, the German input Frieden and the English false cognate freedom), the lack of full correspondence in conceptual representations might be bypassed during processing and the cross-linguistic similarity neighbor might become selected instead of the translation equivalent.

5.5 Bilingual lexical processing with L2 (German) input

The model described so far presented the access and retrieval of translation equivalents in the two monolingual groups. The other two groups in the experiment were bilingual learners of English who received L1 or L2 input stimuli and processed L3 target words. Lexical processing in multilingual settings in the L2 (German) input condition can be described in a network model in the following way.

The processing mechanisms in the noncognate, true cognate and false cognate conditions are postulated to be basically similar to those in monolingual speakers

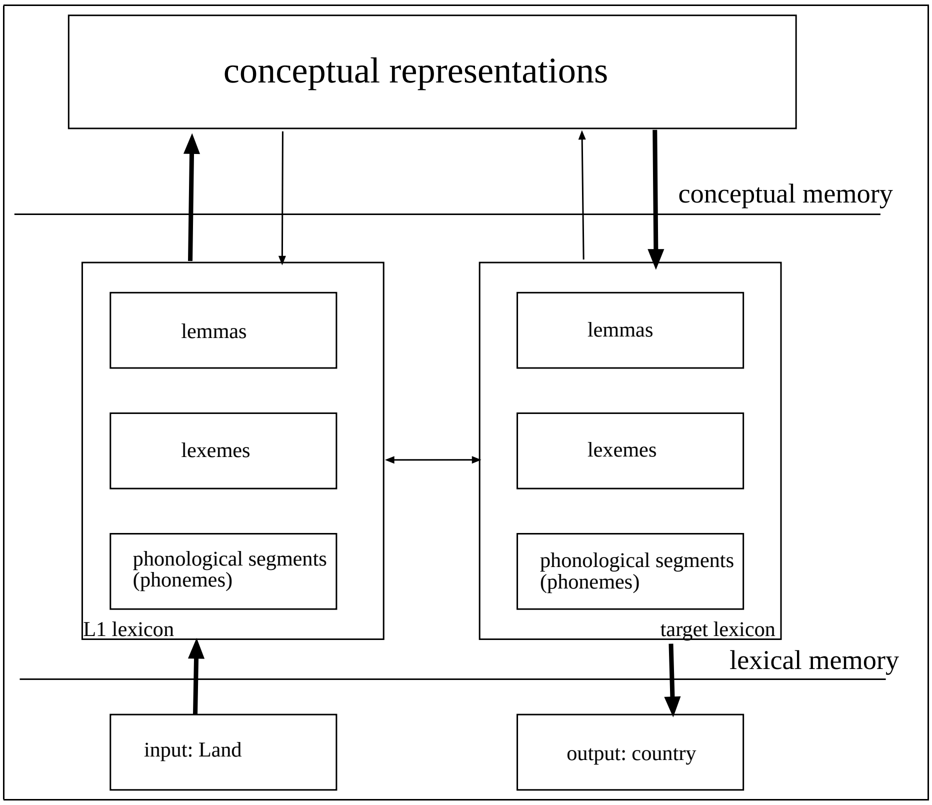

Figure 5.6: Access and retrieval of translation equivalents with formal similarity. False cognate condition, accurate responses.

of a related native language. The fundamental difference appears to be caused by the fact that the bilingual subjects in the experiment were not used to processing L3 stimuli by L2 input. It is presumed that L3 words (at least those that do not have a cross-lexical similarity neighbor in L2 German) are accessible via the L1 lexicon and not directly through the L2 lexicon. This assumption could account for the significantly higher reaction times in the L2 condition. On the one hand, processing L2 input is generally slower than L1 processing, since the connections between L2 lexical and conceptual representations (albeit firm enough for automatic processing) are postulated to be weaker than those between the dominant language (L1) and its conceptual representations. On the other hand, the processing of the L2 lexicon is supposed to be accompanied by the parallel activation of the L1 lexicon. This results in more extensive search with more units being involved (see Figure 5.1). The involvement of the Hungarian lexicon is thus assumed to influence processing time in particular and not the rate of accurate responses.

5.6 Bilingual lexical processing with L1 (Hungarian) input

The access and retrieval of English target words appears to be a more complex process with L1 Hungarian stimuli, particularly in the cognate conditions. Here, the crucial question is whether or not the German lexicon is involved in the processing. If it is not, the learners process noncognates. If it is, they process cognates in an implicit way. The results in the accuracy analysis have left no doubt about the involvement of the L2 lexicon in the cognate condition in the processing of L3 words by L1 input stimuli. On this account, the processing of L3 words by L1 input can be described the following way.

The processing starts with the bottom-up unfolding of the Hungarian input, just like in the monolingual condition. However, from the conceptual level the activation is postulated to spread simultaneously to both the L3 English and the L2 German lexicons (see Figure 5.7). Since the connections between conceptual memory and L2 lexical representations are supposed to be the stronger ones (the bilinguals being highly proficient speakers of the L2, but nonfluent in the L3), German lexemes can receive activation prior to the L3 English lexemes. The German equivalent of the Hungarian input can even receive such high activation that it is selected for production. In such cases, the output is the L2 German translation equivalent of the L1 Hungarian input (for example, if the input L1 is kabát, the English translation equivalent would be coat, but the output is the German translation equivalent Mantel). In this way, the involvement of the German lexicon in the processing can impede the retrieval of the English translation equivalent.

If the L2 (German) lexeme that is activated by the L1 (Hungarian) input bears formal similarity with the L3 (English) translation equivalent of the input word (in other words, it is an *indirect true cognate*, for example the Hungarian input is ”vihar”, the German equivalent is ”Sturm” and the English translation is ”storm”), the activation of the German lexical item can facilitate the selection of the English translation equivalent. The cross-linguistic L3 similarity neighbor receives activation from the L2 lexical unit and becomes selected in a similar way as in the monolingual (German) true cognate condition (see Figure 5.8). Phonological interference is not excluded here, either. The more automatically accessible L2 formal representations may (partially or fully) suppress the retrieval of L3 phonological information, resulting in the production of *hybrids* or *complete shifts* (e. g. [zeː], [land], [ʃuldər]). In the case of complete shifts, it is an open question, whether the interference occurred between the phonetic representations of the L3 lexical unit and the L2 similarity neighbor, or an L2 lexical item was selected instead of the L3 word. It is a question deserving of more attention in future research.

