THE INFLUENCE OF NATIVE LANGUAGE SKILLS ON FOREIGN LANGUAGE LEARNING: PHONOLOGICAL, ORTHOGRAPHIC, AND SEMANTIC CONTRIBUTIONS

By

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This dissertation is dedicated to my children,

Benjamin and Audrey Gilligan

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The primary goal of this study was to examine how native language skills influence foreign language learning. Additional goals included determining which native language skills are most predictive of foreign language learning and investigating whether spelling, vocabulary, and rapid automatized naming skills transfer between native and foreign languages. These relationships were explored for a range of learning abilities. Sixty-five college students enrolled in a first-semester German course participated in the study. Specific English language skills were measured to determine the degree to which native language skills were predictive of proficiency in the acquisition of specific skills in German. The independent variables were select phonological, orthographic, semantic, and rapid naming skills in English (native

language) and the dependent variables were select German orthographic, semantic, and rapid naming skills.

Of the four primary predictor variables of English phonological skills, English spelling, English vocabulary, and English rapid automatized naming, English spelling was the best predictor of acquisition of select basic German skills (German composite score). Several interactions among the predictor variables also made significant contributions to the German composite score.

English phonological skills of varying levels of difficulty were examined. The phonological tasks that involved elements of orthographic and/or semantic processing (e.g., spelling clues) were more strongly associated with the German composite score than were the simpler English phonological tasks. Cross-language transfer of spelling and vocabulary skills between English and German was also demonstrated in this study.

Data from this study (1) provide support for the Linguistic Coding Differences Hypothesis, which states that native language skills influence foreign language learning; (2) underscore the predictive power of phonologically-based skills; and (3) demonstrate cross-language transfer of specific skills.

CHAPTER 1
INTRODUCTION

Background of the Study

Many colleges and universities in the United States require foreign language courses for students seeking a bachelors degree in liberal arts (Ganschow, Myers, & Roeger, 1989). McColl (2000) pointed out that learning a second language enhances linguistic development, social development, and cultural awareness. Foreign language training enhances native language development by improving one's awareness of the linguistic structures (words and sentences) of the native language. Socially, students who study a foreign language are able to practice turn-taking and other social skills in the language. Finally, learning another language helps students to understand better the culture of the countries where the target language is spoken. Having a broad world view is important for international relations in the areas of commerce and government.

The Standards for Foreign Language Learning (1996) identify five goal areas for foreign language education: communication, cultures, connections, comparisons, and communities. "Communication" includes students understanding written and spoken language, engaging in conversation, and expressing ideas. "Cultures" means demonstrating an understanding of the culture where the target language is spoken. "Connections" refers to the reinforcement and application of other disciplines through the study of foreign languages (i.e., geography, political science, literature). "Comparisons" gives students the opportunity to better understand their own culture by comparing it to

the culture where the target language is spoken. Finally, "communities" relates to using the foreign language outside of the school setting.

Spolsky (1989) developed a model of second language learning that identified several conditions that influence the ease or difficulty with which another language is learned. First, the learner must be motivated to put forth the effort that is needed to learn a new language. Motivation then joins with other key intrinsic conditions including age, personality traits, and previous knowledge of the target language. Finally, an individual's facility with language in general and other cognitive skills also affects the ease with which he or she will learn a foreign language. Having stronger skills in the native language generally aids the acquisition of another language. While Spolsky's (1989) model may have merit, the relative contribution of each element in the model has not been examined empirically.

In the early 1990s, foreign language educators felt that difficulties learning a foreign language were caused by affective variables such as anxiety, lack of motivation, or poor learning strategies. Several studies (Sparks, Ganschow & Javorsky, 1993; Ganschow et al., 1994; Javorsky, Sparks, & Ganschow, 1992) challenged this view with support that affective differences are the *result* of language learning differences, and not the cause.

Dinklage (1971) was among the first to describe foreign language learning difficulties when he wrote about students at Harvard University who were unable to pass the foreign language requirement. He discussed students' errors in three areas: spelling and reading, auditory discrimination, and auditory memory. These deficits were reflected in native language as well as foreign language. Dinklage (1971) believed that a foreign

language learning disability did not exist in isolation but co-occurred with native language deficits. He reported that some of the students who had experienced difficulty had been diagnosed with learning disabilities previously although they believed that they had "overcome" the disability. We now know that language-based learning disabilities persist throughout life, although they may look different at different points in time (Shaywitz, 2003).

The areas of weakness described by Dinklage (1971) reflect, to a large degree, deficient phonological processing skills. Difficulty processing information at the phonological (sound) level is now considered a core deficit in developmental dyslexia. Shaywitz (2003) suggested that, "Persistent difficulties in learning a foreign language provide an important clue that a student may be dyslexic" (p. 116).

During the last 15 years, the research of Sparks, Ganschow, and colleagues has supported their hypothesis that an individual's ability to learn a foreign language is strongly influenced by his or her native language skills. Initially they proposed this idea as the Linguistic Coding Deficit Hypothesis and claimed that variability in foreign language acquisition was accounted for by individual differences in phonological, syntactic, and semantic components of native language, as well as verbal memory (Sparks, Ganschow, & Pohlman, 1989; Sparks & Ganschow, 1991). They argued that inefficient processing of language codes will manifest across languages and that problems in one (or more) of the areas of language will be evident in the native language as well as the foreign language.

Sparks (1995) revised the theoretical framework from the Linguistic Coding *Deficit* Hypothesis to the Linguistic Coding *Differences* Hypothesis (LCDH) to reflect his

belief that there is rarely a strict cut-off point for a deficit (Ganschow & Sparks, 1995; Ganschow, Sparks, Javorsky, Pohlman, & Bishop-Marbury, 1991; Sparks & Ganschow, 1993a; Sparks, Ganschow, Javorsky, Pohlman, & Patton, 1992a). Linguistic skills, like many other skills, occur on a continuum. Thus an emphasis on differences emphasizes individual variation rather than disability.

As noted above, phonological deficits are present in learning disabilities such as developmental dyslexia. Individuals with dyslexia typically have extreme difficulty learning a foreign language (Shaywitz, 2003, p. 124). Phonological differences can also be subtle (not severe enough to be considered "dyslexia"), but can have an effect on foreign language learning. Sparks et al. (1998) found no significant differences in the profiles of students with diagnosed learning disabilities and those who were not diagnosed but struggling to learn foreign language (called "at-risk"). At times it is not until a student exhibits an atypical degree of difficulty learning a foreign language at the college level that he or she is diagnosed with a learning disability.

Downey and Snyder (2000) described common characteristics of "at-risk" foreign language learners, who are students that struggle to learn a foreign language but have not been diagnosed with a learning disability. Typically these students had academic difficulties in high school. They avoided math, science, and foreign language. Many began college at the community college or junior college level and then transferred to a four-year school. Often these students are "nontraditional" (over 25 years old) and have had a history of foreign language failure. They typically described themselves as hard workers, slow readers, and poor spellers.

Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act protect students with identified disabilities. These laws focus on ensuring equal access to programs and services. Under these laws, colleges and universities are required to provide reasonable accommodations so that students with disabilities can access the same programs that are available to their non-disabled peers. Among the accommodations that students enrolled in foreign language courses may need are extended test-taking time, use of a note-taker, and tutoring. Waivers and substitutions for the foreign language courses may also be an option in some colleges and universities; however they are not always available. In a recent landmark court case, a judge ruled that a school could determine whether eliminating a required course, such as foreign language, "fundamentally alters the nature" of the degree (*Guckenberger v. Boston University*, 1998, p. 19). The Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973 do not require postsecondary institutions to eliminate essential elements of the curricula (*Guckenberger v. Boston University*, 1997, p.95).

Guckenberger v. Boston University (1998) reinforced the court's ruling that a college or university is not obligated to grant a course waiver for a student with a diagnosed disability. Therefore a student who experiences difficulty with foreign language should take care in selecting a school and/or major that does not require study of a foreign language or attend a school with a proactive office of disabilities which can grant a course waiver or substitution. Another option is a modified foreign language requirement. A program of this type has been developed and implemented at the University of Colorado at Boulder (Downey & Snyder, 2001). In the Foreign Language Modification Program, eligible students can enroll in a three-semester sequence of

foreign language courses. While taking these courses students receive direct teaching of the phonological/orthographic system, extra time for exams and quizzes, decreased quantity of content, and extensive pretest preparation. Enrollment is limited and students must sign a contract indicating that they agree to attend every class. Students must also take a decreased academic load when studying foreign language, participate in class discussions, and attend weekly tutoring sessions (Downey & Snyder, 2000).

If foreign language learning differences were better understood, more colleges and universities might be willing to provide courses that are adapted for students who are struggling. Students could then avoid some of the stress caused by college-level foreign language courses; yet still fulfill the degree requirements of the institution.

Rationale and Purpose

Previous work addressing the relationship between native language skills and foreign language learning has primarily focused on individuals experiencing difficulty learning a second language. The Linguistic Coding Differences Hypothesis states that native language skills are the foundation for foreign language learning and that problems with one language skill (such as phonological/orthographic processing) will impact both the native and foreign language learning systems (Sparks, Ganschow, & Pohlman, 1989). When students who struggled with foreign language courses (sometimes called "at-risk") were compared with students who did well in foreign language courses, the groups showed significant differences in performance on measures of phonology-orthography (such as word recognition and spelling) but not on semantics (Sparks, Ganschow, Javorsky, Pohlman, & Patton, 1992b; Sparks, Ganschow, Fluharty, & Little, 1996).

The primary goal of the current study was examine how native language skills, specifically in the areas of phonology, orthography, and vocabulary, contribute to foreign language learning. Looking at these native language skills can provide a better understanding of individual variation among students enrolled in foreign language courses. This study examined specific language skills that have been identified as being correlated with foreign language learning. This study expands on previous work and looks at foreign language learners with a wider range of abilities. If native language skills are the foundation for foreign language learning, individuals with native language weaknesses should experience difficulty learning a foreign language while those with strengths in native language should be very successful foreign language learners. Examination of students with both strong and weak native language skills helps us to better understand individual differences in foreign language learning, across the spectrum of learning abilities.

This study also looked at phonological processing skills in detail. Previous studies identified phonological processing skills in a broad way (i.e., spelling). The current study included a range of phonological processing skills, including tasks that integrated phonological processing with orthographic and semantic processing (e.g., spelling clues). The strongest predictors of foreign language skills are identified.

The third goal of this study was to examine the idea of cross-language transfer of vocabulary, spelling, and rapid automatized naming skills between native and foreign language. Most of the previous research in this area has looked at the correlation of phonological skills between native and foreign language (e.g., Durgunoglu, Nagy, & Hancin-Bhatt, 1993). This study looked at vocabulary, spelling, and rapid automatized

naming skills to determine if the cross-language transfer relationship holds in these areas as well.

Research Questions

1. Is there a relationship between native English language skills in (a) phonological knowledge, (b) orthographic knowledge, (c) semantic knowledge, and (d) speed of processing; and German foreign language performance, as measured by a composite score on a battery of tests in German?
2. Which specific phonological-orthographic skills (elision, nonword repetition, spelling, spoonerisms, rapid automatized naming, phoneme reversal, spelling clues, number learning) best predict performance in foreign language (German composite score)?
3. Do native English language skills in vocabulary, spelling, and rapid automatized naming predict foreign language (German) performance in these same areas, indicating cross-language transfer of skills?

Hypotheses

The research questions motivated several hypotheses, which are listed below.

1. Based on the Linguistic Coding Differences Hypothesis, it is hypothesized that native English language phonological skills will be associated with German foreign language performance after one semester of instruction.
2. With respect to overall German foreign language proficiency (German composite score), native English language phonological and orthographic (i.e., spelling) skills will more strongly predict German performance than English language semantic skills will.

3. Phonological-orthographic skills which are more difficult (spelling, spoonerisms, phoneme reversal, number learning, and spelling clues) will be better predictors of foreign language proficiency (as measured by German composite score) in college students than easier phonological-orthographic measures (elision, nonword repetition, and rapid automatized naming).
4. German spelling skills will be influenced by English spelling skills.
5. German vocabulary will be influenced by English vocabulary skills.
6. German rapid automatized naming will be influenced by English rapid automatized naming ability.

Significance

Previous work in foreign language difficulties has focused on group differences between students with learning disabilities and their non-learning disabled peers. Several differences in native language abilities between the two groups have been identified. This study will build on previous work by emphasizing the continuum of language skills and how relative strengths and weaknesses contribute to foreign language learning. This study also takes an in-depth look at the influence of phonological processing skills at varying levels of difficulty. Additionally, this study extends the concept of cross-language transfer of skills to the spelling, vocabulary, and rapid automatized naming domains. Previous work focused on cross-language transfer of phonological skills.

Because foreign language is required for many university degrees, it is important to understand the skills that are necessary for successful completion. If a student is struggling through the foreign language requirement, he or she may spend an inordinate amount of time on this class, possibly at the expense of other courses. The student may

also receive a failing grade, which will affect his or her grade point average and may result in diminished self-esteem. If the student can better understand the nature of the learning difference, he or she will be able to be a better self-advocate.

Understanding the contribution of native language skills can help in the development of modified or remedial foreign language instructional strategies. Modified foreign language courses can be taught in ways that match students' learning abilities and maximize their potential for completing the course. When surveyed, 90% of college students who received waivers for foreign language courses would have enrolled in 'modified' foreign language courses if the courses were available (Ganschow, Philips, & Schneider, 2000).

Limitations

Native language skills are not the only area contributing to success or failure in foreign language courses. Good or poor native language skills will not definitively predict how a student will do in foreign language courses. As Spolsky (1989) pointed out, strong native language skills are necessary, but they are not a sufficient explanation for successful foreign language learning.

Additionally, this study was limited to college students in their first semester of German. The results may not generalize to younger foreign language learners, those learning in an immersion environment (versus a classroom environment), or individuals who are learning a more versus less transparent (one-to-one grapheme/phoneme correspondences) language.

CHAPTER 2
REVIEW OF THE LITERATURE

The purpose of this study is to describe how native English language skills contribute to foreign language learning. The chapter begins with a review of studies related to the Linguistic Coding Differences Hypothesis (LCDH). An overview of research studies related to semantic processing, orthographic processing, phonological processing, and processing speed is included. Finally, a discussion of processing deficits in English and German is provided.

Linguistic Coding Differences

Background

Individual differences in foreign language learning were described as early as 1959 when Carroll and Sapon developed the *Modern Language Aptitude Test* (MLAT) (Carroll & Sapon, 1959). This test, designed to predict an individual's strength or struggle when studying a foreign language, is still in use. The test can be used to evaluate the strengths and weaknesses of an individual's memory and language skills in English. The MLAT score may be useful for program placement according to ability. Further, the MLAT may be an important component of an evaluation for learning disabilities; however a score on one test is not enough to make a diagnosis.

In the mid- and late-1960s, Pimsleur, Sundland, and McIntyre (1964) and Pimsleur (1968) identified students who struggled with foreign language courses as "underachievers." Despite their difficulty with developing proficiency in learning a

foreign language, the students had average to above average intelligence and passing grades in other courses. The authors hypothesized that deficits in auditory ability (ability to deal with sounds) were responsible for the foreign language learning difficulties.

Dinklage (1971) suggested that difficulties learning foreign languages were grounded in native language differences. He described Harvard University students who were bright and successful in their other courses, but unable to pass the foreign language requirement. He postulated that the students' difficulties fit into one of three groups. The first group had problems with written language (reading and spelling). The second group had "auditory discrimination" deficits, which included difficulty telling the difference between similar sounds, syllables, and words in the foreign language. The third group had problems remembering what they heard (Dinklage, 1971). Since 1971, several researchers have written about phonological processing (e.g., Wagner & Torgesen, 1987, Wagner, Torgesen, Laughon, Simmons, & Rashotte, 1993). Each of the groups described by Dinklage appeared to have difficulty with the phonological aspects of language. Some of these students had been diagnosed with dyslexia in childhood but believed that they had "overcome" it through hard work. When faced with a new sound system in the foreign language classroom, the old problems resurfaced.

Prior to the 1980s, discussion of foreign language learning difficulties was limited to case studies. The first empirical study on foreign language learning abilities was published in 1987 when Gajar compared the performance of students with learning disabilities (LD) with non-LD peers on the MLAT. Students who had been diagnosed with LD had significantly lower scores on the MLAT than students without LD (Gajar, 1987).

