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Multilingualism & Interference: The More Languages We Speak, the More Interference We Experience?

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This research is a product of the graduate program in Speech Communication at Eastern Illinois University. Find out more about the program.

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Multilingualism & Interference: The More Languages We Speak, the More Interference We Experience?

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THESIS

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Abstract
The current study investigates whether interference among languages is related to the number of languages learned. The hypothesis being examined is: The more languages one speaks, the more interference one experiences among the languages. This hypothesis was tested on 44 subjects who participated in the Stroop color-word test. The subjects consisted of 15 monolinguals, 14 bilinguals, and 15 multilinguals. The results suggest that the number of languages one speaks fluently has no effect on that person's response speed. The data suggest that fluency is the key to quickness in the Stroop test. In addition, female subjects responded significantly more quickly than male. Therefore, gender may also be a main factor in one's performance in the Stroop test.
Chapter One: Introduction

The present study examines the speed at which multilingual speakers process their languages. The purpose is to find out whether knowledge of multiple languages inhibits the speaker's thought processes. In the present study, a multilingual speaker is defined as someone who speaks at least three languages fluently. Similarly, a bilingual speaker is one who speaks two languages fluently. (See Chapter Two for more detailed operational definitions of the terms used in this study.)

The Neglected Multilinguals

An increasing amount of research in the United States during the past three decades has led to new discoveries about bilingualism. Information about bilinguals' cognitive development (Harris, 1992; Ricciardelli, 1992), the critical-period theory (Singleton, 1989), and second-language acquisition (Spolsky, 1989) continues to emerge. Meanwhile, topics such as "interlanguage" (Selinker, 1972), code-switching (Nishimura, 1995), identity (Davies & Bentahila, 1989), native/non-native communication (Long, 1983a, 1983b), and native speakers' perception of non-native speakers (Yook, 1997) are some newer areas of study.

Multilingualism, on the other hand, has been virtually neglected. This may be because people who speak three or more languages fluently are less common than bilinguals; hence the need for research has been less urgent. In addition, the multilinguals tend to be found in small clusters in universities and government agencies so that although they can be located, it
is very difficult to recruit them for large-scale, face-to-face studies. Moreover, the difficulty in recruiting a potential participant increases with the number of languages that person speaks; that is, it is hard enough to find fluent trilingual speakers; to find quadrilinguals is harder still, let alone quintilinguals, sexilinguals, septilinguals, and so forth.

Additionally, the proficiency with which people speak their languages complicates the research process. Too often, people claim to be multilingual when in fact they are bilingual. Similarly, many so-called "bilinguals" actually have a deplorable command of their second language. If native or near-native fluency is required in a foreign language, the number of qualified subjects is drastically reduced.

Furthermore, if one considers the traditional indifference in much of the English speaking world toward foreign language learning, one understands why so little is known about multilingualism. With the United States and many other parts of the world becoming more and more ethnically diverse, so that few nations are truly homogeneous linguistically and culturally, multilingualism is a topic that needs to be explored.

Prior Research in Multilingualism


Most of the extensive investigations of multilingualism began in Europe. Vildomec (1963) conducted the first in-depth psycholinguistic analysis of multilingual individuals to investigate how knowledge of several languages affects one's psychology. His conclusions are based on (1) the review of 360
articles and books, (2) the analysis of linguistic errors made by
multilingual learners and speakers, and (3) a self-reporting
survey of 61 subjects. His conclusions provide insights into the
psychology of multilinguals for future studies.

Vildomec states that multilingualism influences the
linguistic performance of the individual in all his or her
languages, including the mother tongue (p. 230). Some of
Vildomec's observations are listed below:

(1) It is relatively rare for a person to speak two or more
languages equally well at the same time of his or her life. The
languages may be specialized for various spheres. Fluency
fluctuates depending on the milieu and opportunities for use.

(2) Multilinguals seem to have an accent in all their
languages, including their mother tongue.

(3) Multilinguals tend to borrow foreign words. Words
borrowed are adjusted to the phonetic and morphological patterns
of the recipient tongue. The number of words borrowed does not
depend on the degree of proficiency in the foreign languages.

(4) The mother tongue exerts tremendous influence on the
syntax and phonology of a multilingual's foreign languages.

(5) It is easier to learn a foreign language which is
phonetically similar to the mother tongue.

(6) Two phonetically similar foreign languages may interfere
with each other more than the mother tongue interferes with
either of them.

(7) Occasionally, the amount of interference from a language
spoken with much effort may exceed that from a language spoken
with ease. This happens when a multilingual has to switch suddenly from one foreign language to another.

(8) Interference from the mother tongue is greater when a foreign language is learned after the age of 25 than when learned in childhood.

(9) Languages known only passively seem to interfere with other tongues less than do languages known actively.

(10) That the subject has more than one linguistic system to express his or her ideas with may lead to hesitancy and slowness in speech, frequent slips of the tongue, stuttering, tiredness, and nervousness.

(11) The mother tongue may not necessarily be the dominant language. The medium of instruction and residence abroad often result in an individual speaking a foreign language better than all the other languages he or she speaks.

(12) There may be a central storage in the brain of a multilingual which acts as a "switchboard" for all his or her languages.

(13) A multilingual may feel insecure and inferior depending on the reactions of people in his or her milieu.

Vildomec’s research documents rather than explains phenomena relating to multilingual speakers. Nevertheless, he sowed the seeds for future investigation into this unexplored topic as the three decades following his investigation witnessed more studies involving third-language learning and multilingualism. These studies would produce similar observations as those documented by Vildomec. By the early 70s, many of Vildomec’s observations had
become evidence of becoming or being multilingual, as DiPietro (1971) states,

The psychological effects of knowing more than one language on the learning of a new one are evident but are not well understood. Language teachers often observe a tendency among some students to confuse the language they are studying with others studied previously or concurrently. (p. 6)

To record the phenomena was only the beginning of a large project. Soon, researchers were faced with the challenge of explaining why these phenomena occur. Kovác (1965) was one of the first to present his viewpoints.


Kovác (1965) notes that multilingualism inhibits cognitive responses to stimuli so that there is a corresponding delay in motor responses. He understandably calls this delayed reaction a "handicap" which persists even after training. This "handicap," Kovác writes, is present in "all situations, in which especially prompt responses are required to verbal stimuli. This is the case, e.g. in various kinds of modern telecommunication."

