A THEORETICAL OVERVIEW OF BILINGUALISM AND PROACTIVE INTERFERENCE TASKS

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by

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To the Graduate and Reasearch Council:

I am submitting herewith a Research Paper written by Alicia Ivon Birch entitled "A Theoretical Overview of Bilingualism and Proactive Interference Tasks." I have examined the final copy of this paper for form and content, and I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts with a major in Psychology.

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Chapter I

Introduction

An obvious question concerning bilingualism has to do with the extent to which the two languages function independently of each other. Specifically, separate versus shared hypotheses for bilingual encoding have been proposed (Kolers, 1963; MacNamara, 1967). The separate store hypothesis suggests that bilinguals have separate lexicons for each language, while the shared storage hypothesis suggests both languages are organized into a single system. The literature in this area has been staggering, yet to date there has been no conclusive support for either hypothesis.

One way to determine if the languages of a bilingual are separate is to find out if different neurological structures are responsible for each language. Specifically, it has been concluded that language in the typical monolingual is a left hemisphere function. In the bilingual, however, it has been speculated that the second language may be lateralized in the right hemisphere. Although a great number of studies have been done, there have been no conclusive findings. One problem has been the methodologies employed. Two examples are dichotic and tachistoscopic presentation. Dichotic listening tasks simultaneously present different auditory stimuli to both ears. The rationale is that the information presented to the right ear would appear to be projected to the left hemisphere first while information to the left ear would be projected to the right hemisphere. This procedure

has allowed investigators to study how the two hemispheres process speech. If there is an advantage in left ear processing, it is interpreted as strong evidence for right hemisphere lateralization. Similarly, tachistoscopic tasks present different visual information simultaneously to both visual fields. An advantage in identifying words from a second language in the left visual field is considered an indication of right hemisphere lateralization. In the dichotic studies of Albanese (1985), Carroll (1980), and Vaid and Lambert (1978), bilingual subjects were presented with words in both languages. They found an equal right ear advantage for both languages, indicating that there was no significant right hemisphere involvement for the either language. Obler (1984) also has concluded that there have been no findings in dichotic and tachistoscopic studies to suggest that a second language is right hemisphere lateralized.

Consequently, researchers have turned to other methods of investigation. It is generally agreed that language is strongly linked to memory (Atkinson & Shiffrin, 1971; Garro, 1986; Springer & Deutsch, 1985). This raises the interesting possibility that bilinguals encode information for memory differently depending on the language used. The separate store hypothesis suggests that there is something different in how bilinguals encoded information for memory storage. As such, researchers have conducted studies using memory tasks as a means of determining those differences.

One potentially useful method for studing bilingual memory is the release from proactive interference paradigm developed by Wickens (1970). The paradigm can be used to determine the dimensions along which information can be encoded. If information is encoded differently in each language, then it would imply that the language systems are separate. Since there has been little research coupling the release from proactive interference paradigm with bilingualism, the present study will address this interaction by reviewing the theoretical and experimental research done on both bilingualism and memory.

Chapter II

Classification

In investigating language encoding among bilinguals, several factors must be taken into account. For example, Obler (1984) and Vaid and Lambert (1978) reported that a crucial factor in studying bilingualism is the age at which the second language is acquired. Because of the maturational state of the brain, if the two languages of a bilingual are acquired simultaneously at an early age, they predict language lateralization among bilinguals will more closely resemble that of monolinguals. This can be seen as support for a shared storage system. De Zulueta (1984), however, has placed the greatest importance on the subject's fluency. Overall, the literature identifies six general bilingual categories (DeZulueta, 1984; Ervin & Osgood, 1954; Vaid & Lambert, 1978).

(1) Balanced: Bilinguals who have a native proficiency in both languages.

(2) Dominant: Bilinguals who exhibit more fluency in one language than the other.

(3) Compound: Bilinguals considered to have their languages organized into a single system.

(4) Coordinate: Bilinguals considered to have their languages organized into two separate systems.