Sparks, Ganschow, and Pohlman (1989) later introduced the Linguistic Coding Deficits Hypothesis, which was based on Vellutino and Scanlon's (1986) description of linguistic coding. Linguistic coding consists of three components: phonological (processing language at the sound/symbol level), syntactic (grammatical and structural forms of language), and semantic (meanings of words and concepts) (Vellutino, 1987; Vellutino & Scanlon, 1986). One assumption of the Linguistic Coding Deficits Hypothesis is that if an individual has difficulty in any of these areas of their native language, he or she will have problems learning a second language. The authors assert that native language phonological problems will have an "immediate and significant impact" on foreign language learning. Individuals with syntactic (grammar) problems (without phonological deficits) are usually able to pass one or two semesters of foreign language course work before encountering remarkable difficulty. Students with semantic (vocabulary) deficits generally experience problems when the course work shifts from written work to conversation and functional use of the language (Sparks, Ganschow, & Pohlman, 1989).

Since development of the Linguistic Coding Deficits Hypothesis, Sparks, Ganschow, and colleagues have demonstrated its efficacy and application by studying different populations, such as adolescents and adults in academic settings. They began by describing the differences between good and poor foreign language learners at the high school (Sparks, Ganschow, Javorsky, Pohlman, & Patton, 1992b; Sparks & Ganschow, 1993b) and college (Ganschow, Sparks, Javorsky, Pohlman, & Bishop-Marbury, 1991) levels. Many of their studies compared students with LD with non-LD peers and described the differences between the groups. The two groups typically had

similar vocabulary skills and nonverbal intelligence. However, they differed in phonological/orthographic skills (word recognition, spelling, pseudoword reading) and foreign language aptitude (MLAT). Students who achieved higher foreign language grades also had significantly stronger native language and foreign language aptitude skills than students who achieved lower grades, whether or not the students had been diagnosed with LD (Ganschow et al., 1991, 1994; Ganschow & Sparks, 1996).

Sparks, Ganschow, and colleagues published several studies in which they reported that linguistic skills, not affective characteristics (such as low motivation, high anxiety, and poor attitude), were responsible for the differences in foreign language learning ability between LD and non-LD students (Sparks, Ganschow & Javorsky, 1993; Javorsky, Sparks, & Ganschow, 1992; Ganschow & Sparks, 1996; Ganschow et al., 1994). They posited that the affective differences between good and poor foreign language learners were likely to be the result of difficulties with language skills. These studies provided additional support for their hypothesis that foreign language learning problems are rooted in native language deficits.

As defined by the Individuals with Disabilities Education Act (1997), diagnosis of a learning disability typically involves a significant discrepancy between a student's intellectual ability (as measured by an IQ test) and academic performance in one or more of the following areas: oral expression, listening comprehension, written expression, basic reading skill (such as word recognition and decoding), reading comprehension, mathematics calculation, and mathematics reasoning. Without a discrepancy, a student does not meet eligibility criteria for this disability category, even if he or she is struggling academically. Sparks and colleagues compared students diagnosed with LD and students

without a diagnosis who were struggling to learn a foreign language (called "at-risk"). They found no difference between the two groups on most language and foreign language aptitude measures (Sparks, Ganschow, Javorsky, Pohlman, & Patton, 1992b). Because there are rarely strict cut-off points to determine the absence or presence of a deficit, the term Linguistic Coding *Deficits* Hypothesis was changed to Linguistic Coding *Differences* Hypothesis (LCDH) to reflect the continuum of difficulties with foreign language learning (Sparks 1995). Difficulties can range from mild to severe.

Predictions from Native Language to Foreign Language

Much of the support for the LCDH has come from group comparisons of high-school and college students enrolled in foreign language courses. When successful foreign language (L2) learners were compared with students who did poorly or failed an L2 course (called "at-risk"), at-risk L2 learners had significantly lower levels of native language (L1) skill in phonological-orthographic areas and L2 aptitude (MLAT). At-risk students (with and without identified learning disabilities) performed significantly worse than successful students on phonological-orthographic processing and L2 aptitude measures (Ganschow & Sparks, 1995; Ganschow, Sparks, Javorsky, Pohlman, & Bishop-Marbury, 1991; Sparks, Ganschow, Artzer, & Patton, 1997).

Findings from some predictive studies have also been published to support the idea that native language skills are the foundation for foreign language learning. Sparks, Ganschow, and Patton (1995) observed that eighth grade English course grades predicted foreign-language learning the following year. Later, Sparks, Ganschow, Patton, Artzer, Siebenhar, & Plageman (1997) found that first-year course grade, native language

vocabulary, and foreign language word decoding were predictive of overall second-year foreign language proficiency in high school students.

Recently, Meschyan and Hernandez (2002) studied the language skills of 80 college-age adults enrolled in an introductory Spanish course and observed a relationship between L1 decoding (a phonological skill), L2 competency and course grade. They administered several tests in L1 and L2 and analyzed the data via multiple regression methodology. L1 decoding predicted L1 competency (as measured by score on the verbal portion of the Scholastic Aptitude Test), however the relationship was mediated by vocabulary skill. Furthermore, they found that L1 decoding predicted L2 decoding as well as course grade.

Durgunoglu, Nagy, and Hancin-Bhatt (1993) studied the relationship between native language (Spanish) skills and foreign language (English) reading in first-grade children. They found that L1 phonological awareness and word reading predicted L2 word and nonword reading. They explained that "cross-language transfer" of phonological abilities was responsible for the relationship.

Cheung (1996) studied twelve-year-old Chinese children who were learning English and found that for students with greater L2 vocabulary, phonological ability was less predictive of L2 vocabulary learning. For children with weaker L2 vocabulary skills, there was a strong relationship between phonological ability and L2 vocabulary. They concluded that new word learning is mediated by both phonological ability and existing vocabulary knowledge.

Finally, Service (1992) provided support for the LCHD when she found that phonological/orthographic tasks and syntactic-semantic comparison tasks predicted

foreign language learning. She followed nine- and ten-year-old children for a three-year period and found that L2 grades at the end of the period were related to phonological skills in the area of nonword repetition (typically considered to be a measure of phonological memory). Nonword repetition ability correlated with degree of success in learning a foreign language.

Triangle Model of Language Processing

Seidenberg and McClelland introduced a frequently cited model of language processing in 1989. This particular model deals with written language processing (i.e., skilled reading), and the connectionist framework of the model underscores the interdependence of semantics, orthography, and phonology. The model is commonly referred to as a "triangle model." The triangle model focuses on the interconnectedness of three processing nodes. The meaning processor, orthographic processor, and phonological processor each share reciprocal connections with the other two processors. The reciprocal connections between the processors represent sharing of information (Metsala & Brown, 1998).

Semantics relates to the study of word meanings. The purpose of any written and oral communication is to express meaning. Adams (1990) explained that in order for meaning to be efficiently processed, the phonological and/or orthographic input must be of high quality (accurate) and the connections between the meaning processor and the phonological and/or orthographic processor must be strong. Semantic processing deficits affect oral (spoken) and written (reading) language comprehension.

The triangle model underscores the importance of processing meaning, which includes the processing of semantic information. The orthographic processor and the

phonological processor are each connected to the meaning processor, and they are also connected to each other. These two processors receive the visual and auditory input of written and oral language. After input is received, connections with the meaning processor help an individual to comprehend the meaning of the transmitted message. With experience the process becomes refined and more efficient.

Connections between the processors are reciprocal. Signals about word meanings are sent both to and from the meaning processor. The meaning processor sends information to the orthographic and the phonological processors. A strong semantic base helps language to be efficiently processed both orally and in writing.

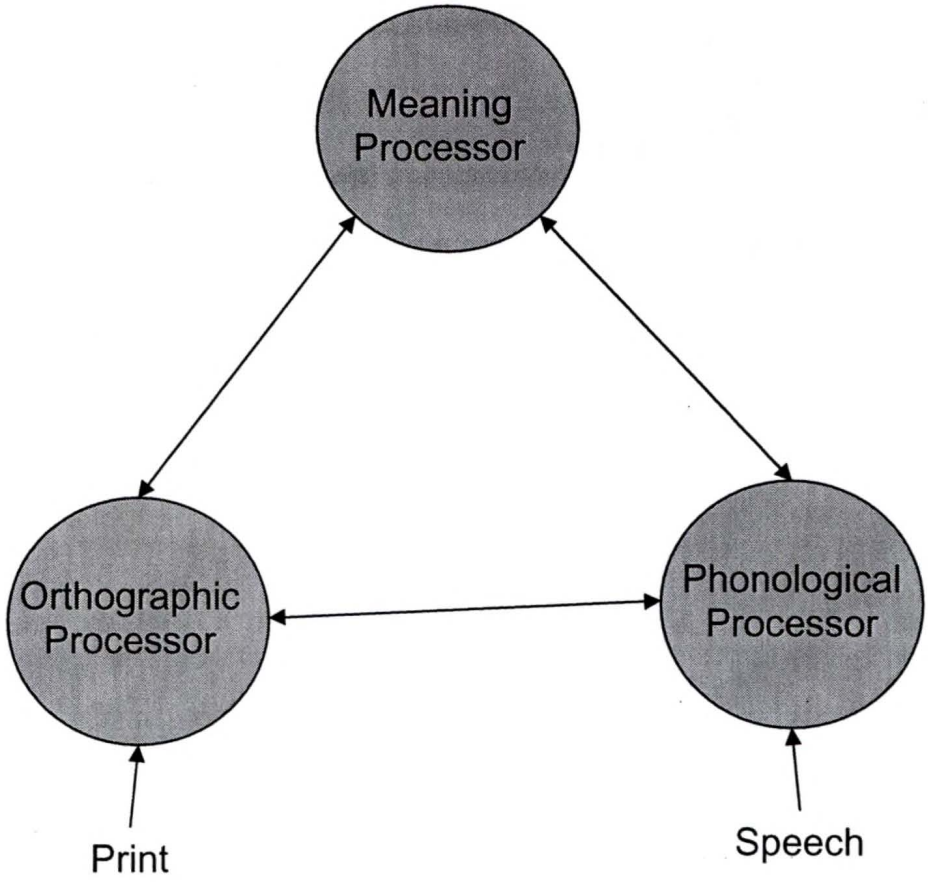

Figure 2-1. Triangle Model of Language Processing. Copyright © 1989 by the American Psychological Association. Adapted with permission.

Each of the three nodes in the triangle model makes a unique and necessary contribution to the language processing system. The processors can also compensate for weaknesses in the system. If a deficit exists at the level of one of the processors, the other two processors can bolster the system so that language can still be understood or produced. For example, an individual can compensate for deficits in phonological processing (such as difficulty sounding out written words) with superior orthographic processing (familiarity with the visual forms of words) and/or superior meaning processing (strong vocabulary and overall language skills).

The processors comprising the triangle model will be discussed in greater detail in the following sections. The relationship between the three processors will be also be discussed, as well as the effect of deficits in the processors.

The Meaning Processor

As noted above, semantics relates to the study of word meanings. Gathercole and colleagues described a relationship between semantics and some areas of phonological processing. In four- to six-year-old children without language disorders, phonological working memory (as measured by nonword repetition ability) and vocabulary growth were highly correlated (Gathercole & Baddeley, 1990b; Gathercole, Willis, Emslie, & Baddeley, 1992). Nonword repetition abilities (good and poor) were associated with receptive vocabulary skill. This association was also present for children with specific language impairment (Gathercole & Baddeley, 1989; 1990a; 1993).

To determine the nature of the correlation between phonological short-term memory and vocabulary development, Gathercole, Willis, and Baddeley (1991) measured these abilities in four- and five-year-old children. They found that nonword repetition (a

measure of phonological short-term memory) at age four accurately predicted receptive vocabulary skills at age five. However vocabulary at age four did not predict nonword repetition at age five. The authors concluded that phonological short-term memory influences long-term storage of phonological information, which is necessary when learning new vocabulary words (Gathercole, Willis, & Baddeley, 1991). Gathercole, Hitch, Service, and Martin (1997) also noted that both phonological short-term memory and existing vocabulary skills contributed to new word learning in five-year-old children. They explained that if an individual knows more vocabulary words he or she will be able to learn a new word by finding phonological approximations in words that are already known (Gathercole & Baddeley, 1993)

Walley (1993) and Metsala (1999) also discussed the relationship between semantics and phonology. The Lexical Restructuring Hypothesis proposed that as vocabulary develops, phonological representations become increasingly refined (segmented). Vocabulary growth improves phonological skills. This hypothesis is not supported in the case of individuals with developmental dyslexia who have strong vocabulary skills. According to the Lexical Restructuring Hypothesis a poor vocabulary would imply phonological difficulties, and a large vocabulary would imply an improved ability to segment words into their component sounds. However in the case of a dyslexic child, as Snowling (2000) noted, a large vocabulary is not necessarily associated with strong phonological representations. Individuals with developmental dyslexia have relatively good vocabulary knowledge in the face of poor phonological processing skills. They have a specific deficit in the area of phonological processing.

The Orthographic Processor

The orthographic processor recognizes strings of letters as familiar patterns (Adams, 1990). Efficiency of the orthographic processor depends on strong spelling abilities. Familiarity with spelling patterns helps an individual to recognize words quickly.

Spelling integrates phonological, morphological, semantic, and orthographic knowledge (Fischer, Shankweiler, & Liberman, 1985). Spelling differs from reading in that spelling requires encoding, which is segmenting sounds into words, translating phonemes into corresponding graphemes, and then blending the parts into a written word (Gillingham & Stillman, 1997).

Children who are able to segment words into their component sounds tend to be better spellers than children who have difficulty with phoneme segmentation tasks (Tunmer & Rohl, 1991). Treiman (1997) also found that in kindergarten and first-grade children learning to spell, early spelling errors reflected use of phonetic strategies. Children did not rely on orthographic knowledge but on their knowledge of the phonological structure of the words, producing "errors" such as 'jres' for 'dress'. This underscores the relationship between phonological awareness and spelling (orthographic) development.

Poor spellers cannot rely on their phonological processing skills to accurately spell words. Bruck (1990) compared college students with a history of dyslexia to age- and reading-matched controls. She reported that the students with a history of dyslexia demonstrated poor knowledge of sound-spelling relationships. They also underused the

orthographic information they encountered, attempting to rely on their (weak) sound-spelling strategies to gain meaning.

For younger children learning to read and spell, phonological awareness skills affect spelling abilities. In a longitudinal study, Stuart and Masterson (1992) assessed phonological abilities at age four and found that these abilities predicted spelling performance at age ten (six years later). Both strong and weak pre-reading phonological abilities were predictive of later spelling.

The Phonological Processor

Phonological processing is defined as an individual's mental operations that make use of the phonological or sound structure of oral language when he or she is learning how to decode written language (Torgesen, Wagner, & Rashotte, 1994, p. 276). It relates to how a communicator uses sound-level information to produce oral and written language and make sense of what is heard. Phonological processing skills include phonological awareness, phonological recoding in lexical access, and phonological recoding in working memory (Share, 1995; Stanovich, 1988; Wagner & Torgesen, 1987). While related to each other, each component represents a different ability.

Phonological awareness

Phonological awareness is a measure of an individual's ability to judge the number, order, and identity of phonemes (sounds) in words (Liberman, 1973; Liberman, Shankweiler, Fischer, & Carter 1974; Lindamood, Bell, & Lindamood, 1992). Individuals who are successful at phonological awareness tasks have access to well-specified sound-level representations (Elbro, 1997). Intact phonological awareness helps individuals to accurately sound out words (convert graphemes to phonemes and blend the

phonemes together) and children with strong phonological awareness skills typically acquire phonics skills more efficiently than children with weaker phonological awareness (Catts & Kamhi, 1999). Phonological awareness is closely associated with reading because in order to understand the letter-sound correspondences and to blend the sounds into words, a reader must understand that words are made up of individual sounds (Tunmer & Rohl, 1991). Phonological awareness encompasses skills such as word-level awareness (number of syllables) and syllabic structure awareness (onsets and rimes).

In young children who are learning to read, phonological awareness skills are often associated with early reading ability. Children with stronger phonological awareness skills prior to reading instruction typically are more successful when reading instruction begins (Bradley & Bryant, 1983; Stanovich, Cunningham, & Cramer, 1984). Early reading involves learning how to sound out or "decode" words, which relies on the ability to analyze (segment) and synthesize (blend) sounds and syllables. Ball (1996) explained that at the early stages of learning to read, the relationship between phonological awareness and reading is causal, but shifts to 'mutual facilitation' (p. 82) as reading develops. Experience with reading helps to improve phonological awareness. Intact phonological awareness skills are a necessary but not sufficient condition for learning to read (Ball & Blachman, 1988; Bruck, 1993).