If multilinguals are slower than other people "in all situations" that require prompt reactions, then the word "handicap" can imply something very serious. For instance, a multilingual person learns to drive. The word "handicap" is acceptable when the multilingual fails to respond quickly to instructions to turn right or left; this may be nothing more than a handicap. However, the word is an understatement when the
person fails to react instantaneously to the instruction to brake. Such hesitation puts at risk the lives of the people in the car and on the road. If Kováč is right about the multilinguals' slowness, then this slowness is not only a handicap but rather a life-threatening danger. The lack of evidence showing a connection between traffic accidents and multilingual drivers implies that this "handicap" may not be as serious as it sounds; in fact, it may not even extend to "all situations" as Kováč claims.

Whatever one's attitudes to this alleged phenomenon, Kováč explains it as being a result of the multilingual's large linguistic repertoire, suggesting that a multilingual's languages are interdependent. Perecman (1984) supports this hypothesis after reviewing studies done on aphasic polyglots. Perecman concludes, "There are undoubtedly links between language systems and it is these links which predispose a polyglot – aphasic polyglots even more so – to mixed language errors" (p. 61).


Ramsay (1977) conducted one of the first examinations of multilingual people in the United States. Although her emphasis was on the learning techniques of multilinguals, psycholinguistic implications can be drawn.

According to Ramsay, the success of foreign language learning among adults depends on such variables as "methods of instruction, motivation, attitude of the learner's culture,
aptitude, communicative or sociolinguistic factors, personality, development or maturation, and cognition" (p. 23). She proposes two additional variables: cognitive style and approach style. She defines cognitive style as the "tendencies in mental organization of complex phenomena," and approach style as "attitudes toward the task" (1989, p. 75). No significance difference was found in cognitive style between monolinguals and multilinguals. Only data concerning approach style reached statistical significance. These findings suggest that to acquire a new language, the learner should have the right attitudes, not necessarily superior cognitive abilities.

Ramsay's findings, however, are tentative, as she herself admits, "The experiment...is heuristic" (1977, p. 73). However, her findings, like Vildoméc's, serve as a guideline for future researchers to probe into this relatively unexplored area. Her study focuses on the conditions which facilitate language learning-- not entirely in line with the present study which examines how being multilingual influences one's verbal and nonverbal processing. Nevertheless, Ramsay's findings have shed some light on the process of becoming multilingual. They can be helpful in identifying the personality type of multilingual speakers.


It was not until the late 70s that more helpful research about multilingualism emerged. Magîste (1979, 1985) shows in two of her studies that the multilingual subjects were slower to respond to stimuli than the bilingual and monolingual subjects.
She explains that the longer reaction times of her multilingual subjects may have been due to the less frequent usage of their languages because of their youth (13 to 18 years of age) (1979, p. 86). Another explanation Magistrate offers for her multilingual subjects' slowness is that there may be interference among the language systems (1979, p. 87). This indicates that "the multilingual has a central semantic system, to which words in [different] languages are linked by language tags. Accessing this central code makes available more perceptual codes than are available to monolingual" (1985, p. 154). Magiste's finding supports the central-storage theory endorsed by Vildomec (1963) and Kovác (1965).

A relevant finding from another study conducted by Magiste (1984b) shows that passive bilingualism seems to facilitate third language learning while active bilingualism may impede it. This finding contradicts a common notion that early bilingualism is an asset in third-language learning. Magiste explains that active command of two languages increases the "potential for interference," thus impeding the acquisition of a third language. Furthermore, Magiste adds that a related language may be easier to learn than an unrelated one. For example, a Spanish speaker may find Portuguese easier to learn than Japanese. Her finding is to a large extent in line with that of Azevedo (1978) who states that learners of Portuguese who have acquired some proficiency in Spanish are both advantaged and disadvantaged. Azevedo explains:

They find themselves in an advantageous situation, for it is possible to facilitate learning the new language by relying
on the great structural similarity between the two languages. However, this very similarity often gives rise to problems, for it may mislead the learner into translating to Portuguese a variety of Spanish features (phonological, morphological, syntactic, and lexical) which do not belong to it. (p. 18)

These findings from Magiste (1984b) and Azevedo (1978) provide insight into the type of interference multilinguals have to overcome to achieve proficiency in their third language.


Of all the previous studies about multilingualism, Shanon's (1991) is one of the most relevant to the present study because it involves proficient multilinguals. Also, it is by far the most insightful because it is the most descriptive, presenting actual events in narratives. Shanon's study is the only qualitative one, documenting multilingual speakers' experiences of blurting out expressions in an inappropriate language. For example, a native Japanese who is fluent in English and Spanish is having a conversation in English. In the course of it, the speaker unintentionally blurts out an expression in Spanish. By Shanon's definition, this type of interference is called "faulty selection of languages." Shanon points out that such a speech error is "extremely rare" (p. 345), but is often strikingly memorable to the multilingual speaker because the slip is sudden, and this suddenness is "accompanied by a striking feeling of the speaker's losing control of his or her linguistic apparatus" (p. 340). Another characteristic of faulty selection of languages is that
it is "not due to poor knowledge of language or a lack of words" (p. 345). Rather, it reflects the speaker's linguistic history. According to Shanon (1991), the languages that multilingual knows have different statuses depending on when and how they were acquired. A multilingual generally has a dominant language (or languages), followed by a subordinate language (or languages) that the speaker has mastered. Next is the weakest or last-learned language (or languages). As Shanon points out, that interlingual errors tend to reflect the linguistic history rather than relative language mastery of the multilingual speaker is very interesting indeed. This trend, Shanon adds, "suggests that even when it reaches maturity, the cognitive system bears a record of its history" (p. 348).

Since Shanon's study suggests that when and how a language is learned influence how it will be processed, it is now important to find out these two factors: timing and learning methods. Avinor's (1994) study attempted to investigate these factors.


Avinor's dissertation investigates whether there is any correlation among multilingualism, learning modes and styles, and the ability to solve analogies. She tested a total of 227 subjects, and based on self-reported information on a questionnaire, they were classified into two groups: (1) monolinguals/partial multilinguals, and (2) competent multilinguals.
Her first finding contradicts her expectation. She did not find any significant difference between the two groups with respect to the ability to solve analogies. Avinor had assumed that "[a]cquisition of an additional language may entail breaking a language barrier or some other kind of cognitive barrier...Multilinguals who have crossed the language barrier may have opened the door to new cognitive potentials" (p. 119). Yet, her subjects' performance did not differ from one another regardless of how many languages they spoke. This finding is consistent with Ramsay's (1977, 1989). Avinor's explanation for this unexpected finding is that it might have been due to the subjects' language combination; they spoke closely related languages which do not seem to enhance analogy-solving ability as effectively as do unrelated languages.

