ASPECTS OF COGNITIVE AND LINGUISTIC DEVELOPMENT OF BILINGUAL CHILDREN : A STUDY OF ENGLISH-LATVIAN BILINGUAL SCHOOLCHILDREN

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SUMMARY

Twenty three English-speaking monolingual children between the ages of 6 and 11 years, were matched for age, sex, school grade, intelligence as measured by Raven's Coloured Progressive Matrices, and the occupational status of the father, with 23 Latvian-English speaking bilingual children. The performance of both groups on three linguistic tasks, i.e. word naming, speed of reading and sentence construction, was compared. The cognitive development stage reached by the two groups was assessed using Siegelman and Block's (1969) form A of Smedslund's (1964) Concrete Reasoning Scale. The four items on this scale measure understanding of concepts of conservation of discontinuous quantity, reversal of spatial order, conservation of length and transitivity of length.

There were no significant differences between the monolingual and bilingual subjects on any of the three linguistic measures. The scores of the bilingual subjects exceeded those of the monolingual subjects on every item of the Concrete Reasoning Scale, but the differences were not statistically significant.

The bilingual sample was divided into concurrent and consecutive subgroups on the basis of the age at which the second language had been introduced. The concurrent group's mean age at the time of introduction of the second language was 27 months, and the consecutive group's mean age at the time of introduction of the second language was 47 months. There were 11 subjects in the concurrent group, 10 boys and 1 girl, while the consecutive group had 12 subjects, 7 boys and 5 girls. Although it was not possible to match the groups on critical variables, statistical analysis showed no significant differences, between the concurrent and consecutive bilingual samples, in age, Raven's Coloured Progressive Matrices scores, grade attended at school or the occupational status of the father.

The concurrent and consecutive bilingual groups were compared on the same three linguistic skills tasks as the monolinguals, but in both Latvian and English. Difference scores between their performance on these tasks in both languages gave measures of bilingual balance or proficiency. Form A of Smedslund's (1964) Concrete Reasoning Scale was used to assess cognitive skills.

Although the consecutive bilinguals performed better than the concurrent bilinguals on almost all the linguistic

tasks, in both languages, there were no significant differences between the groups on these measures. Similarly, the bilingual balance measures, i.e. the difference scores between performance in Latvian and in English, showed no significant differences between the two groups.

The results from the Concrete Reasoning Scale present the same picture. On all but the first item, where both groups scored to criterion, the consecutive bilinguals gave more correct answers, and more adequate reasons for those answers than did the concurrent bilinguals, but none of the differences reached significance.

The possible reasons for these findings, and their implications for theoretical models of bilingualism, are discussed.

AUTHOR'S STATEMENT

This thesis contains no material which has been accepted for the award of any other degree or diploma in any University. Nor, to the best of my knowledge and belief, does it contain any material previously published or written by another person, except where due reference is made in the text of the thesis.

Inara Proske

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CHAPTER 1.

BILINGUALISM AND COGNITIVE DEVELOPMENT.

1. Introduction

This thesis is concerned with the effects of childhood bilingualism on cognitive and linguistic development. More specifically, it is concerned with possible differences in linguistic and cognitive functioning of bilingual children who have learned their two languages either concurrently or consecutively.

Such a topic cuts across two well documented fields of enquiry within the study of bilingualism, that is, the effects of bilingualism on intelligence and cognitive development, and the effects of different language acquisition contexts on bilingual proficiency. Work in both these areas will be briefly reviewed.

2. The relationship between bilingualism and intelligence

The relationship of childhood bilingualism to intelligence is one of the most copiously documented and most hotly debated fields within the study of bilingualism. Despite the numerous reports published on this topic since the early 1920s no consensus of opinion has yet been reached.

Studies supporting the detrimental effects of bilingualism on intelligence numerically outweigh those

supporting its favourable effects. In one of the first, and largest studies in this field, Saer (1923) tested 1400 Welsh-English bilingual children in Wales. Information about socioeconomic status, the language used in the home, and the age of each child was obtained, but no attempt was made to match monolingual and bilingual children on these criteria. A Welsh translation of the 1916 Stanford-Binet Scale was used. It was found that rural bilingual children scored significantly worse on the test than rural and urban monolinguals, and also worse than urban bilinguals. Other findings from this study were that essays written by the bilinguals were inferior to those of monolinguals in power of expression, choice of vocabulary and accuracy of thought.

Jones and Stewart (1951) gave both verbal and nonverbal tests to monolingual and bilingual subjects in rural districts. The monolingual subjects scored significantly better than the bilinguals even though adjustments were made for intergroup differences in nonverbal IQ. However, Jones (1959) himself later pointed out that the groups used in this study varied in terms of the socioeconomic status of the parents and that the differences between the two groups on the IQ tests may be a result of this discrepancy rather than a function of bilingualism.

Anastasi and Cordova (1953) administered the Cattell Culture-Free Test to Spanish-English bilingual children living in the Spanish Harlem section of New York. The standard score IQ for the group was 1.25 standard deviations below the test norm. This was attributed by the experimenters to the low socioeconomic status of the parents and to the bilingualism of the children which made them deficient in both English and Spanish. Anastasi and Cordova concluded that not only test performance, but also general intellectual development were both handicapped by the children's early linguistic confusion.

The three studies reviewed above form only a small part of the large body of literature reporting an overall adverse effect of bilingualism on intelligence as measured by IQ tests. More detailed reviews are to be found in Darcy (1953, 1963), Peal and Lambert (1962) and Macnamara (1966).

A second subcategory of studies reports differences between monolinguals and bilinguals only on verbal IQ measures, but show no differences, or superior performance by bilinguals on performance scales. Seidel (1937), for example, found that monolinguals performed better than bilinguals on verbal tests, but that the bilinguals outstripped the monolinguals on performance scales. The

tests used were the 1916 version of the Stanford-Binet Scale and the Arthur Point Scale of Performance. Darcy (1946), in a study in which monolinguals and bilinguals were matched on age, sex and socioeconomic status, found that the monolinguals performed significantly better on the 1937 revision of the Stanford-Binet Scale but lower on the Atkins Object Fitting Test.

Many of the studies of bilingualism which deal with its effects on intelligence also investigate other, related, effects as well. Carrow (1957) worked with Spanish-English bilinguals in America. Monolingual and bilingual children were matched on age and socioeconomic status, and attended the same school. She found that the groups did not differ significantly on non-verbal IQ as assessed by the Otis Quick-Scoring Mental Ability Test, Alpha. The two groups were assessed by means of the California Test of Achievement, the Durrell-Sullivan Reading Capacity Test and the Fairbanks Test of Articulation for Non-Readers. In addition, a three minute segment of free speech (retelling a story) was analysed under a number of headings including length of clause and number and type of grammatical errors. Scores obtained by monolinguals were higher than those of the bilinguals but only in oral reading accuracy and comprehension, and in "hearing

vocabulary" were the differences significant. It was found that bilinguals made twice as many grammatical errors as monolinguals.

Several investigators report no-difference findings between monolinguals and bilinguals in terms of intelligence test results. Darsie (1926), working with Japanese-English bilinguals in America found the Japanese subjects scored less well than Americans on some tests (e.g. in silent reading), but not in others (spelling). However, no attempt was made to control for the effects of socioeconomic status, or degree of bilingualism. Hill (1936), worked with primary school age Italian-English bilinguals and English-speaking monolinguals in the U.S. His study is of especial interest because he matched the monolingual and bilingual subjects for age, sex, mental age, IQ and socioeconomic status. Bilingualism was assessed by a Language Background Questionnaire, a test of comprehension of spoken Italian and three tests of Italian word meaning. No reliable differences were found, in scores on verbal, non-verbal and performance tests, between Italian children who heard and spoke Italian at home, and Italian children who heard and spoke English at home. These findings are to be expected since the groups had been matched for mental age. More pertinently, there were no significant differences between monolingual and bilingual

subjects on the verbal and nonverbal intelligence tests.

In a study of bilingual university students, Spoerl (1944) matched monolingual and bilingual subjects for age, sex, socioeconomic status and IQ as measured on the Henmon-Nelson Test of Mental Ability. The subjects were then given the 1937 revision of the Stanford-Binet Intelligence Examination and the Purdue Placement Test, in English. Records of school achievement were also collected. No significant differences were found between monolinguals and bilinguals on the Stanford-Binet Scale. The bilinguals scored better on the Purdue Test and had done significantly better than the monolinguals in their high school careers. Spoerl attributes this better school performance, in the face of the no-difference in IQ finding, to a compensatory drive originating in a feeling of "environmental insecurity".

There have been very few studies of childhood bilingualism which demonstrate its favourable effect on intelligence. The two early ones most frequently cited are those of Davies and Hughes (1927) and Stark (1940). The former found that Jewish children were superior to non-Jewish children in arithmetic, English and general intelligence. Stark found differences in IQ between monolinguals and bilinguals at eleven years of age, but found that later the trend was reversed. However, these

studies were relatively poorly controlled. Macnamara (1966) in fact, points out that Davies and Hughes nowhere state that theirs is a study of bilingualism, it is only subsequent interpreters of the data who have assumed that the Jewish children were bilingual.

The best controlled study demonstrating favourable effects of bilingualism on intelligence is that of Peal and Lambert (1962). In this study, ten year old French-English bilinguals were matched for age, sex, and socio-economic status with a group of monolinguals. The bilingual children had to demonstrate equal facility in both languages in order to be included in the sample. This was determined by selecting subjects whose scores on a word association test, a word detection test, the Peabody Picture Vocabulary Test and on a subjective self-rating scale were approximately the same in both languages. The bilinguals and the monolinguals were then given the Lavoie-Laurendeau Test of General Intelligence, and several subtests from Thurstone's Primary Mental Abilities scales. The subjects' marks in French school skills were also collected. Peal and Lambert found that the bilinguals achieved significantly higher scores than the monolinguals on the non-verbal scales of the Lavoie-Laurendeau test, and also significantly higher total IQs.

The bilinguals' school grades were also significantly higher. When mean verbal IQs had been adjusted by analysis of covariance for the difference in mean non-verbal IQs, there was no significant difference between the groups on this variable.

Peal and Lambert factor analysed the data of their study and showed that their bilingual students had a greater number of separate or independent abilities on which to draw in carrying out the tests. This is seen by the experimenters as giving support to the view "that bilinguals have developed more independent abilities and skills at an earlier age through their experiences and their learning of a second language." (Peal and Lambert, 1962, p.16). The authors go on to say that their bilinguals seem to be profiting from a language asset "rather than labouring under a 'language handicap'."

Peal and Lambert suggest that their results may be partially explained by their method of choosing the bilingual sample. When the bilingual balance measures used in the selection procedure did not give a clear indication of whether a child was bilingual or not, more weight was given to the English vocabulary test score. It is therefore possible that children who were balanced bilinguals, but whose English and French vocabularies were small, would be excluded from the sample. This means that less intelligent bilinguals i.e. those who have not acquired

reasonably large vocabularies, would not be considered as subjects. For this reason, Macnamara (1966) doubts the validity of these results, and suggests that they are true only of bilingual children who are highly gifted and show "a flair for language learning", (Macnamara, 1966). Anisfeld (née Peal) and Lambert (1969) elsewhere deny that the sample was in any sense biassed, but go on to point out that "as in any correlation, there may be two possible directions of the cause-effect relation". They themselves prefer the explanation that the process of becoming bilingual influences intellectual development favourably, while Macnamara espouses the view that only the more intelligent children become as proficient at two languages as the original Peal and Lambert study required.

An attempt to enquire more closely into the direction of the relationship between bilingualism and intelligence has been initiated by the Montreal group, in conjunction with Macnamara (see Lambert, Just and Segalowitz, 1970). They have begun a bilingual education scheme by means of which they hope to be able to follow the changes in many aspects of child development which may occur during the process of becoming bilingual. In this programme, public-school, English-speaking children in the first three school grades are taught exclusively in French in the first year, and in the second and third years are taught English as a

subject matter in half-hour sessions. The data from this longitudinal survey are still incomplete, but preliminary data for the first two years are available (Lambert, Just and Segalowitz, 1970).

At the end of Grade 1 under this system there was some ambiguity about the standing of the bilingual classes on intelligence measures. The first classes to pass through this system were below one of the control group classes and equivalent to another on Raven's Progressive Matrices measures. In the second (or follow-up) classes of Grade 1, the bilingual groups scored as well as, but no better than, both the control classes. Lambert et al (1970) say that "at the end of Grade 1, it seems safe to conclude that there is no evidence of intellectual retardation attributable to the experimental program."

After Grade 2, there was again no difference among classes on Raven's Progressive Matrices measures, nor on the Thorndike-Lorge battery of tests. Thus, so far this programme has shown no evidence of cognitive retardation, and it has shown that highly developed skills in French, which the experimental classes now possess, need not be acquired at the expense of "cognitive confusion", and the lowered performance on intelligence tests which was thought to be an almost inevitable concomitant of childhood bilingualism.

Although the Montreal longitudinal survey is probably the best controlled study of bilingualism yet attempted, it still does not resolve the contradictory findings of the many studies dealing with the effects of bilingualism on intelligence. Some of the confusion is probably due to the varying definitions of bilingualism used, which must affect the selection of the sample. Definitions range from Bloomfield's (1933) "native-like control of two languages" to Macnamara's (1969) decision to use the term bilingual "of persons who possess at least one of the language skills, even to a minimal degree, in their second language." The definition used by any researcher is likely to influence the choice of measures of bilingual proficiency used, if any are used at all. The most common measure is the Language Background Questionnaire in which the subject specifies which language he uses with whom, and how often. Many of the more recent studies use more direct measures of bilingual proficiency, but the choice of such measures is still very wide, and their validity and reliability in many cases is still suspect. Macnamara (1969) has analysed rating scale, fluency test, flexibility test and dominance test techniques of bilingual assessment, and has found that self rating scales and speed of reading aloud in both languages, are better indicators of general level of skill in the two

languages than the popular Language Background Questionnaires.

Darcy (1963) suggests other possible reasons, apart from different definitions and measurement techniques, which may account for the divergent results in the field. One of the most obvious is the degree to which, and variables on which, the bilingual and monolingual samples are matched. One of the critical variables seems to be socioeconomic status, which many of the earlier workers completely ignored. Darcy also suggests that part of the conflict may be resolved by stating the age at which the child or adult was first exposed to the second language, since there are likely to be differences between early and later introduction of the second language.

Furthermore, it may also be the case that some of the disadvantages which several researchers attribute to bilingualism may more properly be attributed to the bi-cultural aspects of the situation. Soffietti (1955) feels that "most of the difficulties and retardations indiscriminately ascribed to bilingualism are rather due to the bicultural aspects ... it is the living in two distinct cultures, either overtly or in one's internal life that might create adjustmental problems. It is a conflict between ways of life, beliefs, customs, value systems and not necessarily one between language systems."

In summary, it may be said that studies of the relationship between intelligence and bilingualism fall into four categories: (after Peal and Lambert, 1962).

1. Bilingual children are found to be inferior to monolingual children on both verbal and non-verbal test scores.
2. Bilingual children are found to be inferior on verbal tests, but perform as well as monolingual children on non-verbal tests.
3. Bilingual children score as well as monolingual children on both verbal and non-verbal tests.
4. Bilingual children are found to be superior to monolingual children on both verbal and non-verbal tests.

These contradictory results may reflect use of different definitions of bilingualism and different tests of bilingual proficiency. A large part of the disagreement is probably due to wide variations in the sophistication of the matching procedures, especially for the socio-economic status variable. Finally, it is arguable that many of the detrimental effects of bilingualism, including its effect on intelligence as measured by IQ tests, are attributable to the bicultural rather than the bilingual aspects of the situation. This may be a confounding variable in that not all researchers specify whether they

are dealing with bilingual-monocultural or bilingual-bicultural samples.

3. The effect of bilingualism on cognitive development

Since the mid 1960s, studies of bilingualism have diverged from the earlier global assessments of its effect on intelligence, and have concentrated more on its effects on specific cognitive functions. The impetus for this change in direction comes, at least in part, from the difficulties involved in making sense of the earlier, contradictory findings. A further reason for the changing emphasis is undoubtedly the current resurgence of interest in cognitive development which came with the popularisation of Piaget's theory of development.

One of the first of the new-look studies of bilingualism was that of Anisfeld (1964). Her own earlier finding (Peal and Lambert, 1962) that bilinguals perform better than monolinguals on standard IQ tests led her to examine more closely the ways in which cognitive functioning of monolingual and bilingual children may differ. The term cognitive functioning was used to include those numerical, verbal and spatial abilities normally measured by IQ tests, and also processes such as concept formation and problem solving.

When Anisfeld's monolingual and bilingual subjects were matched for overall IQ scores, the one subtest on

which the bilinguals scored significantly better than the monolinguals was the Lorge-Thorndike Number Series. Ainsfeld argues that this test requires facility in the manipulation of symbols, cognitive flexibility and inductive reasoning. Furthermore, on reanalysing her 1962 data, Ainsfeld found that when subjects were matched on overall IQ scores, the bilinguals performed significantly better on Raven's Progressive Matrices, which is a procedure thought to test the ability to abstract principles and carry out symbolic manipulation. These results are interpreted as suggesting that bilingualism may favour superior cognitive functioning.