(5) Early: Bilinguals who acquire their second language at infancy or early childhood. These bilinguals appear to use an analytic semantic

approach to verbal material.

(6) Late: Bilinguals who acquire their second language during or after puberty. These bilinguals seem to depend more on the physical features of verbal material.

It is apparent that these general categories are interdependent. For example, early bilinguals are more likely to be balanced as well. This is not to say, however, that early bilinguals are rarely dominant. This view is reflected by Dillon, McCormack, Petrusic, Gaynoll, Cook, and Laffleur, (1973). Instead of rigidly adhering to any one factor influencing bilingualism, they suggested that bilingualism lies along a continuum from compound to coordinate.

Chapter III

Physiological Basis for Separate Language Stores

Hemispheric Lateralization of Language

Even among monolinguals, the right hemisphere plays a role in language. Rausch and Walsh (1984) implicated a genetic basis for right hemisphere language dominance. They felt both right hemisphere language dominance and language bilateralization was more prevalent in left-handed subjects, particularly those with familial sinistrality. Physiological reports have indicated that when insult to the left hemisphere occurs early, language skills tend to become a right hemisphere function (Springer & Deutsch, 1985). At the very least, this is strong evidence for hemispheric symmetry during infancy and it poses the question: Is it possible that there can be different storage areas within the brain for different languages?

Because of the symmetry of the two hemispheres, questions have arisen asking whether there can be two separate memory stores. Clearly the starting point would be in assessing how information arriving at one side of the brain interacts with information at the other side. Although split-brain research overwhelmingly confirms that speech control is localized to the left hemisphere, research also confirms that the right hemisphere recognizes some stimuli presented to the left field.

Much information on right hemisphere involvement in language comprehension has come from Zaidel's (1978) research

with patients who had undergone cerebral commissurotomies. Restricting visual stimuli to one hemisphere, Zaidel tested the comprehension abilities of each hemisphere. He pointed out that the right hemisphere is better at some language function than others. For example, the right hemisphere is better at comprehension than at speech. The right hemisphere can process a multitude of words and their definitions, although it seems to have some difficulty with more abstract words. Although the right hemisphere is inferior in phonetic and syntactic abilities, it is able to perform these language functions at a rudimentary level. Experiments on split-brain patients by Gazzaniga (1970) and Zaidel (1975) have also shown that although the right hemisphere is incapable of language production, it is quite capable of language recognition.

Multi-language processing has baffled researchers for some time now. As early as 1895, language recovery among aphasic polyglots, that is people who can speak three or more languages, was studied by Pitres' (De Zulueta, 1984). Normally, aphasic polyglots will lose all languages to the same extent and recover them 'in parallel'. Pitres focused on patients whose language recovery was 'non-parallel', in other words, the languages were not recovered uniformly. What he found in these cases was that language recovery begins with the most familiar or most used language, while the least familiar languages follow later. Galloway's (1980) survey on aphasic patients may provide some insight. He

reported a slightly higher incidence of aphasia due to right hemisphere lesions in bilinguals as compared to monolinguals. This may suggest there is a difference in hemispheric lateralization of language in polyglots.

Hemispheric Differences in Memory

Data supporting hemispheric differences in memory have been reported as well (Springer & Deutsch, 1985). These differences may be directly linked to language. For example, left hemisphere dysfunction affects learning and retention of verbal material, while damage to the right hemisphere results in an inability to process for meaning (Vaid & Lambert, 1978). It has also been found that nonverbal encoding was affected in patients with right hemisphere damage (Springer & Deutsch, 1985). Furthermore, studies using animal models show that animals trained in discrimination tasks can perform the same task after a commissurotomy when the discriminating stimuli is presented separately to each visual field (Springer & Deutsch, 1985). This is strong evidence that duplicate memories must be formed at the time the material was first presented.

It becomes clear that researchers are challenged by the possibility that a bilingual's second language may actually be lateralized in the right hemisphere (Albanese, 1985; Galloway & Krashen, 1980). If so, this would certainly be strong support for the separate store hypothesis. Although findings have not been conclusive, they still support dual-hemispheric involvement in language processing, with the

left hemisphere playing a dominant role and the right hemisphere's role uncertain at best (De Zulueta, 1984).