In false cognates, a similar involvement of the conceptual memory is postu-

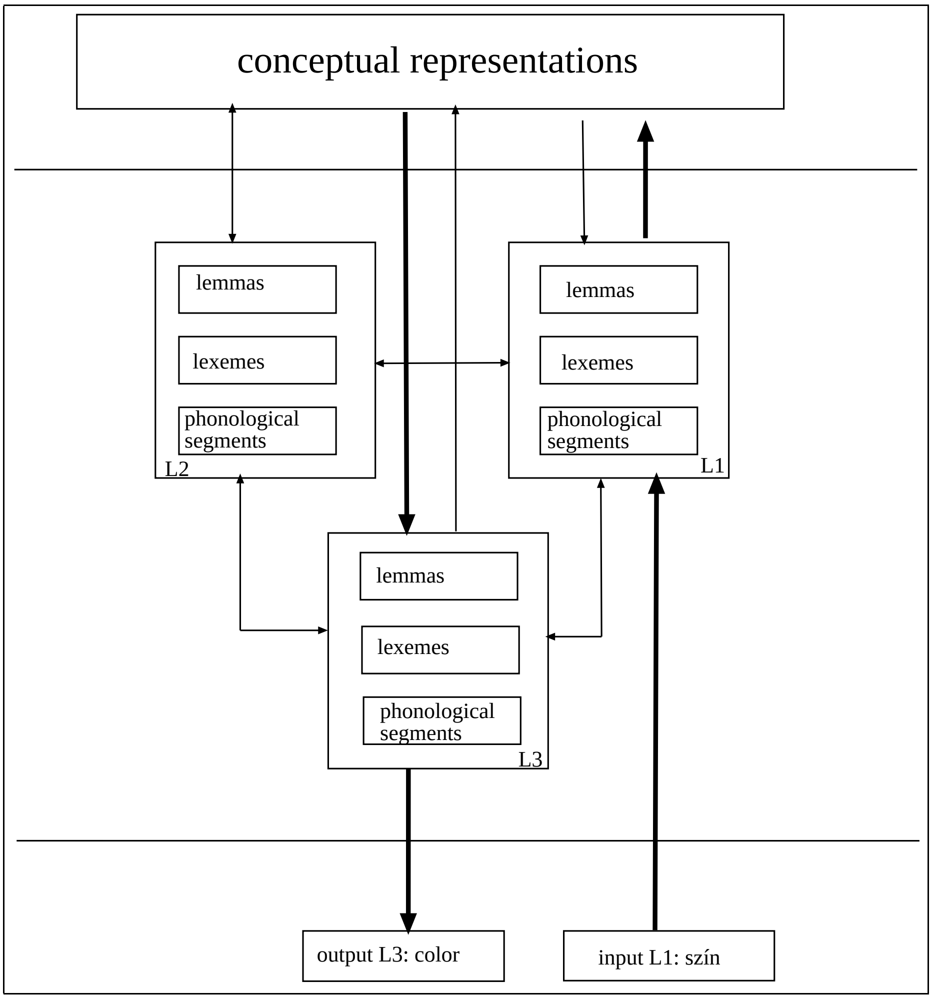

Figure 5.7: Access and retrieval of translation equivalents in bilinguals with L1 input.

lated as in German monolinguals' foreign language processing. However, in multilingual settings, conceptual processing of both L1 and L2 lexemes is postulated. The processing of the Hungarian input stimulus can be followed by the access and retrieval of the target language translation equivalent via concept mediation (for example the input word ország triggers the translation equivalent country, see Figure 5.10). If the connections between conceptual representations and target words are strong, the parallel processing of the German lexeme and its conceptual features might get inhibited. However, if the links between concept memory and the L3 translation equivalent are not yet firmly established, then the L3 target word is either not accessible, or it is suppressed by the more automatically retrievable cross-linguistic similarity neighbor of the L2 word (for example, if the English

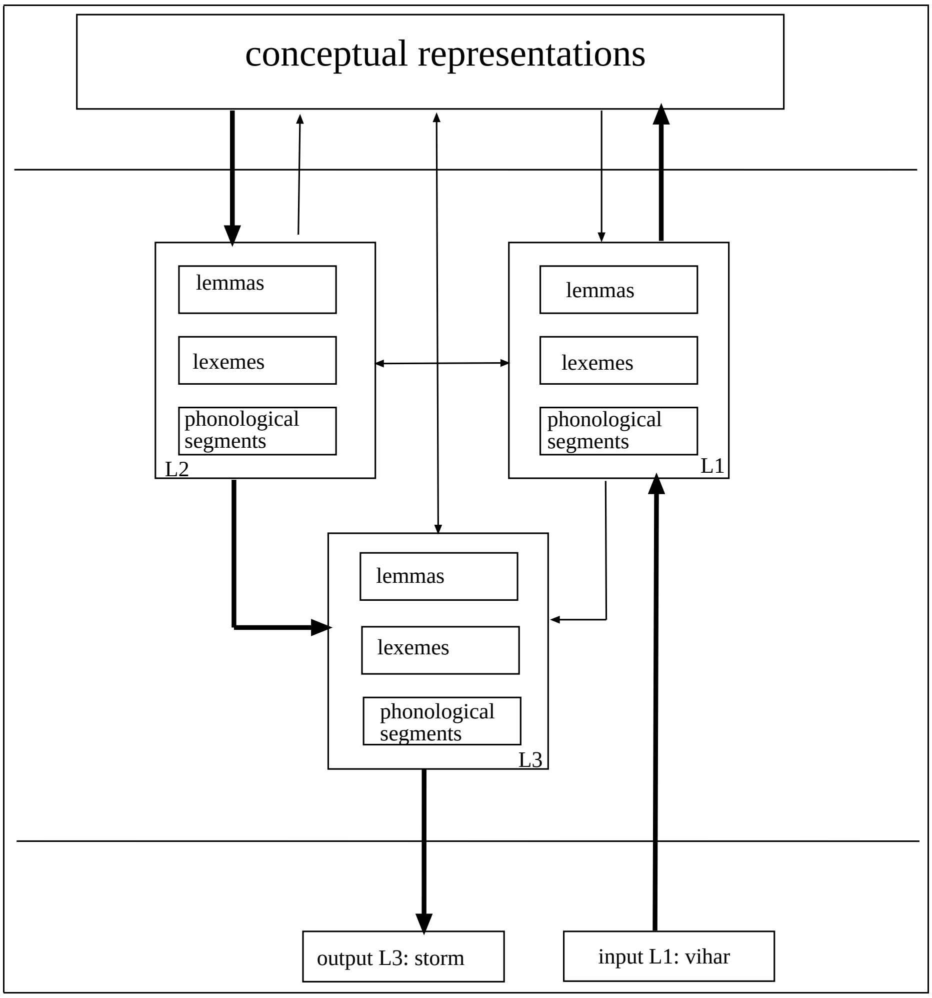

Figure 5.8: Access and retrieval of translation equivalents in bilinguals with L1 input. Indirect true cognates

target country is not retrievable by the Hungarian stimulus ország, the German equivalent Land may trigger the English similarity neighbor land through direct word association; see Figure 5.9). The crucial point is the *weight of connections*. If the target words are weakly established, they might have too high activation thresholds and become suppressed by similarity neighbors. If the target words are already firmly established in memory, less activation is needed for the selection of the L3 word and for the inhibition of a cross-linguistic similarity neighbor.