An experiment designed to test for differences in monolingual and bilingual functioning which is directly tied to Piaget's theories was carried out by Liedtke and Nelson (1968). According to Piagetian theory, cognitive development proceeds through qualitatively different stages which occur in a definite sequence. In each stage the abilities necessary for the next stage are acquired. The rate of acquisition of these preparatory abilities is determined by four factors: maturation, experience, social interaction and equilibration. Both experience and social interaction are culturally, rather than genetically determined, and it is these two factors, asserts Piaget, which are mainly responsible for individual differences in

the speed of cognitive development.

Liedtke and Nelson felt that the process of becoming bilingual, which implies more explicit teaching than monolinguals are accustomed to, and which may also mean that the child is exposed to a greater amount of social interaction, may result in accelerated development. To test this, they developed a series of tests on concepts of linear measurement. This consisted of six subtests designed to measure reconstruction of relationships of distance, conservation of length, conservation of length with change of position, conservation of length with distortion of shape, measurement of length and subdivision of a straight line. All these subtests were derived from Piaget's own tests.

Subjects in the experiment were Grade I monolingual and bilingual children. No definite matching procedure was undertaken, but statistical analysis revealed no significant differences between the samples on age, socioeconomic status and intelligence as measured by the 1962 revision of Thurstone's Primary Mental Abilities Test. The results showed that the mean for the bilingual sample on the whole Concepts of Linear Measurement Test was significantly higher than the mean of the monolingual sample. The same finding applies when the test is broken down into its conservation and measurement component

parts. Liedtke and Nelson interpret their results as showing that "the linguistic and cultural experience of the bilinguals is an advantage. The evidence would seem to demonstrate the importance of social interaction and social environment as ingredients of experience. Intelligence factors necessary for concept formation seem to be developed to a greater extent in the bilingual subjects."

Liedtke and Nelson also found that of the five independent variables they considered, i.e. age, kindergarten attendance, sex, intelligence and socioeconomic status, only intelligence was found to be a significant factor in predicting scores on the concept formation tests. This corroborates earlier findings that on such tests, "brightness pays off."

Results such as these reinforce the idea that becoming bilingual speeds up the rate of at least some aspects of cognitive development. This is further supported, at least partially, by Calabrese's (1971) study. His Italian-English bilinguals were matched for age, sex and socioeconomic status with monolingual subjects, but were not matched for intelligence. He administered four subtests taken from Smedslund's (1964) Concrete Reasoning Scale, i.e. tests of understanding of the addition and subtraction of one unit, reversal of spatial order,

transitivity of discontinuous quantity and transitivity of length. There were no significant differences between the monolinguals and the bilinguals on the first three tests, but on the transitivity of length test the bilinguals scored significantly better.

One of the most carefully controlled experiments designed to study the relationship between bilingualism and cognitive development is that of Worrall (1970). She restricted her bilingual sample to those children who had been brought up in a one person-one language home environment, i.e. where one parent consistently speaks one language to the child, and the other speaks another language. Her subjects were English-Afrikaans bilingual children. They were matched for age, school grade, sex, social class and intelligence as measured by the National Bureau of Education and Social Research Group Test for 5-6 year olds and 7-8 year olds, with both English- and Afrikaans-speaking monolingual control groups.

Worrall's first concern was to test experimentally an assertion frequently made of bilingual children, i.e. that they learn, at an earlier age than monolingual children, to separate content from form in stories, songs and rhymes. This was tested using a semantic and phonetic preference test, and a Vygotsky-type interview. It was found that in the two monolingual samples preference for the semantic

aspect of words increased with age. A significantly higher proportion of bilingual subjects in the nursery school sub-sample (5-6 years) were classified in the semantic preference category when compared with both monolingual control groups. The results of the Vygotsky-type tasks showed that a significant proportion of bilinguals, unlike their monolingual peers, had acquired an understanding of the arbitrary nature of the name-object relationship.

The second aim of Worrall's study was to examine cognitive development of monolingual and bilingual children on three measures, i.e. optional shift and classification and coding tests. The optional shift task was designed to separate those subjects who made mediating responses to the task from those who did not. The classification tasks compared subjects on the extent to which they could formulate or anticipate a plan to classify objects placed before them, on the extent to which they could verbalize the formulations, and finally, on the extent to which they could discover one or several criteria of classification. The tasks were designed to test the Piagetian concepts of flexibility of foresight, or anticipation, and flexibility of hindsight, or retrospection. The coding task compared the speed with which monolingual and bilingual subjects executed a coding task drawn from coding subtest A of the 1949 version of the Wechsler Intelligence Scale for Children.

Contrary to Worrall's predictions, there were no significant differences between monolingual and bilingual subjects on any of the three tests of cognitive development.

The four studies of the relationship between bilingualism and intelligence reviewed here suggest that the earlier pattern of contradictory findings is being replicated, despite the increasing sophistication of experimentation. Ainsfeld (1964) and Liedtke and Nelson (1968) found evidence to support the idea of accelerated cognitive development with childhood bilingualism. However, Liedtke and Nelson did not match experimental subjects individually with control subjects. When such matching was carried out, for age, sex, school grade and socioeconomic status, Calabrese (1971) found that bilinguals performed better than monolinguals on only one out of four Piagetian type tasks. When Worrall (1970) matched experimentals with controls on the same variables, and IQ test scores as well, she found no evidence of accelerated cognitive development in bilingual children. It begins to seem that as matching procedures on all the variables that seem relevant become increasingly meticulous, there is a corresponding decrease in the amount of evidence which supports the idea that childhood bilingualism may lead to an acceleration of cognitive development.

4. Naturalistic observations of childhood bilingualism

There remains a third approach, in addition to the two outlined above, which documents the effect of childhood bilingualism on linguistic and cognitive development, i.e. the intensive longitudinal study of a bilingual child's linguistic and cognitive development. This approach is characterized by relatively informal and anecdotal, but very detailed, description, complete with phonetic transcriptions, of a child's progress through the simultaneous acquisition of two languages.

The best known of these studies are those of the linguists Ronjat (1913) and Leopold (1939-49). Louis Ronjat, son of a German mother and a French father, was exposed to both languages from birth, hearing only German from one parent and French from the other. This scheme was adhered to throughout childhood and was used in order to reduce sources of confusion for the child. By the time Louis was four years old he had a substantial vocabulary in both languages and a reasonable command of their syntactic structures. Ronjat himself was convinced of the advantages of this dual language acquisition procedure. Louis' accent and pronunciation, his knowledge of the two languages and his intelligence, according to his father's estimate, did not differ from those of a monolingual Frenchman or German.

A generation later, in a different setting, Leopold (1939-1949) carried out the same type of study with his two daughters, Hildegarde and Karla. In this case the mother was English-speaking and spoke only English to her daughters, while the father spoke only German to them. It was Leopold who stressed the fact that bilingual children seem to be aware, at an earlier age than monolinguals, of the arbitrariness of the name-object relationship. The conclusions of his longitudinal study are the same as those of Ronjat, i.e. a facility in the use of both languages which is no different from that of their monolingual peers. Indeed their proficiency in the language of their schooling, English, and their general standing in school was above average.

Slobin (1966) has reported a more recent study of the simultaneous acquisition of two languages by a child. Imedadze's daughter acquired Georgian from her parents and grandfather, and Russian from her grandmother and nurse. It is reported that by the end of the child's second year, she was separating the two languages and using them consistently with the people associated with one or other language. These results are interpreted as supporting the view that the early acquisition of two languages enhances the development of language and of intelligence.

These three studies present anecdotal evidence of normal, or in at least Leopold's study, of accelerated cognitive development of young children acquiring two languages simultaneously. However, despite their wealth of documentation, they do not provide insights which could be useful in reconciling the contradictions and conflicting evidence derived from surveys and experiments designed to examine the effects of childhood bilingualism on cognitive development.

5. Theories of bilingualism

One of the major reasons for the confusion in the field of bilingualism is doubtless the lack of an explicit theory. The sociologist, Fishman (1969) makes the point that... "without explicit ties to a model of cognitive functioning on the one hand and without explicit ties to a model of societal patterning on the other, most psychological work on bilingualism seems to have remained theoretically where it was a decade ago."

Fishman's comment deserves qualification. An analysis of bilingualism in social-psychological terms has been initiated by Lambert and his co-workers in Montreal (see Lambert, Gardner, Barik and Tunstall, 1963). Their theory holds that as an individual acquires a second language he gradually adopts various aspects of behaviour which are characteristic of the other linguistic-cultural

group. The ethnocentric attitudes of the learner, and of his family, as well as his attitudes toward the other group are thought to determine his success in acquiring the second language. More specifically, the motivation of the person acquiring the second language is determined by his orientation towards it. The orientation is labelled instrumental if the reasons for learning the second language have to do with the strictly utilitarian value of bilingualism such as job prospects or advancement. The orientation is called integrative if the learner is oriented towards either partial or complete integration into the second group. Gardner and Lambert (1963) have found that integratively motivated students were more successful in acquiring a command of the second language than were instrumentally motivated students. They also found that an integrative orientation correlated highly with a general positive disposition of the learner's family to the other group. There was no correlation between such an attitude and specific aspects of the learner's family such as the parents' skill in the other language (French) or the number of their French acquaintances.

Other findings include the fact that an authoritarian disposition (as measured by the California F-Scale) and feelings of anomie, coupled with both a favourable attitude

to France and an instrumental orientation gave a profile of low achievement in French. Despite the fact that this was true only of beginning students and not of advanced students, Lambert (1963) says elsewhere that "further evidence indicated that the integrative motive was the converse of an authoritarian ideological syndrome, opening the possibility that basic personality dispositions may be involved in language learning efficiency." So at least a beginning has been made in formulating ties between bilingual functioning and the social psychological environment.

Similarly, a beginning has also been made in formulating a psychological theory of childhood bilingualism. Anisfeld (1964) believes that contact with two languages and two cultures from early childhood, when there is maximal growth of the central nervous system, results in more rapid development of intellectual capabilities. She feels that there are at least three possible ways in which bilingual children differ from monolingual children. Firstly, a bilingual will have a slightly different world view than a monolingual. Because a bilingual commands two languages, there are more symbols available to him, and this will lead to semantic enrichment of his verbal repertoire. This follows from the fact that a proficient bilingual can fully understand the

range of fine shadings and nuances in meaning in both languages. For example, a German-English bilingual would not identify the concepts embodied by the translation equivalents of 'fatherland' and 'Vaterland' at any but the most superficial level (example taken from Brown, 1958).

Secondly, Anisfeld feels that bilinguals will show a more flexible approach to problem solving. As Carroll (in Anisfeld, 1964) says: "language users tend to sort out experiences according to the categories provided by their respective languages." This suggests that the dual systems of categories and symbols available to the bilingual will increase the scope of "perceptually salient experiences" and lead to increasing practice in discrimination. Such training in discrimination and also generalization is felt to result in a greater flexibility of approach to new situations. This, in turn, results in the bilingual child gaining a cognitively clearer understanding in a wider variety of situations, than the monolingual child. In other words, the wider the range of available coding systems, the wider the range of experience to which the child will react.

Finally, the process of becoming bilingual is felt by Anisfeld to result in abstract thinking at an earlier age than it appears in monolinguals. This statement is

supported by the anecdotal evidence of Leopold (1939-49) and the experimental evidence of Worrall (1970). Once it is understood that the name of an object performs a symbolic function, rather than being part of the object, more efficient cognitive functioning can take place. Vygotsky (1962) asserts that language comes to be used as an analytic tool in thinking only after the name of a concept has become a symbol or generalization of reality. Piaget holds a similar view. He has stressed that "the adaptive functioning of symbolic processes demand that the subject be able to distinguish a sign and what it stands for" (Berlyne, 1965). However, Piaget places the beginning of such ability at about ten or eleven years of age, which does not argue for any advantages in becoming bilingual in early childhood. This remains one of the many unresolved conflicts in the field.

A similar, but more detailed, theory of childhood bilingualism has been proposed by Worrall (1970). The theory is strictly applicable only to bilinguals who have acquired both languages simultaneously from early infancy since she restricts herself to a particular definition i.e. "the acquisition of two languages by a child exposed from infancy to a one-person, one-language home environment", of bilingualism. Worrall's (1970) theory receives much of its impetus from the observations of Leopold and Ronjat,

but such observations are incorporated into a theory of cognitive functioning which draws heavily on the work of Piaget and Berlyne. Using such a framework, Worrall draws the following conclusions about the effects of childhood bilingualism:

1. The bilingual child may abstract the meaning of words earlier than his monolingual peers, through his experience with two names for one object or event. The reasoning behind this conclusion is similar to that of Anisfeld (above) and will therefore not be elaborated any further.

2. The bilingual child must actively manipulate linguistic events in two media of expression and should thus develop a clearer awareness of language than a monolingual child, and at an earlier stage of development.

3. The bilingual child is forced, from a very early age, to behavioural equivalence with respect to verbal signals, and conversely to acquire distinct labelling responses peculiar to each linguistic circumstance. Behavioural equivalence and labelling responses are considered to be elements of directed thinking, in Berlyne's terms. Directed thinking, which includes reasoning and logical thinking, functions to obtain solutions to problems. Berlyne (1965) says that "directed thinking... not only identifies classes of

stimulus situations that should be made behaviourally equivalent and associated with common labelling responses; it is essentially a means of identifying or constructing appropriate patterns of mediators, including labelling responses."

Worrall maintains that a bilingual child is forced into a form of behavioural stimulus equivalence at an early age, and is constrained to form common labelling responses. This is inherent in the bilingual situation; the same referent, slightly different in each situation depending on which of the languages it is associated with, can elicit both similar and different responses, depending on whether a common instrumental response, or a different linguistic response, is required. Worrall says: "we propose that the bilingual child learns at an early age a form of stimulus equivalence with respect to verbal signals which may serve him in the acquisition of concepts of class, relation and number." This is based on Berlyne's assertion that any form of learning but especially the type of learning which constitutes directed thinking, generalizes readily across different situations. Thus, the development of such patterns of responses as are imposed on a child who is in the process of becoming bilingual, may augment the foundations of logical reasoning.

4. The bilingual child who switches from one language to another is seen as engaging in transformations of data at three different levels, i.e. lexical, pattern and 'chunk' transformations. Worrall sees the process of changing from one language to another, in response to linguistic or contextual cues, as an analogue of Berlyne's transformational process. A transformational-seeking habit will enable a subject to represent to himself the situation which will result from the transformation of a particular situation. A transformation-selecting habit enables the subject, when confronted with two situations, to represent to himself a transformation which will turn the first situation into the second. Worrall contends that these two habits form the basis of directed thinking, and that bilingual children are more practised in these habits through continual switching from one language to the other. Such transformations may operate at three levels. Lexical transformation involves switching from one linguistic response to the translation equivalent in the other. Pattern transformation results from the switch from one phonological, morphological and syntactic pattern to the other. A switch to the most appropriate lexicon, rather than a mere word-for-word translation, involves 'chunk' transformations.

Transformational habits such as these, acquired in the bilingual situation, are assumed to generalize to other stimuli as well.

5. The nature of the bilingual situation, especially when restricted to Worrall's definition, constrains the child to pay particular attention to contextual cues in order to respond in the appropriate language. This may lead to heightened attentional or orienting responses which may generalize over a wide variety of situations. Worrall cites the work of Goss (1961) who thinks of receptor-orienting responses as being functionally equivalent to strategies or attitudes. The chunk transformations described above are seen as being closely related to that exploratory or selection activity which many theorists describe as the essence of central attentive processes. Worrall says that "searching for the right word or the right idea [in translating from one language to the other] could obviously generalize to other situations, notably the hunting and searching for solutions to problems." This is the type of behaviour which Worrall considers constitutes the attentive process in voluntary behaviour, hypothesis production and hypothesis testing, which all serve to increase the efficiency of cognitive functioning. Once again, it is assumed that the orienting responses and the hypothesis testing activities are highly

generalizable from the linguistic to other contexts.

6. The bilingual child is confronted with two linguistic systems, each with its own lexicon and different phonological, morphological and syntactic structures. Worrall contends that this leads to variability in training which may accelerate and enhance a flexible approach to problem-solving, in fact a "set for diversity" is likely to be developed. This set is assumed to generalize to other, non-linguistic contexts, which may, again, accelerate a flexible approach to problem solving.

7. Languages differ in the types of linguistic categories they use to codify experience. The bilingual child, by definition, has a larger number of categories than his monolingual peer, and may, thereby, be in a position to be able to perceive and react to a wider range of experience. This advantage of childhood bilingualism has already been discussed in reviewing Anisfeld's viewpoint, and will not be further elaborated.

8. Worrall shares with Anisfeld the view that a bilingual child will develop a more diversified set of abilities, since cultures differ in the kinds of abilities they prescribe or reinforce, and a bilingual child who is also bicultural (but not necessarily a bilingual-monocultural child) is likely to have more demands, of differing

kinds, made upon him than a monolingual child. This contention has received experimental support from Peal and Lambert's (1962) study.