Chapter IV

Methodologies

A key problem in determining how bilinguals process semantic information is assessing the way in which they encode and retrieve words from memory. Methodologies in studying bilingual memory vary. Sanchez de Herrera (1981), in a study of bilingual memory, identified four commonly employed methods.

Free Recall

In free recall experiments the subject learns a word list which contains words in one language and it's equivalent in the other. Subjects are then asked to recall as many words as possible. The assumption is that if bilingual memory is indeed shared, then presentation of the word in both languages should constitute repetition, therefore increasing the likelihood of recall.

Tulving and Colotla (1970) employed free recall tasks in assessing memory in polyglots. These subjects were asked to learn unilingual, bilingual and trilingual word lists. They found that recall decreased from the unilingual list to the trilingual list, which suggests separate memory stores.

There are some problems evident in free recall tasks. For example, free recall tasks require that the word presented be accompanied by it's equivalent. Different cultures, however, emphasize different perceptions. Consider the word "disgust" and it's equivalent in spanish "osco". "Osco", however, connotes much more than "disgust". It is

more of a cross between disgust and aversion. "Disgusto" could be an equivalent, however it's meaning leans more towards "disappointment". This implies that a word perceived as an equivalent may not be a repetition.

Word Association

In word association tasks, subjects are presented with a word and must respond with the first word that comes to mind. With bilingual studies, if the word given as an association in one language is the same as the word given as an association in the other, it is called common representation. Common representation is interpreted as support for the shared memory hypothesis.

Kolers (1963) tested bilinguals using word association tasks, his assumption being that if language was stored according to common, abstract representations, then similar associations would be elicited among the subjects if the words translated each other. Although he interpreted the results as being supportive of the shared position, the support was not very strong. The findings showed that common representation was accountable for fewer than one-third of the responses. In another study (Kolers & Gonzalez, 1986), he conceded his 1963 findings were "a quantity too small to support the notion of common storage," but also "too large to support the other extreme, absolute independence," (p. 53).

Priming Tasks

Priming tasks involve measuring the time it takes to classify items into a given category. These types of tasks

are based on the spreading activation theory of Collins and Loftus (1975). Word pairs are presented, with the word to be classified called the target and the word preceding it known as the prime. Generally speaking, when the prime is of the same category as the target, the time it takes to classify the target decreases. This is known as a priming effect. For example, it would be easier to classify a robin as a bird after first hearing canary. When words that are of different languages but semantically related produce a priming effect, it is interpreted as support for the shared memory hypothesis. Such was the case in the priming experiment of Wolf (1977). She found semantically related words produced a priming effect regardless whether the prime and target were presented in the same or different languages.

Yet priming tasks may not necessarily provide strong support for a shared storage system. Sanchez de Herrera (1981) offered a plausible explanation. She proposed that words from both languages are encoded separately and linked to a common conceptual network, such as the meaning of a given word. Translation occurs by linking a word in one language to its counterpart via this conceptual network. Since priming involves the activation of meanings, a priming effect would be expected regardless of the language in which the target and prime are presented.

Switching Experiments

Switching experiments are conducted in several ways. Basically, subjects read material which may be entirely in

one language or may randomly alternate between the two languages. Researchers then assess variables such as comprehension, verification time, etc. For example, a task might involve interpreting sentences in alternating languages as either true or false. An increase in time for verification of alternating sentences over sentences entirely in one language would be considered as support of the separate memory hypothesis.

Macnamara and Kushnir (1971) used four different switching experiments. The first experiment employed reading paragraphs and measuring reading time. The second involved verification of sentences with one, two and three switches. The third experiment also involved the same type of sentence verification as experiment two, however half of the switched words were visually distinct, printed in red instead of black. The final experiment was also a verification task similar to experiment two, but was presented auditorily instead of visually. In all four paradigms, the time to complete the task increased. Sanchez de Herrera (1981) replicated Macnamara and Kushnir's second experiment, essentially obtaining the same results.