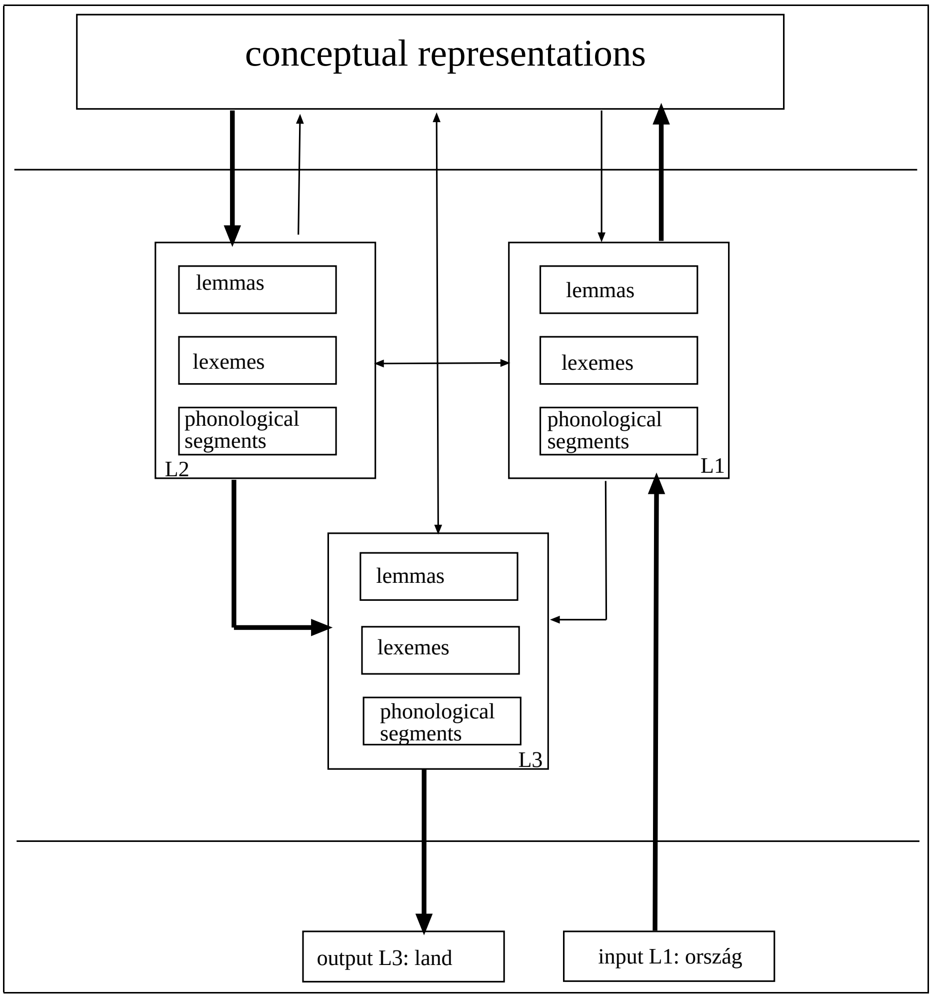

Figure 5.9: Access and retrieval of translation equivalents in bilinguals with L1 input in the (indirect) false cognate condition. Inaccurate responses.

5.7 Summary

The multiple language model proposed in this thesis serves as an *abstract framework* for the interpretation of empirical data. The model attempts to give an account of the role of perceived formal similarity in the access and retrieval of translation equivalents in groups differing in their prior linguistic knowledge. The questions about processing mechanisms in monolingual and bilingual learners of a foreign language cluster around the interrelation of the language subsets with particular respect to the access and retrieval of German and English cross-lexical similarity neighbors. Based on the empirical results, the retrieval of homophones is postulated to occur via direct word association at the lexical level, whereas the

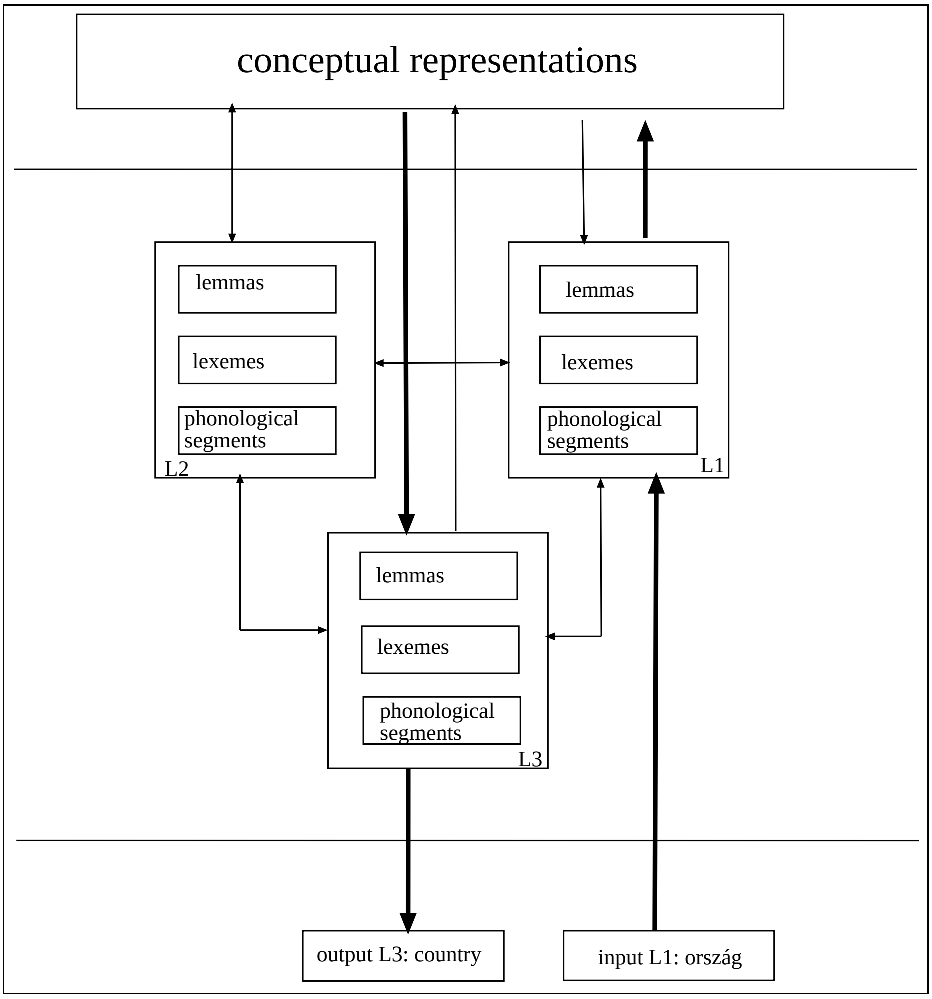

Figure 5.10: Access and retrieval of translation equivalents in bilinguals with L1 input in the (indirect) false cognate condition. Accurate responses

noncognates are processed through the conceptual level. In this light, the translation of homophones might remain a basically bottom-up process, whereas the retrieval of noncognates can be characterized as a top-down process. Target words bearing no formal resemblance with the input stimulus might not be retrievable if the links between the lexical unit and its conceptual and phonological representations are still weak. Thus, learners need a certain number of encounters with the target word to be able to retrieve them in a concept-driven manner. As opposed to this, the activation of homophones is data-driven, the phonological properties of the auditory stimulus contribute to the activation and selection of the target word. On this account, the translation of homophones requires fewer encounters with the target word than the translation of noncognates.