The theories of Anisfeld (1964) and Worrall (1970) differ in extent rather than in content. Both theories are based on the premise that the process of becoming bilingual in childhood provides an enriched early environment which stimulates and accelerates cognitive development. Worrall summarises her viewpoint thus: "All that has been said so far characterizes the bilingual event as a form of enriched early experience. It is one aspect of early training in manipulation, classification, transformation, generalization and discrimination of events which 'can lay the groundwork in the fundamentals that can be used later and with great profit' (Inhelder, in Ausubel 1963)."

It will be remembered that Worrall tested her theory using meticulously matched samples, and found no difference between monolingual and bilingual children in cognitive functioning. However, Feldman and Shen (1971), working with monolingual and bilingual Head Start children, did support Worrall's prediction that bilinguals have significantly better understanding of object constancy in the face of transformations of the object. Various common objects were transformed, in front of the child, e.g. by

crushing a cup, lighting a match and sticking a suction soap-holder onto the wall, so that the child saw it straight-on and sideways. The fact that bilingual children could match the transformed object with its pre-transformation shape supports Worrall's contention that bilinguals can deal more effectively with transformations, in an extra-linguistic context, than can monolinguals.

Worrall feels that her negative results should not be interpreted as outright condemnation of the theory, but should serve to emphasize the fact that bilingualism is a far more complex process than is usually supposed, and that further research should concentrate on elucidating the nature of bilingualism rather than on further comparisons of monolingual and bilingual cognitive development.

6. Some aspects of bilingual functioning

There is already a growing body of research which concerns itself specifically with aspects of bilingual functioning.

The effect of language aptitude on bilingual proficiency has been investigated by Gardner and Lambert (1965). The battery of tests they gave their subjects included Carroll and Sapon's (1959) Modern Language Aptitude Test, intelligence tests, tests of reading fluency,

pronounciation accuracy, marks in French and academic grades. The correlation coefficients derived from correlations of the orthogonal factors they isolated suggest to the experimenters that intelligence is relatively independent both of language aptitude and of second language achievement. There were significant correlations between intelligence and measures of language aptitude, and achievement in French, but Gardner and Lambert feel that it is unnecessary to postulate any relationship between intelligence and these two variables other than that to be expected due to considerable variations in intelligence. However, the results can also be interpreted as suggesting a reliable relationship between language aptitude and intelligence.

Several experiments (Macnamara, 1967, Macnamara et al, 1968, Oléron and Nanpon (1965) have been carried out to study the variables involved in switching and translating from one language to another. Macnamara (1967) found that switching takes a measurable amount of time, but that this can be reduced when the subject can anticipate the switch. Macnamara et al (1968) concluded that switching time is not a function of stimulus uncertainty, but of response uncertainty. They also found that the time taken in switching from one language to another is not measurably different from a monolingual

form of switching. No relationship was found between switching performance and degree of bilingual proficiency.

Both Macnamara (1967a) and Gekoski (1968) found no relationship between degree of bilingualism and speed of translation. It is hypothesized that this occurs because the disruptive effects of switching cancel out any differences associated with differing degrees of bilingual proficiency.

Macnamara (1967) has summarized the considerable number of studies designed to examine the ways in which bilinguals keep their two languages separate from each other. Basing himself largely on data from Preston's (1965) study, Macnamara suggests that a two-switch model of bilingual functioning is appropriate. Such a model postulates that when a bilingual is required to respond in language A, either because of experimental instructions, or because of situational demands, the output system, but not the input system of language A is turned on. The input system would automatically and simultaneously be on in the language of the stimuli, and in a translation task this would not be the language used in the output system. Macnamara suggests that the "linguistic performance of the bilingual is similar to that of a musician who observes the notation for a key at the beginning of a piece of music and then forgets about it, though in his playing he performs

the actions appropriate to the key" (Macnamara, 1967, p.68).

7. The effects of contextual and temporal factors on bilingual proficiency

7. (i) The compound-coordinate distinction.

The brief review (above) of recent experimental findings on bilingual functioning is included to illustrate the type of approach currently being pursued. More directly relevant to the aims of this thesis is the work in another, although related, area. This includes those studies dealing with temporal and contextual factors and their effects on bilingual proficiency, i.e. the effects of language acquisition contexts on bilingualism, the optimum time at which to introduce a second language, and differences in bilingual functioning which may be attributed to concurrent and consecutive modes of acquiring two languages.

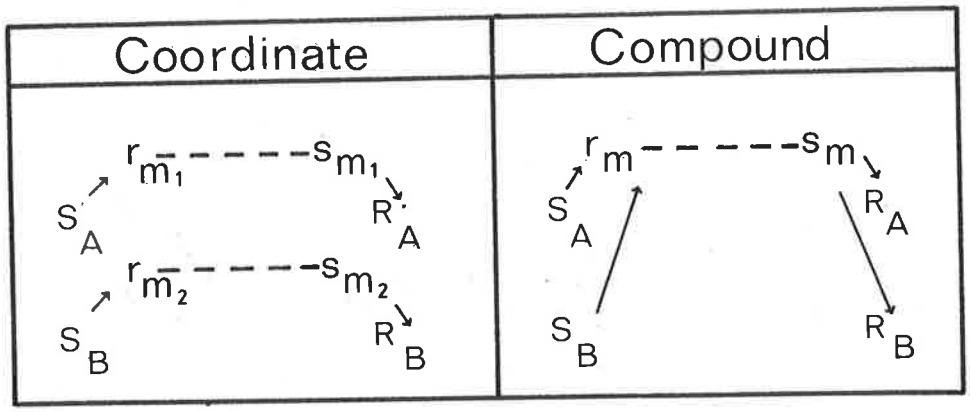
One of the major distinctions between bilinguals, which is thought to result from different language acquisition contexts is that between compound and coordinate bilinguals. This distinction, which refers to the semantic aspects of language was introduced by Weinreich (1953) and was given a theoretical framework by Ervin and Osgood (1954). It is thought that bilinguals who have learned both languages in the same context, as in

a bilingual home, where the same speakers use two languages interchangeably to refer to the same environmental events will develop a fused semantic system. The same fusion is likely to result from the so-called indirect method of language teaching, where one language is taught through the medium of the other. Such bilinguals are thought to develop compound meaning systems, i.e. they attribute identical meanings to corresponding concepts in their two languages. A coordinate meaning system is thought to develop in situations where two languages are learned independently of each other, as, for example, migrant children might learn their first language at home and use it exclusively in that environment, while learning a second language at school, and using that language in any environment but the home. In a coordinate meaning system there are two functionally distinct sub-systems, one attached to each of the two languages.

The different relationships of two languages in a compound and a coordinate meaning system are presented in Figure 1 (from Macnamara, 1970).

There is evidence which supports the compound-coordinate distinction in affective meaning systems at least. The first experimental study in this area is that of Lambert, Havelka and Crosby (1958). They found that semantic differences of translation equivalent terms,

Fig.1. The compound-coordinate distinction.



where S and R stand for sign and response respectively, r and s stand for the mediating process (or meaning) and subscrips A and B stand for different languages. The sub-scrips 1 and 2 in the coordinate part of the diagram also stand for different languages.

measured on semantic rating scales were greater for coordinate than for compound bilinguals. They also found that compound bilinguals benefited more than coordinates from rehearsal in advance with translation equivalent terms of words they were later asked to recall. This argues for a closer dependency across languages for compound than for coordinate bilinguals. Lambert and Fillenbaum (1959) in reviewing case histories of bilingual aphasics, found that people whose language acquisition history suggested that they were compound bilinguals showed disturbances in both languages, while in coordinate bilingual aphasics one language was affected more than the other. Such a finding suggests that the separation of the two meaning systems may have neurological as well as psychological validity.

One of the most interesting studies is that of Jakobovits and Lambert (1961). They used a bilingual version of the semantic satiation technique, which is based on the finding that continuous repetition of a word leads to a reliable decrease in the intensity of its connotative meaning, as measured by semantic differential rating scales. The experimenters hypothesized that there would be more cross-language satiation for compound bilinguals, with their fused meaning systems, than for coordinate bilinguals. This was found to occur, but the coordinates went to the opposite

extreme in that translation equivalent concepts tended toward neutrality with repetition, while for the co-ordinates, repetition in one language tended to heighten its meaning in the other. This was an unexpected result which still remains to be explained.

However, two studies by Olton (1960) do not support the compound-coordinate distinction. In one study, compound and coordinate bilinguals were asked to read through a mixed series of French and English words, and to remember which words functioned as signals for electric shocks. Pressing a key within a given time would inactivate the shock. When these associations were well established, each subject was given a new mixed list of words, some of which were translation equivalents of the original "shock words". It was predicted that compound bilinguals would be faster than coordinates in pressing the shock release key when the translated words appeared, since cross-language associations should build up more rapidly in the fused meaning systems of compound bilinguals. However, no such differences were found. Similarly, Olton found no difference between the two groups in a task which involved learning a mixed list of words, and later recognizing the words and remembering the language in which they appeared. Although it was predicted that

compound bilinguals would make more translation errors, no such difference was found.

Lambert and his Montreal group of students have recently changed their tactics and are now concentrating on asking more general questions about all bilinguals, and are studying the compound-coordinate distinction as a second step. In their recent research (reported by Lambert in Puhvel, 1969) they make extensive use of the Stroop Test. In this test there are several large cards, on one of which are 100 small colour patches. The subject is asked to name the colours as rapidly as possible. A second card contains 100 common words, printed in different colours, and again the subject is to name the colour of the crayon in which the words are written. A third card contains 100 names of colours, but the names are printed in coloured crayons which are different from the colour names they denote. Again the subject's task is to name the colour of the crayon. As Lambert (1969) says: "the problem lies in keeping the colour words from impinging on the requirement of naming the crayon colours, a very difficult task because the word reading tendency is highly automatic for literate people, and the procedure very compellingly calls into play a decoding process that interferes with the desired encoding process."

Preston (1965) constructed a bilingual version of this test so that the colour patch card was used once for measuring speed of colour naming in English, and once in French, to give baseline data. The English non-colour word and the colour word cards were used twice, once in naming the colours in English and once in French. The two corresponding French cards were also used twice in a similar manner. This procedure allows for measurement of the amount of interference caused by simultaneously activating the decoding and encoding processes of the same language, or the decoding process of one language and the encoding process of the other.

When the performance of compound and coordinate bilinguals was compared under these conditions it was found that there was a noticeable difference between them in the colour-word condition, in that the coordinates were better able to gate out the influence of the other language than were compounds. Although the cell differences between interactions for compounds and coordinates were not significant, Lambert feels that the evidence is suggestive enough to postulate that a coordinate meaning system allows such bilinguals to encode more easily in one language while, at least partially, ignoring distraction from the other. When the groups are combined, the results show that all bilinguals are less distracted by the other language decoding process, than by same language decoding.

Other studies by the Montreal group (in Lambert, 1969) used concordant and discordant word lists. Concordant lists are those in which there is agreement or concordance between languages and semantic categories in the sense that categories of words (e.g. types of fish) are reliably marked off by one language. In discordant lists, each of four semantic categories has equal numbers of French and English examples. The study also included single language and mixed language versions of semantic-category and no-semantic-category lists, which the subjects were to learn and recall.

Evidence from this study suggests that in general, language is a secondary means of organizing information in memory, and that semantic categories are more powerful organisational strategies. Nevertheless there was a significant difference between compound and coordinate bilinguals on those tasks, demonstrating more functional segration of the coordinate bilinguals' two language when compared with the compound bilinguals.

Gekoski (1968) compared associative and translation habits of compound and coordinate bilinguals and found that the compound bilinguals gave significantly higher percentages of equivalent responses in intra- and inter-lingual restricted association tasks, but not in free association tasks. Contrary to prediction, compound bi-linguals did not respond faster than coordinates in word

association and translation tasks. Gekoski feels that, although his results indicate that there are some differences between compound and coordinate bilinguals, they are "less pervasive than the theoretical distinction would suggest."

It is becoming increasingly obvious that the distinction is not as clear cut as previously thought. Macnamara (1970) has outlined weaknesses in the original Ervin and Osgood (1954) theoretical model. He feels that their theory, which is a variant of the behaviouristic language acquisition model, albeit with mediational components, "falls heir to all the criticism that Chomsky (1959), Fodor (1965) and others have made of S-R attempts to handle the phenomena of language" (Macnamara, 1970, p.28). The model, furthermore, does not provide for a distinction between connotative and denotative meaning systems, and it cannot cope with the problem of selecting an appropriate meaning from the several meanings which a variety of words possess, and which is determined by contextual cues. Macnamara's extensive criticism of the theoretical model, and the inconsistent experimental data are both evidence of a steady erosion of the credibility of what earlier seemed a promising explanatory tool.

There is an increasingly evident tendency to shift the distinction between bilinguals from the compound-

coordinate categories to a distinction between early and late bilingualism. In this classification, compound bilinguals are those who acquire both languages before they go to school, while coordinate bilinguals are those who acquire their second language some time after school-beginning age. It seems to add further confusion, unnecessarily, to keep redefining terms, so the descriptive, rather than explanatory, terminology of concurrent and consecutive bilingualism is beginning to appear more frequently. Concurrent bilinguals are those who have learned both languages simultaneously, or nearly so, while consecutive bilinguals are those who learn a second language after they have mastered the first.

There are very few experimental studies which deal specifically with any possible differences in bilingual proficiency, or in cognitive development, which may be attributed to concurrent or consecutive bilingualism. However, there is a wealth of evidence, partly experimental, but mostly anecdotal, which deals with the associated problem of the optimum age for the introduction of a second language. The next section will examine the available data and the opposing viewpoints.

7. (ii) The optimum age for the introduction of a second language.

One influential viewpoint on this topic, espoused mainly by educationists, is that a second language should not be introduced until the first language has been fully mastered. This means that, according to this school of thought, the second language should be introduced only when the child is about 10-12 years of age. It is believed, by adherents to this viewpoint, that introducing a second language when the first is still incompletely mastered, or even worse, introducing both languages simultaneously, doubles the cognitive load on the child at a time which is critical for normal cognitive development, and is likely to result in retarded rates of progress in both linguistic and cognitive development.

Jensen (1962) summarizes the range of effects which are thought, by some, to be almost inevitable consequences of too early an introduction of a second language. Such consequences range from faulty articulation and bad pronunciation, from stuttering to excessive reliance on gross, nonverbal festuring and from mental uncertainty and confusion to an impairment of original thinking.

This is a point of view shared by Berelson and Steiner (1963) who say that "children who are taught two

languages from the start are handicapped in both, as compared to the rate of learning either language alone. The difference becomes increasingly noticeable with age, to the extent that the child may have serious difficulties upon entering school."

Most of the evidence used to support this position is either anecdotal or depends heavily upon the early comparisons of monolingual and bilingual children's performance on IQ tests. Recently, Macnamara (1966) has summarized these early studies in elaborating his balance effect theory. After reviewing 77 studies, he concludes that there "is firmly grounded evidence indicating that bilinguals have a weaker grasp of language than monolinguals." This is used in supporting Macnamara's balance hypothesis, that is, that children exposed to a second language from an early age develop linguistic and cognitive skills which are inferior to those of children who speak only one of the bilingual's two languages. In Lambert's words (in preface to Macnamara, 1966): "if a child develops skills in one of his two languages he generally pays for it by a deficit in the other."

This statement is supported by Macnamara's study of Irish-English bilingual children. He found that native speakers of English who have spent 42% of their school

time in learning Irish, do not achieve the same standard in written English as do monolingual English speakers. Their written Irish is also inferior to that of monolingual Irish speakers. However, it should be noted that not all students of this problem agree with Macnamara. He himself cites several studies in which no differences between monolinguals' and bilinguals' linguistic skills were found, but dismisses them as being poorly controlled. Lambert (in Macnamara, 1966) stresses the fact that the intensive study of bilingualism carried out at McGill University has produced no evidence of a balance effect.

To return to another of the claims made in Jensen's (1962) review, that bilingual children's original thinking is impaired, Torrance et al (1970) administered the Torrance Test of creative thinking to over one thousand monolingual and bilingual Chinese and Malayan children and found that the monolinguals performed significantly better than bilinguals in terms of fluency and flexibility. However, despite superior fluency and flexibility, the monolinguals did not exceed the bilinguals on originality; in fact the trend was in the opposite direction, although the overall difference between the groups on originality was not significant.

Fishman (1970) strongly opposes the school of thought exemplified by Berelson and Fischer's (op cit.)

statement, and by Macnamara's balance hypothesis, on three grounds, that it is simultaneously false, misleading and parochial. He asserts that it is false because it "flies in the face of elitist bilingualism - and - educational - excellence throughout history", misleading because it does not distinguish between bilingualism per se and the economic and social disadvantages which frequently are associated with bilingual subgroups, and parochial because it does not distinguish between studies of "socially dislocated minorities" and other naturally occurring kinds or contexts of bilingualism.

One study has investigated the relationship between the age at which the second language was introduced and specific linguistic skills. This is the study of Dockrell and Brosseau (1967) who used three indices of language skill. The first was vocabulary size in the second language (French) as measured by a translation of the Peabody Picture Vocabulary Test. The second and third measures, accuracy in pronunciation and general comprehension, were arrived at through teacher-ratings of children, on these skills, on a seven point scale. All three skills were evaluated at the beginning and end of the school year. The subjects were English-speaking kindergarten children ranging from four to six years in

age. They were taught, for the most part, in French. Dockrell and Brosseau found that the older children (within the narrow age range) showed greater improvement in vocabulary and comprehension, but not in pronunciation. That is, the younger children improved their pronunciation as much as the older ones, but the older children were not handicapped in this respect. The results of this study suggest that there do not appear to be any advantages to beginning the second language at four rather than six years of age. But neither do there appear to be any disadvantages.