Secondly, the competent multilinguals did not differ significantly from the monolinguals/partial multilinguals in learning modes and styles. This is also surprising since it is logical to assume that multilingual speakers have better learning techniques; otherwise, they would not have learned several languages.

Lastly, among the competent multilinguals, Avinor investigated whether the age at which they acquired their languages affected their analogy-solving ability and learning modes and styles. The early competent multilinguals (those who learned the second language before age 12) solved analogies better than the late competent multilinguals (those who learned the second language after age 12), but they did not differ in
learning modes and styles. This finding suggests that early language acquisition benefits one’s cognitive ability.

Avinor’s study provides more information about the cognitive ability of multilingual people. However, the study is not flawless. Her indiscriminate use of the terms "bilingual" and "multilingual" as if they were interchangeable decreases the validity of her study. One example of Avinor’s misuse of the terms is shown by the following sentence: "Thus a person fluent in ASL [American Sign Language] as well as English was considered to be multilingual" (p. 59). First, Avinor meant bilingual. Second, a sign language is not spoken; it is likely to involve different cognitive and motor skills. Comparing a sign language with a spoken language may not yield results that are relevant to bilingual and multilingual speakers.

Another major limitation of Avinor’s study stems from her confusing categorization of subjects. That there was a group called “monolingual/partial multilingual” is baffling. She explains that because she did not have a large number of monolingual subjects, she combined them with the partial multilinguals into one category. How she differentiated partial multilinguals from competent multilinguals is puzzling because according to her, both partial and competent multilinguals “use the second language widely” (p. 66). The only difference was “some degree of fluency in the second language.” Since she classified her subjects based on a self-reporting questionnaire, it is uncertain how she could make such fine distinctions regarding their fluency. Also, if her partial multilingual
subjects were able to "use the second language widely," they were at least bilingual, and, therefore, should not have been grouped with the monolingual subjects. Because of Avinor's misuse of the terms "bilingual" and "multilingual," and because of her questionable categorization of subjects, it is doubtful whether her findings are helpful to the present study.


The last piece of research to be reviewed is by Edwards (1994). The main thrust of his book is sociolinguistics—the study of the relationship between language and society—not quite relevant to the present study which takes a psycholinguistic approach. The purpose of Edward's book is to discuss how social and political forces influence the fate and status of languages. Nevertheless, Edwards devotes some space to psycholinguistics. Firstly, Edwards doubts the possibility of a multilingual being equally proficient in all his or her languages (p. 3-4), even if it were possible to test proficiency at this level. His view is consistent with that of Vildomec (1963) and Shanon (1991). Secondly, Edwards concludes that bilingualism and multilingualism do not seem to affect the speaker's cognitive and intellectual skills, either positively or negatively. This contradicts Kovác's (1965) conclusion that multilingualism is "a handicap" because, he argues, it impairs one's alacrity. Thirdly, Edwards supports the central-storage theory as he states that in the brain, there may be subsystems for separate languages within a central language reservoir. Finally, Edwards comments on interference. He states that of all the forms of interference, those related to phonology and syntax require the most effort to remove; of the
two, the former is more persistent. However, he did not offer an explanation to that observation.

Problems with Prior Research

More than thirty years have gone by since Vildomec (1963) published the results of his survey. Even now, however, not much is known about the effects of multilingualism on the speakers. The difficulties involved in a thorough study of multilingual individuals, as mentioned earlier, may be too discouraging for any researcher with a restricted budget and a limited population pool to select subjects from, however interesting the topic may be. There has not been sufficient research to enable the formulation of theories about multilingualism. The only consistent finding is that multilinguals tend to respond more slowly to verbal stimuli than do bilinguals and monolinguals (See Kovác, 1965; Magište, 1979, 1984b, 1985). Other findings (e.g., interference comes from the dominant language, interference comes from a phonetically similar language, central storage of languages) are merely supported hypotheses which need to be retested to ensure their validity. At this point, not much can be said for certain about people who speak three or more languages fluently--whether they truly experience interference, whether they can avoid it, whether their language-learning ability is innate or acquired, and whether balanced multilinguals exist.

Another problem with existing research on multilingualism is the disagreement over the definitions of "bilingual" and "multilingual." To some researchers, a "bilingual" person is anybody who is a beginner in a second language; but to other researchers, the term refers to someone who has mastered two
languages. Similarly, there are various definitions of a "multilingual" person, ranging from anybody who knows fragments of several languages to somebody who is a proficient polyglot.

**Rationale & Hypothesis**

Since so little is known about multilingualism, there is great potential for interdisciplinary research by scholars from communication, linguistics, neurology, pedagogy, and psychology. Although not much knowledge is available about multilingualism, one particular conclusion seems to appear consistently across studies: multilinguals tend to respond more slowly to stimuli than do bilinguals and monolinguals (See Kovác, 1965; Magičte, 1979, 1984b, 1985). This phenomenon is attributed to the multilinguals' interdependent language systems.

Despite its consistency, this finding may not be generalizable because of the age of the subjects. Magičte is the only researcher to have used the Stroop color-word test to investigate the response speed of multilinguals. However, her "trilingual" subjects were all high school students who were not proficient in all their three languages. Strictly speaking, they were bilinguals with some knowledge of a third language, or even monolinguals with some knowledge of two other languages. In this case, it is likely that the lack of fluency in their languages--not the number of languages they knew--caused their slowness; and their lack of fluency might have been due to their youthfulness.

In order to shed more light on the effect of multilingualism on the speed of cognitive processing, this study continues the line of research by Vildomec (1963), Kovác (1965), and Magičte (1979, 1984b, 1985), by re-examining the one most consistent
finding in prior research.

H: The more languages one speaks, the more interference one experiences among the languages.

This hypothesis will be tested on older subjects with advanced training in their foreign languages to see if maturity, education, and language proficiency affect the frequency of interference.
Chapter Two: Operational Definitions

Proficiency

The main factor in determining whether a person is bilingual or multilingual is the proficiency of his or her languages—not the number of languages this person has learned. Unfortunately, there is neither a reliable nor a standardized measurement of proficiency so that the terms “bilingual” and “multilingual” vary from study to study. Generally, linguists consider a proficient speaker as one who has achieved both linguistic competence and communicative competence. By linguistic competence, Gleason (1997) refers to “phonology, morphology, syntax, and semantics of a language” (p. 5). For example, a speaker who can produce a sentence such as “Whom do I have the honor of meeting?” has achieved linguistic competence as this sentence is grammatically correct. However, the usage of such a sentence must be restricted to highly formal situations. Using it with a child or in a casual setting would be inappropriate or even offensive as it may be interpreted as condescending.