Crombie and McColl (2001) explained that phonological awareness problems affect foreign language learning in the following ways: pronunciation, recognizing familiar words and phrases and confusion of similar sounding words, reading aloud. They suggested several strategies and accommodations for individuals with phonological awareness deficits who are learning a foreign language. The phonics system of the new

language should be introduced early and in a multisensory way (visually, auditorally, written, etc.). Audio tapes and practice cards are recommended for reinforcement of pronunciation and vocabulary (Crombie & McColl, 2001).

Phonological Working Memory

Cowan (1996) explained that short-term memory refers to the aspect of memory that lasts only a few seconds after input is received. Working memory refers to short-term memory when it is used to perform a task (such as solving a problem). Phonological working memory is a component of short-term memory and involves the retention of phonologically-coded verbal information in a temporary memory system. Information is stored in memory by sound-based phonological properties (Gathercole, 1998). Researchers are most interested in measuring the strength of the store of information. Phonological memory is typically evaluated in tasks involving non-word repetition or repetition of a span of digits, letters, or words.

According to Baddeley and Hitch's (1974) working memory model (revised by Baddeley in 1986), working memory has three components: the central executive, the phonological loop, and the visuospatial sketchpad. The central executive controls the flow of information through the system and the visual and phonological systems temporarily process and retain the visual and verbal input. In terms of language learning, the phonological system is of primary interest.

The phonological loop consists of the phonological store and a subvocal rehearsal process (Baddeley, 1986). Verbal information (either auditory or written) enters the phonological store and forms phonological representations. Phonological representations quickly decay (within about 2 seconds) unless the subvocal rehearsal process refreshes

the decaying representations in the phonological store. The subvocal rehearsal process develops during childhood. Gathercole and Hitch (1993) reported that this process does not emerge until age seven.

Nonword repetition is associated with language abilities in typically developing children (Baddeley, Gathercole, & Papagno, 1998; Gathercole, Hitch, Service, & Martin, 1997). In four-year-old children, non-word repetition ability was strongly correlated with vocabulary knowledge (Gathercole, Willis, Emslie, & Baddeley, 1992). Gathercole, Service, Hitch, Adams, and Martin (1999) also found an association between phonological memory (as measured by non-word repetition) and vocabulary in adolescent subjects.

Deficits in short-term memory are associated with the presence of language impairment (Bishop, North, & Donlan, 1996; Gillam & van Kleeck, 1996). Children with specific language impairment performed poorly on non-word repetition tasks (Gathercole & Baddeley, 1990a). Dollaghan and Campbell (1998) found that children enrolled in language therapy did worse on non-word repetition tests than age-matched, typically developing peers. Campbell, Dollaghan, Needleman, and Janosky (1997) suggested that linguistic processing tasks, such as non-word repetition, are a culturally sensitive way to assess language disorders. Ellis Weismer, Tomblin, Zhang, Buckwalter, Chynoweth, and Jones (2000) agreed with this suggestion. They evaluated the nonword repetition abilities of 581 second graders. Children with diagnosed language impairment and children enrolled in language therapy had deficient nonword repetition skills compared to students without language problems. They confirmed that the use of processing measures (such as nonword repetition) is a culturally nonbiased way to

identify language disorders. Deficits in phonological memory have also been found to be associated with severe reading disabilities (Baddeley, 1986).

Gathercole and Thorn (1998) explained that learning the sound structures of new vocabulary in native and foreign language seems to be mediated by the phonological loop. They noted that gifted language learners (i.e., polyglots) have superior phonological short-term memory skills, as measured by nonword repetition. Vallar and Papagno (1995) also discussed verbal short-term memory abilities of polyglots. When they compared native speakers of Italian who knew several other languages with non-polyglots they found that the groups did not differ in general intelligence, visuo-spatial short-term memory, or paired-associate learning of Italian (native language) words. However the polyglots had exceptional abilities in the areas of verbal short-term memory, measured by auditory digit span and nonword repetition, and paired-associate learning of new (Russian) words. The authors concluded that phonological working memory is closely associated with acquisition of foreign languages.

Limited or inaccurate representations in memory may affect foreign language learning in the areas of vocabulary learning and repetition of multisyllabic words. Strategies to deal with these difficulties include presenting/learning information in smaller chunks and allowing extra time for recall. Extensive review of new material is also helpful (Crombie & McColl, 2001).

Rapid Automatized Naming

Although researchers seem to agree that deficits in rapid automatized naming (RAN) are associated with poor reading skills, disagreement exists as to whether RAN is a phonological processing skill or whether the task taps into a separate skill characterized

by processing speech or sequencing. During the RAN task the examinee must quickly name an array of familiar items (letters, numerals, objects) during which they are timed. The task requires rapid access of familiar symbols stored in long-term memory as phonological representations (Wagner, Torgesen, & Rashotte, 1994). Individual with phonological deficits have poorly specified representations of words and sounds, resulting in difficulty accessing and articulating the names of familiar symbols (Baddeley, 1986; Share, 1995; Wagner & Torgesen, 1987).

However, the poor quality of the phonological representations may not be solely responsible for deficits in RAN. Some researchers disagree with the idea of RAN as strictly a phonological skill. In addition to accessing phonological codes, the task requires attention, visual recognition, and articulation (Manis, Seidenberg, & Doi, 1999). Additionally, RAN and phonological awareness have been shown to make independent contributions to reading ability (Badian, 1993; Bowers, 1995; Torgesen, Wagner, & Rashotte, 1997). Processing speed deficits will be discussed in greater detail in the following section.

Efficient retrieval of phonological codes associated with phonemes and words influences how phonological information is used during word reading (Baddeley, 1986). Deficiencies in rapid naming are often associated with reading rate and fluency problems (Bowers, Sunseth, & Golden, 1999; Manis, Seidenberg, & Doi, 1999). Manis, Seidenberg, and Doi (1999) suggested that RAN (the ability to rapidly access arbitrary associations) may influence early reading skills while phonological awareness affects both early and later reading growth.

Speed of Processing

Manis, Seidenberg, and Doi (1999) studied RAN in the framework of Seidenberg and McClelland's (1989) connectionist model described above. According to the connectionist model, RAN is not an aspect of phonological processing. RAN relates to the learning of arbitrary mappings between print (orthographic processing) and sound (phonological processing). Rather than tapping into a processing node, the RAN task corresponds with the *connections* between the orthographic processing node and the phonological processing node (Manis, Seidenberg, & Doi, 1999).

This work agrees with Wolf and Bowers' (1999) double deficit hypothesis, which proposes that timing deficits such as slow letter recognition and rapid naming are independent of phonological deficits. While there is some overlapping variance, the correlation between RAN and other phonological skills such as phonological awareness and phonological memory is weak. Correlations between phonological awareness and phonological short-term memory were stronger.

The double deficit hypothesis states that children with reading problems can have deficits in naming speed and/or phonological awareness. Children with naming speed deficits did poorly on measures of rate and comprehension. They were not deficient in nonword reading. Children with phonological awareness deficits did poorly with word and nonword reading accuracy as well as comprehension. Children with single deficits were generally less impaired than children with double deficits (Bowers, 1995; Bowers & Wolf, 1993; Wolf & Bowers, 1999, 2000).

Crombie and McColl (2001) explained that processing speed limitations may result in slower responses to incoming information, particularly large amounts of

continuous information. Extra response time and extra time for examinations are strategies to deal with deficits in speed of processing.

Persistent Deficits in Linguistic Processing

Individuals with developmental dyslexia have deficits in one, two, or all three areas of phonological processing. Deficits in phonological processing are often associated with difficulty learning to read (Share, 1995; Stanovich, 1988). In a meta-analysis of several articles related to prediction of reading skill, Siegel (1992) found that early phonological processing skills are the best predictor of later reading skill. Phonological processing is a better predictor of reading than are syntactic skills and working memory.

Wagner, Torgesen, and Rashotte (1994) explained that an individual's phonological processing skills are relatively stable characteristics that do not vary with typical academic instruction. Phonological processing deficits persist in older readers with a history of reading struggle, although these individuals have learned to read. According to Gottardo, Siegel, and Stanovich (1997), these "compensated dyslexics" continue to have difficulty sounding out unfamiliar words, spelling, and reading fluently. Problems forming phonological representations (Brady & Shankweiler, 1991; Snowling, 1981) may also affect an individual's ability to learn a foreign language (Sparks, Ganschow, & Pohlman, 1989). When faced with a new code system, the old problems with sound-level (phonological) information seem to re-surface.

Phonological processing abilities exist along a continuum (Shaywitz, 1992). There is not necessarily a strict cut-off point for identifying learning disabilities. As Sparks, Ganschow, Javorsky, Pohlman, & Patton (1992b) have observed, not all

individuals with foreign language learning problems have a previous diagnosis of a learning disability. However when they compared test performance of individuals with and without identified learning disabilities, there were no differences in native language skills and foreign language aptitude between individuals diagnosed with specific learning disabilities and those considered "at risk." In general, however, it is not merely the presence of a phonological deficit but also the severity of this deficit that affects reading and spelling (Snowling, Goulandris & Stackhouse, 1994).

Over time, phonological awareness is a relatively stable skill. Poor phonological awareness persists in compensated dyslexics who have learned to read (Frith, 1997). Some of the consequences of poor phonological awareness include difficulty sounding out unfamiliar words and spelling problems. Wilson and Lesaux (2001) sought to determine the nature of the phonological processing deficits that persist. They compared 28 college students with a history of early and persistent reading problems with 31 controls, with no history of reading problems. Although the "dyslexia group's" performance on phonological tasks was in the average range, it was significantly lower that of the control group. This effect was most pronounced on tasks involving phoneme deletion, a phonological segmentation and manipulation task, and spoonerisms, which involves both phoneme segmentation and time.

Snowling, Nation, Moxham, Gallagher, and Frith (1997) found that college students with dyslexia performed worse than age- and educationally-matched controls on all measures of phonological processing. The students with dyslexia had more difficulty with nonword reading, phoneme deletion, spoonerisms, and phonemic fluency (generating groups of words that begin with the same sound). Interestingly, they did not

find differences in word and non-word repetition in these groups of college students; however when more demands were placed on short-term memory (e.g., retention of the novel items), the dyslexic college students had more difficulty.

In a similar study of college students, Downey, Snyder, and Hill (2000) compared the performance of students enrolled in modified foreign language classes with their peers in regular foreign language classes. The students in the modified foreign language classes either had a diagnosis of a learning disability or repeatedly failed foreign language courses. The students in the modified courses performed significantly worse on language aptitude tests, spelling, and word recognition. No differences were observed between the groups on reading comprehension and vocabulary.

Finally, Gallagher, Laxon, Armstrong, and Frith (1996) studied an interesting group of college-age students who had a history of dyslexia but received early identification, intervention, and education in private schools. These students were highly motivated and had successfully passed rigorous examinations. The authors noted that while these students had well-compensated for their dyslexia, some problems persisted. When compared with controls, the students with a history of dyslexia performed significantly worse than age- and education-matched controls in the areas of nonword reading and spelling accuracy; and spoonerisms, digit naming, and speech rate.

Linguistic Processing in German

Recently several investigators have examined ways in which phonological processing deficits (including dyslexia) are manifested in other languages. German is a more transparent language than English, in that German has a closer one-to-one correspondence between graphemes (written representation of sounds) and phonemes

(auditory signals). Because each sound generally has only one written representation in German, individuals with phonological processing deficits generally are able to learn to read quite accurately. Most education systems in German speaking countries utilize a straightforward phonics approach when teaching children to read. Goulandris (2003) emphasized that both the transparency of a language and the educational methodology used to teach children to read influence the extent to which a phonological processing deficit manifests as a disability.

When Landerl, Wimmer, and Frith (1997) compared the reading abilities of English and German children with dyslexia, the English-speaking children consistently made more errors than the German-speaking children. For example, German children read three-syllable words more accurately than the English children read one-syllable words. Also, the German children with dyslexia read real words as accurately as the German control group. The authors concluded that orthographic consistency has an important influence on dyslexic children's reading performance.

Wimmer and Mayringer (2002) described dissociations between reading and spelling difficulties in third-grade German-speaking children. Some children exhibited deficits in either reading or spelling with stronger skills in the other area. The authors explained that poor reading and adequate spelling was associated with a deficit in processing speed, while spelling deficits in light of normal reading abilities were the result of phonological processing deficits.

Landerl (2003) discussed the possibility that the phonological deficit hypothesis only applies to English because of its phonological complexity. Because of the consistent orthography of German, she hypothesized that a phonological impairment might not

influence German reading acquisition. However, German children with dyslexia had more difficulty reading non-words than real words. Landerl (2003) interpreted this as evidence that German speaking individuals with dyslexia do indeed have specific difficulties with the phonological component of reading.

Wydell and Butterworth (1999) hypothesized that both granularity and transparency of a language influence how children with dyslexia learn to read in that language. Their hypothesis of granularity and transparency is diagrammed below in Figure 2-2. According to the hypothesis, any language that falls into the shaded area should not pose as much difficulty for individuals with phonological processing deficits.

As noted above, transparency relates to the degree to which the correspondence between letter-sound mappings is one-to-one. A transparent language has stricter letter-sound mapping than an opaque language. According to the hypothesis of granularity and transparency, persons with dyslexia who are learning to read in a language that is more transparent will not experience as much difficulty as individuals learning in a less transparent language. German is a more transparent language than English.

Granularity relates to the smallest orthographic unit represented by the written language system. Granularity is represented on a scale ranging from fine to coarse. In languages such as English and German, the orthographic system represents the phonemes of the spoken language system. Their granularity is considered to be "fine". Other languages use the orthographic system to represent segments such as syllables or words ("coarse" granularity). Japanese Kana and Kanji are examples of orthographic systems that represent segments larger than phonemes. According to the hypothesis of

transparency and granularity, the manifestation of reading problems (i.e., dyslexia) is rare in languages with a coarse granular size (Wydell, 2003).

Hypothesis of Granularity and Transparency

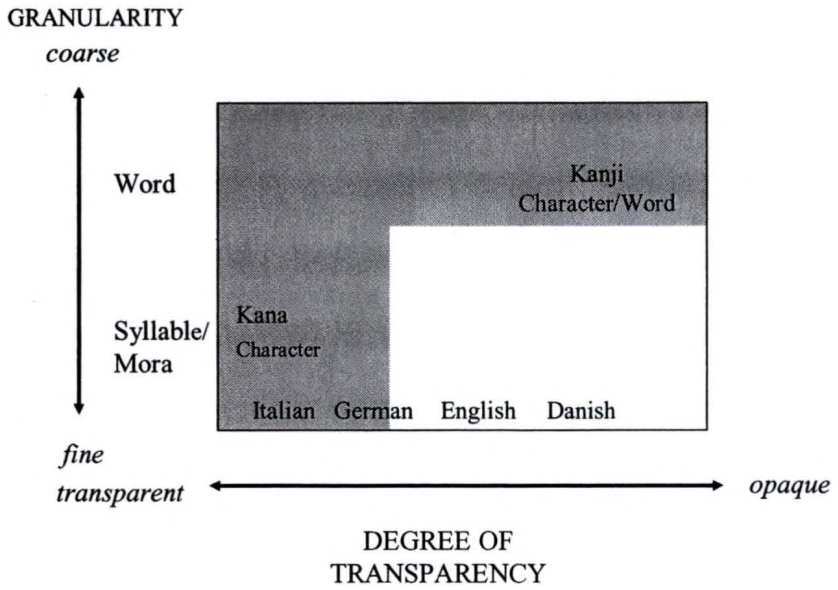

Figure 2-2. Hypothesis of Granularity and Transparency, developed by Wydell and Butterworth (1999) and published in Wydell (2003). Reprinted with permission.

Summary

This chapter began with a description of the Linguistic Coding Differences Hypothesis (Sparks, Ganschow, & Pohlman, 1989). Next, a connectionist model of language processing was described (Seidenberg & McClelland, 1989). Semantic (meaning), orthographic, and phonological processing were then described in detail. Phonological processing deficits are often associated with reading problems. This relationship was addressed. Further, the Linguistic Coding Differences Hypothesis states that if an individual has deficits in phonological processing, he or she will have difficulty learning a foreign language. The validity of the Linguistic Coding Differences

Hypothesis will be addressed in this study and phonological processing skills will be closely investigated. This study also looks at cross language transfer in the areas of vocabulary, spelling, and rapid automatized naming.