Within the last decade the view of first language acquisition has undergone a radical change. The strict learning theory view of first language acquisition was seriously weakened by Chomsky's (1959) review of Skinner's Verbal Behaviour (1957). Since that time there has been a steady stream of experimental and longitudinal study type of evidence to suggest that man is in some way innately equipped for language acquisition. Chomsky does not deny that learning plays a significant part in language acquisition, but he puts the stronger stress on innate processes which are designed specifically for language acquisition. This viewpoint is also strongly supported by Lenneberg (1964, 1967). McNeill (1966) hypothesises the existence of an innate "Language Acquisition Device"

which is not a passive receptor of linguistic input, but which actively strains, filters and reorganizes it. Longitudinal studies of first language acquisition suggest that the first grammar which results from this reorganization is a categorization of linguistic material into two classes, the pivot class and the open class (McNeill, 1966). The pivot class contains a small number of words of a relatively high frequency of occurrence e.g. allgone, big, my, see. The open class contains a larger number of words, and its members have a relatively lower frequency of occurrence. Additions of new words to this class occur at a higher rate than for the pivot class. The way in which utterances are formulated from among members of these two classes suggests that a young child has abstracted a grammatical rule which says that a sentence can be produced by combining elements from the pivot and open classes, in that order, or by a single word from the open class, but not from the pivot class.

Such a differentiation and categorization of linguistic input is held to be the first of a series of similar rules which are extrapolated from the incoming data, and are then used surprisingly consistently by the growing child. McNeill thinks that the hierarchy of grammatical categories "represents linguistic universals that are part of the child's innate endowment. The role of a universal

hierarchy of categories would be to direct the child's discovery of the classes of English. It is as if he were equipped with a series of 'templates' against which he can compare the speech he happens to hear from his parents... We can imagine, then, that a child classifies the random specimens of adult speech he encounters according to universal categories that the speech exemplifies. Since these distinctions are at the top of a hierarchy that has grammatical classes of English at its bottom, the child is prepared to discover the appropriate set of distinctions." (McNeill, 1966, pp.35-36).

The concept of linguistic universals refers to the fact that in many respects, different languages are similar. They all make use of a limited vocal repertoire, they all have a syntactic structure and all of them make use of units of increasing complexity i.e. morpheme - word - phrase - sentence - discourse (Stern, 1968-69). Furthermore, it is argued that such linguistic universals are a reflection of fundamental cognitive processes in man.

The psycholinguistic theory of first language acquisition has generated experimental studies whose results have implications for the acquisition of second languages and these will be discussed in some detail later. For the moment, we are more interested in the viewpoint of psycholinguists as to the best time to introduce a second

language. Ervin-Tripp's (1970) view is that results of psycholinguistic research, including her own, suggest that at about two or three years of age children learn a second language quite easily with "no serious hazards to the first" (Ervin-Tripp, 1970). Evidence from experimental studies shows that phonological acquisition is very easy at this age.

However, Ervin-Tripp feels that for most efficient learning it may be better to wait until the child is slightly older before introducing a second language, so that a child already controls a relatively sophisticated semantic system. Most of such a system is composed of semantic universals, so that the child will already have an apparatus available to help him learn the semantic system of the second language. "So, if you consider that accent in the second language isn't all that important in the practical sense, there may be efficiencies in later learning from the standpoint that a lot of basic devices involving both syntactic and semantic processes are common to many languages, particularly if they are closely related languages in area or in history, so that one can be transferred to the other" (Ervin-Tripp, 1970, p.345). Ervin-Tripp also points out that, if a second language is introduced at the beginning of a child's school career, as is the case in the Montreal study, and is used for considerable

periods of time in daily teaching, the language is learned efficiently, and the other school subjects (including skills in the mother tongue) do not suffer.

Jakobovits (1968) makes no prediction about the effect of introducing a second language in infancy, but he points out advantages to introducing the second language when the child is about four years of age. Such advantages are identical with those enumerated by Ervin-Tripp (1970), i.e. that the child's cognitive development is sufficiently advanced to allow more rapid learning of the second language, and that he is already in possession of one syntactic and semantic structure, the universal components of which should readily transfer to the second language.

To summarize: the psycholinguistic viewpoint on the optimum age at which to introduce a second language agrees, in part, with that of early educational psychologists in that both suggest that a second language is likely to be learned more efficiently, once the first language has been learned. However, the two schools of thought diverge on the degree to which the first language needs to be mastered, the traditionalists urging that the second language be postponed till the child is of high school age, while the psycholinguists feel that a start at the lowest primary school grades, when cognitive systems are at their most flexible, will result in most efficient learning of the

second language. There is another point of divergence between the viewpoints, in that the traditional educationists predict a variety of dire consequences (see Jensen, 1962) if the second language is introduced from infancy, whereas Ervin-Tripp implies that even a very young child will be able to deal adequately with two languages presented simultaneously.

This section has briefly summarized differing viewpoints on the advisability of teaching a second language to a young child. Although there is some experimental evidence (Dockrell and Brosseau, 1968) relating age at which the second language is introduced with specific linguistic skills, there has, so far, been little experimental investigation of possible differential effects on bilingual proficiency, of two languages presented concurrently or simultaneously, rather than consecutively or sequentially. The three studies which have dealt with this aspect of childhood bilingualism will now be reviewed.

7. (iii) Studies of the concurrent and consecutive acquisition of two languages

Chronologically first among these studies is that of Lambert and Witelson (1961, reported in Ervin-Tripp, 1970). They found that code separation of lexical material under experimental conditions was better when the two codes were

presented concurrently rather than consecutively. Ervin-Tripp (1970) suggests that in concurrent learning of two languages the basic processes of primary language learning are used. Presumably the only difference is that young bilinguals learning two languages in this way employ some tagging or marking system which allows the two systems to remain relatively independent of each other.

Lowe (1966, reported in Worrall, 1970) investigated the performance of concurrent and consecutive bilinguals on a concurrent paired-associate list where two nonsense syllables were to be associated with the same nonsense form. The subjects were university students, all majoring in Afrikaans, and it was assumed that they were all more or less equally proficient in that language. The concurrent bilinguals were those who had been exposed to both English and Afrikaans from infancy, while the consecutive bilinguals had acquired English first, and had been introduced to Afrikaans in Grade 3.

There was no significant difference in the performance of the two groups on the task, but there was a suggestion that the concurrent bilinguals found the task easier than the consecutive bilinguals ($p = .20$ for errors and $p = .10$ for trials). Analysis of the type of approach used in the task suggested that the concurrent bilinguals learned both responses jointly more frequently than the

consecutive bilinguals. Worrall (1970) feels that the difference in strategy used is a consequence of the different early learning experiences.

It is hardly surprising that the concurrent bilinguals performed a little better than the consecutives on the learning task, since the nonsense syllables were paired concurrently and no consecutive condition was included in the experimental design. Yeni-Komshian and Lambert's (1969) experiment included both concurrent and consecutive orders of presentation in a variety of combinations. They attempted to replicate experimentally at least one of the learning conditions which apply to the bilingual situation, i.e. vocabulary learning.

The subjects in this experiment were tenth grade children of above average intelligence. It is not clear from Yeni-Komshian and Lambert's report whether any of their subjects were bilingual in the conventional sense, although presumably at least some of them were, since the study was carried out in Montreal. The subjects' task was to learn two artificial vocabularies, which were presented in varying orders. The vocabularies consisted of unfamiliar symbols and referents. The referents were nonsense forms and the symbols which denoted the forms were CVC nonsense syllables. Contrasting items, which the subjects were to learn, consisted of two syllables,

each belonging to a distinctive vocabulary, both associated with a common form. All subjects were required to learn eight different items (form-syllable combinations), four for each vocabulary. Items were identified as belonging to either vocabulary 1 or vocabulary 2 by the colour (red or blue) of a frame drawn around the nonsense syllables.

There were six learning conditions in the experiment. Four of these were experimental analogues of concurrent bilingualism. These conditions varied in the degree to which shifts from one language (or vocabulary) to the other were predictable, in temporal separation between each shift and in the number of times pairs of glosses (defined as the two syllables in each contrasting item) from the two vocabularies appeared sequentially.

There were two consecutive orders of presentation. In the successive consecutive condition, subjects were to learn one vocabulary first and then the other. In the indirect consecutive condition, the subjects were required to learn vocabulary 1 first, and then the response terms from vocabulary 1 were used as stimulus terms in learning vocabulary 2. This condition was included since it replicates the indirect method of language teaching where one language is taught through the medium of the other.

When subjects had mastered the two vocabularies they were given tests of recall of the material, in various

orders of presentation. Subjects were retested again two to three weeks later.

Results of this experiment showed that fewer trials to criterion were needed by the consecutive order groups than by the concurrent order groups. However, when speed of learning and quality of retention on immediate and delayed tests were both considered, it was found that one of the concurrent groups (glosses Red, Blue, Blue, Red,) performed best. In this group, the vocabulary items were presented in a sequence of glosses, i.e. each item was followed by its counterpart in the other vocabulary. The number of times an item from the blue-framed vocabulary preceded the corresponding item from the red-framed vocabulary was counterbalanced. This condition replicates the situation in a one-person, one-language bilingual home environment where one referent, e.g. a house, is associated first with the symbol "house" and then with "la maison". The red and blue frames around the vocabulary items, which are the cues specifying which vocabulary is to be used, may be likened to the contextual cues used by a child in a household where he speaks French to one parent and English to the other.

Yeni-Komshian and Lambert interpret this reliance on the colour cue in Gibson's (1963) terms, i.e. "that subjects in the concurrent-order groups were made to

respond to those features of stimulation which were critical for rendering each referent unique." (Yeni-Komshian and Lambert, 1969, p.214). They also stress the fact that their study is limited to vocabulary learning, and whether their findings in this context are generalizable to other areas of language learning needs to be determined by experimental investigation.

The three studies which have examined the effects of learning two languages, or two vocabularies concurrently or consecutively reach surprisingly unanimous conclusions. Witelson (1961) and Lowe (1966) presented evidence which was suggestive rather than conclusive, but both concluded that subjects learning two languages concurrently performed better on various learning tasks than subjects learning them consecutively. This finding is supported by Yeni-Komshiam and Lambert's experiment. However, no report has been published which examines aspects of linguistic and cognitive development of concurrent and consecutive bilingual children who are still in the process of acquiring basic linguistic and cognitive skills. This thesis is designed to bridge the gap.

8. Statement of aims

The twofold aims of the present study are:

1. To investigate the performance of matched samples of

monolingual and bilingual children on Smedslund's Concrete Reasoning Scale and on three measures of linguistic skills.

2. To investigate differences in bilingual proficiency, as defined by three measures, and in cognitive development, as measured by Smedslund's Concrete Reasoning Scale, of bilingual children who have acquired their two languages, Latvian and English, either concurrently or consecutively.

CHAPTER 2.

METHOD

I. Subjects.

Subjects were 46 school children aged between 6½-11½ years. Twelve of the Ss were girls and 34, boys. The school grades of the Ss ranged from Grade 2 to Grade 7 of the South Australian primary school system.

Twenty three of the Ss (6 girls, 17 boys) were English speaking monolinguals, and 23 (6 girls, 17 boys) were Latvian and English speaking bilinguals. The two groups formed related samples, having been matched as closely as possible on five variables, i.e. age, sex, grade in school, occupational status of the father, and scores on Raven's Coloured Progressive Matrices.

The bilingual sample was divided into 2 groups, the concurrent and the consecutive bilinguals. The concurrent bilinguals had been introduced to the second language by a mean age of 27 months. There were 11 children (1 girl, 10 boys) in this group. The consecutive bilinguals were introduced to the second language by a mean age of 47 months. There were 12 children (5 girls, 7 boys) in this group.

There was only one experimenter, the writer, who administered all tests and questionnaires personally, both in English and in Latvian.

II. Selection of the bilingual subjects.

The Latvian-English bilingual children were selected from the pupils of the Latvian parochial school conducted by the Latvian community in Adelaide and held on every Saturday morning of the school year. In all but two cases both parents of the child were Latvian. One pair of siblings had an Australian mother and a Latvian father. These children had been taught both languages from the time they started to speak, and since their scores on the various tests did not differ markedly from those of the other Ss, both these children were retained in the sample. All subjects were from intact families. Only children aged between 6½ and 11½ years were considered, i.e. those in the concrete reasoning stage of cognitive development.

There were 69 children in this age range at the school and they were all administered Raven's (1956) Coloured Progressive Matrices (Forms A, Ab, B). This was done at the school and each child was tested individually.

Then letters were sent to the parents of children in the sample explaining the aims of the study and asking for permission to test their children individually for a further 2-3 hours. Included with the letter was a short questionnaire (see Appendix A) in Latvian asking for biographical information about the child, and also for the occupations of both parents. The last question asked the parents to

state, to the nearest month, the age at which the second language had been introduced to the child. In all cases where the languages were taught sequentially (i.e. in the consecutive bilingual sample) the first language to be taught was Latvian.

The parents of 32 of the original population of 69 returned completed questionnaires. The parents of several of this much reduced sample could not be contacted, and two refused the experimenter access to their children. The final bilingual sample consisted of 23 children, 6 girls and 17 boys.

At this stage the bilingual sample could be described in terms of the five variables on which they were finally matched with the monolinguals, i.e. age, sex, Australian school grade, Ravens matrices scores and occupational status of the parents. Classification into occupational status groups was carried out using Congalton's (1969) "Status ranking lists of occupations in Australia". Congalton's subjects categorized 134 occupations into perceived status categories on a seven point scale. The following categories resulted from the Australian-wide survey:

Category 1: Professionals

Category 2: Proprietors and managers

Category 3: Office and sales workers

Category 4: Farmers

Category 5: Skilled workers

Category 6: Semi-skilled workers

Category 7: Unskilled workers

The family's occupational status was to be rated according to the higher status occupation, be it the husband's or the wife's. In practice, the status of the father's occupation was always higher than the wife's.

A full description of the bilingual sample in terms of the 5 criteria will be found in Table 1 of Appendix B.

III. Selection of the monolingual sample.

The children of the monolingual sample were chosen from the pupils of Linden Park Demonstration School. This school was chosen because 5 of the 23 bilinguals were enrolled there, so that for a proportion of the combined samples, the school environment was identical. The rest of the bilingual sample was scattered around the Adelaide metropolitan area in ones and twos.

The very generous cooperation of the Headmistress of the Infant School and the Headmaster of the Primary School ensured access to the data cards of the pupils. The monolingual sample was matched with the bilingual sample on 4 criteria initially.

(i) Sex.

Each bilingual was matched with a monolingual of the same sex.

(ii) Age.

Each bilingual was matched as closely as possible with a monolingual of the same age. It was impossible to match all pairs exactly, but no difference between such pairs exceeded 6 months. Thirteen of the 23 pairs show discrepancies of up to 6 months between the ages of the children. In 6 of the pairs the monolinguals are older, in 7 pairs the bilinguals are older than their monolingual pair-mates.

(iii) Australian school grade.

Each bilingual was matched with a monolingual in the same school grade, but not necessarily in the same school. However, 45 of the 46 Ss in the total sample are being educated in the State school system, while only one (bilingual) S attends a parochial Catholic school.

(iv) Occupational status of the father.

Each bilingual was matched with a monolingual whose father's occupation was either the same, or at least fell into the same category of Congalton's (1969) seven point status scale. In 3 of the 23 pairs there is a difference of 1 category between the occupational status ranks of the fathers. In 2 of these pairs, the difference is towards slightly higher status for the monolinguals, while in the third pair, the difference is in the direction of slightly higher status for the bilingual member of the pair.

(v) Scores on Raven's Coloured Progressive Matrices.

The monolingual sample selected according to the 4 criteria outlined above was then given a battery of tests (described below) which included Raven's Coloured Progressive Matrices (Forms A, Ab, B). A preliminary analysis revealed that there was a significant difference ($p < .01$) between the monolinguals and the bilinguals in favour of the bilinguals. It was then decided to include a fifth criterion, i.e. scores on Raven's tests, as a variable in the matching procedure. As a general principle, these monolingual children whose scores differed from those of their bilingual partner by more than 3 points (of a total of 36) were discarded. The gaps left in the pairs were filled by pairing with the bilingual a monolingual who fulfilled the 4 criteria outlined above, and in addition was considered intelligent and "bright" by the class teacher. Despite this, it was still impossible to match exactly on the Raven's score measure. Two pairs with 6 point discrepancies had to be included. However the majority of the other pairs showed discrepancies of 2 or 3 points. Ten pairs of subjects showed discrepancies of 3-6 points, five of these pairs favoured the monolingual member, and five favoured the bilingual member of the pair. Using the data from this new sample, statistical analysis by the t-test for related samples technique showed no

significant differences between the monolinguals and the bilinguals.

Table 2 of Appendix B gives raw scores on the five matching criteria for the monolingual sample.

Characteristics of the final monolingual and bilingual samples are summarized in Table 1 below.