Semantic overlap in the access and retrieval of target words bearing formal resemblance with the input stimulus also plays an important role. Similarity neighbors were judged to be translation equivalents only if the two words shared some features of meaning. This indicated that the bottom-up word-association process was accompanied by top-down feedback activation from the conceptual level. The familiarity analysis indicated that the higher number of encounters with a target word made the lexical entry and the stored phonological representations of the word more easily accessible, and it strengthened the connections between the corresponding formal features at lexical memory and the conceptual features at conceptual memory. The familiarity analysis also revealed that subjects tended to associate similarity neighbors only if they already established a representation for the target lexical item. In other words, only perceived similarity resulted in facilitation. If the learners had a low number of exposures to the target word, it was not yet retrievable through word association. However, differences in cognitive style must be taken into account at this point. Some learners showed a tendency towards reckless guessing, others did not. This aspect of lexical processing is worthy of more attention in future research. Inhaltseintrag für Anhänge per Hand

Appendix A

Lexical errors due to German – English interference

- I know **dies man* (German “dies Man” = “this man”).
- I don’t come **weile* it’s cold (German “weil” = “because”).
- He is **even so* clever as me (German “ebenso...” = “just as...”).
- It is **interessantiger* than the other (German “interressanter” = “more interesting”).
- My **Gasts* arrived (German “Gast” = “guest”).
- A **dieth* stole it from the shop (German “Dieb” = “thief”).
- Painters have to make beautiful **bilds* (German “Bild” = “picture”).
- It’s time you **begann* something useful (German “begann” = “began”).
- My father likes **angling* (German “angeln” = “fishing”).
- I listen **Musik* **oft* (German “Musik” = “music” and German “oft” = “often”).
- I like in the summer that we **mustn’t* go to school (German “müssen nicht” = “needn’t”).
- I started English **for three years* (German “vor drei Jahren” = “three years ago”).
- I know him **since five years* (German “seit fünf Jahren” = “for five years”).

- Is this *place free? (German “Platz” = “place”).
- I need good-looking boys *with them I can dance (German “mit denen” = “with whom”).
- I always *become bad notes in *Physik (German “bekommen” = “get”).
- He wrote *romans and poems (German “Roman” = “novel”).
- It has no *sin at all (German “Sinn” = “sense”).
- Hungary is a *land in middle Europe (German “Land” = “country”).
- I tried to *trust him, but I couldn’t (German “trösten” = “comfort”).
- This room is quite *hell (German “hell” = “bright”).
- How much did they *laugh? (German “laufen” = “run”)
- *When I can pass the exam, I will be happy (German “wenn” = “if”).
- My *Bruder lives *direct at the sea (German “Bruder” = “brother” and German “direct am See” = “right at the seaside/by the lake”).
- I like trousers more than *rocks (German “Rock” = “skirt”).
- It was yesterday *null grade (”null Grad” = “zero degree”)
- Can you *helfen, I don’t know it (German “helfen” = “help”).
- Please *bring them with (German “bring sie mit” = “bring them with you”).
- My father works in that *fabric (German “Fabrik” = “factory”).
- Will tomorrow *pass you? (German “passt es Dir...?” = “will it be okay for you...?”).
- We have a farm and many *house animals (German “Haustier” = “domestic animal”).
- When he went, *I have weined long (German “ich habe lange geweint” = “I cried for long”).

Appendix B

Written vocabulary test (Test A and Test B)

1.

Free association

Write down at least 10 English words to each of the following 5 words! You should write what comes to your mind when you read these words.

Szabad asszociáció

Irj legalább 10 angol szót az alább felsorolt szavak mindegyikéhez. Azokat a szavakat írd le, amik az eszedbe jutnak ezekről a szavakról.

Freie Assoziation

Schreibe mindestens 10 englische Wörter auf, die Dir zu den 5 folgenden Wörtern einfallen! Du solltest das aufschreiben, was Dir einfällt, wenn Du diese Wörter liest.

Test A:	school	Test B:	village
	sunshine		fast
	to laugh		to learn
	city		rain
	nice		teacher

2/a.

Write at least 10 English words that begin with the given letters!

Irj legalább 10 angol szót, amelyek a megadott betükkel kezdődnek!

Schreibe mindestens 10 englische Wörter auf, die mit den gegebenen Buchstaben beginnen!

Test A:	‘p...’	Test B:	‘b...’
	‘h...’		‘s...’

2/b.

Write at least 10 English words that end with the given letters!

Irj legalább 10 angol szót, amelyek a megadott betükkel végződnek!

Schreibe mindestens 10 englische Wörter auf, die mit den gegebenen Buchstaben enden!

Test A:	'...d'	Test B:	'...r'
	'...n'		'...t'

3.

Odd one out: which word does not fit the others regarding the meaning? Underline the odd one and explain why it does not fit! (You can write the explanations in Hungarian. Try to write it as briefly as you can.)

Melyik szó nem illik a többi közé a szavak jelentését tekintve? Húzd alá és indokold is meg! (Az indoklást írhatod magyarul - lehetőleg röviden és tömören.)

Welches der folgenden Worte paßt aufgrund seiner Bedeutung nicht zu den anderen? Unterstreiche das unpassende Wort und erkläre, warum es nicht paßt! (Du kannst die Erklärung auf Deutsch schreiben - sie sollte so kurz wie möglich sein.)

Test A:

1.	glasses	earrings	watch	cup
2.	slow	fast	deep	quick
3.	to cut	to break	to tear	to knit
4.	strawberry	plum	garlic	melon
5.	worried	afraid	cheerful	fearful
6.	elbow	feet	shoes	stomach
7.	architect	to construct	hospital	shop-assistant
8.	thief	sales-manager	composer	mechanic
9.	thunder	rainbow	lightning	star
10.	diner	mushroom	kitchen	living-room

Test B:

1.	knee	head	boots	stomach
2.	worried	afraid	cheerful	fearful
3.	architect	to construct	hospital	shop-assistant
4.	glasses	necklace	watch	plate
5.	slow	fast	deep	quick
6.	to cut	to knit	to tear	to break
7.	cherry	carrot	melon	peach
8.	thief	sales-manager	composer	mechanic
9.	mushroom	hall	kitchen	living-room
10.	thunder	rainbow	lightning	star

Appendix C

Questionnaire

1. Wann hast Du angefangen, Deutsch zu lernen? (Wie alt warst Du?) Wieviel Jahre hast Du insgesammt Deutsch gelernt?

2. Hattest Du bereits Deutschkenntnisse vor der Grundschule?

   JA NEIN

3. Wenn ja: wie gut hast Du die deutsche Sprache vor der Grundschule gesprochen? (z.B. genau so gut, bzw. fast so gut wie die ungarische Sprache; nur einige Wörter, usw.)

4. Wie oft und mit wem hast Du die Möglichkeit außer in der Schule Deutsch zu sprechen? (z. B. mit Familienmitgliedern, bzw. mit deutschen Verwandten, Freunden; im Sommer, in Deutschland, usw.)