CHAPTER 3
METHODS

The primary goal of this study was to determine if specific native language skills predict foreign language learning ability, addressing the ideas presented as the Linguistic Coding Differences Hypothesis (Sparks, Ganschow, & Pohlman, 1989). Several dimensions of students' native language skills were measured to determine the degree to which their native language skills were predictive of their proficiency in the acquisition of specific skills in German. Native English skills were measured in the areas of phonological processing, spelling, vocabulary, and rapid automatized naming and foreign language skills were measured in spelling, vocabulary, and rapid automatized naming. Participants in the study were a group of college students enrolled in a first-semester German course. The purpose of this chapter is to describe the setting of and participants in the study, define the dependent and independent variables, and describe the instrumentation and data collection procedures.

Setting

This study was conducted over three academic semesters at the University of Florida. A series of tests in English and German was administered to university students enrolled in the first semester of German language study (Basic German I). All courses were taught by teaching assistants who were doctoral students in the German Department. The University of Florida Institutional Review Board (IRB-02) approved all

procedures used in this study and determined that the research plan adequately addressed the ethical dimensions of the project (See Appendix A).

Basic German I is an introductory level foreign language course offered through the Department of Germanic and Slavic Languages. The objective of the course is to provide an introduction to reading, writing, speaking, and listening in German. Basic German I is a four-credit undergraduate level course with no pre-requisite coursework. Foreign language study is a requirement in some programs of study. Some of the students enrolled in the course were taking the course to fulfill a requirement for their degree program, while others were taking it because of personal interests.

Participants

The participants were 65 students enrolled in Basic German I. Participants included 38 males and 27 females, ranging in age from 18;8 through 42;3 (years;months). The mean age was 21 years, 2 months. Participants had no prior exposure to the German language, either through coursework or family/friends and all of the participants had previously studied another foreign language, either in high school or college. The most commonly studied language was Spanish. Most participants reported that they did well (e.g., "As and Bs") in their previous foreign language study. The following demographic information was also reported by the participants: (1) one student reported difficulty learning to read; (2) two participants reported having been diagnosed with reading, language, and/or learning problems (one with Dyslexia and one with Attention Deficit/Hyperactivity Disorder); (3) eight participants reported a history of enrollment in speech and/or language therapy; and (4) eleven participants reported a family history of reading, language, and/or learning problems.

Participation in this study was voluntary and all students enrolled in the course were given the opportunity to participate. All students participating in the study met the following inclusionary criteria: (1) no prior experience with German, (2) free of sensory deficits in hearing or vision (uncorrected), and (3) enrolled in Basic German I during the semester of data collection. Any students who had previously studied German or who were non-native speakers of English were excluded from the study.

Students who participated in all phases of the study earned five (5) points of extra credit added to their final examination grade. Students who chose not to participate were given the opportunity to earn the extra credit by writing a short paper, as discussed with the instructor. This extra credit opportunity was presented to all students enrolled in Basic German I during the Spring, Summer, and Fall Semesters of 2003. At the first data collection session, students read and signed the Informed Consent document (see Appendix B). They also filled out a questionnaire, which included questions on basic demographic information and on demographic and educational history.

Operational Definition of Variables

The primary hypothesis tested in this study is that native English skills will correlate with performance on a battery of German tasks in students who were enrolled in a first-semester German foreign language course. All variables were measured (not manipulated) by test scores. The independent variables were measures of English language in four areas of processing: semantic processing, orthographic processing, phonological processing, and speed of processing. Some of the tasks tapped into more than one of these areas. For example, the English spelling clues task incorporated phonological, semantic, and orthographic skills; and the spoonerisms task incorporated

phonological skills and processing speed. The dependent variables were German spelling, vocabulary, and rapid automatized naming. Table 3.1 summarizes the tests administered to the participants. Each instrument is described in detail in the "Instrumentation" section.

Data Collection Procedures

Data collection took place over three sessions for each of the participants. The first session was a group session during which the English vocabulary, English spelling, and Number Learning tests were administered. The next session was an individual session that involved English language phonological awareness testing (Elision, Phoneme Reversal, and spoonerisms), English phonological memory, and rapid automatized naming in English and German. During Phases I and II of data collection (described below), the computerized task was also administered during the individual session. In the final session, conducted at the end of the semester, a German vocabulary test and a German spelling test, along with the spelling clues subtest from the MLAT were administered. The author conducted all testing.

Data Collection Phases

There were three phases of data collection for this project. Phase I was completed during the Spring 2003 semester, involving 28 participants. Phase II was completed during the Summer 2003 semester and involved seven participants. Phase III was completed in the Fall 2003 semester. Thirty students participated in Phase III. After Phase II, the test battery was modified. Rationale will be discussed.

The study was originally designed for administration of the phonological awareness (Elision), phonological memory (Nonword Repetition), receptive vocabulary,

spelling measures, and several computerized tests, which examined single-word reading and spelling accuracy and speed in English. After the first semester of data collection, a preliminary analysis of the data was conducted. The computerized instruments were found not to be predictive of acquisition of select basic German skills. Consequently, administration of the computerized tasks was discontinued because it appeared to be too easy for college students and it was a time-consuming task. Similarly, the phonemic awareness task of Elision was not predictive of the German composite score, as had been expected; however the task was retained as part of the battery because it has been used widely in previous predictive studies of reading skill.

During Phase III, two higher-level phonological awareness measures (phoneme reversal and spoonerisms) were added to determine if advanced phonemic awareness tasks might be more predictive of foreign language (L2) learning. The new phonemic awareness tasks were believed to be more sensitive to the individual differences in the population studied because of their higher levels of difficulty. Rapid automatized naming in English was also added because speed is often predictive of adolescents and adults with reading problems who are proficient in phonological decoding. Finally, the spelling clues subtest of the *Modern Language Aptitude Test* was added because the task combines several elements of language, including semantics and phonological/ orthographic processing, and was believed to be at an appropriate level of difficulty for a college-age population.

Table 3-1. Listing and Description of Experimental Tasks in English and German

Area of Linguistic Processing	Task Name	Description	Number of Participants
ENGLISH			
Semantic Processing	Receptive Vocabulary	Choose picture to match vocabulary word from an array of four	65
Orthographic Processing	Spelling	Write spelling word produced by examiner	65
Phonological Processing Composite Score	Composite	Composite of scores from Elision, Nonword Repetition, and Number Learning subtests	65
•Phonological Awareness	Elision	Sound manipulation task. Remove phoneme from target word and produce new word.	65
	Spoonerisms	Sound manipulation task. Reverse initial sounds in two words.	30
	Phoneme Reversal	Word is pronounced backward on audiotape. Reverse sounds to identify the word.	30
•Phonological Memory	Nonword Repetition	Repetition of pseudo-words heard on audiotape.	65
	Number Learning	Participant learns new number system and produces numbers using the newly learned #s	65
Speed of Processing	RAN	Timed rapid naming of an array of digits.	30
Integration of Phonological, Orthographic and Semantic Processing	Spelling Clues	Choose correct definition for phonetically spelled word (orthographic and semantic processing)	30
GERMAN			
Semantic Processing	Receptive Vocabulary	Choose picture to match vocabulary word from an array of four	65
Orthographic Processing	Spelling	Write spelling word heard on audiotape	65
Speed of Processing	RAN	Rapid automatized naming of an array of digits. Timed	65
German Composite	Composite	Composite of 3 German measures: Semantic, Orthographic, and Speed	65

Because of the additional tasks, not all tasks were administered to all 65 participants. The English spelling, English vocabulary, English phonological composite (elision, nonword repetition, number learning), and the German spelling, vocabulary, and rapid automatized naming (RAN) measures were administered to all 65 participants. The English spoonerisms, phoneme reversal, RAN, and spelling clues were added during Phase III of data collection and were administered to 30 participants.

Instrumentation

Standardized tests, adaptation of standardized tests, and experimental procedures were used to collect data on the participants' language skills in both English and German. Each measure will be described in detail, including scoring procedures.

English Language Measures: Five Domains

English semantic processing was evaluated using a receptive vocabulary test. Items from the *Peabody Picture Vocabulary Test – Revised* (Dunn & Dunn, 1981) were presented on an overhead projector. The researcher produced the target vocabulary word. Participants chose the picture that best matched the target word and circled the number corresponding to that item on their answer sheet. There were 20 receptive vocabulary words (selected from items 148-167 from the *Peabody Picture Vocabulary Test - Revised*). These stimulus items are listed in Appendix D. Each item was scored as correct if the appropriate item number was circled. Each participant's error rate on the task was reported (i.e., low error rate indicates good performance). This task was administered to all 65 participants in groups of three to fourteen students.

English orthographic processing was evaluated using selected items from the Spelling portion of the *Wide Range Achievement Test – Revised* (Jastak & Wilkinson,

1984). Stimulus items included 25 words selected from the more difficult (end) of the test (Items 16-40 on the "Blue" form of the *Wide Range Achievement Test - Revised*). A list of these stimulus items is included in Appendix D. The researcher pronounced the word to be spelled and used it in a sentence. Participants wrote the target word on a blank on their answer sheet. Stimulus words progressed in difficulty. Rather than using the standard correct/incorrect scoring procedure, each word was scored based on the number of graphemes that were correctly spelled. This more detailed scoring was used to evaluate the participants' knowledge of graphophonemic representation in words that they misspell. Again, error rates were reported for the spelling task, based on the scoring procedure just described. The spelling task was administered to all 65 participants in groups of three to fourteen students.

English phonological processing was evaluated using several measures of phonemic awareness and phonological memory. A composite score was also computed for analysis purposes.

Phonemic awareness was evaluated with the following three measures.

- *Elision*, a subtest of the *Comprehensive Test of Phonological Processing* (CTOPP) (Wagner, Torgesen, and Rashotte, 1999), is a sound manipulation task that requires the participant to take out a phoneme from the target word and say the new word (e.g., "say driver without the /v/" = dryer). Elision was administered during an individual data collection session. This subtest has 20 items. Error rate was determined for each participant. The elision subtest has a test-retest reliability of r=.77 for individuals 18 years and older.

- *Phoneme reversal*, another subtest of the CTOPP, is an 18-item task during which the participant hears a word pronounced backward on an audiotape and must reverse the sounds to make a word (e.g., "say *neves* backwards" = seven). Rate of error was reported. Phoneme reversal has a test-retest reliability coefficient of r=.81 for individuals 18 years and older.
- *Spoonerisms*, a researcher-constructed task widely used to measure phonological awareness, requires the participant to reverse the initial sounds in two words (e.g., birthday cake = *kirthday bake*). Accuracy (error rate) and speed (in seconds) for the entire list were measured. The "Spoonerisms Total" score was calculated by adding each participant's accuracy and speed. The ten stimulus items chosen for the spoonerisms task are shown in Table 3-2, below.

Table 3-2. Stimulus items for the researcher-designed spoonerisms task.

Stimulus Item	Target Response
table lamp	"lable tamp"
copy paper	"poppy caper"
birthday cake	"kirthday bake"
lazy dog	"dazy log"
barn door	"darn boor"
new car	"kew nar"
four men	"mour fen"
red chair	"ched rair"
potato chips	"chotato pips"
big test	"tig best"

Phonological memory was evaluated using a commonly used task, nonword repetition, as well as a second memory task that taps memory in the context of new word learning. These measures are described in greater detail below.

- *Nonword repetition*, a subtest of the CTOPP, evaluates an individual's ability to accurately repeat nonsense words. In the nonword repetition task the participant hears a nonsense "word" presented on an audio tape. Stimulus items gradually increase in number of syllables and phonological complexity (ranging from one to six syllables). After the word is presented, the participant must repeat the target word exactly to get credit for the item. No partial credit is given. Items are scored as correct or incorrect immediately after the participant produces the nonwords. Error rates were reported. This test was individually administered. The Nonword Repetition subtest of the CTOPP has a test-retest reliability coefficient of r=.67 for individuals 18 years and older.
- *Number learning*, a subtest of the *Modern Language Aptitude Test* (MLAT) (Carroll & Sapon, 1959), evaluates an individual's ability to quickly learn a new number system. The task involves memory, learning strategies, and is timed. This test was administered in a group setting. Participants learned a new number system by listening to an audiotape. They first learned nonsense words representing the numbers one through four (1-4), then 10-40, and finally 100-400. After learning the number system, they were asked to write the one-, two-, or three-digit numbers that they heard on the tape. The auditory presentations of the test items

were rapid. Participants earned credit for each correct digit (out of 43) that they wrote on their answer sheet. Error rates were reported for all 65 participants.

Phonological processing composite was derived for the purpose of data analysis. In order to reduce the number of independent variables, three of the phonological measures were combined into a phonological processing composite score. This score included the error rates for elision, nonword repetition, and number learning. The three error rates were added together. A low composite score indicates better performance and a high composite score indicates weaker performance.

English speed of processing was measured with stimulus materials from the rapid automatized naming of digits subtest of the CTOPP. Each participant was presented with an array of numerals on a page and was asked to quickly say the names of each numeral. Performance was timed and time (in seconds) was recorded. A faster (lower) time in seconds indicates stronger rapid automatized naming ability and a slower (higher) time indicates weaker performance. This subtest was individually administered.

English integration of semantic, orthographic, and phonological processing was measured with the spelling clues subtest of the MLAT. The spelling clues subtest is timed. Participants are given 15 minutes to complete 50 items. The participant must choose the one word out of five printed words that corresponds most nearly in meaning to the target word. An example of this task is for the target word "luv", with the choices: carry, exist, affection, wash, spy. The participant circled the word most closely related to "love", which was "affection". Error rate was recorded for each participant.

German Language Measures: Four Domains

German semantic processing was evaluated using a receptive vocabulary test. The procedure was similar to the English Semantic Processing task and was researcher-designed and constructed. Target words were selected from textbook chapters that were covered over the course of the semester. Students should have had at least minimal exposure to each stimulus item. The author consulted with a faculty member from the German department to confirm that a representative variety of semantic and phonological forms were selected. To ensure consistency of presentation, the target vocabulary words were presented via audiotape. The stimulus items were produced and recorded by a student who had taken several courses in the German department, leading to an academic minor in German. Stimulus items are listed in Appendix E.

As in the English semantic processing task, the participants selected the picture that best matched the target word and circled the number corresponding to that item on their answer sheet. There were 25 stimulus items that were scored as correct/incorrect. Error rate was recorded. This task was administered in a group setting to all 65 participants in groups of three to fourteen participants.

German orthographic processing was evaluated using selected items from the textbook chapters. The author consulted with a faculty member from the German department to ensure that a variety of orthographic forms was included. Like the English orthographic processing measure, participants were asked to spell the target word that they heard. Stimulus items were presented via audiotape, and were recorded by a student holding an academic minor in German. These items are included in Appendix E. Items were scored based on the number of graphemes that were correctly spelled. Error rates

were recorded. This task was administered to all 65 participants in groups of three to fourteen participants.

German speed of processing was measured via a rapid automatized naming task. Each participant was presented with an array of numerals on a page and was asked to quickly say the names of each numeral in German. Performance was timed. Time was recorded in seconds. A faster (lower) time in seconds indicates stronger rapid automatized naming ability and a slower (higher) time indicates weaker performance. This subtest was individually administered to all 65 participants.

German composite score was computed to represent foreign language proficiency. Error rates for German semantic processing (receptive vocabulary) and German orthographic processing (spelling) were added to the time for German speed of processing (rapid automatized naming) to obtain a composite score for all German measures.

CHAPTER 4
RESULTS

The primary goal of this study was to provide data to examine the Linguistic Coding Differences Hypothesis (Sparks, Ganschow, & Pohlman, 1989), which states that native language skills influence foreign language learning. Data were collected and analyzed to examine the influence of native language skills on the learning of first-semester German skills in university students.

The results of data analysis are reported for each of the three research questions shown below. Data were analyzed using SAS version 9. Analyses included correlations and multiple regressions. Shavelson (1996) describes these analyses as follows. Correlation analysis identifies the strength of the relationship between variables by providing an index to quantify this relationship. However, correlation does not necessarily imply causation. Linear regression addresses the predictive nature of the relationship between the independent variable(s) and the dependent variable. Linear regression specifies a functional relationship between the variables by fitting a straight line to represent how the dependent variable changes as a result of changes in the independent variable(s). The fitting of a straight line is done by selecting a model that best describes the relationship between the independent variable(s) and the dependent variable (Shavelson, 1996).

Research Question 1: Is there a relationship between native English language skills in: (a) phonological knowledge, (b) orthographic knowledge, (c) semantic

knowledge, and (d) speed of processing; and German foreign language performance, as measured by a composite score on a battery of tests in German?

For Research Question 1, the independent (predictor) variables were English phonological, English spelling, English vocabulary, and English RAN. The dependent (outcome) variable was the German composite score. The German composite score was comprised of German spelling, German vocabulary, and German RAN. Descriptive statistics for the four English predictor variables and the German composite score are shown in Table 4-1.