Table 1. Mean scores of monolingual and bilingual subjects on the five variables used in the matching procedure.

	Monolinguals N = 23	Bilinguals N = 23
Sex	6F, 17M	6F, 17M
Grade	Members of each pair were matched exactly	
Age	$\bar{X}$ = 9.09	$\bar{X}$ = 9.13
	S = 1.65	S = 1.49
Occupational status	$\bar{X}$ = 2.87	$\bar{X}$ = 2.91
	S = 1.48	S = 1.56
Raven's scores	$\bar{X}$ =28.09	$\bar{X}$ =28.09
	S = 3.46	S = 4.69

IV. Selection of the concurrent and consecutive bilingual samples.

The division of the bilingual sample into concurrent bilingualism and consecutive bilingualism samples was decided on the single criterion of the time at which the second language was introduced. This information was supplied by the parents in response to one of the items of the initial questionnaire. The times at which the second language was introduced ranged from 18 months of age (i.e. from the time the child first started to speak) to 66 months (i.e. when the child started attending Australian school).

It was originally intended to classify as concurrent bilinguals only those children whose parents had spoken both languages to them from birth. However, in the sample available for study there were only 6 such children, and 17 would then be classified as consecutive bilinguals.

In order to give more equally balanced groups it was decided to use 36 months (i.e. age at which the second language was introduced) as the dividing line. Children introduced to the second language by the time they were 36 months old formed the concurrent bilinguals group. There were 11 such children, 1 girl and 10 boys. Children introduced to the second language at from 42 to 66 months of age formed the consecutive bilinguals group. There were

12 such children, 5 girls and 7 boys. The mean age (in months) at which the second language was introduced was 27.09 months for the concurrent bilinguals group, and 47.00 months for the consecutive bilinguals group. Table 2 below describes the concurrent and consecutive bilingual samples on 5 measures. Although no matching procedure could be undertaken, these data are included to allow comparison with the monolingual and the combined bilingual samples.

Table 2. Mean scores of concurrent and consecutive bilinguals on 5 measures

	Concurrent bilinguals (N = 11)	Consecutive bilinguals (N = 12)
1. Sex	1F 10M	5F 7M
2. Grade	$\bar{X}$ = 4.18 S = 1.40	$\bar{X}$ = 4.33 S = 1.75
3. Age	$\bar{X}$ = 9.18 S = 1.28	$\bar{X}$ = 9.08 S = 1.66
4. Occupational status	$\bar{X}$ = 2.81 S = 1.34	$\bar{X}$ = 3.00 S = 1.73
5. Raven's scores	$\bar{X}$ = 28.00 S = 4.31	$\bar{X}$ = 28.17 S = 5.01

V. Test materials and procedures.

Differences in intelligence, in bilingual balance and in reasoning ability between the concurrent and the consecutive bilinguals were investigated using a battery of tests. Where appropriate, the same tests were also given to the monolingual sample.

The tests were administered to the monolinguals at their school. Most were tested in a small, private room, but a few had to be tested in the school's Staff Room. Each monolingual subject was tested individually by the experimenter. The bilingual subjects were visited in their homes, and were tested individually by the experimenter, after a short interview with the child's mother. The bilingual subjects were always asked to specify the language they would like to speak with the experimenter. Sixteen chose to speak Latvian, and seven to speak English. The instructions for the tests were then given in the language of the subject's choice.

Every effort was made to put the child at ease. The experimenter introduced herself as being interested in finding out something about how children think. It was explained that the child would be set several tasks (the word tests was carefully avoided) for the experimenter and play some games with her. The children responded readily to this introduction and showed every sign of being at ease

in the situation. Most of the children said that they found the tasks interesting and "fun to do". Some of the younger subjects showed signs of flagging interest toward the end of the testing session, so rest pauses were introduced whenever this became apparent. During such times, chatting about anything the child found interesting was sufficient to revive enthusiasm to finish the tasks.

A few bilingual subjects showed signs of strain when doing the reading task in Latvian (see below). This strain manifested itself either in apologizing for being so slow, or in demanding to know how much longer the session was going to last. In such cases, the subjects were reassured either that they were doing very well, or that the session was nearly over. This was sufficient to ensure cooperation for the rest of the session.

1. The intelligence test.

The test chosen was Raven's Coloured Progressive Matrices (1956, 65). Raven (1965) describes it as a "test of observation and clear thinking." This test was chosen because it is a nonverbal test of ability, and as such would not penalize those bilingual children whose verbal fluency may be affected by the process of becoming bilingual.

The test was administered individually to each mono-

lingual and bilingual subject. It formed part of the battery of tests given to the monolinguals, and was given in accordance with the instructions in Raven's "Guide to using the Coloured Progressive Matrices" (1965). This test was the first given to the bilingual subjects. Each child at the Latvian School between 6 and 11 years of age was tested individually at the school. The children were asked which language they would prefer to use with the experimenter. With very few exceptions the children chose to speak Latvian. This may reflect their adherence to the rule of the school that only Latvian be spoken, rather than a genuine feeling that Latvian was the easier language for them to use.

The test was scored in accordance with the key provided in the Guide. In the following sections all Raven's scores are given as raw scores and not as ranks of any kind, since only quartile ranks are given by Raven and these do not discriminate sufficiently between subjects.

2. Measures of bilingual usage and balance.

Four measures of the extent of usage and mastery of the two languages were used.

(a) Bilingual Background Questionnaire

This was a general background questionnaire which aimed at finding out the degree to which, and under what

circumstances, the second (in this case Latvian) language is used by the child and to the child. The questionnaire is a slightly adapted form of Hoffman's (1934) Bilingual Background Questionnaire. A copy of the questionnaire used is given in Appendix C(i).

Six major sections are covered in the questionnaire. The first three deal with the degree to which Latvian is spoken to the child by members of the family, by the child to members of the family and by family members to each other. The other three sections deal with the extent to which Latvian books and newspapers are read by family members, letters are written in Latvian and Latvian theatre and lectures are attended by family members. The final question asks the child the degree to which he "thinks in Latvian".

All the questions are answered on a 5-point scale, i.e. 1 = never, 2 = sometimes, 3 = often, 4 = mostly and 5 = always. The data from this scale are amenable to statistical analysis, but Macnamara (in Kelly, 1969) doubts the validity of this measure as an indicator of overall bilingual proficiency, so these data were collected with a view to using them descriptively only.

The questionnaire was administered verbally and individually to the mother or father (or occasionally both parents) of the child. The final question was asked

directly of the child. All the parents interviewed were cooperative and presented no objections to answering any of the questions.

(b) Word naming task.

The second and more direct measure of bilingual proficiency used was the word naming task initially used by Johnson (1953). In this task, subjects are asked to say as many different words as they can within a given time period, first in one language and then the other. This very simple task was found by early workers to correlate highly with other assessments of language proficiency. However, Macnamara (in Kelly, 1969) says it is a weak predictor of bilingual proficiency, and favours speed of reading in place of this task. The word naming task was retained nonetheless, and compared with the speed of reading task (see below).

The instructions were very simple: the subject was asked to say as many words as possible in one minute. The only restrictions were that the subject was not to count or to use sentences. The monolingual subjects carried out this task in English only, while the bilinguals did the task first in English and then in Latvian. Subjects were given a rest pause between the two tasks. The experimenter timed the subjects with a stop watch and wrote the words as they were produced. The scoring consisted simply of

totalling the number of words produced by each subject in each of the languages.

(c) The reading task.

The third measure used to assess bilingual proficiency was a speed of reading task. This was chosen for two reasons. The first is that it taps a different language skill to that of the word naming task and thus allows a more complete evaluation of a child's bilingual proficiency. The second is that it is this type of task which is said by Macnamara (in Kelly, 1969) to be a powerful predictor of all four major linguistic skills. In Macnamara's analysis of direct and indirect measures of bilingualism this factor contributed significantly to eleven of the fifteen regressions. Macnamara says that "... of all the indirect measures it (i.e. speed of reading) proved to be the most valuable not only in the size of its contribution to regression but also in the number of regressions to which it contributed." (Kelly, 1969, p.87).

The passage given to the child to read depended on the grade he was in at Australian school. Children in grades 2 and 3 read a passage from "The city adventures of Marmalade Jim" by Alan Sillitoe in English, and in Latvian, a passage from "Rūķis un govs" (The leprechaun and the cow) an Irish folk story in a Latvian translation. Both texts deal with similar domains i.e. fairy tales about talking

animals and sprites. The Latvian text was suggested as suitable by one of the teachers at the Latvian school, while the English text was vetted and passed as suitable by a teacher at the Australian school. The Latvian passage read by the children consisted of 124 words and the Latvian one of 122 words. It was impossible to get exact matches without mutilating sentences.

Children in grades 4-7 read texts again either suggested or approved by teachers from each of the schools. The English passage was taken from A.A. Milne's "Winnie the Pooh" (180 words), while the Latvian passage (of 179 words) came from "Pasaules labākais Karlsons" (The world's best Karlsen) a Swedish story by Astrid Lindgren translated into Latvian by Elija Kliene.

Scoring this task meant merely timing the reading with a stop watch. The experimenter made no comment during the time the children were reading, except on two occasions. Two bilingual subjects came to a standstill in reading the Latvian passage over an inability to pronounce a word. Both times the word was read out to them to enable them to finish the passage.

The bilingual subjects read the English passage first and then the Latvian passage. Monolingual subjects read only that English passage appropriate to their grade level.

(d) The sentence construction task.

The final test of bilingual proficiency measured writing skills. One common method of testing such skills (see Kelly, 1969) is to present a topic to the child and ask him to write a short essay or composition about it. This approach was rejected on the grounds that standardized assessment of such compositions is comparatively difficult to achieve. In an attempt to standardize the procedure more effectively a variation of Gekoski's (1968) task was used. Gekoski presented adult subjects with 20 pairs of same-language words and asked them to make up and write 20 sentences each sentence containing both members of a given word pair. In order not to make the sentences too straightforward and simple to construct, the words chosen were paired in unusual ways, e.g. mountain-lip, rather than face-lip.

The same principle was used in this study. Common English words were chosen from the common tables of Thorndike's word count lists. No comparable Latvian list is readily available, to the writer's knowledge, so Latvian translation equivalents of different English words were used for the Latvian task.

Five word pairs were chosen for each language, and subjects were instructed to make up five sentences, one for each word pair. As in Gekoski's study, the pairing

of the words was made as unusual as possible, at least within the constraints imposed by the commonness of the words. Appendix C(ii) contains both the English and Latvian word pair lists.

The bilingual subjects completed the English task first and then the Latvian version. Monolinguals completed only the English version.

The instructions were written at the top of the sheet of paper on which the task was to be done, complete with an example, but instructions were also given verbally in the language in which the task was to be done. Any questions raised by incomplete understanding of the instructions were answered by the experimenter. This usually involved explaining the worked example at the top of the page a second time. No advice on spelling was given, although it was frequently requested.

Assessment of the sentences, for all subjects, was made by an independent judge. The judge was a Latvian woman who is a highly proficient bilingual. A highly qualified teacher, she had taught for several years in the Australian school system, and has been teaching at the Latvian school for many years.

The assessment schedule used was based on one first used in a similar study by Calabrese (1971) and based on guidelines from Schonell and Schonell (1960). The

schedule is divided into two parts:

1. assignment of marks for good sentence construction including
   (a) an overall mark of 20 for "goodness of fit" of the two words of each pair into a sentence.
   (b) 1 mark for each adjective, up to a maximum of 5.
   (c) 1 mark for each conjunction up to a maximum of 5.
2. deduction of marks for inaccuracy including
   (a) 1 mark deducted for each spelling mistake up to a maximum of 5.
   (b) 2 marks deducted for each grammatical mistake up to a maximum of 10.

Each sentence (i.e. 5 for the monolinguals and 10 for the bilinguals) was marked according to this schedule. Then a mean sentence construction score was worked out for each child, by summing his total marks and dividing by 5. Thus each monolingual subject has one sentence construction score, with a possible maximum of 30, while each bilingual subject has two such scores, one for English and one for Latvian sentence construction.

(e) Concrete reasoning scale.

A test of reasoning ability, as distinct from "IQ-type" tests, was included to determine whether the enriched environment provided by two languages speeds up the reasoning processes of bilinguals when compared to their monolingual peers. Similarly, such a test should also differentiate between concurrent and consecutive bilinguals if it is true, as is frequently suggested, that simultaneous acquisition of two languages leads to "mental confusion", a term left conveniently undefined.

The test selected for this purpose was Form A of Siegelman and Block's (1969) set of Piagetian tasks based on Smedslund's (1964) Concrete Reasoning Scale. Siegelman and Block reanalyzed Smedslund's data using scalogram analysis. They also rearranged items in the scale to give two parallel forms which are functionally similar in that they have similar means, standard deviations and reliabilities. Form A rather than Form B was chosen quite arbitrarily.

There are four subtests in the scale testing the child's understanding of conservation of discontinuous quantity, reversal of spatial order, conservation of length and transitivity of length. The tests will be described only briefly here. For a full description, see Appendix C(iii).

Item 1. Conservation of discontinuous quantity.

Two piles of small red squares are shown to the child and he is told that there are 50 squares in each pile. One pile is then compressed into a small circle and the other is spread out. The child is then asked if there are still the same number of squares in each pile. He is also asked to give a reason for his answer. The procedure is then repeated with 2 sets of yellow squares. Both answers and reasons were noted. Answers were scored as correct or incorrect. Reasons were classified as adequate or inadequate according to the rationale and examples given by Smedslund.

Item 2. Reversal of spatial order.

The experimenter holds a black hollow tube and inserts into it, while the child watches, a black stick painted red at one end and blue at the other. The stick in the tube is then rotated through 180^{o} either once or twice in a counterclockwise direction. The child's task is to say which colour will come out of the left end of the tube when the rotation stops. This procedure is followed for 20 test trials. Scoring is simply done: the child's score is the number of times he responds correctly.

Item 3. Conservation of length.

The materials consist of two black sticks, one of

them ¼" longer than the other, and 4 V-shaped figures for inducing the Müller-Lyer illusion. This, of course, suggests a reversal of the actual size relationship. The child is shown both sticks held upright first and then placed onto the V-shapes. The stick actually shorter is placed onto the outward pointing arrowheads so as to look longer in comparison with the other stick. The child must now say which stick is the longer (in the illusion situation) and also give reasons for his answer. The left-right position of the sticks is then reversed and the procedure is repeated. Answers are scored as correct or incorrect and the reasons given by the child are scored as adequate or inadequate according to the rationale and examples given by Smedslund.

Item 4. Transitivity of length.

The apparatus is the same as for Item 3 (above) but also includes a blue stick intermediate in length, between the two black sticks. By a process of systematic questioning and demonstration the relationship of black sticks to the blue stick is established. The blue stick is then removed from the table and the child is asked which of the two black sticks is the longer. Once again, the child must supply reasons for his answers. Then the left-right positions of the sticks are reversed and the procedure is repeated. Answers are scored as correct or

incorrect and the reasons given by the child are scored as adequate or inadequate according to the rationale and examples given by Smedslund.

VI. Order of presentation.

The tests were presented to the bilingual subjects in the following order:

1. Raven's Coloured Progressive Matrices.
2. Bilingual background questionnaire (to parents).
3. Smedslund's concrete reasoning scale.
4. Word naming task (first English and then Latvian).
5. Reading tasks (first English and then Latvian).
6. Sentence construction task (first English and then Latvian).

Test 1 was administered to subjects at the Latvian school, and approximately six months later the rest of the battery was given in the subject's home.

The tests were presented to the monolingual subjects in the following order:

1. Smedslund's concrete reasoning task.
2. Word naming task.
3. Raven's Coloured Progressive Matrices.
4. Reading task.
5. Sentence construction task.

Monolingual subjects were tested individually but in their school.

CHAPTER 3.

RESULTS AND CONCLUSIONS

I. Comparisons of performance of monolingual and bilingual subjects.

The analysis of the data obtained from the monolingual and the combined bilingual samples will be given first, followed by a comparison of the data of the concurrent and consecutive bilingual samples.

1. Data from three measures of linguistic skills.

Table 3 summarizes data obtained from the matched monolingual and bilingual samples on the three measures of linguistic skills, i.e. the word naming task, the speed of reading task and the sentence construction task. The scores obtained by the monolinguals are compared with the scores of the bilinguals on the English versions of the tasks. Raw scores of the subjects on these tasks are given in Appendix D.

2. Analysis of results from three measures of linguistic skills.

Since the samples were matched on five variables thought likely to affect the subjects' performance on the tasks, the data were analysed using the t-test for related samples.

The significance or non-significance of the results was evaluated against a nondirectional alternative hypothesis. Values of the t-test are given in Table 4.

Table 3. Data from monolingual and bilingual subjects on three measures of linguistic skills

Type of task		Monolinguals (N = 23)	Bilinguals (N = 23)
1. Word naming task	$\bar{X}$	29.91	32.13
(no. of words/min.)	S	9.47	9.17
2. Reading task	$\bar{X}$	116.26	102.22
(time in secs. to read set text)	S	83.98	71.80
3. Sentence construction task	$\bar{X}$	15.68	15.45
(possible max. = 30)	S	3.57	4.04

Table 4. Analysis of scores of monolingual and bilingual subjects on three measures of linguistic skills

Task	Value of statistic	Significance
1. Word naming	t = 0.3663	NS
2. Reading	t = 1.3320	NS
3. Sentence construction	t =-0.4836	NS

These results show that there are no significant differences between matched pairs of monolingual and bilingual children on the linguistic skills measures.