What can also happen is that people with communicative competence do not adhere to grammatical rules. Actually, this is very common among native speakers whose speech has been shown to be often ungrammatical (See Owens, Jr., 1996, p. 15). “Even though much that is said is ungrammatical, native speakers have relatively little difficulty decoding messages” as “comprehension is influenced by the intent of the speaker, the context, the available shared meanings, and the linguistic complexity of the utterance” (Owen, Jr., 1996, p. 15); these are the information that a nonnative speaker lacks.
Determining somebody's proficiency is by no means simple as it involves a variety of factors, from linguistic rules to speaker's performance. Owens, Jr. (1996) states, "Linguistic competence cannot be measured directly" (p. 15); it must be "deduced" from its actual usage in relation to a particular situation. Gleason (1997) echoes this point: "Language development includes acquiring the necessary ability to use language appropriately in a multiplicity of social situations" (p. 5). However, what is appropriate is arbitrary; so are the standards by which linguistic competence should be deduced, and communicative competence evaluated.

The lack of a clear, universal guideline for determining language proficiency has led to different definitions of the terms "bilingual" and "multilingual." Some researchers set a very stringent standard. Selinker (1972) defines proficiency as "absolute success." To be considered proficient, the individual's "productive performance in the TL [target language]" must be "identical to that produced by the native speaker of that TL." Selinker's definition is accepted by Ho (1987) who points out that the focus is not only on one's competence in the language but also one's "knowledge and expressive representations of the culture of the community" (p. 405). Ho adds that however literate one is in a foreign language, one cannot be considered to have achieved native-speaker competence if one's utterances are distinguishable from those of the native speakers, and if one lacks "sensitivity to subtle nuances of meaning...particularly with respect to idiomatic or vernacular expressions" (p. 405). Ho adds, "Even an absence of characteristic mistakes not unusually
made by native speakers may give hints that the subject is, after all, not one of them!"

Selinker's and Ho's interpretation of proficiency is problematic. Its major weakness is its failure to account for dialects and language variations within dialects. "As far as linguists are concerned, all dialects are equally valid exemplars of a language. Some dialects may share more features with the standard dialect than others, but this makes them no more correct" (Gleason, 1997, p. 239). If accent, cultural knowledge, and usage of local expressions are qualifications for being a native speaker of a language, this will mean that when an American goes to England, he or she will stop being an English native-speaker.

Another weakness is that it places too much emphasis on the natives' speech which, as Ho himself admits, is often not perfect. As mentioned earlier, native speakers may be fluent but are often ungrammatical. In fact, Ho points out that it is not uncommon for a nonnative speaker to be more accurate in grammar and more precise in word choice than a native speaker. Therefore, to rely solely on a native's speech as the basis for judgment of nonnative speech, and to set a standard that excludes everything but "absolute success" is unrealistic and impracticable.

Without the resources for measuring linguistic and communicative competence, the present study relies on two indicators of proficiency when selecting subjects; they are education and fluency. The present study recruits subjects with an advanced degree in a foreign language with the assumption that these people have acquired linguistic competence through higher
education. The second indicator, fluency, is a behavior that can be measured by time. To gauge fluency, Starkweather and Givens-Ackerman (1997) have established these guidelines:

Rate and continuity are the two visible manifestations of an underlying construct that seems to be at the heart of fluency...Fluent speakers are those who can produce long strings of syllables without apparent effort, as shown by their combination of rapid rate and continuous utterance. In other words, not only do they produce an utterance that matches their intention closely, but they are able to produce this match without slowing down, either by inserting pause time or by reducing the velocity of movement of the parts of the vocal tract. (17-18)

This definition of fluency contains several measurable factors: the rate of word production, long strings of syllables, and presence or absence of pauses. In addition, this definition allows the speakers to assess their own performance in terms of "apparent effort." For example, if more effort is needed to speak the second language than the first, then one may conclude that the speaker is less fluent in the second language. For fluent bilinguals and multilinguals, they should feel comfortable speaking any of their languages. Starkweather and Givens-Ackerman’s (1997) definition of fluency will serve as a guideline in the selection of subjects for the present study. With the help of Starkweather and Givens-Ackerman’s definition, the terms monolingual, bilingual, and multilingual will be defined as follows.

Monolingual, Bilingual, and Multilingual
The term "monolingual" is self-explanatory; it refers to having a command of one language. A monolingual person is someone who is able to communicate fluently in most social situations in only one language. Usually, this language is the first language a person learns, commonly known as the mother tongue.

A bilingual is someone who is fluent in two languages. In most everyday interactions, the bilingual individual is able to communicate comfortably and effortlessly in either of his languages.

A multilingual person speaks at least three languages fluently in most everyday situations. A person who is fluent in three languages is trilingual; one who is fluent in four languages is quadrilingual. However, some researchers (e.g., Edwards, 1994; Vildomec, 1963;) have expressed doubts about the existence of quadrilinguals, quintilinguals, sexilinguals, and so on.

**Interference**

Interference is defined as the inevitable negative transfer of elements from one language to another, resulting in speech distortions. Scholars from various subdisciplines of linguistics—behavioral, applied, contrastive, and neurological—have contributed much effort to explaining the causes and effects of interference. Their findings are summarized in the following section.

The Behavioral Perspective

An early assumption is that language transfer may be nothing but the transferring of habits. In his classic work *Verbal Behavior*, Skinner (1957) proposed a behavioral theory of language
acquisition. This theory claims that language is a learned behavior which is either reinforced or discouraged. A child's linguistic performance is conditioned to resemble that of the community as he imitates the adults' language behaviors. Two years later, Chomsky (1959) dismissed Skinner's argument that "slow and careful shaping of verbal behavior through differential reinforcement is an absolute necessity" (p. 42), noting that adults tend to emphasize the content of a message more than the grammatical construction. In fact, it is very common for an adult to engage in "baby talk" with a child, using ungrammatical sentences. However, despite the adults' failure to reinforce the correct speech, the child grows up speaking normal language. If language skills were habitual, then it would be easy to explain why acquisition of a second language is such a problematic task, but since Chomsky's review, the argument that habits from the first language inhibit the formation of new habits in a second language has lost much support. Nevertheless, the argument that language is habit formation still holds true in certain aspects of language acquisition. For example, the acquisition of phonemes in a foreign language is through imitation and practice. The old phonological habits are transferred to the new language in the form of an accent, and it is logical to assume that the older the habit, the harder it is to break. The behavioral perspective, therefore, may explain why children tend to acquire a better accent than adults (See Cochrane & Sachs, 1979).