To answer this question, a correlation analysis between all independent and dependent variables was first performed and is reported in Table 4-2. Multiple regression analysis was then run to determine which of these predictor variables best predicted proficiency in German, which was defined as the score on the German composite.

Table 4-1. Simple Statistics for the Four English Predictor Variables and the German Composite

Variable	N	Mean	Std. Dev.	Sum	Minimum	Maximum
Eng. Phon. Composite	65	43.22	24.01	2809	5	104
English Spelling	65	9.15	4.57	595	0% (error rate)	19% (error rate)
English Vocabulary	65	25.88	13.07	1682	0% (error rate)	60% (error rate)
English RAN	30	11.69	2.75	350.79	8.00 sec.	18.92 sec.
German Composite	65	55.86	21.86	3630.69	25.52	124.30

Table 4-2. Pearson Correlation Coefficients for the Four English Predictor Variables and the German Composite

	Eng. Phon. Composite	English Spelling	English Vocabulary	English RAN	German Composite
Eng. Phon. Composite	---	.36*	.33*	.62*	.33*
English Spelling		---	.33*	.08	.39*
English Vocabulary			---	-.02	.33*
English RAN				---	.26
German Composite					---

* The correlation is significant at $p < .05$

Correlation analyses showed that three of the four English predictor variables were significantly correlated with the German composite score. Significant correlations were found between the German composite (dependent variable) and the English phonological ($r(60) = .33, p < .05$), spelling ($r(60) = .39, p < .05$), and vocabulary ($r(60) = .33, p < .05$) scores. There were also significant correlations among the English predictors (main effects) in the areas of English phonological and English spelling ($r(60) = .36, p<.05$), English phonological and English vocabulary ($r(60) = .33, p<.05$), English phonological and English RAN ($r(60) = .62, p<.05$), and English spelling and English vocabulary ($r(60) = .33, p<.05$). High significance between the main effects implies the presence of interaction effects. In fitting a full model through multiple regression analysis, interaction effects must be taken into account.

For the full model, R^2 was equal to .67, meaning that 67% of the variance for the German composite is explained by the influence of the four predictor variables. The combination of predictor variables strongly contributed to the German composite. As noted above, because there were significant correlations between the predictor variables,

interaction between the variables also produced significant predictors of German proficiency, measured by a composite of select basic German skills. When the full model was considered, including the four predictor variables, there were four significant predictors of the German composite score, as shown in Table 4-3, below. The *English vocabulary* measure was a significant predictor of the composite of select basic German skills ($\beta = 10.02$, $P = .05$). The interactions between *English phonological and English spelling* ($\beta = .40$, $P = .01$); and *English vocabulary and English RAN* ($\beta = -.73$, $P = .05$) were also significant. Finally, one three-way interaction between variables was significant. The interaction between *English phonological, English spelling, and English RAN* ($\beta = -.03$, $P = .02$) was a significant predictor of the German composite score. If the four-way interaction between all four predictor variables was significant, then the full model (including all four predictor variables) would have been significant. However, the four-way interaction was not significant.

Table 4-3. Contributors to the German Composite Score

English Predictor Variables			
Source	Mean Square	F-Value	P-Value
English Phonological	703.83	2.42	.14
English Spelling	125.78	0.43	.52
English Vocabulary	1335.08	4.59	.04*
English RAN	7.75	0.03	.87
Significant two-way interactions			
Source	Mean Square	F-Value	P-Value
E-Phon*E-Spell	2161.31	7.44	.01*
E-Voc*E-RAN	1271.52	4.37	.05*
Significant three-way interaction			
Source	Mean Square	F-Value	P-Value
E-Phon*E-Spell*E-RAN	1779.79	6.12	.02*

*The relationship is significant at $p \leq .05$

To illustrate visually the effect of differential performance, one of the three-way interactions was selected for plotting. Although this interaction was only significant at

p=.08, it was selected for plotting because it contained a wide range of English skills (vocabulary, spelling, and RAN). This example should provide a clear picture of the nature of the relationship between English and German skills.

Figure 4-1, below, demonstrates the differences in English spelling performance trends when English vocabulary and English RAN were held constant at three levels of performance. These variables were held constant for vocabulary and RAN scores at the 25th percentile (best performance = better than 75% of the participants), the 50th percentile (median performance), and the 75th percentile (poorest performance). To plot the trend lines, the vocabulary and RAN values were then inserted into the equation for the three-way interaction. With vocabulary and RAN held constant, the trend lines represent how different English spelling scores affect the German composite score.

Figure 4-1 illustrates the differential performance in the composite of select basic German skills for participants with strong, median, and poor native language skills. For participants with the strongest native English language abilities, spelling performance did not influence the German composite score. Actually, as spelling *error rate* increased (i.e., spelling performance got worse), the German composite score improved. For the group of participants with language abilities in the median range, spelling performance had no effect on the German composite score. The German composite score remained relatively constant as spelling performance decreased (as measured by increasing error rate) for the group in the median range. Finally, and most interestingly, for the participants with the poorest language abilities (those with the highest rate of error), as spelling error rate increased, the German composite score also increased (indicating poorer performance). This differential effect suggests that perhaps strong and weak

performance in foreign language are predicted by different factors. For example, it is possible that poor native language skills predict poor foreign language performance, while strong native language skills do not necessarily predict strong foreign language performance. This possibility will be discussed in greater detail in the following chapter.

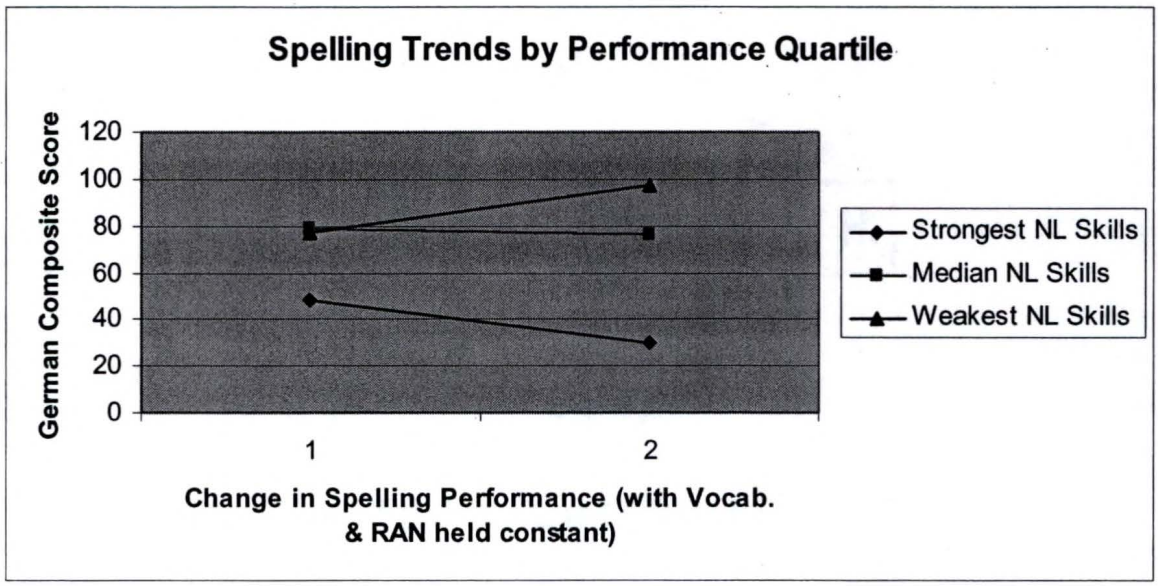

Figure 4-1. Comparison of the Association between English Spelling and the German Composite for Differential Abilities in English Vocabulary and English RAN.

It is important to note that because the RAN task was added during the second phase of data collection, only 30 scores were recorded. For the above analysis, only these 30 participants' scores could be used. RAN is considered to be a measure of speed of processing and does not seem to measure the integrity of a particular processor (e.g., phonological, orthographic, meaning). RAN interacted with other English variables to significantly predict the German composite score. To further examine the predictive relationships between the other three English language measures and the German composite score, a second analysis was performed on all 65 participants' scores. To determine whether English phonological, English spelling (orthographic), and/or English

vocabulary predicted the German composite score, additional regression analyses were performed.

As described in Table 4-2, there were several significant correlations between the English phonological, English spelling, English vocabulary, and German composite variables. Each of the three English measures was significantly correlated with the German composite score ($r(65) = .33$; $r(65) = .39$; $r(65) = .33$, respectively). There were also significant correlations between English phonological and English spelling ($r(65) = .36$), English phonological and English vocabulary ($r(65) = .27$), and English spelling and English vocabulary ($r(65) = .33$). Again, high degrees of correlation imply the presence of interaction effects.

For the full model (including all interactions), none of the coefficients for the main effects (English phonological, English spelling, or English vocabulary) were significant. R^2 was .32 for the full model. However, there were significant interaction effects in the areas of *English phonological and English spelling* (β=.04, P=.05), *English phonological and English vocabulary* (β=-.009, P=.02), and the three-way interaction between *English phonological, English spelling, and English vocabulary* (β=.0005, P=.002). When each individual effect was examined (without considering interaction effects), $R^2 = .23$, only *English spelling* contributed significantly to the German composite score ($\beta = .24$, P=.04).

In summary, when the four English predictor variables were analyzed, all contributed to the German composite score, either alone or interacting with each other. When English RAN was removed from the analysis and the scores of all 65 participants were analyzed, English spelling emerged as a somewhat stronger predictor of the German

composite score than English phonological or English vocabulary skill. Spelling alone significantly contributed to the German composite score, as did the interaction between English spelling and English phonological, the interaction between English phonological and English vocabulary, and the three-way interaction between English spelling, English phonological, and English vocabulary.

Hypotheses Related to Research Question 1

- *Hypothesis:* Based on the Linguistic Coding Differences Hypothesis, it was hypothesized that native English language phonological skills would be associated with German foreign language performance after one semester of instruction.

  Result: This hypothesis was **NOT DIRECTLY SUPPORTED** by the data. While the interaction between English phonological skills and English spelling and English RAN did significantly contribute to the German composite score, the other English predictor variables also contributed. However, English spelling, which incorporates phonological as well as orthographic skills, made a significant contribution to the German composite score, so this hypothesis was partially supported by the data.

- *Hypothesis:* With respect to overall German foreign language proficiency (German composite score), native English language phonological and orthographic (i.e., spelling) skills would more strongly predict German performance than English language semantic skills would.

  Result: This hypothesis was **SUPPORTED** by the data. While English vocabulary made a significant contribution to the German composite in

interaction with the other English predictor variables, English spelling and English phonological made stronger contributions to the German composite score, both independently and in interactions.

<u>Research Question 2</u>: Which specific phonological-orthographic skills (elision, nonword repetition, spelling, spoonerisms, rapid automatized naming, phoneme reversal, spelling clues, number learning) best predict performance in foreign language (German composite score)?

Descriptive statistics for the English language measures are shown in Table 4-4, followed by the Pearson correlation coefficients for all of the English language measures in Table 4-5.

Because of the strong correlations among the English language measures and between the English language measures and the German composite scores, multiple regression analyses were not performed on all of the English phonological predictor variables. Due to the large number of predictors, there would likely be too many significant interactions between variables to make any definitive conclusions. Interestingly, however, the correlations between English spelling clues and the other phonological measures were consistently strong. *Spelling clues* correlated with the *elision* task, $r(30) = .66$, $p < .01$; with the *English spelling* task, $r(30) = .55$, $p < .01$; with the *English vocabulary* task, $r(30) = .54$, $p < .01$; with the *English spoonerisms* task, $r(30) = .54$, $p < .01$; and with the *English phoneme reversal* task, $r(30) = .62$, $p < .01$. The English spelling clues task requires integration of phonological, orthographic, and semantic skills. The task must be completed within a defined period of time, so processing speed is also a dimension of the task.

Table 4-4. Simple Statistics for the English Language Measures

Variable	N	Mean	Std. Dev.	Sum	Minimum	Maximum
Elision	65	11.31% (error rate)	9.65	735	0	40%
Phonological Memory	65	20.72% (error rate)	10.97	1347	0	50%
Number Learning	65	11.18% (error rate)	12.45	727	0	51%
English Spelling	65	9.15% (error rate)	4.57	595	0	19%
English Vocabulary	65	25.88% (error rate)	13.07	1682	0	60%
Spoonerisms	30	74.63 (error+time)	41.02	2239	35.1	198.65
Phoneme Reversal	35	28.03% (error rate)	18.63	981	0	67%
Spelling Clues	36	14.89% (error rate)	12.05	536	2	60%
RAN-Eng.	30	11.69 sec. (time)	2.75	350.79	8	18.92 sec.

Table 4-5. Pearson Correlation Coefficients for the English language measures

	1	2.	3	4	5	6	7	8	9	10
1 Elision	---	.23	**.40***	.23	.23	**.58***	**.62***	**.66***	.27	.27
2 Nonword rep		---	.24	.20	.17	.00	.03	.28	.23	.09
3 # Learn.			---	**.33***	.19	.29	.29	.27	**.73***	**.34***
4 E-Spell.				---	**.33***	**.41***	.27	**.55***	.08	**.39***
5 E-Vocab.					---	**.33***	.06	**.54***	.02	**.33***
6 Spoon. Total						---	**.62***	**.54***	.23	**.36***
7 Ph. Rev.							---	**.62***	**.45***	**.66***
8 Sp. Clues								---	.12	**.53***
9 RAN-E									---	.26
10 Germ. Comp.										---

*** Correlation is significant at the 0.01 level.**

Since the spelling clues task integrates linguistic processing skills of interest in this study, it is not surprising that spelling clues was correlated strongly with many of the other English language measures. However, because the English spelling clues task was added during the second phase of data collection, only 30 participants' scores were available for analysis. A simple regression analysis was performed between the 30 scores

on the English spelling clues task (predictor) and the corresponding scores on the German composite (outcome) to determine if a predictive relationship existed. Spelling clues alone contributed to 24% of the variance in the German composite score (r^2=.24) with a P-value of .0024. Figure 4-2 below illustrates the strength of the predictive relationship between spelling clues and the German composite scores.

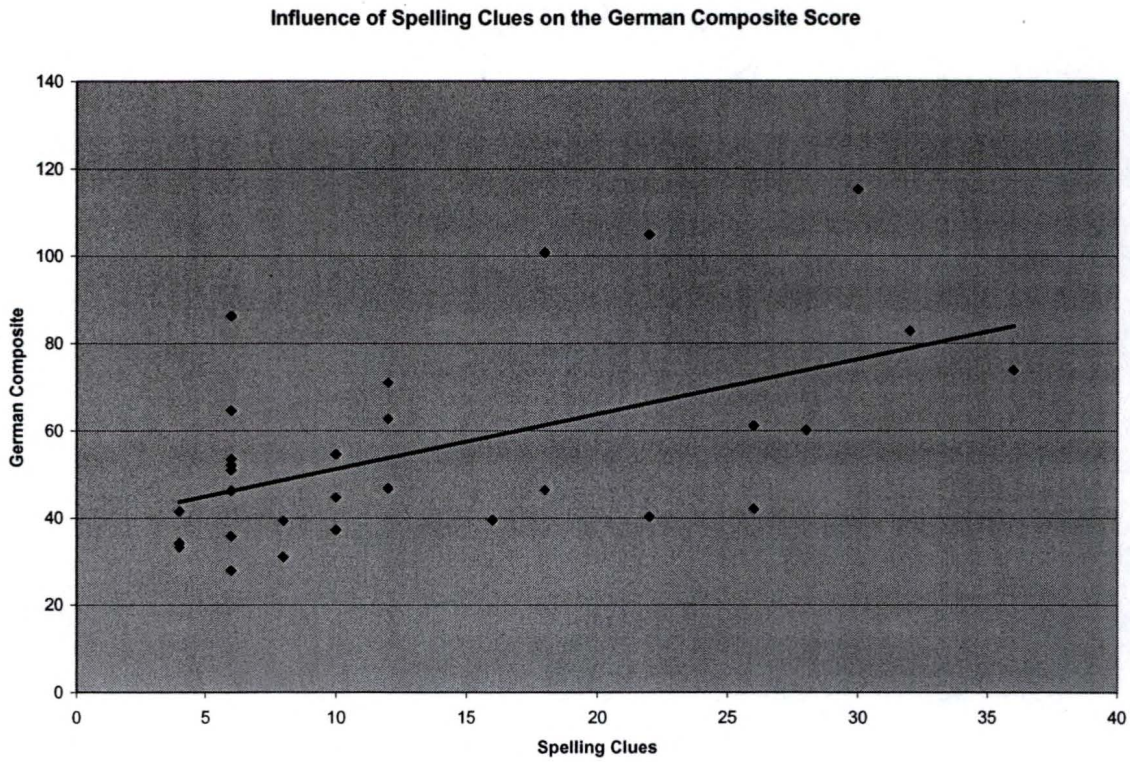

Figure 4-2. Simple Linear Regression Plot of the Association between Spelling Clues and the German Composite.