3. Data from the Concrete Reasoning Scale

Table 5 sets out the percent of correct answers, and of adequate reasons for those answers, given by the monolingual and bilingual subjects to the four items of the Concrete Reasoning Scale.

Table 5. Results of monolingual and bilingual subjects on the Concrete Reasoning Scale

Item Number			Monolinguals	Bilinguals
Item 1	Correct answers	(%)	93.5	100
	Adequate reasons	(%)	91.3	100
Item 2	Correct answers	(%)	92.0	95.0
Item 3	Correct answers	(%)	63.0	95.7
	Adequate reasons	(%)	56.5	82.6
Item 4	Correct answers	(%)	78.3	95.7
	Adequate reasons	(%)	43.5	76.1

4. Analysis of data from the Concrete Reasoning Scale.

The analysis of the data was carried out using the variable Chi-square technique (Runyon and Haber, 1967) for Items 1, 3 and 4. Item 2 data were analysed using the t-test for related samples, since this was the only item on the scale to yield an exact numerical score. In Items 1, 3 and 4, results from the first and second trials were

collapsed to give a single answers and reasons score for each item. Table 6 shows the results of this analysis.

Table 6. Analysis of results of monolinguals and bilinguals on the Concrete Reasoning Scale

Name of item	Value of statistic	Significance
1. Conservation of discontinuous quantity	Answers: χ^2 = 0.045	NS
	Reasons: χ^2 = 0.102	NS
2. Reversal of spatial order	t = 0.2162	NS
3. Conservation of length	Answers: χ^2 = 2.71	$p < .10$
	Reasons: χ^2 = 1.89	NS
4. Transitivity of length	Answers: χ^2 = 0.625	NS
	Reasons: χ^2 = 3.56	$p < .10$

These results show that monolinguals and bilinguals do not differ in their understanding of conservation of discontinuous quantity, or of reversal of spatial order. In the tests of conservation and transitivity of length the data suggest that the bilinguals' understanding of these concepts may exceed that of the monolinguals. However, the data are suggestive rather than conclusive.

II. Comparison of the performance of concurrent and consecutive bilingual subjects

1. Description of the concurrent and consecutive bilingual samples.

Table 2 in the preceding chapter described the two bilingual samples in terms of five variables. The scores of the subjects on four of these variables, i.e. age, grade in school, occupational status of the father and scores of Raven's Coloured Progressive Matrices were analyzed using the t-test for unrelated samples. Table 7 presents the results of this analysis.

Table 7. Analysis of differences between concurrent and consecutive bilinguals on four biographical variables

Variable	Concurrent Ss mean	Consecutive Ss mean	Value of statistic	Significance
Age	9.18	9.08	t = 0.152	NS
Grade	4.18	4.33	t =-0.218	NS
Occupational status	2.81	3.00	t =-0.268	NS
Raven's score	28.00	28.17	t =-0.081	NS

The analysis shows that there are no significant differences between the two samples in terms of four major biographical variables. It will be remembered that there is a

discrepancy between the group in terms of the number of boys and girls in the group, the consecutive group having four more girls in it than the concurrent group. The one variable which could presumably be affected by this imbalance is the mean Raven's score for each of the two groups. Since this does not differ between the groups, it may be assumed that the effect of the unbalanced sexual composition of the groups is minimal.

2. Data from the Language Background Questionnaire.

The LBQ seeks information about six sections of the child's home and community life, and also, asks the child to say how frequently he thinks in Latvian. The data in Table 8 summarize this information. The numerical categories 1-5 refer to the frequency of usage of Latvian according to the following scale:

1 = Latvian never used
2 = " sometimes used
3 = " often used
4 = " mostly used
5 = " always used

It can be seen from Table 8 that the usage of Latvian in the families of both the concurrent and the consecutive bilingual samples is virtually identical. In both groups Latvian is spoken in the family very frequently (4 = mostly),

but is read and written less frequently (2 = sometimes). In both groups the children think in Latvian, according to their own estimates, only sometimes.

Table 8. Data from LBQ for concurrent and consecutive bilinguals

Category of behaviour	Concurrent Ss mean score	Consecutive Ss mean score
1. Degree to which Latvian is spoken by the family to the child	3.7	3.9
2. Degree to which Latvian is spoken by the child to the family	3.8	3.7
3. Degree to which Latvian is spoken among members of extended family	4.0	4.6
4. Degree to which Latvian books and newspapers are read by family members	2.4	2.3
5. Degree to which letters are written in Latvian by family members	2.6	2.4
6. Degree to which Latvian lectures and plays are attended by family members	2.7	2.3
7. Degree to which the child estimates that he thinks in Latvian	2.2	2.3

3. Data from the linguistic skills measures.

Tables 9(i) and (ii) show the mean scores of the concurrent and consecutive groups on the linguistic skills measures, i.e. the word naming task, the reading task and the sentence construction task.

Table 9. (i) Data from concurrent and consecutive bilinguals on the English versions of three linguistic skills measures

Type of task		Concurrent (N=11)	Consecutive (N=12)
1. Word naming task (no. of words/min.)	$\bar{X}$	32.82	31.50
	S	8.14	9.98
2. Reading task (time in secs. to read text)	$\bar{X}$	106.73	98.08
	S	69.04	74.00
3. Sentence construction task (possible max.=30)	$\bar{X}$	13.89	16.85
	S	4.53	2.91

Table 9. (ii) Data from concurrent and consecutive bilinguals on the Latvian versions of three linguistic skills measures

Type of task		Concurrent (N=11)	Consecutive (N=12)
1. Word naming task (no. of words/min.)	$\bar{X}$	21.27	22.25
	S	6.03	6.66
2. Reading task (time in secs. to read text)	$\bar{X}$	242.73	224.33
	S	119.54	151.41
3. Sentence construction task (possible max.=30)	$\bar{X}$	11.73	14.42
	S	6.05	4.32

4. Analysis of data from the linguistic skills measures.

Tables 10(i) and (ii) show the results of analysis using the t-test for unrelated samples. Differences between the two groups were evaluated against a non-directional alternative hypothesis, since no prediction was made about the direction of differences between the two groups.

Table 10. (i) Analysis of results of concurrent and consecutive bilinguals on English linguistic skills measures

Type of task	Value of statistic	Significance
1. Word naming	t = 0.3299	NS
2. Speed of reading	t = 0.2761	NS
3. Sentence construction	t =-1.7972	p < .10

Table 10. (ii) Analysis of results of concurrent and consecutive bilinguals on Latvian linguistic skills measures

Type of task	Value of statistic	Significance
1. Word naming	t = -0.3514	NS
2. Speed of reading	t = 0.3072	NS
3. Sentence construction	t = -1.1799	NS

This analysis of the raw scores of concurrent and consecutive bilinguals on English and Latvian linguistic skills shows no significant differences between the two groups at the conventional $p < .05$ level. However, in the sentence construction tasks, in both languages, the consecutives score slightly better than the concurrents; for the English version

the difference is significant at $p < .10$ and this level is almost attained also on the Latvian version of the task. But once again, the results are not conclusive.

One of the most frequently used measures of bilingual proficiency is the bilingual balance score. This involves finding the difference between the results of the same (or similar) tests given in each of the two languages. A small difference score indicates that the subject's command of the particular skill measured by the test is equally good (or equally poor) in both languages, while a large difference score indicates that the subject is more skilled in one language than the other. Table 10(iii) gives mean difference scores for concurrent and consecutive bilinguals on the three linguistic skills measures, and also shows the results of analysis of these difference scores using the t-test for unrelated samples.

These data show no statistically significant differences between concurrent and consecutive bilinguals on bilingual balance measures. Both groups show marked imbalance in control of skills in the two languages. However, the slight differences between the groups are all in the same direction, i.e. the consecutives' balance scores are all slightly less than the concurrents suggesting more equally balanced skills in the two languages. This finding suggests that there may be consistent differences

between the two groups which may be partially masked as a consequence of the way in which the two groups were selected from the total bilingual sample.

Table 10. (iii) Bilingual balance scores of concurrent and consecutive bilinguals

Type of task		Concurrent (N=11)	Consecutive (N=12)	Value of Statistic	Sig.
1. Word naming	$\bar{X}$	11.64	9.25		
	S	6.47	4.76	t = 0.9680	NS
2. Speed of reading	$\bar{X}$	136.00	126.25		
	S	63.03	87.35	t = 0.2911	NS
3. Sentence construction	$\bar{X}$	4.27	3.33		
	S	2.73	2.26	t = 0.8608	NS

A partial correlation technique, partialling out the effects of IQ (in this case, Raven's scores), and determining the degree of correlation, over the total sample, between the various difference score measures and the time, in months, at which the second language was introduced, may reveal relationships between these data which may be diminished in the earlier analyses. The results of this analysis are presented in Table 11. Pearson's product-moment correlational technique was used.

Table 11. Partial correlational analysis

(i) Variable 1 : Raven's scores

Variable 2 : age (in months) at which second language introduced

Variable 3 : difference scores in word naming tasks

r_{12}	r_{13}	r_{23}	$r_{23.1}$
0.12	0.25	-0.06	-.094
NS	NS	NS	NS

(ii) Variable 1 : Raven's scores

Variable 2 : age (in months) at which second language introduced

Variable 3 : difference scores in reading tasks

r_{12}	r_{13}	r_{23}	$r_{23.1}$
0.12	-0.25	-0.23	-0.208
NS	NS	NS	NS

(iii) Variable 1 : Raven's scores

Variable 2 : age (in months) at which second language introduced

Variable 3 : difference scores in sentence construction tasks

r_{12}	r_{13}	r_{23}	$r_{23.1}$
0.12	-0.36	0.03	0.079
NS	$p < .10$	NS	NS

Although none of the correlations is significant at $p < .05$, the highest correlations are between the IQ (Raven's scores) measures and the bilingual balance scores. The correlations between the age at which the second language was introduced and the bilingual balance measures are relatively low, as are the partial correlations. These data suggest that the three variables of IQ, bilingual balance measures and the time at which the second language was introduced are largely independent of each other. In an attempt to determine whether the most promising correlation, i.e. that between sentence construction difference scores and Raven's Matrices scores would hold up independently for the concurrent and consecutive bilingual samples, a parallel line assay technique (Finney, 1955) was used. The results of this are given in Table 12.

The non-significant results show that there is no linear relationship between sentence construction difference scores and Raven's Matrices scores between the two groups, i.e. within the concurrent and consecutive bilingual groups these two variables are independent of each other.

Table 12. Parallel line assay

Source	df	sum of squares	mean square	F ratio	Significance
Between groups	1	28.70	28.70		
Regression	1	143.33	143.33	.6106	NS
Parallelism	1	7.04	7.04	.0299	NS
Linearity	14	369.78	26.41	.1125	NS
Between scores	17	548.85			
Error	5	1173.63	234.73		

It will be remembered that one of the aims of this study was to validate Macnamara's (1969) assertion that there is a low correlation between word naming and speed of reading tasks as measures of bilingual proficiency. Data from the total bilingual sample for these two variables was analysed using Pearson's product moment correlation coefficient. The value obtained was $r = -.3508$ which is not significant.

Raw scores and difference scores of concurrent and consecutive bilinguals on the word naming, reading and sentence construction tasks are given in Appendix E.

5. Data from the Concrete Reasoning Scale

Table 13 sets out the percent of correct answers, and

of adequate reasons for the answers, given by concurrent and consecutive bilinguals on the four items of the Concrete Reasoning Scale.

Table 13. Concrete Reasoning Scale results for concurrent and consecutive bilinguals

Item number			Concurrents	Consecutives
Item 1.	Correct answers	(%)	100	100
	Adequate reasons	(%)	100	100
Item 2.	Correct answers	(%)	93.2	97.1
Item 3.	Correct answers	(%)	90.9	100
	Adequate reasons	(%)	72.7	91.7
Item 4.	Correct answers	(%)	90.9	100
	Adequate reasons	(%)	77.3	75.0

6. Analysis of Concrete Reasoning Scale Data

In items 1, 3 and 4 the results of the first and second trials were collapsed to give a single answers and reasons score for each item.

The analysis of these data was carried out using the one variable case Chi-square technique (Runyon and Haber, 1967) for items 3 and 4, and the t-test for unrelated samples for item 2, the only item on the scale to yield an exact numerical score for each subject. Table 14 shows the results of this analysis.

Table 14. Analysis of results of concurrent and consecutive bilinguals on the Concrete Reasoning Scale

Name of item	Value of statistic	Significance
1. Conservation of discontinuous quantity	Both groups scored to criterion	NS
2. Reversal of spatial order	$t = -1.5285$	NS
3. Conservation of length	Answers : $\chi^2 = 0.429$	NS
	Reasons : $\chi^2 = 2.194$	NS
4. Transitivity of length	Answers : $\chi^2 = 0.532$	NS
	Reasons : $\chi^2 = 0.033$	NS

This analysis shows no significant differences in reasoning ability between the two groups. The consecutive bilinguals give adequate reasons for their answers to questions about the conservation of length more frequently than the concurrents ($p = .20$) but once again the data are suggestive rather than conclusive.

III. Summary of conclusions

Monolingual-bilingual comparison

1. There are no significant differences in the performance of monolingual and bilingual subjects on three measures of linguistic skills, i.e. on the word naming task, the

reading task and the sentence construction task.

2. There are no significant differences in the performance of monolingual and bilingual subjects on the Concrete Reasoning Scale at the conventional $p < .05$ level. However, there are differences, in favour of the bilinguals, between the two groups in their answers to item 3 (conservation of length) and in their reasons for the answers to item 4 (transitivity of length) which are significant at the $p < .10$ level.

Concurrent-consecutive bilingual comparison

1. Members of both the concurrent and the consecutive bilingual groups speak Latvian more often than they read or write it.

2. The bilingual balance of the two samples, tested on three measures, does not differ significantly. However, on all three measures the mean values of the consecutive sample's scores indicate that their linguistic skills are somewhat more evenly balanced.

3. The correlational analysis shows a stronger relationship between the measures of linguistic skills and scores on Raven's Coloured Progressive Matrices than between the measures of linguistic skills and the time at which the second language was introduced.

4. There are no significant differences in the performance of concurrent and consecutive bilinguals on the Concrete Reasoning Scale.

CHAPTER 4.

DISCUSSION

The discussion of results will be subdivided into two sections corresponding with the order of presentation of the results, and will be followed by a final section in which the implications of the results are examined.

1. The monolingual-bilingual comparison

1a. Linguistic skills.

Although there are no significant differences between monolingual and bilingual children in word naming, reading speed and sentence construction skills, the bilinguals demonstrate a slight superiority on the word naming and reading tasks, while the scores on the most demanding task, sentence construction, are virtually identical.

This finding runs counter to the balance hypothesis elaborated by Macnamara (1966). He maintains, and has shown experimentally, that acquiring a second language in childhood, results in inferior linguistic skills in both languages, when performance is compared with that of monolingual speakers of both languages. In this study, that means that the children should perform worse than monolingual English and monolingual Latvian speakers. The first of these assertions is demonstrably false, and it is impossible in Australia, to test the second. It is

obvious from the data that the children's skills in Latvian are inferior to their English language skills, and it is highly probable that their Latvian is inferior to that of monolingual speakers of the language, but their English language skills are not inferior to those of English-speaking monolinguals.

1b. Cognitive skills.

A similar trend is shown by the data from the Concrete Reasoning Scale. Although there are no significant differences between monolinguals and bilinguals on any of the four items in the scale, on every one the bilinguals performance is slightly better than that of the monolinguals.

It is evident from the very high scores obtained by both the monolinguals and the bilinguals on the first two items, i.e. those testing conservation of discontinuous quantity and reversal of spatial order that the tasks are too easy to have discriminatory value. In the third item, which tests conservation of length, the bilinguals answer correctly more frequently than the monolinguals ($p < .10$) and similarly, the bilinguals give more adequate reasons ($p < .10$) than the monolinguals to questions about transitivity of length. Thus the evidence from this study does not support the acceleration hypothesis of Ainsfeld (1964) and Worrall (1970) conclusively, but the trend which is evident in the data suggests that such an hypothesis

need not be discarded in its entirety.

It may be that the differences between the groups would be greater if the monolingual and bilingual subjects had been matched on overall IQ scores, as was done by both Anisfeld and Worrall, rather than on Raven's Coloured Progressive Matrices. This latter test measures the ability of children to abstract principles and carry out symbolic manipulation, and it is arguable that items in the Concrete Reasoning Scale tap just these abilities, so on these grounds no major differences between the samples need be predicted.

There is a possible alternative explanation of the no-difference finding between the monolingual and bilingual groups. It is highly speculative, but is offered since it may suggest an explanation of the contradictory findings in this field. This explanation is based on two premises. The first of these is that an enriched environment stimulates and may accelerate cognitive development. Hunt (1961) and Kagan and Henker (1966) review experiments in this field and conclude that there is experimental evidence to support this view. The second premise of this argument is that there is an optimum level of stimulation which will facilitate development, and stimulation above this level will have little or no effect. To my knowledge, there is no experimental evidence in support of this proposition.