5. Hälst Du Dich für einen ungarndeutschen Bilingualen (Zweisprachigen)?

   JA NEIN WEISS NICHT

6. Was trifft am besten auf Deine Deutschkenntnisse zu?

   Meine Deutschkenntnisse sind

   a) besser als
   b) genau so gut wie
   c) fast so gut wie
   d) schlechter als

meine Sprachkenntnisse in Ungarisch,

oder (wenn keiner von diesen Punkten zutrifft):

e) Deutsch ist für mich eine Fremdsprache, die ich noch nicht gut beherrsche.

Appendix D

Phonological, orthographic and semantic neighborhood in the vocabulary test

Phonological & orthographic neighbors beginning with 'p'	**Phonological & orthographic neighbors beginning with 'h'**
play pay	head held
play plant	hear hero
plan plant	here hear
palace place	hear hair have hang
palace peace	hope home
peace place	hat hot hold had
please peace	hospital hostess
please place	hungry Hungary
peace peach	high hi
peach peace	hurry hurricane
place play	hurry hurt
play plate place	hear hand here hair head
plum play place	hammer ham
parent pen parrot	have head ham home
park party	hit hot
pond pound	house husband
pollution pole pool	happy help heavy health
past pass	held helmet
perfect perhaps	help helm ham
pill pillow	had hand
pull push	hand hat

Phonological & orthographic neighbors beginning with 'p'	**Phonological & orthographic neighbors beginning with 'h'**
pea peace peaceful	hero heroine
poster postman police policeman	health heaven heavy
policeman postman	hall hill
postmen policemen	hear hair
postman postcard poster popstar popcorn	hero heroine
post possible	
prize price	
price prize	
pool poor	
poor pool	
pig pick	
photo phone	
pen pencil pet	
pen penfriend penny	
probably properly	
poor pork	
plan plane	
Phonological neighbors beginning with 'p'	**Phonological neighbors beginning with 'h'**
peace piece	high how
parent pen	hello Halloween
people pupil	high height heart
pupil people	have head
	heart hard
	happy help
	helm ham
Orthographic neighbors beginning with 'p'	**Orthographic neighbors beginning with 'h'**
prince prize pizza	hear heart
prince price peace	heavy heat
pear peach	heart heat health heaven heavy hear
peach pearl	house horse hours
pub put	house horse
place peace	hour house
	hour house horse
	hand hard
	hungry *hundert
	hot hold

Stems and their derived forms beginning with ‘p’	**Stems and their derived forms beginning with ‘h’**
particularly part publicity pub peace peaceful popstar popular poster postman police policeman postman postcard poster popstar popcorn prince princess pen pencil pencil pen pen penfriend pencil person personality	him her him her his her his him he him her homework home homework homeless hand handsome how however hand handball hang hangover head headache
Semantic neighbors beginning with ‘p’	**Semantic neighbors beginning with ‘h’**
policeman postman pig pork prime minister, *parlament president, prime minister plum peach pear plum prison police police prison people person passenger plane passenger pilot past present perfect past picture paint	hi hallo homework housework
Collocations beginning with ‘p’	**Collocations beginning with ‘h’**
pink panther present perfect	happy hour hold hand holiday home

Phonological & orthographic neighbors beginning with 'b'	**Phonological & orthographic neighbors beginning with 's'**
bottle bottom	skin skull
bring boring	secret see
boring board	she sea sell see
bad bag	solicitor soldier
bad bed	snake snail
bat bed	snail snake
bed bad	several seven
book back	short shop snow show
body bobby	shot shit
below belong become because	sun son
become believe behind begin	supper summer
be begin behind	see sea
banana bank band	sea see
been bean	sit see sea
bear beer	spend send
bath both	say stay
but buy boy	super supper
bottle battle	*sommer some
beatle battle	
Phonological neighbors beginning with 'b'	**Phonological neighbors beginning with 's'**
basket biscuit	skull sculpture
	see sing
	sit see
Orthographic neighbors beginning with 'b'	**Orthographic neighbors beginning with 's'**
bridge bride	soup supper
bridge bright	shark shadow
bad bath	said sail
	shower show
Stems and their derived forms beginning with 'b'	**Stems and their derived forms beginning with 's'**
bow bowling	sun sunshine
butter butterfly	student study
built building	
below belong become because	

Semantic neighbors beginning with 'b'	**Semantic neighbors beginning with 's'**
black blue	sing soul sail ship sail ship sink sink ship *sommer spring sun season spring summer sun sea summer strand salt sugar ship space seven six swim sea sun

Collocations beginning with 'b'	**Collocations beginning with 's'**
black board bed breakfast big bag	sing song space ship sun shine

Phonological & orthographic neighbors ending with ‘d’	**Phonological & orthographic neighbors ending with ‘n’**
wild wood word[1]	*sun son*
word world wood	*sun soon*
wood would	*soon son*
bored board	*run rain*
board bored	*clean can*
word world	*men melon*
bread bad	*melon mean*
bed bad	*man melon*
had head	*melon man woman*
*round *rand*	*mean man woman mansion*
paid pad	*moon mean*
send sand	*rain written*
had head heard	*when win*
had hand helped head	*than then*
hand had	*then than*
stand spend	*begin bean*
God good	*begin been*
good God	*children chicken*
good God gold	
grand gold god good	thorn born
	town clown
head bad	run sun
mad bad	run sun son
lead read	sun run
read red	sun fun
lead speed read	fun run
bed dead read	fun sun
sad bad mad had	run gun
end mend land send	afternoon moon
send lend mend and	earn learn
hand spend land stand	can than then ten
hand send spend end	can ten
hand had fad sad	then when

[1]Words in *italics* are associations written by the subjects that end with the given letter and at the same time *begin* with the same letter.

Phonological & orthographic neighbors ending with ‘d’	**Phonological & orthographic neighbors ending with ‘n’**
friend end send lend	
hand had and	chicken kitchen
hand and end	kitchen chicken
hand land	lemon melon
had bad pad	
end and band	
end and	
and end	
end hand	
end send	
end spend	
end stand	
send end	
friend end	
end friend hand	
told hold	
hold cold	
kind find	
find kind	
could would	
would should mood	
would could should	
should would could	

Phonological neighbors ending with ‘d’	**Phonological neighbors ending with ‘n’**
could wood	
friend hand	
should mood	

Orthographic neighbors beginning with ‘d’	**Orthographic neighbors beginning with ‘n’**
world would	*clean can*
kid kind	
cold cloud	in coin
wood word	
head lead	
read head	
head read dad	
word sword	

Stems and their derived forms ending with ‘d’	**Stems and their derived forms ending with ‘n’**
	noon afternoon sun sunburn

Semantic neighbors beginning with ‘d’	**Semantic neighbors beginning with ‘n’**
hundred thousand	*lesson learn* man woman woman man man woman children

Collocations beginning with ‘d’	**Collocations beginning with ‘n’**
dead end	learn lesson rain man lesson began been written German lesson

Phonological & orthographic neighbors ending with ‘t’	**Phonological & orthographic neighbors ending with ‘r’**
meet meat *last lost left* *parrot part* *let left* night bright knit bit suit fast last let net cat shot lot hit bit cat rat boat coat eat meet meat	*litter letter* *better bear beer bar* *heater hear* bar car car far far car car bar star clear near fear river silver hair chair hear year hear year tear hear near hair pair wear hear tear star