The Applied Linguistic Perspective

From a similar but different perspective--the applied linguistic perspective--Corder (1973) explains the transfer
phenomenon as the result of ignorance, not of habit.

[L]earners transfer what they already know about performing one task to performing another and similar task. But the learner does not know what the full nature of the new task is; until he has learned in what way the two tasks are different he will perform the second task in the only way he knows, that is, as if it were the same as the first task. He will continue to apply the old rules where new ones are needed. And he will make mistakes of course. Making errors in the second language can, in part, be explained by the notion of transfer. It is sometimes called "negative transfer" or interference. Where the nature of the two tasks happens to be the same, of course, this tendency to transfer is an advantage. This is called positive transfer or facilitation. (p. 132)

In Corder's view, negative language transfer occurs because the learner does not know the rules in the new language, but as soon as he learns them, the negative transfer is quickly discontinued. This is called the "ignorance hypothesis," and one should not confuse it with the habit-transfer hypothesis discussed earlier because habits (such as smoking) are usually not easily discontinued (even if people realize that they are undesirable). A simple corollary of the ignorance hypothesis is that interference is correlated with the learner's lack of proficiency, if not caused by it; that is, the higher the proficiency, the less the interference. This idea, however, has not received much support from researchers (e.g., Kovác, 1965; Magiste, 1979, 1982a, 1984b). In fact, Ho (1987) states that "L
[first language] interference may persist and thus add a formidable dimension to L2 [second language] learning difficulty, regardless of the proficiency level achieved" (p. 406).

The Neurological Perspective

To investigate the cause of interference, researchers may also turn to neurolinguistics. Here, the interference phenomenon may be explained by the way languages are organized in the brain. Multilingual aphasic patients have often been the subjects of observation, and have provided valuable information. During their recovery, some aphasic patients seem to have no control over any of their languages as they slip from one tongue to another (See Perecman, 1984, Zatorre, 1989), whereas for other multilingual aphasics, only one language is impaired (See Paradis & Goldbulm, 1989). From the observation of these patients, many findings have emerged. For instance, Zatorre (1989) states that in most people "the left cerebral hemisphere is specialized for language processing" (p. 127). This is true, Zatorre says, for monolinguals, bilinguals, and multilinguals. For multilinguals, "most if not all languages are represented primarily in the left hemisphere, with right hemisphere participation limited to comprehension of certain classes of words and production of overlearned phrases" (p. 139), and because of this overlapping of languages within the same hemisphere, "one might expect varying degrees of interference with each language" (p. 143).

In a similar vein, Perecman (1984) notes that in a polyglot aphasic the languages may be inter-linked differently at different linguistic levels.

The ubiquity of language mixing suggests that language
boundaries are poorly delineated in the polyglot aphasic's mental grammar. It may turn out that there is a hierarchical structure to the organization of the multiple languages of a polyglot such that at the lexical level, individual grammars are closely linked while at subsequent levels of linguistic organization, the individual grammars begin to individuate more and more...There are undoubtedly links between language systems and it is these links which predispose a polyglot - aphasic polyglots even more so - to mixed language errors. (p. 61)

This finding by Perecman (1984) strongly resembles that obtained by Shanon (1991) regarding multilinguals' faulty selection of languages (See Chapter One for a review of Shanon's study). The two studies seem to point to the same idea that multilinguals' languages are linked--if not interdependent--and the linkage occasionally causes the speakers to blurt out words in an inappropriate language, and when the speakers suffer a brain injury, the faulty selection of languages becomes a greater problem as the brain loses control of language processing.

However, that the languages are linked or even interdependent may not be proof enough for the central-storage theory endorsed by many psycho- and neurolinguists (e.g., Wildomec, 1963; Kovác, 1965; Magîste, 1979, 1984b, 1985; Zatorre, 1989). Regarding the location of languages in the brain, Paradis and Goldblum (1989) have a different view. After observing a trilingual aphasic who after brain surgery exhibited "obvious deficits" in only one of his languages, Paradis and Goldblum hypothesize that there may be differential localization of
languages (i.e., each language is geographically located in a different part of the brain). Paradis and Goldblum cite the conclusion by Ojemann and Whitaker from their 1978 study that "these areas of differential localization provided an anatomic basis for the abilities to segregate different languages and switch between them" (p. 70). Another hypothesis Paradis and Goldblum posit is differential lateralization (i.e., some languages are located in the right hemisphere while others are in the left hemisphere). Paradis and Goldblum report, "Albert and Obler (1978) have suggested that the Hebrew language might be intrinsically less left-lateralized than English" (p. 70).

Where the languages are stored is still a hot topic for debate among the neurolinguists. If languages are stored together in the same place, it will be easy to explain the interference phenomenon; but if they are separately located, one will have to turn to other possibilities to identify its cause. At this stage, no evidence from either side has proven conclusive.
Chapter Three: Research Method

A modified version of the Stroop color-word test was used in the present study. The test consisted of 42 cards each showing one of these seven words: black, blue, brown, green, pink, purple, and red. Each word appeared six times in six different incongruent ink colors. For example, the word "black" was printed in blue, brown, green, pink, purple, and red. The word "red" was printed in black, blue, brown, green, pink, and purple. Subjects were shown one card at a time, and asked to name as quickly as possible the color of the ink, ignoring the word itself. Their responses were tape-recorded and timed.

The Stroop color-word test is appropriate for the present study because it requires both verbal responses (recognizing colors and written words) and motor responses (articulating the colors). It is an effective test of a person's ability to coordinate his or her cognitive and motor abilities.

About the Stroop Color-Word Test

Jensen and Rohwer, Jr. (1966) state, "the origins of the Stroop test go back almost to the beginning of experimental psychology" (p. 36). In 1886, McKeen Cattell reported in Mind "the first experimental study of the relative speeds of color-naming and color-word reading" (Jensen & Rohwer, Jr., p.36). It found that naming a color requires more time than reading a color-word (i.e., it takes more time to identify the color "red" than to read the word "red").

This finding inspired researchers to create other versions of the test. One of the most popular versions involves color-word interference (the version used in the present study). In this
version, subjects are not supposed to read the word, but to name the incongruent ink color. According to Jensen and Rohwer, Jr., this version originated in Marburg, Germany in the 1920s. In 1935, the American psychologist John Ridley Stroop introduced the color-word interference test to American psychology in a study published in the *Journal of Experimental Psychology*. It has since been known as the Stroop color-word test, and the color-word induced interference is known as the Stroop effect.