An even stronger predictive relationship emerged when the four predictors that were most correlated with the German composite were entered into a model. *Phoneme reversal and English spelling* stood out as important in describing the variation in the German composite score. Figure 4-3 (to be added) illustrates the strength of this predictive relationship. The interaction between phoneme reversal and English spelling contributed 62% of the variance in the German composite; and when the two outlier

scores (participants 1 and 13) were removed from the analysis, the predictive power of this interaction was a very strong $r^2 = .78$ (β=.07, P=.0057).

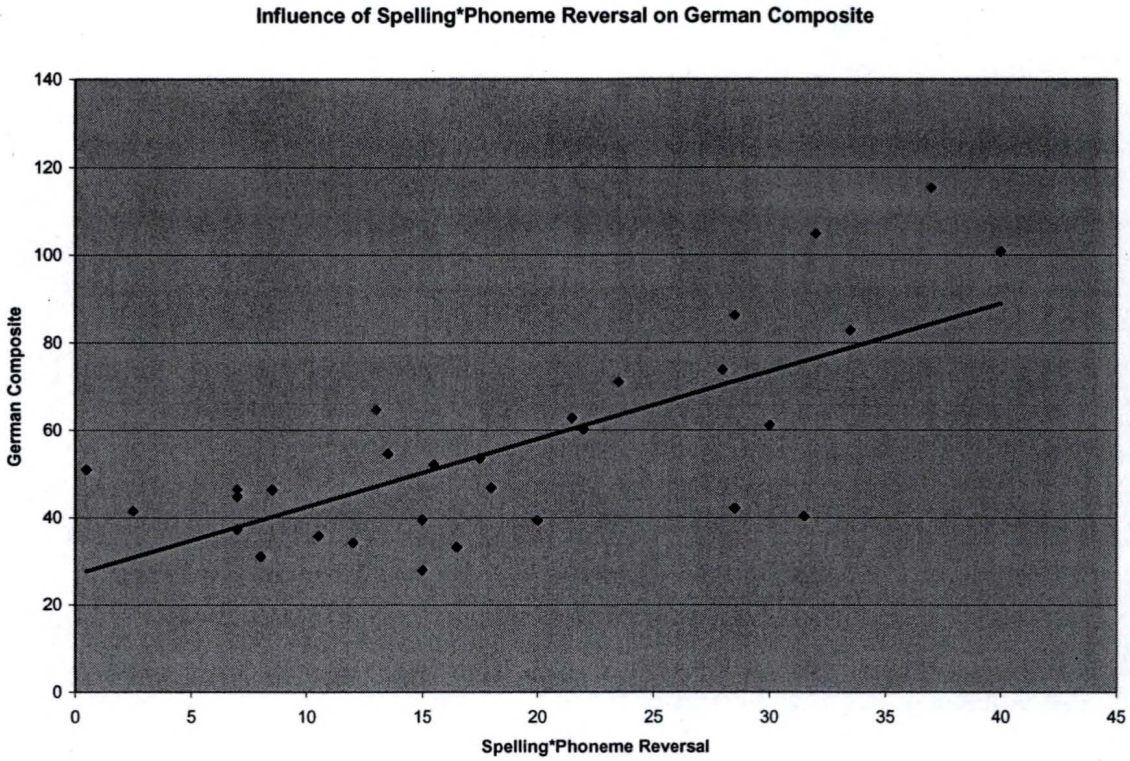

Figure 4-3. Simple Linear Regression Plot of the Association between the Interaction of English Spelling and Phoneme Reversal and the German Composite.

Hypothesis Related to Research Question 2

- *Hypothesis:* Phonological-orthographic skills which are more difficult (spelling, spoonerisms, phoneme reversal, number learning, and spelling clues) will be better predictors of foreign language proficiency (as measured by German composite score) in college students than easier phonological-orthographic measures (elision, nonword repetition, and rapid automatized naming).

  Result: This hypothesis was **SUPPORTED** by the data. The relatively difficult measures of phoneme reversal and spelling clues were most strongly correlated with the German composite score. These measures incorporate more than simply

phoneme manipulation or knowledge of spelling rules. They integrate phonological processing, memory, and semantic knowledge. Spoonerisms, number learning, and English spelling were also significantly correlated with the German composite score. Elision, nonword repetition, and English RAN were not significantly correlated with the German composite score. Although these tasks are commonly used in predictive studies of reading abilities, the tasks were probably too easy for college-age students who have reached a proficient level of literacy. The spelling clues, phoneme reversal, and spelling tasks were predictive because they tap into a higher level of literacy skills, involving the integration of orthographic, phonological, and semantic skills, as well as memory.

Research Question 3: Do native English language skills in spelling, vocabulary, and rapid automatized naming predict foreign language (German) performance in these same areas, indicating cross-language transfer of skills?

To determine whether cross-language transfer of spelling, vocabulary, and RAN skills was present, three separate multiple regression analyses were conducted. For each analysis, the three independent variables were English spelling, English vocabulary, and English RAN. The dependent variables were German spelling, German vocabulary, and German RAN, respectively.

Of the three predictor variables, *English spelling* was the only variable that made a significant contribution to German spelling performance ($\beta = .93$, $P < .0001$, $R^2 = .54$) (see Table 4-6). This indicates that a relationship exists between native language spelling skills and foreign language spelling skills, supporting the idea of cross-language transfer of spelling skills. Taking the three English predictor variables into account R^2 was .54,

meaning that 54% of the variance in German spelling was accounted for by the English predictor variables.

Table 4-6. English Predictors of German Spelling

English Predictor Variables			
Source	Mean Square	F-Value	P-Value
English Spelling	500.38	24.69	<.0001*
English Vocabulary	35.56	1.75	.20
English RAN	49.37	2.44	.13

*The relationship is significant at p ≤.05

The German vocabulary score was significantly associated with the *English vocabulary* score (β = -1.17, P = .01) and the interaction between *English vocabulary and English spelling* (β = .11, P = .003) (see Table 4-7). While cross-language transfer of vocabulary skills was evident, spelling skills had a strong enough influence to make a significant contribution to German vocabulary as well. R^2 was .43. Forty-three percent of the variance in German vocabulary was accounted for by the English predictor variables.

Table 4-7. English Predictors of German Vocabulary

English Predictor Variables			
Source	Mean Square	F-Value	P-Value
English Spelling	261.93	3.84	.06
English Vocabulary	597.97	8.76	.01*
English RAN	13.59	0.20	.66
Significant two-way interaction			
Source	Mean Square	F-Value	P-Value
E-Spell*E-Voc	721.30	10.57	.003*

*The relationship is significant at p ≤.05

Finally, English RAN <u>did not</u> make a unique significant contribution to German RAN (see Table 4-8). English vocabulary seemed to make the strongest contribution to German RAN. Significant associations with German RAN were found for *English vocabulary* (β = 5.21, P = .03), the interaction between *English vocabulary and English spelling* (β = -.43, P = .04), the interaction between *English vocabulary and English RAN* (β = -.39, P = .03), and the three-way interaction between *English vocabulary, English*

spelling, and English RAN ($\beta = .03$, $P = .04$). Although English RAN did not make a significant contribution to German RAN, when English RAN was dropped, the remaining predictor variables became slightly less significant, indicating that English RAN did make a contribution to the German RAN score. R^2 was .51. The English predictor variables accounted for 51% of the variance in German RAN.

Table 4-8. English Predictors of German RAN

English Predictor Variables			
Source	Mean Square	F-Value	P-Value
English Spelling	94.76	1.20	.29
English Vocabulary	436.16	5.50	.03*
English RAN	183.85	2.32	.14
Significant two-way interactions			
Source	Mean Square	F-Value	P-Value
E-Spell*E-Voc	371.59	4.69	.04*
E-Voc*E-RAN	444.10	5.60	.03*
Significant three-way interactions			
Source	Mean Square	F-Value	P-Value
E-Spell*E-Voc*E-RAN	377.24	4.76	.04*

*The relationship is significant at $p \leq .05$

This question addressed the issue of cross-language transfer of specific English language skills to German skills in the same areas. Figure 4-3, below, summarizes the relative contributions (expressed in F-values) of English skills in spelling, vocabulary, and RAN to German skills in these same areas.

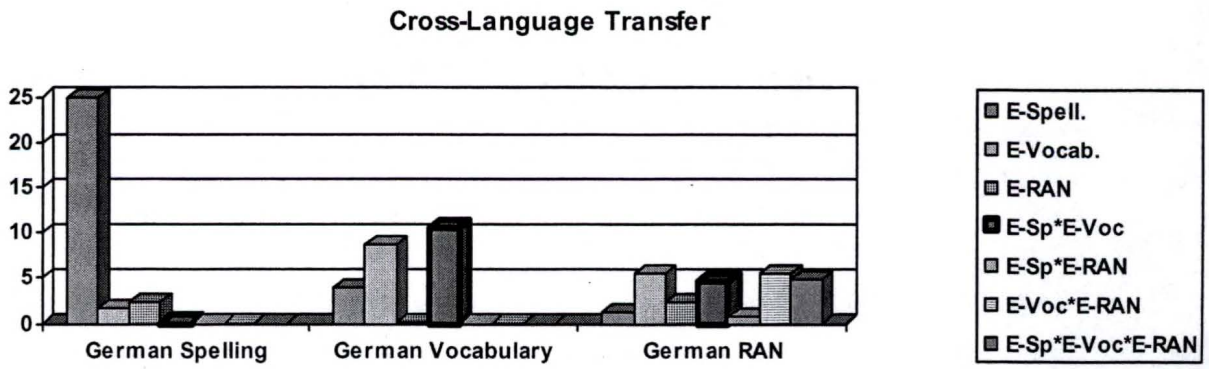

Figure 4-4. Relative Contributions of English Predictors to German Dependent Variables (expressed in F-Values)

Hypotheses Related to Research Question 3

- *Hypothesis*: German spelling would be influenced by English spelling.

  Result: This hypothesis was **STRONGLY SUPPORTED** by the data. English spelling uniquely predicted German spelling.

- *Hypothesis:* German vocabulary would be influenced by English vocabulary skills.

  Result: This hypothesis was **SUPPORTED** by the data. English vocabulary predicted German vocabulary; however English spelling skills also predicted German vocabulary, as did the interaction between English vocabulary and English spelling.

- *Hypothesis:* German rapid automatized naming skills would be influenced by English rapid automatized naming ability.

  Result: This hypothesis was **NOT SUPPORTED** by the data. While English RAN did contribute to the German RAN score, German RAN was better predicted by English vocabulary. This relationship will be discussed in greater detail in the following chapter.

Summary

Native English language skills generally predicted foreign language learning, as measured by the German composite score. Because some of the English language skills were related to each other, interactions between the variables resulted in significant contributions in many cases. No one native English language variable emerged as a unique predictor of the German composite score, although spelling contributed to a somewhat greater degree than the other predictor variables. For the model with four

predictor variables: English spelling, English vocabulary, English phonological, and English rapid automatized naming, English spelling was involved in two of the four significant contributions to the German composite. When English RAN was removed from the model and all 65 participants' scores were analyzed, *English spelling emerged as the strongest predictor of the German composite score.* The interactions between English spelling and English phonological and English spelling and English vocabulary also significantly contributed to predicting the German composite score.

Level of difficulty for phonological skills was also examined. The more difficult phonemic manipulation tasks (e.g., phoneme reversal, spoonerisms, spelling clues) correlated more strongly with the German composite score than did the easier tasks. For college-age students, the simple phoneme manipulation (such as elision) and phonological memory (nonword repetition) tasks did not appear to be sensitive enough to differentiate students' performance. *By far, the strongest predictor of proficiency in German (German composite score) was the interaction between the English spelling and phoneme reversal tasks.*

Analyses for examining cross-language transfer of skills revealed that English spelling uniquely predicted German spelling. English vocabulary and English RAN did not contribute to German spelling. English vocabulary, English spelling, and the interaction between the two variables made significant contributions to German vocabulary. Cross-language transfer of skills was evident. However English RAN did not predict German RAN, as had been hypothesized. German RAN was best predicted by English vocabulary. All of the relationships described in the chapter will be discussed in the following chapter.

CHAPTER 5
DISCUSSION

Overview of Findings

This study explored the relationship between native language skills and foreign language learning ability. The Linguistic Coding Differences Hypothesis states that native language skills influence foreign language learning and that deficits in native language will impact the ability to learn a foreign language. The primary goal of this study was to determine how native language skills in phonological processing, vocabulary, spelling, and rapid automatized naming contribute to the acquisition of select basic foreign language (German) skills. German testing was in the areas of spelling, vocabulary, and rapid automatized naming. The Linguistic Coding Differences Hypothesis claims that phonological processing deficits will affect first-semester foreign language learning.

A related goal of the study was to determine if phonological tasks of varying difficulty were differentially predictive of foreign language skill. Phoneme manipulation tasks have been shown to be reliable measures for predicting reading disability in beginning readers (Catts & Kamhi, 1999). However, a simple phoneme manipulation task (elision) was too easy for college students studied who had achieved a relatively high level of language and literacy. Because the task was not predictive of foreign language ability, this study sought to determine whether more complex phonological processing tasks would better predict foreign language performance.

The third goal of this study was to determine whether cross-language transfer of spelling, vocabulary and rapid automatized naming (RAN) skills was evident between English and German. Previous research had looked at cross-language transfer of phonological skills (Durgunoglu, Nagy, & Hancin-Bhatt, 1993). This study extended the concept to determine if similar transfer of skills occurs for spelling, vocabulary and RAN.

Linguistic Coding Differences

The first research question addressed the relationship between native language skills and foreign language learning. Understanding this relationship can help to clarify why some foreign language learners experience great difficulty, in light of strong performance in other courses.

Previous research on prediction of foreign language proficiency (operationalized as foreign language grades) identified English (native language) course grades and foreign language aptitude as predictors of first-year foreign language course grade. English spelling was also identified as a significant predictor in one of the two experiments (Sparks, Ganschow, & Patton, 1995). A follow-up study on the same group of students after they completed the second year of foreign language study found that end of first-year foreign language grade and foreign language word decoding ability were the best predictors of second-year foreign language grades (Sparks et al., 1997).

In the current study, college students' language skills were determined by performance on various experimental measures. While testing may not be the most comprehensive or accurate measure of foreign language proficiency, for the purposes of this study, test procedures provided a consistent measure that could be used in a standard manner across all participants. Course grade was not considered as a measure of

proficiency because factors such as motivation, class attendance, and participation often contribute to final grades.

Several significant correlations were identified among a number of English language skill measures: (1) English spelling and the English phonological composite, (2) English vocabulary and the English phonological composite, (3) English RAN and the English phonological composite, and (4) English vocabulary and English spelling. These correlations underscore the interdependence of the phonological, orthographic, and semantic processors in English.

Several of the English predictors, either alone or in interaction with other predictors, showed a significant influence on the German composite score. Significant two-way interactions were found between English spelling and English phonological skills and between English phonological skills and English RAN. A significant three-way interaction was found between English spelling, English phonological, and English RAN.

Because the aim of this study was to examine the influence of the predictors on the German composite score, all four English predictors were included in the data analysis. However not all of the predictors contributed to the German composite. When developing a model to identify the best predictors, only the strongest contributors are included. The following section (Phonological Task Levels of Difficulty) identifies the best predictors of the German composite score.

Inclusion of RAN in the analysis demonstrated that speed of processing interacts with the individual processors to influence efficiency of the language processing system. When RAN was removed from the analysis, a cleaner predictive picture emerged. When

the four predictors were analyzed, only 30 participants' scores could be used because the RAN task was only administered during the second phase of data collection. Without RAN, the analysis of all 65 participants' scores yielded significant contributions by English spelling and by the interactions between English spelling and English vocabulary and between English spelling and English phonological.

It was predicted from the Linguistic Coding Differences Hypothesis that the English phonological composite would contribute to first-semester German proficiency. The Linguistic Coding Differences Hypothesis states that deficits in phonological processing would negatively affect foreign language performance during the first semester of study. This relationship was not directly supported. English phonological did not uniquely or significantly contribute to the German composite. One reason for this is because of the significant correlations between English phonological and the other predictor variables. Significant correlations between predictors imply significant interaction effects between variables. The English phonological score was involved in three significant interactions.