Phonological neighbors ending with ‘t’	**Phonological neighbors ending with ‘r’**
shit sheet	*butter brother*
net cat	
put foot	pear air
	pair wear
	hair wear
	hear beer clear

Orthographic neighbors ending with ‘t’	**Orthographic neighbors ending with ”r’**
hot hat	*bear beer bar*
	rider river
put cut	*wear war*
cut put	
what that	wear far
eight night	car war bar far
	car war
	hear pear
	hear wear
	dealer leader

Stems and their derived forms ending with ‘t’	**Stems and their derived forms ending with ‘r’**
	teacher baker waiter
	actor singer writer

Semantic neighbors ending with ‘t’	**Semantic neighbors ending with ‘r’**
life-raft *boot	father mother brother daughter sister
	mother father daughter
	mother father brother sister
	brother sister father mother
	sister brother father mother tiger
	October November
	supper dinner
	summer weather
	teacher doctor actor singer writer
	far near

Collocations ending with ‘t’	**Collocations ending with ‘r’**
	father mother brother daughter sister mother father daughter mother father brother sister brother sister father mother sister brother father mother tiger October November supper dinner summer weather teacher doctor actor singer writer far near

Words ending and also beginning with the same letter without much formal similarity	
ending in ‘n’	**ending in ‘d’**
gun grandson cardigan competition competition question can town train lesson learn person prison man million reaction revision can caravan begin burn sunburn soon town train pen person burn brain	hard hold pound pleased bad board wind world find friend read round good glad hand heard

ending in ‘r’	**ending in ‘t’**
summer star	adjust adapt carrot construct construct cut *assistent architect accident architect architect August meet most

Appendix E

ALD input stimuli

E.1 The set of input material in the lexical decision task

Language condition: Hungarian			Language condition: German		
Real words		Nonwords	Real words		Nonwords
Concrete	Abstract		Concrete	Abstract	
1. hang	3. gond	7. pút	3. Stimme	3. Sorge	1. puht
2. sár	4. düh	8. fácen	4. Match	4. Wut	2. fatzen
3. hús	5. szomj	9. kotel	5. Fleisch	5. Durst	3. kotel
4. tövis	6. hős	10. minte	6. Stachel	6. Held	4. minte
5. kő	7. harc	11. koncet	7. Stein	7. Kampf	5. konzet
6. szarv	8. eskü	12. hind	8. Horn	8. Schwur	6. hind
7. tea	9. nyom	13. korm	9. Tee	9. Spur	7. korm
8. út	10. dac	14. náz	10. Straße	10. Trotz	8. nas
9. boka	11. csúcs	15. úrt	11. Gelenk	11. Spitze	9. uhrt
10. gomb	12. ész	16. svájd	12. Knopf	12. Sinn	10. schweid
		17. derc			11. derz
		18. brát			12. brat
		19. lost			13. loscht
		20. fünt			14. fünt
		21. holb			15. holb
		22. bőrend			16. böhrend
		23. éder			17. ehder
		24. münke			18. müncke
		25. pulg			19. pulg
		26. bláne			20. blanz

E.2 Within-group mean reaction times by word status and neighborhood density

1. Group MonHu

Group	Mean	SD	95% confidence interval	
nonwords in denser neighborhood	626.208	112.994	578.495	673.922
nonwords in a sparser neighboorhood	512.792	133.433	456.448	569.135
real words in a denser neighborhood	397.542	104.59	353.375	441.708
real words in a sparser neighborhood	373.042	95.219	332.834	413.249

2. Group BilHu

Group	Mean	SD	95% confidence interval	
nonwords in denser neighborhood	729.696	128.756	674.017	785.374
nonwords in a sparser neighboorhood	607.261	118.750	555.910	658.612
real words in a denser neighborhood	440.609	115.758	390.551	490.666
real words in a sparser neighborhood	400.826	91.390	361.306	440.346

3. Group MonGe

Group	Mean	SD	95% confidence interval	
nonwords in denser neighborhood	802.438	78.512	760.601	844.274
nonwords in a sparser neighboorhood	701.188	71.049	663.328	739.047
real words in a denser neighborhood	446.000	52.172	418.200	473.800
real words in a sparser neighborhood	373.500	57.667	342.772	404.228

4. Group BilGe

Group	Mean	SD	95% confidence interval	
nonwords in denser neighborhood	1042.348	241.581	937.880	1147.815
nonwords in a sparser neighboorhood	988.783	198.191	903.078	1074.487
real words in a denser neighborhood	681.739	125.953	627.273	736.205
real words in a sparser neighborhood	586.435	139.946	525.918	646.952

Appendix F

OWT input stimuli

F.1 Grouping of the input set by cognate status

TRUE COGNATES	FALSE COGNATES		NON COGNATES	OTHER
	ACCIDENTAL COGNATES	DECEPTIVE COGNATES		
1. year	1. *build/Bild - picture	1. *freedom/Frieden	1. danger	window
2. storm		- peace	2. cherry	dog[1]
3. ambulance	2. *deep/Dieb - thief		3. question	bicycle[2]
4. thousand		2. *sea/See - lake	4. armchair	ear[3]
5. policeman	3. *tear/Tier - animal		5. colour	
6. problem		3. *land/Land - country	6. city/town	
7. shoulder	4. *held/Held - hero		7. mountain	
8. lamp		4. *gymnasium/Gymnasium	8. death	

[1]The above two words (window, dog) were used in the experiment as practice items. They are not included in any analysis.

[2]The English word bicycle and the Hungarian input stimulus bicikli are Hungarian-English true cognates. For this reason this input word is not included in the the analyses where the role of German-English cognate status is examined.

[3]Even though the German input stimulus Ohr and the English translation equivalent ear are true cognates, the German input stimulus has also a false cognate in the Hungarian language: orr which means in English: nose. The German lexical item Ohr and the Hungarian lexical item orr are accidental homophones that may interfere in the translation process. For this reason, the input stimulus Ohr is not included in the analysis of German-English cognates.