Following its importation to the United States, According to Jensen and Rohwer, Jr., the Stroop color-word test was considered by many researchers to be of "considerable psychological interest" because it "yields highly reliable and stable measures" (p. 36); by the mid 60s the test had been used "in a large variety of studies" and had shown "significant correlations with a host of other, often more complex, psychological measurements" (p. 36). The popularity of the Stroop color-word test continued into the 1990s as shown by the wide range of studies reporting the administration of the test (e.g., Harbeson, Kennedy, & Bittner, 1981; Sovcikova & Bronis, 1985; Connor, Franzen, Sharp, 1988; Bruyer, Linden, Rectem, & Galvez, 1995; Vakil, Manovich, Ramati, & Blachstein, 1996; Siegrist, 1997). These studies have found variables that affect a person's ability to perform the Stroop test. The following section discusses these main variables which are age, attention, gender, literacy, and, possibly, the number of languages learned (See Jensen & Rohwer, Jr., 1965, and MacLeod, 1991, for detailed reviews of the Stroop test).

**Age.** An overwhelming amount of research indicates that older people respond more slowly and suffer more interference
than younger people (e.g., Cohn, Dustman, & Bradford, 1984; Panek, Rush, Slade, 1984; Bruyer, Linden, Rectem, & Galvez, 1995; Li & Bosman, 1996; Vakil, Manovich, Ramati, & Blachstein, 1996). MacLeod found that interference "begins early in the school years," then it "declines through the adult years until approximately age 60, at which point it begins to increase again" (p. 185). However, age may not be the only factor in increased slowness. Rush, Panek, and Russell (1987) found that cautious subjects responded more slowly, and that the level of cautiousness increased with age.

**Attention.** Attention is found to be a significant factor that determines the Stroop test performance. Lufi, Cohen, and Parish-Plass (1990) compared 29 Attention Deficit children, 21 emotionally disturbed children, and 20 normal children. The Attention Deficit group performed the slowest, followed by the emotionally disturbed. The normal children were the quickest.

**Gender.** According to Mekarski, Cutmore, and Suboski (1996), "men were consistently slower than women" in performing the Stroop color-word test. "Differences may be ascribed to greater verbal and fine motor abilities of women and greater spatial ability of men" (p. 563). Other researchers have obtained the same finding (e.g., Dash & Dash, 1982; Nayak & Dash, 1987; Sovcikova & Bronis, 1989). Nayak and Dash (1987) found the same result in grade school children: "girls showed less interference and a more stable pattern for interference than boys" (p. 87). Other researchers have not found such differences (e.g., Connor et al., 1988; MacLeod, 1991).

**Literacy.** A commonly accepted interpretation of the
Stroop effect is that reading is a more automatic process than naming. This interpretation sets the ability to read, i.e., literacy, as the prerequisite for the Stroop interference. In other words, people who are illiterate in a language are not distracted by the color-words, and can, therefore, perform the Stroop test quickly. This has been proven by Gerhand, Deregowski, and McAllister (1995) who tested 40 English-Gaelic bilinguals. The subjects used Gaelic "as their preferred spoken language, but rarely for written communication." The researchers found that "the process of reading in Gaelic was less automatic than the process of reading in English," therefore, the subjects performed the Stroop test faster in Gaelic than in English because the Gaelic words did not distract them as much as the English words.

Number of languages learned. In psycholinguistics, the Stroop color-word test also has an important place. In 1965, Preston used the test in his doctoral dissertation on interlingual interference in bilingual subjects. It was apparently one of the first adaptations of the test in psycholinguistics in the United States. The popularity of the Stroop color-word test among psycholinguists continued into the 70s and 80s. Numerous studies (e.g., Dyer, 1971; Hamers and Lambert, 1972; Kiyak, 1982; Magiste, 1984a; Ingraham, Chard, Wood, & Mirsky, 1988) examined the effect of knowing two languages on promptness. They overwhelmingly obtained the same findings: (1) bilingual subjects responded more slowly than monolingual subjects, and (2) inter-lingual interference is greater from the dominant language (cf. Gerhand et al., 1995). Most of these researchers attributed the slowness among the
bilinguals to interlingual interference (i.e., their two language systems interfere with each other), and they suggest that interference is inevitable because it is a natural consequence of being bilingual.

It was not until 1984 that multilingual subjects became the focus of the Stroop color-word experiment. Magište (1984b) compared monolingual, bilingual, and trilingual students and found that the trilingual ones took the longest time to perform the Stroop task. She concluded that "a potential for interference increases with the number of languages a student knows" (p. 420). Magište repeated her study the next year, and arrived at the same conclusion. "With an increasing number of language systems, the response times for the different verbal tasks increases...trilingual subjects generally needed more time to perform the tasks than bilingual subjects" (1985, p. 147).

However, one can argue that since all of Magište's subjects were high school teenagers, they obviously had not had enough time to achieve the kind of fluency a monolingual teenager had. Therefore, it might have been their lack of fluency, not interlingual interference, that slowed them down. Magište herself is not blind to this fact, as she (1984a) states that "the degree of interference from a language is directly related to experience in that language" (p. 315). Since age is an important factor in a person's language experience, the present study will focus on older multilinguals.

Subjects in the Present Study

A total of 44 subjects participated in the present study; of them, 23 were male, 21 female (See Table 1 for the subject
distribution in each linguistic group). Their education, profession, and socio-economic status were matched. Most subjects had a Ph.D. degree, held a teaching position, and are from the middle or upper-middle class. Based on information they provided in a language questionnaire they were categorized into three groups: monolingual (15 subjects), bilingual (14 subjects), and multilingual (15 subjects).

All subjects were between 43 and 62 years of age. Since one’s language fluency grows with experiences which in turn accumulate with age, it is important to set a minimum age to ensure fair comparison among subjects. The maximum age limit--62 years of age--was set to avoid age being an extraneous variable in the Stroop color-word test. Research has indicated a positive correlation between old age and longer reaction times.

**The Experimental Groups**

There are three experimental groups in the present study: monolingual, bilingual, and multilingual. The monolingual group consists of 15 English-native monolinguals. All of them are professors or instructors from a mid-Western American university. The bilingual group consists of 14 participants who are fluent in two languages, one being English. Most bilingual subjects in the present study are university professors or instructors in the department of foreign languages. All bilingual subjects either are native speaker of two languages or have at least a bachelor’s degree in their second language. The multilingual group consists of people who speak at least three languages fluently. Most of the multilingual participants come from similar backgrounds as the bilinguals, being professors or instructors of foreign
languages so that they have an advanced degree in at least one of their foreign languages and extensive training in another. Many multilingual subjects grew up bilingually, and mastered a third language later in life. Only two subjects are in professions other than higher education. One person had a master’s degree in his second language and extensive overseas training in his third. The other subject speaks his second language at work and his third language with his family.