Another potential explanation for the result is that the tasks comprising the English phonological composite were too simple for college students who had a relatively high level of language and literacy skills. Although the elision and nonword repetition tasks are commonly used to predict reading and language abilities in young children, they were not sensitive enough to predict foreign language learning in adults. Sparks, Ganschow, and Patton (1995) reported a similar finding when they had hypothesized that the *Lindamood Auditory Conceptualization Test* (Lindamood & Lindamood, 1979) would predict first-year foreign language proficiency in high school students. The test was not

predictive. The authors suggested that it was not a good measure because most students achieved a high score on the test (ceiling effect).

In the current study, the English spelling task was at a more appropriate level of difficulty for college students, which is likely the reason for the stronger association between spelling and foreign language learning. It is important to note, however, that spelling involves phonological processing, in addition to orthographic processing.

In the English spelling task, the examiner dictated the target word and then used the word in a sentence. The participants wrote down the target word on their answer sheets. Responses were scored based on the percentage of phonemes correctly/incorrectly spelled. Each word was not scored as simply correct or incorrect. Rather, the participant was given credit for the number of correctly spelled phonemes. For example, in the word "reasonable" there are eight phonemes to be correctly spelled. If all eight phonemes were not correctly spelled, the participant would receive a proportion of credit.

Graphing the relationship between English spelling and the German composite, with English vocabulary and English RAN held constant, yielded an interesting relationship. This analysis suggested that perhaps strong and weak native language skills contribute to foreign language learning in different ways. Although only one relationship was illustrated, it is possible that relatively strong native language skills are a necessary but not sufficient criterion for successful foreign language learning, while weak native language skills strongly predict struggle in foreign language learning.

Cheung (1996) discussed similar differential effects in twelve-year-old native speakers of Chinese who were learning English. He found that in students with strong

second language vocabulary, phonological ability was less predictive, while in individuals with weak second language vocabulary, there was a strong relationship between native language phonological skills and second language vocabulary.

Obler (1989) described the characteristics of an individual with particularly strong foreign language learning abilities. This individual was able to learn languages within a few weeks simply by being exposed to them. Some of his characteristics appear to contradict the Linguistic Coding Differences Hypothesis. First, the subject reported that his reading is slow and laborious, both in native and foreign language. On standardized testing, his intellectual functioning was in the average range (full scale IQ of 107). He did, however, demonstrate significant strengths in vocabulary and any task requiring the acquisition of a new code system. His verbal memory was also outstanding.

Sparks, Ganschow, and colleagues do not address the idea of verbal memory at any great length. In discussing foreign language learning difficulties, they focus on phonological and orthographic processing as well as syntax and semantics. It is possible that phonological/orthographic processing deficits are associated with foreign language learning problems, while strong phonological and orthographic skills are a necessary but not sufficient pre-requisite for successful foreign language learning. Perhaps in addition to strong phonological and orthographic skills, an individual also needs a strong verbal memory in order to be a successful foreign language learner. In the current study, there was some indication that memory played a role, particularly in the area of phoneme reversal, which will be discussed in the following section.

As Spolsky (1989) discussed, several areas contribute to successful foreign language learning. There is no one-to-one best predictor of foreign language learning

success. Results of this study underscored the interaction among several predictor variables. It is possible that the more strong predictors an individual learner has, the more successful he or she will be at foreign language learning. Each individual has a profile of relative strengths and weaknesses. Certain strengths can compensate for areas of weakness; but sometimes an area of weakness is so significant, or there are not enough strong areas to compensate, that a disability is manifested.

Phonological Task Levels of Difficulty

The second research question examined the effect of task difficulty on the predictive nature of the phonological measures. Correlation analysis yielded strong correlations between several of the English language measures. The spelling clues task was significantly correlated with several of the other English language measures and with the German composite score. Because correlation does not imply causation, spelling clues was examined more closely. A simple regression analysis was conducted. A significant regression analysis has stronger implications for demonstrating predictive relationships than correlation does. A significant association was found between spelling clues and the German composite.

The spelling clues task incorporates spelling, phonological processing, and semantic abilities, so it is not surprising that the task was correlated with the other predictor measures. Although this regression analysis was conducted on only 30 participants' scores, it is likely that analysis of more scores would yield similar results.

A very strong predictor of the German composite score emerged from the interaction between English spelling and phoneme reversal. Spelling involves knowledge of orthographic expectancies, as well as phonological processing to understand the

relationship between the sounds and their graphemic representations. In the phoneme reversal task, participants heard a word pronounced backward on an audiotape (e.g., "Say *neves* backwards"). They had to identify the target word by reversing the phonemes ("seven"). This task requires knowledge of the phonological system as well as short-term verbal memory, particularly as the stimulus words got longer.

The finding that more sensitive phonological skills are associated with foreign language learning relates to the persistence of phonological processing deficits. As Wilson and Lesaux (2001) noted, individuals with a history of reading problems performed significantly worse than controls on phonological tasks, particularly on tasks involving phoneme deletion, a phonological segmentation and manipulation task, and spoonerisms, a task that involves phoneme manipulation and is often timed.

Snowling, Nation, Moxham, Gallagher, and Frith (1997) also found that students with dyslexia had more difficulty than controls on nonword reading, phoneme deletion, spoonerisms, and phonemic fluency tasks. Similarly, Gallagher, Laxon, Armstrong, and Frith (1996) found that college students with a history of dyslexia performed worse than controls on nonword reading and spelling accuracy; and spoonerisms, digit naming, and speech rate tasks. Together these studies demonstrate that phonological processing problems are persistent. Phonological processing problems initially contribute to difficulties learning how to read and later manifest as difficulties learning foreign language.

Cross-Language Transfer of Skills

The third research question addressed the issue of cross-language transfer of skills. Beginning foreign language learners are typically stronger in some skills than

others (such as reading vs. writing; listening vs. speaking). Studying the variables that contribute to German spelling, vocabulary, and rapid automatized naming provided a better understanding of the particular predictor variables most strongly associated with each area.

In the area of spelling, English spelling made a significant and unique contribution to German spelling. English vocabulary and English RAN did not significantly contribute to German spelling. German is a more transparent language than English, meaning that German has a closer to one-to-one system of letter sound correspondence. Participants who were better spellers in English were also better able to learn the spelling rules in German. The concept of cross-language transfer of phonological skills had been previously discussed by Durgunoglu, Nagy, and Hancin-Bhatt (1993). Spelling involves phonological processing so it follows that English spelling would be associated with German spelling.

In the area of vocabulary, English vocabulary significantly contributed to the prediction of German vocabulary; however English spelling and the interaction between English vocabulary and English spelling also made significant contributions to German vocabulary. Perhaps the phonological processing aspect of spelling helps learners of a foreign language acquire new vocabulary words. Individuals with strong phonological skills can more easily learn the new word forms in the target language. Service (1992) studied the relationship between phonological and vocabulary skills in younger foreign language learners. She noted predictive relationships between native language phonological skills and foreign language vocabulary learning. Results of the current study suggest that this relationship may hold for older foreign language learners as well.

Finally, in the area of RAN, the German RAN was not predicted by English RAN, as was hypothesized. English vocabulary skills made a stronger contribution to German RAN. A possible explanation for this is that the RAN task in German may have less to do with speed of processing than with an individual's ability to learn the names for the numerals. Individuals with stronger native language vocabulary skills may be better able to learn the names of new vocabulary words (letter names) and have an easier time accessing them for production. Another possible explanation for why English RAN did not predict German RAN is that after only one semester of foreign language study, automaticity is not yet established in the new language.

Summary of Research Questions

Consistent with previous findings, English spelling emerged as a somewhat stronger predictor of the German composite score than English vocabulary, English phonological, or English RAN were. However interactions between all predictors support the idea that phonological, orthographic, and semantic processing are inter-connected.

Although most phoneme manipulation tasks are predictive of reading skills for adolescents and adults with learning disabilities, for college students without disabilities, some tasks were too easy. Ceiling effects were evident. For the population in the current study, phonological tasks which also integrated orthographic processing, semantics, and/or memory emerged as better predictors of foreign language learning abilities.

This study also looked at the concept of cross-language transfer of skills between native and foreign language. Cross-language transfer of specific skills was evident in the

areas of spelling and vocabulary. English skills in these areas predicted German skills in the same areas. The relationship did not hold for rapid automatized naming.

Profiles of select participants' performance highlight the issues addressed in this study. In the following section, the performance of students who demonstrated particularly weak foreign language learning, particularly weak native language skills, particularly strong foreign language skills, and particularly strong native language skills will be discussed. The performance of students who reported a history of learning problems will also be described.

Profiles of Select Participants' Performance

This study included a range of foreign language learners, from strong to weak, as defined by the German composite score. This section contains in-depth information on participants who were very successful at the foreign language tasks in this study (i.e., "good foreign language learners"), participants who struggled with the tasks, and participants who reported a history of language learning difficulties. Salient characteristics of good and struggling foreign language learners are discussed. Support for the hypothesis that native language skills underlie foreign language learning abilities will be discussed, including examples of predictive relationships between the English and German measures in participants whose scores were high and low.

Profiles of Strong Foreign Language Learners (Low Rate of Error/Fast Time on the Experimental Measures)

Good German composite score. Two participants who did well on the tests of select basic German skills were Participant #35 and Participant #58. Their performance on the experimental measures and reported learning background will now be described.

Participant #35 was a 29-year-old male majoring in computer science. He reported studying Spanish and Latin in the past and reported that he did well in these courses. This participant was involved in phase 1 of the study, so only the basic phonological, spelling, and vocabulary tests were administered. Of particular importance is that Participant #35 was the only participant who did not make any errors on the English spelling test. He also had the best score on the German spelling test, making only one slight error. Interestingly, this participant did not do very well on the nonword repetition task (22% error rate), however as discussed in the Methods and Discussions sections, this task did not seem to contribute to the performance of college students learning a foreign language.

Participant #58 was a 22-year-old male double majoring in math and English. He reported a history of studying Spanish, Latin, and Dutch. He is fluent in Spanish. This student reported high scores on both the verbal and quantitative portions of the SAT (750 and 760 out of 800, respectively). These high scores are probably indicative of high intelligence. All phonological measures were administered to this participant, as he was involved in phase 2 of the study. He did well on most of the English measures, again with the exception of nonword repetition (33% error rate). He did particularly well on the spoonerisms task.

Good English predictor scores. To examine the influence of English predictor scores on German composite scores, performance of participants who did exceptionally well on the English predictor tasks will now be discussed. As mentioned above, Participant #35 did exceptionally well on the English spelling as well as the German spelling. He also did well on the German vocabulary measure, missing only one item.

Participant #38 was a 23-year-old male majoring in classical studies. He reported that initially he was a physics major but preferred studying language. He has studied Latin, Greek, French, and Spanish and earned grades of "A" in all of these classes. This student reported his SAT scores were 800 verbal and 740 math (each out of 800). On the English experimental measures, Participant #38 made no errors on the elision, phoneme reversal, spoonerisms and number learning tasks and had only a 1% error rate on the English spelling. In German, he did well on the vocabulary and spelling measures but was relatively slow on the German RAN task. His English RAN score was very fast. As a result of the difficulty with the German RAN task, the German composite score was in the median range (33rd out of 65).

Participant #14 was a 22-year-old male double major in philosophy and molecular biology. He reported that his verbal SAT score was 800 out of 800 and he made no errors on the English vocabulary test. He also did well on the nonword repetition, elision, spelling, and number learning measures. His German spelling and vocabulary scores were strong, however as a consequence of his "average" German RAN score, Participant #14's German composite score was ranked 19th out of 65 participants.

Profiles of Weak Foreign Language Learners (High Rate of Error/Slow Time on the Experimental Measures)

Poor German composite score. Participants #3 and #56 did particularly poorly on the German composite measure. Characteristics of these participants will now be described.

Participant #3 was a 20-year-old female Business Administration major. Her German composite score was the poorest of all of the participants. She reported studying Spanish in the past and did not report a history of learning problems. She struggled with

all of the English language measures, ranking among the poorest performers in each measure. She experienced particular difficulty with vocabulary, elision, and nonword repetition.

Participant #56 was an eighteen-year-old female majoring in Political Science. She did not report a history of learning difficulties but rated her own spelling abilities as "poor". She participated in phase 2 of the study, so all of the phonological measures were administered. She had particular difficulty with the phoneme reversal task, the timed aspect of the spoonerisms task (taking over two minutes to complete the 10-item task), and the English vocabulary measure. German vocabulary and rapid automatized naming were particularly difficult for this participant, contributing to her poor score on the German composite measure.

Poor English predictor scores. Participants #47 and #52 had a great deal of difficulty with the English spelling test. Participant #47 will be described in greater detail below because he reported a history of learning problems. His difficulty with English spelling predicted a poor score on the German spelling measure, which contributed to a poor German composite score. Participant #52 did poorly on the English spelling and the English vocabulary measures, as well as the German spelling and Vocabulary measures.

Participants #10, #16, and #21 struggled with the English vocabulary measure which corresponded to poor German vocabulary performance.

Reported history of learning problems

Two of the participants reported a history of learning difficulties. One reported that he had attention deficit/hyperactivity disorder (Participant #47) and the other reported a history of difficulty learning foreign languages (Participant #46).

Participant #47 had a great deal of difficulty with the phoneme reversal task, the spelling clues task, and the number learning task. These tasks require a certain degree of concentration. It is possible that this participant's attention problems affected his performance on these tasks. His German composite score was in the poor range (63rd out of 65).

Participant #46, who reported a history of foreign language learning difficulty, had difficulty with the phoneme reversal task and the nonword repetition task; however his German skills were all within the average range, in comparison to the other participants. He appeared to be a very motivated student who was taking the course for personal growth rather than to fulfill the requirements for a degree. Compared with the other participants, is German composite score ranked 35th out of 65.

Participant #61 did not report a history of learning problems on her questionnaire but verbally expressed that she felt that the experimental phonological tasks were difficult for her. She also said that she did not understand why she had such a high score on the verbal SAT (700 out of 800), is getting As in her other courses, and expected to get a B in German. She demonstrated good insight into her situation when she said, "I guess it's too late for *Hooked on Phonics*." Compared to the other participants, Participant #61 had the most difficulty with the phoneme reversal task (24th out of 30) and English spelling (45th out of 65). Because of her strong vocabulary skills, she did relatively well on the

spelling clues test. However her German composite score was 60th out of 65. She struggled with the German spelling and RAN measures.

Summary – Anecdotal Reports

These anecdotal reports provide support for the hypothesis that native language skills influence foreign language learning. In general, strong skills in English predicted strong skills in German; and weak English skills predicted weak German learning.

Limitations and Future Directions

Limitations of this study include the fact that only one foreign language was studied. Results may not be able to be generalized to other foreign languages that are more or less transparent than German. Also, this study involved college students. Younger learners may learn foreign languages in a different way, so the results of this study may not apply to younger learners. Also, this study only looked at foreign language learners in a classroom setting. Criteria for foreign language learning in an immersion environment may vary.

Future directions for research in the area of foreign language should include study relationships between English and languages with various sound and syllable structure (i.e., varying degrees of granularity and transparency). It would also be interesting to study foreign language learners at different ages to further investigate the idea of a critical period for foreign language learning. Comparing predictors of proficiency in immersion learning versus classroom learning could yield some interesting relationships. This study touched on the possibility that strong and weak native language skills may affect foreign language learning in different ways. This relationship should be looked at in greater depth. Finally, since the spelling clues subtest of the *Modern Language*

Aptitude Test was such a strong predictor of foreign language proficiency, the entire test should be examined in greater detail and possibly standardized. The published norms are outdated and incomplete. It would be valuable to have updated information on this instrument.

Clinical Implications

Because foreign language is required for many university degrees, it is important to understand the skills that are necessary for successful completion. If a student is struggling through the foreign language requirement, he or she may spend an inordinate amount of time on this class, possibly at the expense of other courses. The student may also receive a failing grade, which will affect his or her grade point average and may result in diminished self-esteem. If the student can better understand the nature of the learning difference, he or she will be able to be a better self-advocate.

After the *Guckenberger vs. Boston University* (1998) ruling that gave universities increased discretionary power in the granting of foreign language course waivers, fewer institutions are offering this option to students with learning disabilities. Students must complete foreign language courses with academic accommodations. Understanding foreign language learning problems can help institute appropriate course accommodations so that students with learning problems can successfully fulfill foreign language requirements. Examples of such accommodations include: use of note-takers, audiotaping class lectures, access to textbooks on tape, breaking large amounts of information into smaller segments, extended test-taking time, taking tests in a distraction-free environment, and alternative test formats (such as written instead of oral tests, or vice versa).