TRUE COGNATES	FALSE COGNATES		NON COGNATES	OTHER
	ACCIDENTAL COGNATES	DECEPTIVE COGNATES		
9. grass 10. knee 11. number 12. hat 13. engineer 14. vase 15. dream 16. music 17. honey 18. rainbow	5. *rock/Rock - skirt	Gymnasium - secondary school	9. factory 10. wedding 11. carpet 12. teacher 13. doctor 14. money 15. rope 16. cinema 17. answer 18. coat 19. shirt	

F.2 Degree of concreteness in the OWT input set

Concrete words	Abstract words
1. cherry	1. question
2. skirt	2. thousand
3. armchair	3. money
4. bicycle	4. storm
5. mountain	5. danger
6. lake	6. color
7. shoulder	7. problem
8. picture	8. peace
9. shirt	9. death
10. carpet	10. wedding
11. lamp	11. animal
12. grass	12. number
13. knee	13. hero
14. ear	14. dream
15. hat	15. answer
16. coat	16. year
17. vase	
18. rope	
19. rainbow	
20. honey	
21. music	
22. ambulance	
23. town/city	
24. secondary school	
25. thief	
26. country	
27. engineer	
28. teacher	
29. doctor	
30. policeman	
31. factory	
32. cinema	

F.3 Familiarity – Frequency of occurrence in the course book material

Words that appear regularly in the course material	Words that appear more that 10 times in the course material	Words that appear less than 10 times in the course material	Words that appear once in the course material
1. year	1. policeman	1. animal	1. ambulance
2. question	2. colour	2. factory	2. danger
3. town/city	3. problem	3. thousand	3. cherry
4. picture	4. mountain	4. armchair	4. storm
5. teacher	5. money	5. bicycle	5. death
6. country	6. dream	6. skirt	6. shoulder
7. music	7. cinema	7. peace	7. carpet
8. answer	8. doctor	8. lake	8. thief
9. number		9. shirt	9. knee
		10. wedding	10. hero
		11. lamp	11. vase
		12. grass	12. rope
		13. ear	13. rainbow
		14. hat	14. secondary school[4]
		15. engineer	
		16. coat	
		17. honey	

[4]The expression secondary school does not appear directly in the course book, but each group of learners was exposed to this word already at the time of testing.

F.4 Mean reaction times and standard deviations in the OWT

All input included.

Group	Number	Mean RT (in msec)	SD
MonHu	553	957.75	514.79
BilHu	636	1002.85	492.29
MonGe	411	960.1	432.51
BilGe	609	1459.86	767.07

Noncognates.

Group	Number	Mean RT (in msec)	SD
MonHu	509	986.39	511.53
BilHu	252	1000.5	519.82
MonGe	151	986.15	453.31
BilGe	246	1488.23	719.66

True cognates.

Group	Number	Mean RT (in msec)	SD
MonHu	44	626.45	434.35
BilHu	279	968.58	476.02
MonGe	203	893.62	396.75
BilGe	273	1376.56	782.1

Appendix G

Reading task

“Many people who are interested in art come to Greenwich Village, which is a section of New York City. They like the Bohemian life of the village, and they enjoy living among so many artists. The buildings and apartments are often very old and dirty, but this only adds to the interest of the place. At the top of an old, three-storey brick house, Mary and Arthur had their studio. One of them was from the state of Main, the other from California. They had met in the restaurant of a little Eighth Street hotel. Both of them were artists who had recently come to New York to make their living.”

(Dixon, 1989: 1)

Appendix H

Phonological interference and multitrial answers

Input: Hungarian German	MonHu	N	BilHu	N	MonGe	N	BilGe	N
mentő Ambulanz	[ˈʌmbulʌnsiʌ] [ˈambulansi]	1 1	[ambuˈlans] [ˈambulens] [ˈembulans] [embuˈlens]	1 1 1 1	[ˈambuləns] [ˈembuləns] [ˈembuˌlents]	1 5 1	[ˈambulans] [ˈambulant] [ˈambulens] [ˈembulens]	1 2 1 2
veszély Gefahr								
év Jahr								
cseresznye Kirsche	[ˈʃeri]	3	[ˈʃeri]	6	che. . . cherry	2	[ˈʃeri]	2
kérdés Frage								
vihar Sturm			[ˈʃtroːm]	1			[ʃtɔrm...storm] [ʃ...storm]	1 1
fotel Sessel	arm. . . chair	2			ch [tʃ] . . . armchair	1		
ezer Tausend	[ˈtʌʊzend]	3	[ˈtaʊzend] [ˈtɔʊzend]	5 2	[ˈfaɔzənt] [ˈsaɔzənt]	1 9	[ˈtaʊzend] [ˈtɔʊzənd] [ˈtuːzend]	4 2 1
rendőr Polizist	poli. . . policeman police. . . man	1 1	pol. . . policeman police. . . man [ˈpɔlits]. . . [pɔˈliʃən] [pɔˈlisʃn]	1 1 1 1 1	police. . . man [pɔlisˈmeːn] politiker pollucist	2 2 1 1	[pɔliˈtsist] [pɔliˈsist] [pɔliˈʃən] poli. . . policeman police. . . man	1 1 1 1 2

Input: Hungarian German	MonHu	N	BilHu	N	MonGe	N	BilGe	N
Bicikli Fahrrad								
szín Farbe	col. . . color	1						
város Stadt								
probléma Problem	[ˈprɔblem]	4	[ˈprableːm] [ˈprɔblem] [prɔbˈleːm]	1 2 2	[ˈprɔblem] [prɔbˈleːm]	3 1	[prɔbˈlem] [ˈprɔblem]	6 2
szoknya Rock	s. . . skirt	1	[skirt]	1				
béke Frieden								
hegy Berg								
tó See	[lek] [lak...ladʒ]	1 1						
halál Tod	[diːs] [diːt]	1 1					[tiːs]	1
gyár Fabrik	[ˈfaktori]	1	[ˈfaktʃəri]	1			[ˈfa...faktori] [ˈf...fæk...fæktəri]	2
váll Schulter			[ˈʃʊlder] [ˈʃʊlter] [ˈʃul...der]	1 1 1	[ˈʃaldɐ] [ˈʃʊldɐ]	1 2	[ˈʃalder] [ˈʃoːlter] [ˈʃul...ʃɔʊlder] [ˈʃʊ...ʃɔ...ʃʌlder]	2 1 1 1
kép Bild								
ing Hemd			sh. . . shirt	1			[ʃɪrt]	1
gimnázium Gymnasium					highschool [ˈhaɪʃuːl]	1		
esküvő Hochzeit								
szőnyeg Teppich								
lámpa Lampe	[lamp]	2					[lamp]	2
fű Gras								
tanár Lehrer								
tolvaj Dieb	[tiːs] [siːf]	1 1					[tiːf]	1

Input: Hungarian German	MonHu	N	BilHu	N	MonGe	N	BilGe	N
ország Land								
állat Tier								
térd Knie			[kniː] [knaɪ]	4 1	[kniː] [kniːz]	2 1	[kniː]	4
orvos Arzt								
fül Ohr								
szám Nummer	na. . . ne. . . number numero	1 1	ne. . . number [ˈnammər]	1 2	[nammɐ]	2	[ˈneːmbɐr] num. . . ber num [nʊm] . . . number	1 1 1
kalap Hut	[hat]	2	[hat] [ha...het] [huːt]	9 1	[hat] [ha...hat] [huːt]	4 1 1	[ha...het] [ha...hat] [hat]	1 1 5
mérnök Ingenieur								
hős Held	[ˈeːro] [ˈheːro]	1 1					[ˈheːro]	1
kabát Mantel								
pénz Geld								
váza Vase	[vaːz]	1	[vaːz] [ˈvaːze]	1 2	[veːz]	1	[vaːz] [ˈvaːze] [vɔːz]	2 1 1
kötél Seil								
álom Traum	d. . . dream	1						 1
zene Musik			[mjʊˈzɪːk] [mʊˈzɪːk]	2 3	[mʊˈzɪːk]	3	[ˈmʊːzɪk] [mʊˈzɪːk] [mʊˈsɪːk] [mjʊˈzɪːk]	1 2 1 1
méz Honig			[hɔ...hoːni] [hon...hani] [ˈhoːni] [ˈhoːnik]	1 1 3 1	[hɔ...hani] [ˈhoːni] [hon...hani]	1 3 1	[ˈhoːni] [hon...hani]	2 2 1
mozi Kino			[tʃin]. . . cinema	1				
válasz Antwort			reply [ˈreplı]	1				
szivárvány Regenbogen			re. . . rainbow		rain. . . rainbow rain. . . bow	1 1	r. . . rain . . . rainbow rain. . . bow	1 1