**Procedures**

All subjects were individually interviewed about their language history and experience. During the interview, they were asked to fill out a questionnaire in which they listed all the languages that they had learned in chronological order (See Appendix A for the questionnaire). In the questionnaire, they also had to assess their own fluency. This questionnaire helped the researcher make a quick assessment of the subjects' fluency and to identify their dominant languages. Since all subjects either had an advanced degree in their languages or were native speakers of their languages, it was not necessary to test their proficiency.

Following the questionnaire, the Stroop color-word test was administered. The monolingual subjects were shown the Stroop cards in English only. The bilingual subjects were tested in both their languages. For example, an English-Spanish bilingual would be tested first in English, then in Spanish. Therefore, by the end of the experiment, this person would have responded to 84 Stroop cards (42 cards x 2 languages). The multilingual subjects were tested in three of their strongest languages. For example, a
Multilingual who speaks English, French, and Spanish fluently was tested first in English, then in French, and finally in Spanish. Therefore, this subject would respond to a total of 126 cards (42 cards x 3 languages).

Seven colors (black, blue, brown, green, pink, purple, and red) were used in each language. Before each experiment, the subject had a review of the seven colors to ensure correct color vision and to standardize the color names.

During the experiment, the subjects had to name as quickly as possible the color of the ink, ignoring the word itself. The response language must be the same as that in which the word was printed (i.e., no translation was involved).

The experiments were recorded on audio tapes, and responses were individually timed. To make it possible to time each response, at the same time a card was revealed, the researcher tapped the desk gently to indicate the moment when the subject saw the card. The audio tape recorded the tapping of the desk and the subject's response, and the time lapse between them was later timed manually by the researcher. Also noted were the subjects' mistakes and hesitation (See Appendix B for a randomly chosen response record). The same tape recorder with newly-charged batteries was used for all interviews. The recorded responses were always played back on the same player and the same stop watch was used to time them. In order to increase accuracy in timing, the researcher usually took six or seven attempts to time one single response, and each language (42 responses) took an average of 45 to 60 minutes to time.

Results
The data collected were analyzed to test three relationships: (1) the relationship between the number of languages learned and overall quickness, (2) the relationship between the number of languages learned and quickness in the dominant language, and (3) the relationship between gender and quickness. The analyses are as followed.

**Number of Languages and Overall Quickness**

An analysis of variance (ANOVA) was performed to determine the relationship between the number of languages spoken fluently by the subjects and their response times. Table 2 lists the mean response times of the 44 subjects (See also Figure 2 for a graphic representation of the statistics). A response time represents the average time a subject took to respond to a Stroop card. Contrary to previous findings, the data did not yield any significant difference between the number of languages spoken and response time ($p<.05$).

**Number of Languages and Quickness in the Dominant Language**

The bilinguals' and multilinguals' responses in their dominant languages were compared with the monolingual's responses. An ANOVA performed on the three groups of responses did not reveal any significant difference ($p<.05$). Table 3 lists the response times for the subjects' dominant languages (See also Figure 3 for a graphic representation of the statistics).

**Gender and Quickness**

Gender is the third independent variable examined. There were 23 males and 21 females in the present study. An ANOVA was used to find out whether gender affects a subject's (1) overall mean response time, and (2) response time in the dominant
language. A significant difference was found in both. The females responded significantly faster than the males regardless of how many languages they spoke.

**Discussion**

Contrary to prior research, the finding of the present study does not support the hypothesis that the more languages one speaks, the more interference one experiences. Neither bilingualism nor multilingualism seems to affect the speaker's reaction speed; that is, these factors do not slow it down; nor do they quicken it. Two reasons may explain why the present finding contradicts previous studies. First, the design of the test apparatus in the present study is fairer to the bilingual and multilingual subjects. Almost all previous studies employing the Stroop color-word test did not reveal the color-words individually; rather, all the words were printed on a single board, and the total time taken for the subjects to name the first to the last color was recorded. This conventional design is inflexible as it does not allow the subjects any break. Often, people burst into laughter when they make a mistake; the laughing time is included in the total response time. Nor does the conventional design allow the subjects time to sneeze, to cough, or to clear the throat--such unexpected physiological distractions can contaminate the data.

Another problem with the conventional design is that it fails to address the length of a word. Some languages have longer words for the same color than others. For example, the color PINK is a monosyllabic word in English, but it is disyllabic in German (ROSA), and trisyllabic in Spanish (ROSADO). Obviously, the time
taken for the subject to pronounce the complete word in German is twice as long, and in Spanish thrice as long. Since the time taken to pronounce the complete word is part of the total score, the conventional design of the Stroop test is invalid. In this case, to make the conclusion that Spanish- and German-speaking subjects complete the Stroop test more slowly than English speaking subjects would be biased. To ensure accurate collection of data, the color-words ought to be individually revealed to the subjects, and the responses ought to be individually timed, from the moment the card is shown to the moment the subject begins to utter the response; the complete pronunciation should not be included.

The high degree of mastery of the subjects in the present study is probably the other reason why the hypothesis is not supported. Subject selection was very strict. All subjects had to be between the ages of 43 and 62 which is the age group that offers the most number of proficient language speakers. This particular age group was chosen because the subjects were old enough to know their languages well, but young enough to perform the Stroop test well, since responses in the Stroop test seem to slow down after approximately age 60 (See MacLeod, 1991) as "age increases the difficulty of inhibiting irrelevant information" (Bruyer, Linden, Rectem, & Galvez, 1995; also see Zacks & Hasher, 1994). The age variable is important in the present study because it plays a role in both a person's language proficiency and Stroop performance. This variable, therefore, had to be controlled.

The present finding points to the idea that mastery and
active usage of a language are the key to quickness. This is a conspicuous contradiction of the interdependent theory of languages which argues that high proficiency in two or more languages causes them to interfere with one another. As Magiste (1979) states, "People who possess one dominant language are dealing with concepts that are more readily available" (p. 86), adding that when there are alternative words for the same concept which are equally readily available, it is logical that more time is needed for the person to sort through the alternatives for the desired one.

However, the other side of the argument is that automaticity comes with practice. The better one has learned to sort through the repertoire of alternatives, the quicker one does it. In fact, how quick a bilingual and multilingual speakers are may be related to how they use their languages, not how many they speak. Magiste (1982b) has found that bilingual subjects who used two languages interchangeably to solve arithmetic problems were slower than bilingual subjects who used only one language. Therefore, it seems that quickness is related to how well the speakers are able to "switch off" the inappropriate languages, and the finding of the present study suggests that when language speakers have arrived at the expert level, they have become more skilled in separating the languages. If the languages can be easily separated, they cannot be interdependent; rather, they are merely linked, and the better one is at one's languages, the weaker are the links among them.