However, if both these premises are accepted, certain conclusions follow. One of these is that middle class children live in an enriched environment, i.e. enriched in the usual meaning of the term which includes more interested parents with more time to devote to them, more diverse experiences, more toys, educational games etc. Their environment is enriched also in the sense that they possess two language codes, an elaborated and a restricted one (Bernstein, 1961). Middle class monolingual and bilingual children would differ only insofar as the bilinguals have a third code, in another language. If the optimum-level-of-stimulation premise is accepted, it can be hypothesized that such a level is already reached in any middle class environment, so that the extra stimulation of a second language would serve merely as a form of over-learning. Thus, according to this speculation, there should be little difference in the cognitive development of middle class monolingual and bilingual children.

The situation in a lower class setting is somewhat different. The monolingual lower class child's environment is likely to provide less stimulation than that of his middle-class peer, and he is likely to possess only one, restricted language code, according to Bernstein's theory. Under these circumstances, the process of acquiring a second language may well add the extra environmental stimulation

which serves to accelerate cognitive development. The prediction here would be that the cognitive development of the lower class bilingual child should proceed at a faster rate than that of his monolingual peer.

Feldman and Shen (1971) argue in much the same way when they say that "there might be comparable advantages from the two sorts of codes found in the lower class bilingual and in the middle class monolingual child."

The suggestion that there should be no major differences between middle class monolingual and bilingual children is borne out by the results of the present study, where the subjects were largely middle class. Similarly, the occupational status ranks of Worrall's subjects suggest that they are largely middle class, and she found no differences on Piagetian tasks between monolingual and bilingual children. The longitudinal study of bilingualism at present under way in Montreal has so far shown no significant differences in cognitive functioning between monolingual and bilingual children, and this study is being carried out in a middle class environment.

Liedtke and Nelson (1968) did find differences between largely middle class monolingual and bilingual children's cognitive development, but the variance of the socio-economic status variable is very large, so it may be hypothesized that the difference is due largely to the differential performance of the lower class children in the

sample. Anisfeld's (1962, 1964) study of monolingual and bilingual children was carried out in a predominantly middle class setting and she found that bilinguals performed better on two scales. Only the mean values of the socio-economic status of the two groups are given in the 1962 report so it is impossible to say whether the same loophole which was used for Liedtke and Nelson's study can be used to explain away Anisfeld's results.

The other prediction, that lower class bilinguals' cognitive development is accelerated in comparison with that of their monolingual peers is supported by Feldman and Shen's (1971) study. They found that young bilingual children were superior in comprehension of object constancy, and naming and using labels in sentences. Both the monolingual and bilingual children attended Head Start school programmes, and such programmes are reserved for culturally deprived, lower class children. Similarly, Calabrese (1971) found that lower class Italian-English bilingual children performed significantly better than English monolinguals on the same test of understanding of transitivity of length as was used in the present study. He found no differences on three other tasks, but for the same reasons that this study shows no differences in items 1 and 2, i.e. that the tasks were too simple to have any discriminatory value.

The amended and elaborated view of the enrichment hypothesis put forward here leads to predictions which are at least partially confirmed by the available evidence. Further research dealing specifically with the social class variable, and with the notion of an optimum level of stimulation is necessary before this idea can move from the realm of speculation to that of empirically validated fact.

2. Concurrent-consecutive bilingual comparison

2a. Linguistic skills.

There were no significant differences in the performance of concurrent and consecutive bilinguals on either the English or the Latvian versions of the three linguistic-tasks. However, the consecutive bilinguals performed at a higher level of proficiency on all but one (words in English) of the tasks. On the most demanding task, sentence construction, the consecutives performed better than the concurrents at the $p < .10$ level for the Latvian task, and very close to the same level for the English task. In fact, the consecutive bilinguals performed better than the concurrent bilinguals, the total bilingual sample and the monolingual sample on the English sentence construction task.

Similarly, on the bilingual balance scores, the differences between the concurrents and the consecutives

are not significant, but the differences which do exist all favour the consecutive group, i.e. their command of the two languages is slightly more evenly balanced. Thus there is suggestive evidence that learning two languages consecutively results in greater linguistic proficiency than learning them concurrently.

It is possible that the greater number of girls in the consecutive group, in comparison to the concurrent group, may be a confounding variable. However, the studies most directly comparable to this one, those of Liedtke and Nelson (1968) and Calabrese (1971) found no differences between the performance of boys and girls, so it is not necessary to postulate that the slight but consistent superiority of the consecutive bilingual group is a function of the unequal number of girls in the two bilingual samples.

The correlational analysis of the results showed only one significant correlation, that between scores on Raven's Coloured Progressive Matrices and sentence construction. The linear regression analysis, however, showed that this relationship was not strong enough to hold up when the bilingual sample was divided into its component parts. Despite this, an inspection of the raw data suggests that there is a relationship between intelligence (as measured by Raven's Coloured Progressive

Matrices), time at which the second language was introduced and performance on the linguistic tasks. To determine whether there is any factual basis for what seems, intuitively, a sensible proposition, the data of the bilingual sample was divided four ways, i.e. groups consisting of the five highest scorers on Raven's Matrices who were consecutive bilinguals, the five highest scorers who were concurrent bilinguals, the five lowest scorers who were consecutive bilinguals and the five lowest scorers who were concurrent bilinguals. If Raven's Matrices are accepted as a test which measures components of intelligence, this subdivision then allows a comparison of the most and least intelligent consecutive and concurrent bilinguals. The mean scores of the four groups on all linguistic measures are given in Appendix F, Table F(i).

The differences in scores of the most intelligent concurrent and consecutive bilinguals are given in Table 15 and the differences in scores of the least intelligent concurrent and consecutive bilinguals are in Table 16.

It is clear from these tables that learning two languages either concurrently or consecutively has different consequences depending on the intelligence of the child. There is relatively little difference between the linguistic skills of highly intelligent concurrent and consecutive bilingual children, and the direction of the differences

favour consecutives on three tests, and concurrents on the other three. It seems reasonable to infer from this that if children are highly intelligent it makes little difference to their linguistic proficiency if the two languages are taught concurrently or consecutively.

Table 15. Difference scores of most intelligent concurrent and consecutive bilinguals on Latvian and English Linguistic measures

Difference in Latvian words scores	+ 2.4*	Difference in English words scores	- 3.0
Difference in Latvian reading times	-11.8**	Difference in English reading times	- 1.0
Difference in Latvian sentences scores	+ 1.6	Difference in English sentences scores	+ 1.1

Table 16. Difference scores of least intelligent concurrent and consecutive bilinguals on Latvian and English Linguistic measures

Differences in Latvian words scores	+ 2.8*	Differences in English words scores	+ 3.8
Differences in Latvian reading time	+134.6	Differences in English reading times	+62.6
Differences in Latvian sentences scores	+ 5.6	Differences in English sentences scores	+ 5.8

* + sign denotes that the difference is in favour of the consecutive bilinguals

** - sign denotes that the difference is in favour of the concurrent bilinguals

However, for less intelligent children, the timing of the introduction of the second language is far more important. Table 16 shows that the differences on all linguistic measures are larger across the less intelligent bilingual groups than across the more intelligent. Moreover, every one of the difference scores, in both languages, is in favour of the consecutive group. In other words, if children are less intelligent, it is to their advantage, linguistically, to be taught the languages consecutively rather than concurrently.

Furthermore, if the less intelligent concurrent groups performance is compared with that of their monolingual pair-mates, on the English linguistic tasks, (see Appendix F, Table F(ii)), it is seen that on all three tests the bilinguals' level of performance is below that of the monolinguals. The equivalent comparison of the less intelligent consecutives and their monolingual peers shows that the bilinguals perform better on the reading and sentence construction tests, and only on the word naming task do the monolinguals perform slightly better. Both the highly intelligent bilingual groups perform very slightly better than their monolingual matched pair-mates, except on one subtest where the scores are equal.

Thus, it may be true of the less intelligent concurrent group, and of this group alone, that childhood bi-

lingualism results in a "language handicap."

It must be stressed that this subdivision of the bilingual sample leaves only five members in each group, so no firm conclusions can be drawn from the data. But the consistency of the trend in favour of consecutive bilingualism, especially at lower levels of intelligence suggests that the hypothesis that concurrent and consecutive bilingualism in children of lower intelligence has different consequences for linguistic development would repay closer and more systematic experimental investigation.

2b. Cognitive skills.

The data from the Concrete Reasoning Scale reinforce the trend which is evident in the linguistic data. There are no significant differences between the concurrent and consecutive groups on any of the items, but on almost all the subtests there is a slight difference in favour of the consecutives.

If the bilingual group data is again subdivided into more and less intelligent concurrent and consecutive subgroups (see Appendix F, Table F(iii)), the differences between the scores of the more intelligent concurrents and consecutives are again smaller than the differences between the less intelligent groups. The direction of the difference between these two groups is again in favour of

the consecutive bilinguals. However, the low ceiling of the Concrete Reasoning Scale does not permit of very fine discrimination between the groups.

The previous studies of concurrent and consecutive bilingualism (Witelson, 1961, Lowe, 1966 and Yeni-Komshian, 1969) have presented results which show a trend in favour of concurrent bilinguals on learning and memory tasks. The trend in the present study is in the opposite direction. But none of the previous studies dealt with young bilingual children learning two actual, as opposed to artificial, languages either concurrently or consecutively so the results are not directly comparable. Moreover, the learning tasks used in the previous studies, i.e. nonsense syllables paired with novel forms, are in no way analogous to the linguistic and cognitive tasks used in the present study.

To summarize: the results of the concurrent-consecutive bilingual comparison show no significant differences in the linguistic and cognitive development of the two samples. However, there is a trend evident on almost all subtests which suggests that the performance of the consecutive bilinguals is slightly superior to that of the concurrent bilinguals. When the samples are sub-divided into more and less intelligent groups, it becomes clear that the overall trend in favour of the consecutives is due to a marked superiority of the less intelligent

consecutive bilinguals when compared with the less intelligent concurrent bilingual children.

3. Implications of the results

The overall conclusion of this study is that, in general, becoming bilingual in early childhood is in no way detrimental to a child's linguistic and cognitive development, and may be advantageous. The only condition in which this is probably not the case is in teaching a child of average, or slightly below average, intelligence two languages simultaneously. The evidence suggests that a consecutive mode of presenting two languages is more efficient and will not penalize a child's cognitive and linguistic development.

This finding supports the view of Ervin-Tripp (1970) that the most efficient way of teaching two languages is to introduce the second only when the rudiments of the first have been mastered. In adopting this approach, base structure linguistic and semantic universals deduced in learning the first language can be used as tools in acquiring the second. The evidence of the Montreal longitudinal study, and of this study, suggests that this leads to efficient learning and rapid mastery of the second language.

Jakobovits (1968) maintains that it is important to teach a second language in a manner which makes specific use

of the deep rather than the surface structures of languages, since surface structure similarities are generally useless as aids to semantic interpretation, whereas deep structures are identical, or at least very similar, across languages. He feels that grammatical competence in a second language would be facilitated by exercises in performing transformations where similarities of deep structure in the presence of diverse surface structures are stressed. For example, the statement "I cannot pay my rent because I am broke", means the same as "If I weren't broke I could pay my rent" and "Given the fact that I have no money I cannot pay my rent", etc. (examples from Jakobovits, 1968, p.106). This emphasis on a common semantic deep structure in sentences of different surface structure would presumably utilize a meaning system already elaborated in the course of acquiring a first language. Jakobovits offers other principles to be observed in teaching a second language, all of which rest on the assumption that the problems of second-language learning are related to acquisition of surface structures of the language, and that the common deep structures can be acquired quite readily.

Stern (1968-69) says of this that "there is no definite proof for this viewpoint from any experiments in language teaching." He also feels that learning a second language after the first has already been acquired may be a process

quite different from first language acquisition, since the second language is filtered through a language acquisition device already modified by the experience of learning the first language.

Suggestions as to how to teach a second language are beyond the scope of this thesis. Suggestions as to when to teach a second language are its central concern. The evidence of this study shows that if children are highly intelligent it makes no difference to their cognitive and linguistic competence whether the two languages are taught concurrently or consecutively. Their performance on tasks designed to assess such competence will be at least equivalent to that of their monolingual peers. It also shows that less intelligent children may be handicapped by the concurrent teaching of two languages, but are likely to perform as well as monolinguals of their own level of intelligence if the languages are taught consecutively. Thus, it might be suggested that in order to minimize the possibility of affecting a child's linguistic and cognitive development adversely, it is perhaps safer to introduce a second language only when the rudiments of the first have been mastered.

APPENDIX A.

Letter and questionnaire sent to parents of children in the bilingual sample.

1. Sample letter, translated into English.

Dear parents,

I am engaged in carrying out research in the field of bilingualism for an M.A. degree at the University of Adelaide. I am particularly interested in determining whether different methods of teaching two languages lead to differences in performance on linguistic and cognitive tasks.

Some psychologists think that it is best to teach both languages at the same time. Others think it best to teach the second language only when the first has already been mastered, while still others think that it makes no difference when the second language is introduced.

Since there has been little experimental investigation into this question, I would like to compare the performance of children who have spoken both languages, i.e. Latvian and English, from infancy with children who have first learned one language, i.e. Latvian, and have started learning to speak English only later.

I would like to ask for your cooperation in filling in the enclosed questionnaire and returning it to me in the

enclosed envelope so that I can sort out groups of children on the basis of the age at which they learned to speak the second language.

All the information in the questionnaire will, of course, remain confidential.

The results of some Canadian and American studies of bilingualism suggest that the parents' occupation or profession is a relevant variable, and it is for this reason that I have requested this information in the enclosed questionnaire.

In order to collect the experimental data I need, it would be necessary for me to see each child individually for about 2-3 hours, either in their home, or at Adelaide University.

If you have any questions you would like to ask please telephone me, Inara Lejējs-Proske, at 32 2792 any evening after 7.30 p.m.

Thank you for your cooperation.

Yours sincerely,

Inara Proske.

APPENDIX A. Continued.

2. Sample of questionnaire, translated into English.

Questionnaire.

1. Child's name _____
2. Date of birth _____
3. Address _____
4. Telephone _____
5. Are both parents Latvian? _____
6. Father's occupation _____
7. Mother's occupation _____
8. When your child began to speak,
   a) did he speak only Latvian? _____
   b) did he speak mostly Latvian and only a little English? _____
   c) did he speak about as much English as Latvian? _____
   d) did he speak mostly English and only a little Latvian? _____
   e) did he speak only English? _____
9. If your child spoke one language before he began learning the second, at what age did he start speaking the second language?

_____

(please give the age in months, in question 9).

APPENDIX B.

Raw score data from monolingual and bilingual samples on the five measures used in the matching procedure.

Table B(i) The bilingual sample

S	Sex	Age	School Grade	Occupl. status	Raven's scores
1	F	7	2	1	30
2	F	7½	3	3	30
3	F	11½	7	2	29
4	F	10½	6	5	25
5	F	8	3	4	29
6	F	10	5	4	27
7	M	9½	4	4	29
8	M	7½	2	4	22
9	M	7½	3	4	21
10	M	10½	6	4	26
11	M	7½	3	1	26
12	M	10½	6	1	33
13	M	10½	6	3	32
14	M	11	6	5	28
15	M	9	4	2	30

Table B(ii) The monolingual sample

S	Sex	Age	School grade	Occupl. status	Raven's scores
1	F	7	2	1	24
2	F	7½	3	3	26
3	F	11½	7	1	31
4	F	11	6	5	30
5	F	8½	3	4	27
6	F	9½	5	4	25
7	M	9	4	4	26
8	M	7	2	4	23
9	M	7½	3	4	25
10	M	10½	6	4	32
11	M	8	3	1	26
12	M	11	6	1	31
13	M	11	6	3	30
14	M	11	6	5	28
15	M	8½	4	2	31

Table B(i). continued

S	Sex	Age	School Grade	Occupl. status	Raven's scores
16	M	11	6	2	35
17	M	7	2	4	15
18	M	9½	5	1	35
19	M	7	2	1	27
20	M	9½	4	1	33
21	M	11	6	1	34
22	M	9	4	4	25
23	M	7½	3	6	25

Table B(ii). continued

S	Sex	Age	School grade	Occupl. status	Raven's scores
16	M	11	6	2	31
17	M	6½	2	4	20
18	M	10	5	1	33
19	M	6½	2	2	29
20	M	9	4	1	33
21	M	11	6	1	31
22	M	9	4	4	24
23	M	7½	3	5	30

APPENDIX C.

Samples of tasks performed by monolingual and bilingual subjects.

APPENDIX C(i).

Total.....
Answered .....
Score .....

Hoffman Bilingual Schedule

Name..... Date.....

School.....

Grade.....

Age .....

Brothers

Age	Grade
_____	_____
_____	_____
_____	_____

Sisters

Age	Grade
_____	_____
_____	_____
_____	_____

Does your father understand English? ..... Your mother .....
Name all other languages your father understands .....
.....

Name all other languages your mother understands .....
.....

Name all other languages you understand (besides English) ...
.....

APPENDIX C(i) continued.