Appendix I

Semantic interference between input words and their translation equivalents

Input: Hungarian German	MonHu	N	BilHu	N	MonGe	N	BilGe	N
mentő Ambulanz			hospital nurse emergency	1 1 1	hospital	2	hospital emergency	5 2
veszély Gefahr	rescue *_gamblierer_ [ˈgæmbliərər] medicine	1 1 1	enemy stranger	1 1	dangerous	3	emergence accident / excited [ɪkˈsaɪdənt]	1 1
év Jahr	age an [ʌn]	1 1					age	1
cseresznye Kirsche	*_rashmerry_ [ˈraːmərɪ] *_catberry_ [ˈkætbərɪ] strawberry	 1 1 1	kirsch. . . cherry	1	Strawberry	1 1	strawberry . . . cherry	1 1
vihar Sturm	thunder tempest	2 1	thunder tornado	1 1	wind	2	thunder	1
kérdés Frage	Ask		answer ask	1 1	phrase [fraːz]	1	ask. . . question answer	1 1
fotel Sessel	fotel [ˈfɔtəl] sofa chair	4 2 1	fotel sofa chair couch	1 2 5 1	chair. . . armchair chair	1 1	sofa chair	4 6

Input: Hungarian German	MonHu	N	BilHu	N	MonGe	N	BilGe	N
ezer Tausend	hundred mile (mail)	8 1					Hundred	1
rendőr Polizist	police *_politian_ [pɔˈlɪʃən] *_policetian_ [pɔˈlɪsʃən]	5 1 1	police potitiker *_pollucist_	2 1 1	police *_politian_… …polisch [pɔˈlɪʃən...] [ˈpɔlɪʃ]	 1	police	3
bicikli Fahrrad			Cycling	1			circle [sɪrkl]	1
szín Farbe			farbe [færb]	1				
város Stadt	village	1						
probléma Problem							mother…matter [ˈmʌdər] [ˈmatər]	1
szoknya Rock			rock shirt	4 1	rock	1	rock fels…rock s…script	1 1 1
béke Frieden			freedom	9	freedom	2	freedom victory	10 1
hegy Berg	Hill	1	Hill	1	hill hill…mountain	4 1	rock rock…mountain	1 1
tó See			sea See [zeː]	5 1	sea	6	sea See [zeː]	12 2
halál Tod	die died dead	8 2 3	die died died	8 1 4	die died dead	2 2 8	die died dead deed [dɪːd] date [deɪt]	3 2 4 2 1
gyár Fabrik	fabrik [ˈfabrɪk] fabrik [ˈfæbrɪk] fun [fʌn] …factory	1 2 1	company fabrik [ˈfabrɪk] fabrik [ˈfæbrɪk] firm [fɪrm]	1 3 1 1	fabrik [fabˈrɪk] fabrik [ˈfæbrɪk]	1 1	manu… manufactor industry [ˈɪndʊstrɪ] fabrik [ˈfabrɪk] fabrik [ˈfæbrɪk]	 1 1 1 1
váll Schulter							neck	1
kép Bild	image pain	1 1			photo	1		
ing Hemd		 2 1	short short T-shirt	2 1 1	short pullover Hemd	1 1 2	T-shirt	2

Input: Hungarian German	MonHu	N	BilHu	N	MonGe	N	BilGe	N
gimnázium Gymnasium	[dʒɪmˈneːzɪəm] [gɪmˈneːzɪəm] [ˈdʒɪmnəzɪ] gim [dʒɪm]	3 2 1 1	primary school elementary school university [gɪmˈnejzjəm] [dʒɪmˈneːzɪəm] [gɪmˈnaːzɪəm] [dʒɪmˈneːʃjəm]	1 1 1 2 2 2 1	college [dʒɪmˈneːzɪəm] [gɪmˈneːzɪəm] [ʊnɪˈverzɪtɪ]	1 1 1 1	college gim [dʒɪm] [gɪmˈnaːzɪəm] [dʒɪmˈnaːzɪəm]	2 2 3 2
esküvő Hochzeit	marriage mar. . . got married funeral	6 1 1	marry married marriage hochzeit. . . . . . marriage	1 1 2 1	marry married just married	2 4 1	marry married marriage	1 1 2
szőnyeg Teppich					floor	1		
lámpa Lampe			light	2	light	2	light	1
fű Gras	grow grey glass. . . ses	2 1 1						
tanár Lehrer	Professor	1 1						
tolvaj Dieb	chief **stoler* [ˈstoːlər] steal. . . stole robber robbler rob dealer	1 1 1 2 1 1 1	burglar robber Dieb/deep [dɪːp] Smuggler	3 4 1 1	rob	2	burglar robber Dieb/deep [dɪːp]	4 5 1
ország Land	village town camp state	1 1 1 1	state land land. . . country	1 6 2	area land land. . . country	1 9 2	land land. . . country	5 1
állat Tier								
térd Knie	Knickers	1					knife neck	1 2
orvos Arzt	**medician* [mæˈdɪʃən] medicine	1 1 1	Medikament medik. . . doctor	1 1	**mednician* [mædˈnɪʃən] accident ambulanceman	1 1 1		

Input: Hungarian German	MonHu	N	BilHu	N	MonGe	N	BilGe	N
fül Ohr	hear hair	1 1	Ohr. . . watch	1 1			air [eːr] Ohr nose Nase [ˈnaːzə]	1 1 1 1
szám Nummer	Note	1						
kalap Hut	cap head	1	cap	1			cap hood	1 1
mérnök Ingenieur	*mecanitian* [mækaˈnɪʃən] architect professor	2 1 2 1						
hős Held	herk. . . herkules	1	held	1			Hold	1
kabát Mantel	jacket	5	jacket suit clothes	7 1 1	jacket	2	jacket mantel [mæntl̩]	5 1
pénz Geld								
váza Vase							was [woːz]	1
álom Traum								
zene Musik	musical	1						
méz Honig	money. . . honey	1					mon. . . honey	1
mozi Kino					Kino	1	kino picture. . . cinema	1 1
válasz Antwort								
szivárvány Regen- bogen							umbrella Regenschirm	1 1

Erklärung

Hiermit versichere ich, die vorliegende Dissertation selbständig und nur unter Verwendung der im Literaturverzeichnis angegebenen Hilfsmittel angefertigt zu haben. Diese Arbeit ist bisher an keiner anderen Hochschule oder Universität eingereicht worden.

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