In the present study, gender is the only independent variable which significantly affected the subjects' response
times. This finding is in line with that in many studies (e.g., Dash & Dash, 1982; Nayak & Dash, 1987; Sovcikova & Bronis, 1989). Since the male-female ratio in the three experimental groups is consistent, gender is not an extraneous variable in the present study. However, many previous studies involving bilinguals and multilinguals did not address the gender variable (e.g., Kiyak, 1982; Lee, Wee, Tzeng, & Hung, 1992; Magište, 1984b, 1985; Sebova & Árochová, 1985). These studies did not mention how many males and females were in each experimental group. Comparing monolingual females with bilingual males, or vice versa, would very likely produce skewed results.

Limitations and Suggestions for Future Research

A few limitations of the present study need to be addressed. First, the data collection was subject to human errors as the subjects' responses were manually timed. Although the researcher timed each response six, seven times, the scores were still approximate rather than absolute. It is suggested that automated timing device is used in future studies to more accurately capture the response times.

Second, the sample size of 44 subjects is too small for the finding to be applicable to the general population. The finding is most applicable to people who are highly-educated, who are teachers, and who are from the middle or upper-middle class. Further research needs to focus on bilingual and multilingual people from other socio-economic, educational, and professional backgrounds.

Lastly, the twenty-year age range among the subjects is quite wide. A ten-year or even a five-year range would have been
ideal; unfortunately, it was difficult for the present study to set a more stringent age requirement due to the shortage of available subjects. However, in places where multilingual subjects are more readily available, a longitudinal study should be conducted.

Future studies should also pay attention to the gender variable to avoid skewed results. Also, they should provide more description about the subjects' proficiency and/or fluency; this will facilitate comparison with other research.

**Conclusion**

The present study investigated whether multilingualism affects one's cognitive and motor responses. A total of 44 subjects took the Stroop color-word test. The findings did not support the hypothesis that the more languages one speaks, the more interference one experiences. Nor did the findings support the interdependent theory of languages. It seems that people who have superior mastery of their languages and who use them actively are able to separate them more efficiently. Rather, gender is the only significant variable; females responded faster than males regardless of how many languages they spoke. Findings from the present study add to the limited knowledge about multilingual people; that is, their rate of information processing and motor responses does not seem to differ from that of monolingual and bilingual individuals, suggesting that multilingualism is not a result of superior cognitive ability; neither does it enhance nor impair it.
References


Starkweather, C. W., & Givens-Ackerman, J. (1997). *Stuttering*. Austin, TX: PRO-ED.


Table 1

**Distribution of Subjects in Respect to Number of Languages Spoken and Gender**

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<th>Female</th>
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<tr>
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</tr>
<tr>
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<td>6</td>
<td>14</td>
</tr>
<tr>
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<td>7</td>
<td>8</td>
<td>15</td>
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Table 2

**Mean Response Times Per Stroop Color-Word Card (in Seconds)**

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<tr>
<th>Groups</th>
<th>Subjects</th>
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<td>0.779524</td>
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<tr>
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<td>1.037921</td>
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Table 3

Average Response Times per Stroop Color-Word Card in Subjects' Dominant Languages (in Seconds)

<table>
<thead>
<tr>
<th>Groups</th>
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<td>0.779524</td>
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<td>0.8453</td>
<td>0.9361</td>
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<td>0.7624</td>
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Figure 1

Mean Response Times Per Stroop Color-Word Card (in Seconds)
The chart illustrates the response time in seconds for different subjects. The y-axis represents the response time in seconds, ranging from 0 to 2. The x-axis represents the subjects, numbered 1 to 15.

Legend:
- □: Monolingual
- ■: Bilingual
- □: Multilingual

Each subject is represented by a bar, with the height indicating their response time. The bars are color-coded according to the language proficiency level (monolingual, bilingual, multilingual).
Appendix A

**Questionnaire**

Name: ___________________________________________ Profession: ___________________________________________

Address & Phone: __________________________________________

Please circle your age group: 42 and younger  between 43 and 62  63 and older

<table>
<thead>
<tr>
<th>First language/s (L1):</th>
<th>Second language/s (L2):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third language/s (L3):</td>
<td>Fourth language/s (L4):</td>
</tr>
<tr>
<td>Fifth language/s (L5):</td>
<td>Sixth language/s (L6):</td>
</tr>
<tr>
<td>Seventh language/s (L7):</td>
<td>Eighth language/s (L8):</td>
</tr>
</tbody>
</table>

<table>
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<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>L5</th>
<th>L6</th>
<th>L7</th>
<th>L8</th>
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</tr>
<tr>
<td>Spoken at ages 11-15</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Spoken at ages 16-20</td>
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</tr>
<tr>
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<tr>
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<tr>
<td>Spoken at ages 61-63</td>
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<td></td>
<td></td>
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</tbody>
</table>

Currently spoken with native/near native fluency

Once spoken with native/near native fluency

Never achieved native/near native fluency

Rusty, forgotten much of it

Completely forgotten

No accent

Very light, almost undetectable accent

Light accent

Strong accent

Spoken with immediate family members

Spoken at work
In which language do you dream most?

In which language do you perform the following tasks most easily or quickly

Thinking
- Doing mental calculation
- Remembering phone numbers
- Remembering names

Chatting
- Chatting with strangers at a formal dinner
- Chatting with strangers on the street
- Quarreling with a friend
- Quarreling with a stranger

Telling stories
- Telling jokes

Writing
- Writing a short story
- Writing an essay
- Writing a budget report
- Writing a personal letter

Reading
- Reading a novel
- Reading a textbook
- Reading a bedtime story to a child
- Reading a newspaper

Asking
- Asking directions

Telling
- Telling directions
- Telling the hairdresser/barber how you want your hair cut

Seeing
- Seeing a doctor

Calling
- Calling a company about a job you want

Answering
- Answering questions during a job interview

Ordering
- Ordering food at a restaurant
- Ordering food by phone for delivery
Appendix B

A Randomly Chosen Response Record

Subject Profile: Male, Multilingual, Foreign Language Professor

Response Language: Spanish (Subject’s first but non-dominant language)

<table>
<thead>
<tr>
<th>Cards</th>
<th>Expected Responses</th>
<th>Subject’s Responses</th>
<th>Time (sec)</th>
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Average time: 1.12190