Siegel (1999) emphasized that the accommodations should specifically relate to the nature of the learning disability. For example, if a student has trouble processing auditory information, he or she would benefit from audiotaping class lectures in order to review the material after class. On the other hand, for a student who is a slow reader, extended test-taking time would be an appropriate accommodation.

DiFino and Lombardino (in press) recommended specific strategies to assist struggling foreign language learners. An example is the use of color-coded index cards for students having difficulty memorizing the gender of nouns (i.e., pink for feminine, blue for masculine, and yellow for neutral). These authors also developed a checklist to help foreign language instructors identify "red flags" which could be associated with foreign language learning problems (e.g., confusion during class, presence of unexpected spelling errors, and difficulty with memorization).

Understanding the contribution of native language skills to foreign language learning can also help in the development of modified or remedial foreign language instructional strategies. Modified foreign language courses can be taught in ways that match students' learning abilities and maximize their potential for completing the course. Sparks, Ganschow, Kenneweg, and Miller (1991) described how a multisensory, structured language approach which involves explicit teaching of phonology could be incorporated into foreign language instruction. Sparks, Ganschow, Pohlman, Skinner, and Artzer (1992) extended this work when they compared instructional methodology for three groups of struggling foreign language learners. One group received multisensory instruction and explicit teaching of the phonological system of both native and foreign language (MSL/ES). The second group only received multisensory/explicit instruction in

foreign language (MSL/S). The third group of struggling learners received only traditional instruction without explicit instruction of the phonological system of the foreign language (NO-MSL). Both MSL groups made gains in foreign language aptitude and the MSL/E group also made gains in native language phonology, vocabulary, and verbal memory. The NO-MSL did not make gains in either native language skills or foreign language aptitude. Foreign language performance in these modified courses was not discussed (Sparks, Ganschow, Pohlman, Skinner, and Artzer, 1992).

Goulandris (2003) explained that the manifestation of dyslexia is less prevalent in languages that are transparent. These languages have a strong sound-symbol correspondence; and instruction typically involves a direct phonics approach. The combination of these two factors helps to minimize the effects of phonological processing deficits, which are often associated with reading problems. If foreign language study, particularly in transparent languages, incorporated a similar emphasis on the sound system, perhaps foreign language learning problems would be minimized.

Conclusions

In summary, this study provided support for the Linguistic Coding Differences Hypothesis by examining a range of foreign language learning abilities. For a sample of 65 college students enrolled in a first-semester German course, native language skills influenced foreign language learning. The effect of task difficulty in the area of phonological skills was also examined. A simple phoneme manipulation task (elision) was too easy for college students who had achieved a relatively high level of language and literacy. The more complex phonological tasks that also incorporated orthographic and/or semantic skills were better predictors of foreign language performance. Finally,

this study demonstrated cross-language transfer of skills in the areas of spelling and vocabulary.

APPENDIX A
INSTITUTIONAL REVIEW BOARD (IRB) PROTOCOL

PROTOCOL # 2003-4-121
REVISED (Tasks, Number of Participants)

1. TITLE OF PROTOCOL: The Influence of Native Language Skills on Foreign Language Learning: Phonological and Semantic Contributions (Protocol # 2003-4-121)

2. PRINCIPAL INVESTIGATOR(s): (Name, degree, title, dept., address, phone #, e-mail & fax): Gerianne M. Gilligan, M.A., Doctoral Candidate, Communication Sciences and Disorders, 435 Dauer Hall, 392-2041, gerianne@ufl.edu, fax: 846-0243

3. SUPERVISOR (IF PI IS STUDENT): (Name, campus address, phone #, e-mail & fax): Linda J. Lombardino, Ph.D., Professor, Communication Sciences and Disorders, 336 Dauer Hall, 392-2113, llombard@csd.ufl.edu, fax: 846-0243

4. DATES OF PROPOSED PROTOCOL: From: 2/3/03 To: 12/31/03

5. SOURCE OF FUNDING FOR THE PROTOCOL (As indicated to the Office of Research, Technology and Graduate Education): None

6. SCIENTIFIC PURPOSE OF THE INVESTIGATION:
The purpose of this investigation is to describe how native language skills in phonology, orthography, and semantics contribute to learning a foreign language. By looking at these areas of native language ability, we hope to better understand the difficulties experienced by some foreign language learners, as well as the strengths of "good" foreign language learners.

7. DESCRIBE THE RESEARCH METHODOLOGY IN NON-TECHNICAL LANGUAGE. The UFIRB needs to know what will be done with or to the research participant(s).

Dr. Sharon Difino, Associate Professor of German and coordinator of all teaching assistants in the Department of German and Slavic Languages, is involved in this study and will help with the coordination of this project. Participants are enrolled in a first-semester German course, with no prior exposure to the language. During enrollment in the course, native language skills will be evaluated through individual and group testing of English phonological (phonological awareness and phonological memory),

orthographic (reading, spelling), vocabulary, and acquisition of code (ability to quickly learn a new numeric code system). These skills are not influenced by instruction in a foreign language. Administration of the native language (English) tasks will involve about 45 minutes of tests administered to a group of students and individually scheduled sessions of 15 minutes, for a total of 60 minutes of English language testing (across three sessions). At the end of the semester, acquisition of select basic German skills will be evaluated by group administration of vocabulary and spelling tests. German language testing will involve about 15 minutes of testing. The following table describes the tasks.

Language	Skill	Description	Time
English	Vocabulary	Group administration. An array of four pictures will be presented on overhead projector. Examiner (PI) will say word. Participants will write the # of the picture that corresponds with the word.	10 min.
	Spelling	Group administration. Examiner will say words for participants to write.	10 min.
	Number Learning (Verbal Working Memory)	Group administration. Nonsense words to represent numbers. Participants' ability to learn new "numbers" is evaluated. Example of task: "ba" is 1, "baba" is 2, dee is 3, "tu" is 20, "ti" is 30. What is "ti-ba", what is "baba". This is a subtest from the *Modern Language Aptitude Test* (Carroll and Sapon, 1959).	10 min.
	Spelling Clues (integration of phon. and vocabulary)	Group administration. Task taps into vocabulary and phonological knowledge. Participant sees a word such as "knfrns" and must choose the appropriate definition from a field of five. The appropriate definition for this example would be "discussion meeting" (conference). This is a subtest from the *Modern Language Aptitude Test.*	15 min.
	Phonological Awareness	Individual administration. Spoonerisms task. Examiner will say two words (e.g., Walt Disney) and participant will be required to switch the initial sound in each part ("Dalt Wisney").	2 min.
		Individual administration. Elision task (from the *Comprehensive Test of Phonological Processing*, Wagner, Torgesen, & Rashotte, 1999). Participant says a word such as "driver" and then is asked to say the word again, without one phoneme (e.g., "v"). Participant must say "dryer".	4 min.

Language	Skill	Description	Time
English	Phonological Awareness (cont.)	Individual administration. Phoneme Reversal task (from the *Comprehensive Test of Phonological Processing*, Wagner, Torgesen, & Rashotte, 1999). Participant hears individual phonemes which, when reversed, make up a word. Participant must provide the real word.	4 min.
	Phonological Short-term Memory	Individual administration. Nonword repetition task (from the *Comprehensive Test of Phonological Processing*, Wagner, Torgesen, & Rashotte, 1999). Participant repeats multi-syllabic nonwords that are presented on audiotape. Must be repeated 100% accurately.	4 min.
	RAN	Individual administration. Naming a series of numbers in English. Timed task.	1 min.
German	Vocabulary	Group administration. Similar to English vocabulary task with German words.	8 min.
	Spelling	Group administration. Similar to English spelling task, with German words.	7 min.
	RAN	Individual administration. Naming a series of numbers in German. Timed task.	1 min.

8. POTENTIAL BENEFITS AND ANTICIPATED RISK. (If risk of physical, psychological or economic harm may be involved, describe the steps taken to protect participant.)

No risks are anticipated. Findings of the study are intended to better understand the difficulties experienced by some students when learning a foreign language. When difficulties are understood, modifications to traditional foreign language courses can be developed, rather than granting waivers to all students experiencing difficulty. With appropriate accommodations and/or modifications, students with disabilities can more fully participate in the curriculum developed by the University.

9. DESCRIBE HOW PARTICIPANT(S) WILL BE RECRUITED, THE NUMBER AND AGE OF THE PARTICIPANTS, AND PROPOSED COMPENSATION (if any):

Students enrolled in first-semester German courses in the German Department will be given the option to participate. For their participation, students will earn 5 points of "extra credit" to be added on to their final examination grade for the course. 65 students will participate in the study, ages 18-45. Students who do not participate will be given the opportunity to write a one-page paper on some aspect of the German language in order to earn 5 points for "extra credit" on the final examination.

10. DESCRIBE THE INFORMED CONSENT PROCESS. INCLUDE A COPY OF THE INFORMED CONSENT DOCUMENT (if applicable).
Students enrolled in Beginning German I will be invited to participate in this study. For their voluntary participation they will earn five extra credit points added on to their final examination grade. A copy of the Informed Consent document is included as Appendix B.

ATTACHMENTS
Appendix B: Informed Consent
Appendix C: Questionnaire

_____
Principal Investigator's Signature

_____
Supervisor's Signature

I approve this protocol for submission to the UFIRB:

_____
Dept. Chair/Center Director Date

APPENDIX B
INFORMED CONSENT TO PARTICIPATE IN RESEARCH FORM

Project Title: The Influence of Native Language Skills on Foreign Language Learning

Purpose of the study: The purpose of this study is to better understand how native language skills contribute to learning a foreign language.

What will this mean for you? You will participate by taking a variety of tests. Some will be administered to a group of students and others will be scheduled on an individual basis at other times. The total time is about 60 minutes for group administration tests and a total of about 15 minutes individual administration. For your participation, you will earn 5 points of extra credit added to your final examination grade in Basic German.

Criteria for entrance into the study:

- No prior exposure to German, either through coursework or family/friends.
- Enrolled in Basic German
- Absence of sensory deficits

Confidentiality: All information obtained from this investigation will remain classified and your identity will be kept confidential to the extent provided by law. Each participant will be assigned an identifying number and the number will be used when managing data and reporting results. However, it is possible that information obtained from this investigation will be presented at professional conferences and/or published in scholarly journals, and your name will not appear at any time.

Voluntary Participation: Your participation in this study is completely voluntary. There is no penalty for not participating. Once included, you may feel free to withdraw from this investigation at any time. On the questionnaire you do not have to answer any question you do not wish to answer.

Potential Risks involved in the study: There are no known risks to you in this investigation. All of the above procedures and instrumentation for this research are routinely used in clinical and/or research procedures at the Department of Communication Sciences and Disorders at the University of Florida. All procedures are considered non-invasive in nature and you will not be subjected to procedures considered discomforting during the investigation.

Potential benefits: It is possible that we will have a greater understanding of individual variation in foreign language learning. The participants may also gain a greater understanding of their own strengths and weaknesses with respect to native language skills and foreign language learning abilities.

Whom to contact if you have questions about the study: Gerianne M. Gilligan, M.A., Dauer Hall, 392-2041.

Whom to contact about your rights in the study:
University of Florida Institutional Review Board (UFIRB), P.O. Box 112250, University of Florida, Gainesville, FL 32611-2250; Phone: (352) 392-0433

Signed Consent:

I, _____ (PLEASE PRINT YOUR NAME) have read the information contained on this form and give my consent to participate in the research project outlined herein. All procedures have been explained, all questions have been answered, and I have received a copy of the INFORMED CONSENT TO PARTICIPATE IN RESEARCH FORM.

Research Participant: _____ Date: _____

Witness: _____ Date:_____

And/or

Principal Investigator: _____ Date:_____

APPENDIX C
QUESTIONNAIRE

The Influence of Native Language Skills on Foreign Language Learning

General Background Information:

Today's Date:_____ Name:_____

Date of Birth:_____ Male___ Female____

Major area of study:_____

Grade point average:_____

Have you ever taken a foreign language before in high school or college?_____

If so, what language(s)?_____

When did you take them?_____

How did you do in the course(s)?_____

Number of languages spoken at home:_____

Languages:_____

Please describe any exposure you have had to the German language.

_____

Did you have any difficulty learning to read in elementary school? Yes____ No___

Did you receive speech therapy, reading tutoring or any other special assistance in elementary school, middle school, high school, or college? Yes_____ No_____

If yes, please describe:_____

How would you rate your spelling abilities? Good_____ Average____ Poor___

Have you ever been diagnosed with a reading, language, or learning problem? Yes____ No_____

If yes, what was the diagnosis?_____

Does anyone in your family have a reading, language, or learning problem?
Yes___ No__

Do you have:
a) difficulty reading out loud? Yes_____ No_____
b) difficulty comprehending what you read? Yes_____ No_____
c) a history of difficulty learning a foreign language? Yes____ No____

What are your scores on college entrance exams?
SAT: V_____ Q____ A____ ACT: V_____ Q____

Are you right-____ or left-____ handed?

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS QUESTIONNAIRE!

APPENDIX D
ENGLISH STIMULUS ITEMS
(VOCABULARY AND SPELLING)

English Vocabulary Items

1. arrogant
2. confiding
3. tangent
4. inclement
5. trajectory
6. fettered
7. waif
8. jubilant
9. pilfering
10. repose
11. carrion
12. indigent
13. convex
14. embellishing
15. entomologist
16. constrain
17. infirm
18. anthropoid
19. specter
20. incertitude

English Spelling Items

1. surprise
2. believe
3. brief
4. reasonable
5. quantity
6. character
7. success
8. executive
9. decision
10. recognize
11. anxiety
12. opportunity
13. lucidity
14. enthusiasm
15. conscience
16. possession
17. belligerent
18. medieval
19. charlatan
20. cacophony
21. camouflage
22. acquiesce
23. pusillanimous
24. malfeasance
25. vicissitude

APPENDIX E
GERMAN STIMULUS ITEMS
(VOCABULARY AND SPELLING)

German Vocabulary Items		German Spelling Items	
21. trinken	to drink	26. schwarz	black
22. schlaffen	to sleep	27. und	and
23. Käse	cheese	28. schwimmen	to swim
24. Hempt	shirt	29. (das) Frühstück	breakfast
25. Tisch	table	30. beschreiben	to describe
26. Uhr	clock	31. (das) Wochenende	weekend
27. Baum	tree	32. (das) Wörterbuch	dictionary
28. lessen	to read	33. (die) Strasse	street
29. schreiben	to write	34. freundlich	friendly
30. Tür	door	35. (die) Tochter	daughter
31. hören	to hear	36. (die) Schwester	sister
32. Hose	pants	37. kochen	to cook
33. essen	to eat	38. jetzt	now
34. Zeitung	newspaper	39. leider	unfortunately
35. spielen	to play (a game)	40. (das) Jahr	year
36. Obst	fruit	41. (das) Deutschland	Germany
37. fliegen	to fly	42. verstehen	to understand
38. Lebensmittel	groceries	43. scheinen	to shine, to seem
39. Schnee	snow	44. ziemlich	fairly, quite
40. besprechen	to discuss	45. wohnen	to live
41. Hugel	hill	46. fleissig	industrious
42. schenken	to give a gift	47. (die) Sprache	language
43. steil	steep	48. neu	new
44. entscheiden	to decide	49. (die) Brezel	soft pretzel
45. volkig	cloudy	50. (die) Hausfrau	housewife

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BIOGRAPHICAL SKETCH

Gerianne Muldoon Gilligan was born on April 25, 1967, in Somerville, New Jersey. She grew up in Mahwah, New Jersey, and graduated from Mahwah High School in 1985. In June 1989, she earned a Bachelor of Arts degree from Bucknell University in Lewisburg, Pennsylvania. She earned a Master of Arts degree in communication sciences (speech-language pathology) from Temple University in Philadelphia, Pennsylvania, in May 1996. Ms. Gilligan has held the Certificate of Clinical Competence in Speech-Language Pathology from the American Speech-Language Hearing Association since 1997 and has been working as a speech-language pathologist in the public schools since 1996. She has worked in Oakland, California, and New York City; and during the time she was completing the degree requirements for the Doctor of Philosophy she worked as a speech-language pathologist in the public schools in Alachua County, Florida.

Upon completion of the Doctor of Philosophy degree, Ms. Gilligan will begin a career as an assistant professor in the Department of Audiology, Speech-Language Pathology, and Deaf Studies at Towson University in Towson, Maryland.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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Professor of Communication Sciences and Disorders

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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This dissertation was submitted to the Graduate Faculty of the Department of Communication Sciences and Disorders in the College of Liberal Arts and Sciences and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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