Summary

The results from these methods have been contradictory. This may be due to the extent to which a given task utilizes lexicons or the conceptual network (Sanchez de Herrera, 1981). For example, the results of methods like word association and priming experiments may always appear to

support a shared store hypotheses because both lexicons would tap into a common conceptual representation, especially when dealing with concrete, rather than abstract, words. Since language and memory are so closely linked, it could be that a closer examination of memory tasks may hold the answer to the separate versus shared question.

Chapter V

The Phenomenon of Proactive Interference

Little research in bilingualism has been done utilizing proactive interference tasks. These few studies have consistently shown that when a shift in language occurs, there is a release from proactive interference. It appears these tasks may provide some answers to the separate versus shared dilemma.

Proactive interference refers to a subjects inability to retain information because of previously learned material; or more aptly put, how learning interferes with the ability to learn. For some time proactive interference was thought to affect only long term memory, but today researchers agree that this type of interference is the cause of most short term and long term memory loss (Keppel & Underwood, 1962; Wickens, 1970; Wickens, Born & Allen, 1963).

In 1959, Peterson and Peterson found that there was a relationship between the amount of time a subject was prevented from rehearsing material and recall. As the rehersal prevention task increased from 3 to 18 seconds, the number of correct responses decreased. Although Peterson and Peterson argued that the decline in recall was the result of decay, Keppel and Underwood (1962) argued that it was the result of proactive interference which was building up over the series of test trials.

Wickens, Born and Allen (1963) suggested that the build-up of proactive interference depended on the similarity

of the learning material. Their results showed that when items were dissimilar, there was little interference. When items were of the same class however, either all numbers or all letters, interference occurred in as few as three trials. In a subsequent study, Wickens (1970) suggested the effect of proactive interference was a result of how an item was encoded into memory. In other words, if several psychologically similar items were encoded into the same category this would interfere with retrieval. When subjects were presented with a shift of item categories within a test, there was a "release" from proactive interference. These results tend to support the notion that words are semantically encoded into some sort of cognitive organization.

Procative Interference and Bilingualism

Given these data, Goggin and Wickens (1971) attempted to validate the separate memory store hypothesis. They surmised that if different languages had separate stores, then a shift in language would result in a release from proactive interference. Their data indicated that there was indeed a release from interference when a shift in both language, and language and category, occurred. Goggin and Wickens concluded that their findings supported a separate memory store hypothesis.

Dillon, McCormack, Petrusic, Cook, and Lafleur (1973) compared compound and coordinate bilinguals in the hopes of finding differences between the two groups. They surmised

that coordinate bilinguals would show a higher rate of release over compound bilinguals since coordinate bilinguals were thought to store each language separately. Although there was a release, the data from this study did not indicate a difference between the two groups. Newby (1976) conducted essentially the same study and found the same results. Because there were no differences between these two groups, both Newby and Dillon et al. suggested that the release from interference observed in language shifts might be due to other variables and not simply a case of separate memory stores.

O'Neill and Huot (1984) based their study on Newby and Dillon et al's. interpretation of the data. They speculated that the release obtained with the shift in language was due solely to the different phonological systems of the languages. In other words, the release occurs because it sounds different; not because of separate encoding. O'Neill and Huot employed the release from proactive interference paradigm using consonant-vowel-consonant (CVC) pairs to assess differences in language shifts. These CVC's were rated either low in meaning and high in meaning. Not only did they find a release from proactive interference because of a language shift, but they also found there was a greater recall when there was a shift in meaningfulness as well. O'Neill and Huot felt that a second language would always result in a release because of the different phonological systems, much like a baseline, with a true release occurring

when there is a shift in meaningful material. Thus they did not support a separate memory store hypothesis.