Hoffman Bilingual Schedule

1. Do the following speak to you any language other than English?

	Never	Sometimes	Often	Mostly	Always
a) Father.....					
b) Mother	N	S	O	M	A
c) Grandfather	N	S	O	M	A
d) Grandmother	N	S	O	M	A
e) Brothers & sisters	N	S	O	M	A
f) Relatives	N	S	O	M	A

2. Do you speak to the following any language other than English?

	Never	Sometimes	Often	Mostly	Always
a) Father					
b) Mother	N	S	O	M	A
c) Grandfather	N	S	O	M	A
d) Grandmother	N	S	O	M	A
e) Brothers & sisters	N	S	O	M	A
f) Relatives	N	S	O	M	A

3. Does your father speak to the following any language other than English?

	Never	Sometimes	Often	Mostly	Always
a) Mother					
b) Brothers & sisters	N	S	O	M	A

4. Does your mother speak to the following any language other than English?

	Never	Sometimes	Often	Mostly	Always
a) Father					
b) Brothers & sisters	N	S	O	M	A

APPENDIX C(i) continued.

Hoffman Bilingual Schedule (continued)

5. Do your brothers & sisters speak to the following any language other than English?

	Never	Sometimes	Often	Mostly	Always
a) Father					
b) Mother	N	S	O	M	A

6. Do the following read any newspaper in a language other than English?

	Never	Sometimes	Often	Mostly	Always
a) Father					
b) Mother	N	S	O	M	A
c) You(yourself)	N	S	O	M	A

7. Do the following read any books in a language other than English?

	Never	Sometimes	Often	Mostly	Always
a) Father					
b) Mother	N	S	O	M	A
c) You(yourself)	N	S	O	M	A

8. Do the following write any letters in a language other than English?

	Never	Sometimes	Often	Mostly	Always
a) Father					
b) Mother	N	S	O	M	A
c) You(yourself)	N	S	O	M	A

9. Are letters written in a language other than English received in your home?

Never	Sometimes	Often	Mostly	Always

10. Do the following attend lectures given in a language other than English?

	Never	Sometimes	Often	Mostly	Always
a) Father					
b) Mother	N	S	O	M	A
c) You(yourself)	N	S	O	M	A

APPENDIX C(i) continued.

Hoffman Bilingual Schedule (continued)

11. Do the following attend the theatre where plays are given in a language other than English?

		Never	Sometimes	Often	Mostly	Always
a)	Father					
b)	Mother	N	S	O	M	A
c)	You(yourself)	N	S	O	M	A

12. Do you do your thinking in a language other than English?

Never Sometimes Often Mostly Always

13. Are there any books other than English in your home?

None Some Many Most All

APPENDIX C(ii) a.

Language useage scale

Name ..... Group.....

Instructions: There are 5 pairs of words on this page. Make up 5 sentences in English, using each of the pairs once. Both words of each pair should be included in the sentence.

For example: if the word pair is name:garden the sentence could be: It takes a very long time to learn the name of every flower in the garden.

1. table:horse

2. letter:world

3. sun:present

APPENDIX C(ii)a.continued.

Language useage scale (continued)

4. arm:street

5. sea:work

APPENDIX C(ii) b.

LANGUAGE USEAGE SCALE

NAME ..... GROUP .....

Instrukcijas: Šinī lapaspusē ir 5 vārda pāri. Uzraksti, pa latviski, vienu teikumu katram pārim, tā, lai abi vārdi ir iekopoti teikumā.

Piemēram, ja vārda pāris ir laiks:durvis, teikums varētu būt: Kad māmiņa vakarā aiztaisa durvis, tad ir laiks aizmigt.

1. grāmata:pilsēta _____
_____
_____
_____

2. roka:gimene _____
_____
_____
_____
_____

3. diena:papīrs _____
_____
_____
_____
_____

4. vārds:ūdens _____
_____
_____
_____

APPENDIX C(ii) b. continued

LANGUAGE USEAGE SCALE continued.

5. seja:stunda _____

_____

_____

_____

_____

APPENDIX C(iii)

Concrete reasoning scale

FORM A

Name _____

Date of testing _____

Date of birth _____ Age _____

Item 1. (IV) Conservation of discontinuous quantity

Subitem 1a. (red)

2 collections placed close together, forming 2 roughly circular areas.

Preparatory questions: (Subject told that 2 collections contain exactly the same amount).

1. Do you think there is more here (pointing), the same in both, or more here (pointing).

Answer: ----------

(This question repeated till correct response is elicited)

(The collection to the right is spread out to cover a roughly circular area, about 6" diam).

2. You watched me spread this (right collection) out. Did I add anything to it or take anything away from it?

Answer: ----------

(If "no" say "that's right, I didn't add anything or take anything away." If "yes", correct S and repeat that nothing was added or taken away)..

APPENDIX C(iii) continued.

Concrete reasoning scale (continued)

Test questions: 3. What do you think now? Is there more here (pointing at left collection), the same in both, or more here (pointing at right collection)?

Answer: ----------

4. Why do you think so?

Answer: ----------

Subitem 1b (yellow)

Answer (1) ----------

Answer (2) ----------

Answer (3) ----------

Answer (4) ----------

Item 2 (III): Reversal of spatial order.

Standard question: Which colour will come out first at this (left) end of the tube?

1 rotation = 180°, horizontally, counter-clockwise.

In case of 2 rotations, hold tube motionless for a moment after the first rotation.

Preparatory questions: no rotations, and S allowed to see actual outcomes. Otherwise S not allowed to see outcomes.

APPENDIX C(iii) continued.

Concrete reasoning scale (continued)

Questions	Colour first in	Number of rotations	Answer
1	red	-	----------
2	blue	-	----------
3	blue	-	----------
4	red	-	----------
-			
5	red	1	----------
6	blue	1	----------
7	blue	2	----------
8	red	1	----------
9	blue	2	----------
10	red	2	----------
11	red	1	----------
12	red	2	----------
13	blue	1	----------
14	blue	2	----------
15	blue	1	----------
16	red	1	----------
17	red	2	----------
18	blue	2	----------
19	blue	1	----------
20	red	2	----------
21	blue	1	----------
22	red	1	----------
23	blue	2	----------
24	red	2	----------

APPENDIX C(iii) continued.

Concrete reasoning scale (continued)

Item 3 (VII): Conservation of length

Subitem 3a (Black sticks placed on M-L figures, longer to the right).

Preparatory questions:

1. First a very easy question. Which one of these two looks longer? Don't count these (M-L figs.), only the sticks! (If S does not respond to illusion, sufficient to ask, with doubt in voice, "Do you really think that one looks longer?")

Answer: _____

(both sticks held upright and close together, with lower ends on the table).

2. Which one is longer now?

Answer: _____

(sticks laid down again on respective M-L figs).

3. Do you remember which one was longer when they were upright?

Answer: _____

(If answer incorrect, both sticks held upright again, and procedure repeated from question 2).

Test questions:

4. Which one is longer now?

Answer: _____

APPENDIX C(iii) continued.

Concrete reasoning scale (continued)

5. Why do you think so?

Answer: _____

Subitem 3b As above, except that the longer stick is placed to the left, and Q 1 is not asked (sticks upright, longer stick on the left).

Answer to 2 _____

Answer to 3 _____

Answer to 4 _____

Answer to 5 _____

Item 4 (VI): Transitivity of length

Subitem 4a (When M-L figures are used, each black stick is placed with its ends a little outside the apex of the figures. The longer stick is always on 2 figures with arms pointing inwards, and the shorter stick on figures with arms pointing outwards). (S is corrected each time he fails to give correct answer to questions 1-6).

Preparatory questions

(Black sticks placed close together, longer stick to right, ends nearest experimenter coinciding).

1. Which one of these two is longer?

Answer: _____

(Black sticks placed 2" from each other. M-L figs. under sticks, longer stick to right).

APPENDIX C(iii) continued.

Concrete reasoning scale (continued)

2. Which one of these two looks longer? Don't count these (M-L figs.), only the sticks. That's a very easy question!

Answer: _____

(Distance between sticks 20", M-L figures, longer stick to left, blue stick compared with longer stick, ends toward the experimenter coinciding).

3. Which one of these two is longer?

Answer: _____

(Blue stick compared in the same way with shorter stick).

4. Which one of these two is longer?

Answer: _____

(Blue stick between the 2 others).

5. Do you remember which one was longer, this one (longer stick), or this one (blue stick)?

Answer: _____

6. Do you remember which one was longer, this one (shorter stick), or this one (Blue stick)?

Answer: _____

APPENDIX C(iii) continued.

Concrete reasoning scale (continued)

Test questions:

(Blue stick removed from table, but held visible in the experimenter's hand).

7. Which one is longer of these two (longer and shorter black sticks)?

Answer: _____

8. Why do you think so?

Answer: _____

Subitem 4b

(Black sticks placed 20" from each other. M-L figs. under sticks, longer stick to left)

Preparatory questions

1. Which one of these two looks longer? Don't count these (M-L figs), only the sticks! That's a very easy question!

Answer: _____

(Distance between sticks 20", M-L figs., longer stick to right, blue stick compared with longer stick, ends toward the experimenter coinciding).

2. Which one of these two is longer?

Answer: _____

APPENDIX C(iii) continued.

Concrete reasoning scale (continued)

(Blue stick compared in the same way with shorter stick).

3. Which one of these two is longer?

Answer: _____

(Blue stick placed between the two others).

4. Do you remember which one was longer? this one (longer stick) or this one (blue stick)?

Answer: _____

5. Do you remember which one was longer, this one (shorter stick) or this one (blue stick)?

Answer: _____

(If answer to 6 is wrong repeat both 5 and 6).

Test questions

(Blue stick removed from table but held visible in experimenter's hand).

6. Which one is longer of these two (longer and shorter black sticks)?

Answer: _____

7. Why do you think so?

Answer: _____

APPENDIX D.

Raw score data from monolingual and bilingual samples on three linguistic skills measures in English.

Table D(i)
The bilingual sample.

S	Reading time	No. of words	Sentence construct.
1	49	45	19.2
2	81	25	14.8
3	60	40	21.4
4	77	49	19.8
5	335	21	12.8
6	64	37	10.8
7	114	35	13.6
8	66	34	15.6
9	315	16	6.2
10	96	20	8.6
11	102	29	14.2
12	61	32	16.0
13	58	33	14.6
14	76	22	13.0
15	115	31	8.4
16	90	38	20.8
17	117	16	16.8
18	80	42	20.6
19	83	38	18.6
20	58	47	17.6
21	52	26	16.8
22	112	33	16.6
23	90	30	18.6
$\bar{X}$	102.2	32.1	15.5

Table D(ii)
The monolingual sample.

S	Reading time	No. of words	Sentence construct.
1	128	18	12.2
2	89	21	19.0
3	48	55	21.4
4	70	42	12.2
5	80	32	20.6
6	64	47	20.4
7	102	26	14.2
8	406	28	9.6
9	50	25	15.0
10	170	26	11.8
11	120	19	19.8
12	55	39	16.0
13	68	22	17.0
14	143	35	19.6
15	94	36	11.6
16	74	38	20.0
17	324	18	12.8
18	72	30	16.4
19	79	19	14.2
20	105	33	16.4
21	74	28	14.8
22	154	27	9.2
23	105	24	16.4
$\bar{X}$	116.3	29.9	15.7

APPENDIX E. Raw score data from concurrent and consecutive bilingual samples.

Table E(i) Concurrent bilingual sample.

S	Sex	Age	Grade (School)	Occuptl. status	Raven's scores
1	F	10	5	4	27
2	M	9½	4	4	29
3	M	7½	2	4	22
4	M	7½	3	4	21
5	M	10½	6	4	26
6	M	10½	6	1	33
7	M	9	4	2	30
8	M	11	6	2	35
9	M	7	2	1	27
10	M	9½	4	1	33
11	M	9	4	4	25
$\bar{X}$		9.2	4.2	2.8	28

APPENDIX E. continued.

Table E(i). (continued)

	Latvian reading time	English reading time	Diffce. reading time	Latvian words score	English words score	Diffce. words score	Latvian sentence score	English sentence score	Diffce. sentence score
1.	191	64	+ 127	26	37	+ 11	15.2	10.8	- 4.4
2.	315	114	+ 201	21	35	+ 14	11.0	13.6	+ 2.6
3.	210	66	+ 144	27	34	+ 7	6.8	15.6	+ 8.8
4.	560	315	+ 245	6	16	+ 10	4.0	6.2	+ 2.2
5.	310	96	+ 214	17	20	+ 3	5.4	8.6	+ 3.2
6.	106	61	+ 45	23	32	+ 10	19.6	16.0	+ 3.6
7.	261	115	+ 146	22	31	+ 9	5.4	8.4	+ 3.0
8.	125	90	+ 35	30	38	+ 8	19.2	20.8	+ 1.6
9.	220	83	+ 137	21	38	+ 17	7.8	18.6	+10.8
10.	146	58	+ 88	18	47	+ 29	21.2	17.6	- 3.6
11.	226	112	+ 114	23	33	+ 10	13.4	16.6	+ 3.2
$\bar{X}$	242.7	106.7	136.0	21.3	32.8	11.6	11.7	13.9	4.3

APPENDIX E. continued.

Table E(ii). Consecutive bilingual sample.

S	Sex	Age	Grade	Occuptl. Status	Raven's scores
1	F	7	2	1	30
2	F	7½	3	3	30
3	F	11½	7	2	29
4	F	10½	6	5	25
5	F	8	3	4	29
6	M	7½	3	1	26
7	M	10½	6	3	32
8	M	11	6	5	28
9	M	7½	2	4	15
10	M	9½	5	1	35
11	M	11	6	1	34
12	M	7½	3	6	25
$\bar{X}$		9.1	4.3	3.0	28.2

APPENDIX E. continued.

Table E(ii). (continued)

	Latvian reading time	English reading time	Diffce. reading time	Latvian words score	English words score	Diffce. words score	Latvian sentence score	English sentence score	Diffce. Sentence score
1.	56	49	+ 7	34	45	+ 11	20.8	19.2	- 1.6
2.	336	81	+255	20	25	+ 5	11.0	14.8	+ 3.8
3.	126	60	+ 66	31	40	+ 9	16.4	21.4	+ 5.0
4.	170	77	+ 93	27	49	+ 22	16.8	19.8	+ 3.0
5.	680	335	+345	18	21	+ 3	4.8	12.8	+ 8.0
6.	167	102	+ 65	21	29	+ 8	10.4	14.2	+ 3.8
7.	193	58	+135	24	33	+ 9	17.6	14.2	- 3.4
8.	216	76	+140	14	22	+ 8	12.8	13.0	+ 0.2
9.	224	117	+107	11	16	+ 5	13.4	16.8	+ 3.4
10.	146	80	+ 66	28	42	+ 14	19.6	20.6	+ 1.0
11.	166	52	+114	16	26	+ 10	17.2	16.8	+ 0.4
12.	212	90	+122	23	30	+ 7	12.2	18.6	+ 6.4
$\bar{X}$	224.3	98.1	126.3	22.3	31.5	9.3	14.4	16.9	3.3

APPENDIX F.

Table F(i).

Mean scores of high and low scorers on Raven's Coloured Progressive Matrices.

	Means from 5 highest consecutives	Means from 5 highest concurrents	Means from 5 lowest consecutives	Means from 5 lowest concurrents
Latvian words	25.2	22.8	21.4	18.6
Latvian reading	183.4	171.6	185.8	320.4
Latvian sentences	14.8	13.2	15.4	9.8
English words	34.2	37.2	32.0	28.2
English reading	80.4	81.4	77.6	140.2
English sentences	17.5	16.4	17.0	11.2
Words balance score	9.0	14.4	10.6	9.6
Reading balance score	103.0	90.2	108.2	180.2
Sentences balance score	2.7	3.2	1.6	1.4

APPENDIX F. continued.

Table F(ii).

Comparisons between more or less intelligent concurrent and consecutive bilinguals and their monolingual matched pairs. The figures in the columns are difference scores between monolingual and bilingual matched pairs.

a. More intelligent consecutive bilinguals compared with their monolingual matched pair-mates.

Difference in word scores	+	11.8*
Difference in reading times	+	42.4
Difference in sentences score	+	0.7

b. More intelligent concurrent bilinguals compared with their monolingual matched pair-mates.

Difference in word scores	+	4.2
Difference in reading times		0
Difference in sentences score	+	0.8

c. Less intelligent consecutive bilinguals compared with their monolingual matched pair-mates.

Difference in word scores	-	2.2**
Difference in reading times	+	53.0
Difference in sentences score	+	0.4

d. Less intelligent concurrent bilinguals compared with their monolingual matched pair-mates.

Difference in word scores	-	2.0
Difference in reading times	-	32.2
Difference in sentences score	-	2.9

* + sign denotes difference in favour of bilingual sample.

** - sign denotes difference in favour of monolingual sample.

APPENDIX F. continued.

Table F(iii).

Percentage correct answers and reasons (collapsed) for high and low scorers on Raven's Coloured Progressive Matrices.

	Item 1	Item 2	Item 3	Item 4
High scoring concurrents	100	94	80	95
High scoring consecutives	100	99	90	90
Low scoring concurrents	100	91	85	80
Low scoring consecutives	100	96	100	90

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