Chapter VI

Discussion

Critical Observations

To date researchers have experienced several difficulties in attempting to answer the separate versus shared question. The first problem is in subject selection, such as determining which subjects are coordinate and which are compound. By definition, coordinate bilinguals store their languages separately, yet the concept of separate language stores is still under debate. Since coordinate bilinguals may not exist in reality it becomes impractical to compare two hypothetical groups for differences. For example, the study by Dillon et al. (1973) assessed compound-coordinate differences in proactive inhibition tasks in order to shed some light on the separate versus shared issue. Subjects were selected on the basis of self-report interviews and labeled as either compound or coordinate bilinguals. If a person learned both languages in the home prior to the age of six, as opposed to after the age of six at school, he was labeled as a compound bilingual. Both groups were clearly early bilinguals. There is no hard evidence, however, which supports the notion that early bilingual can be categorized strictly as either compound or coordinate. Dillon et al. found no differences between the two groups, leading them to hypothesize that there may be no true compound-coordinate distinction.

The second problem arises with the type of methodology

employed. As noted earlier, tachistoscopic and dichotic presentation are not sensitive enough to establish a distinction in language processing. In addition, free recall tasks may be confounded by different cultural perceptions. Other types of methodologies have had discernable problems as well. For example, MacNamara and Kushnir's (1971) third switching experiment involved sentence verification where half of the switched words were printed in red, making them visually distinct. Both Grand (1968) and Dyer (1973), however, found that color-word tasks may result in interference. Dyer pointed out in his review of the Stroop effect, "Since the word aspect of the Stroop stimulus strongly effects naming of the color, it is logical to assume that a similar interference might occur for the reading of the words as a result of the presence of colors," (pg. 108). This interference can be extended to switching tasks which employ different colors to identify key words. It may be that these switched word provide a visual distraction which may result in a slower reading time.

Of all the methodologies proposed, proactive interference has lent itself best to the investigation of the separate versus shared question. Although there have been few experiments in this area, the data from these studies have shown a consistent release from proactive interference whenever a second language is presented. This may be interpreted as support for the separate store hypothesis. Proactive interference tasks, however, have not been without

it's critics. In this area, O'Neill and Huot (1984) are the strongest opponents to the separate store hypothesis. Their study would suggest that the subject is attending to the physical characteristics of an item rather than the psychological classifications. Yet studies utilizing deaf subjects in studies of memory and language have shown this not to be the case.

Only two studies have investigated the effects of proactive interference and deaf subjects. In a comparison of deaf and hearing children, Hoemann, Andrews and DeRosa (1974) found deaf children were subject to the effect of proactive interference build-up when the same conceptual class of material was presented. Additionally, the deaf group also showed a release when sets from different categories were presented. They concluded that deaf children are able to think abstractly, thereby encoding information categorically instead of phonologically. In light of this finding, it is feasible to assume that O'Neill and Huot's interpretation of the data is incorrect and that subjects do attend to the psychological characteristics of words. Although the existence of deaf bilinguals has been established (Christensen, 1986; Kannapell, 1986), there have been no studies on the effects of proactive interference on this group. This may be because deaf bilinguals would constitute a very small percentage of the population.

Rationale for Further Investigation

Proactive interference tasks would appear to be best

suited to investigating the phenomenon of separate encoding among bilinguals, yet there is need for further clarification of variables which may confound the data. Criteria for subject selection need to be re-evaluated. One possible model would be to compare early and late bilinguals who possess the same level of fluency in both languages. Self-report assessments on fluency can be subject to suspect, and should be avoided.

Another area not thoroughly accounted for is the use of distractor tasks. Release from proactive interference build-up may be affected by any materials presented within the session. Although distractor tasks utilized in past studies have involved non-semantic processing (ie: counting backwards, adding, etc.), they are still performed verbally, in either one language or the other. The assumption that the release from proactive interference is due to the phonological change which occurs also suggests a subject will attend to the novelty of the sound. For example, if the first three sets are in English, and the distractor task is in English as well, it is possible when the last set is presented in the alternate language that a shift occurs solely because the change was unfamiliar. It is possible that different results may be obtained if the subject's second language is presented throughout a session as a distractor task, minimizing the last set's novelty. If a shift is indeed observed, it could be viewed as strong support for separate language stores.

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