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ABSTRACT

Studies conducted with middle-class balanced bilinguals in "additive" environments, where both languages are prestigious, have generally reported that bilinguals showed a higher level of cognitive performance than monolinguals. In these studies, bilinguals showed higher levels of general intellectual skills, higher levels of divergent thinking, a more analytic orientation to language and greater sensitivity to feedback cues. However, studies conducted in "subtractive" environments, where the less prestigious first language is in the process of replacement by the second language, have tended to report that bilinguals experienced difficulties in expressing their intelligence through language. The competence that a bilingual gains in his two languages may act as an intervening variable in mediating the effects of his bilingual learning experiences on cognitive growth, i.e., there may be threshold levels of linguistic competence which bilingual children must attain in order both to avoid cognitive deficits and to allow the potentially beneficial aspects of becoming bilingual to influence cognitive growth. (Author/CFM)

The Cognitive Development of Bilingual Children: A Review of Recent Research

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Abstract

Studies conducted with middle-class balanced bilinguals in "additive" environments, where both languages are prestigious, have generally reported that bilinguals showed a higher level of cognitive performance than unilinguals. In these studies, bilinguals showed higher levels of general intellectual skills, higher levels of divergent thinking, a more analytic orientation to language and greater sensitivity to feedback cues. However, studies conducted in "subtractive" environments, where the less prestigious first language is in the process of replacement by the second language, have tended to report that bilinguals experienced difficulties in expressing their intelligence through language. It is suggested that the competence a bilingual gains in his two languages may act as an intervening variable in mediating the effects of his bilingual learning experiences on cognitive growth, i.e. there may be threshold levels of linguistic competence which bilingual children must attain both in order to avoid cognitive deficits and allow the potentially beneficial aspects of becoming bilingual to influence cognitive growth.

The Cognitive Development of Bilingual Children: A Review of Recent Research

Investigations of the relationship between bilingualism and cognition conducted during the past 15 years strongly suggest that childhood bilingualism, can, under different conditions, have both positive and negative effects on cognitive functioning. In the present paper these studies will be critically analyzed and an attempt will be made both to delineate the conditions under which beneficial and detrimental effects occur and also to specify mechanisms through which bilingualism might influence children's cognitive development.

First, the findings of recent studies will be briefly outlined and factors which distinguish studies which have reported positive effects from studies which have reported negative effects (henceforth called "positive" and "negative" studies) will be considered. The research findings will then be examined in detail, within this framework, both in order to assess their validity and to synthesize the explanatory hypotheses suggested by different investigators.

Investigations conducted prior to the Peal and Lambert study in 1962 generally fourd that bilingual children performed at a lower level than unilinguals on measures of verbal intelligence (see reviews by Darcy, 1953; Jensen, 1962; Peal & Lambert, 1962). In addition, Macnamara (1966) has reviewed a large number of studies

which reported that bilinguals were inferior on various types of verbal academic tasks.

Some recent studies support these earlier findings. Macnamara (1966) for example, found evidence of retardation in problem arithmetic associated with instruction through the medium of a weaker language and Tsushima and Hogan (1975) report an increasing deficit in verbal intelligence and academic skills between grades 3 and 5 among Japanese-English bilinguals. A study conducted in Singapore (Torrance, Gowan, Wu & Aliotti, 1970) found that Chinese and Malayan children whose second language was English scored significantly lower than unilingual children on the fluency and flexibility scales of the Torrance Tests of Creative Thinking. Finally, some studies (Ben-Zeev, 1977a, 1978; Doyle, Note 3) have reported that bilinguals had significantly lower scores on the Peabody Picture Vocabulary Test as compared to unilingual controls.

In marked contrast to these negative findings, a large number of recent studies have reported that access to two languages in early childhood can positively influence cognitive functioning. Some of these studies suggest that bilingualism can accelerate the development of general intellectual skills (Bain, 1975; Balkan, 1970; Barik & Swain, 1976; Cummins & Gulutsan, 1974a; Liedke & Nelson, 1968; Peal & Lambert, 1962). There is also evidence that becoming bilingual promotes an analytic orientation to language (Ben-Zeev, 1977a, 1977b, 1978; Cummins, 1978;

Ianco-Worrall, 1972). A positive association between bilingualism and divergent thinking has also been noted (Carringer, 1974; Cummins & Gulutsan, 1974a; Landry, 1974; Scott, Note 4), and several studies suggest that learning a second language increases children's sensitivity to feedback cues (Bain, 1975, Note 1; Ben-Zeev, 1978; Cummins, 1976b; Cummins & Mulcahy, Note 2).

Distinguishing Features of "Positive" and "Negative" Studies

Cummins (1976a) has hypothesized that the level of competence attained by a bilingual child in his two languages may act as an intervening variable in mediating the effects of his bilingual learning experiences on cognitive growth. This hypothesis attempts to resolve the apparent inconsistencies in the results of "positive" and "negative" studies and is derived from an analysis of methodological differences and differences in second language acquisition contexts between these two types of studies.

The methodological difference which is most relevant to specifying conditions under which bilingual learning experiences might exert a positive or negative influence on cognitive growth is related to procedures for choosing the bilingual sample. The majority of recent "positive" studies have taken precautions to ensure that the bilingual subjects were "balanced" bilinguals i.e. had a similar (but not necessarily equal) degree of competence in both languages.

In other words, bilinguals who were very much more dominant in one of their two languages were excluded from the bilingual sample. Studies which reported negative effects, on the other hand, failed to assess the bilingual subjects' relative degree of competence in their two languages.

Two points should be noted in relation to this methodological difference. Firstly, while many recent studies suggest that "balanced" bilingualism may be associated with accelerated cognitive development, these studies tell us nothing about the cognitive growth of children who remain very dominant in one of their two languages. Secondly, a "balanced" bilingual may have either a high level of competence or a low level of competence in both languages. Thus, by itself, the fact that subjects in "positive" studies have been "balanced" provides only a partial picture of the linguistic competence of these subjects.[1] In order to specify more precisely the differences in linguistic competence between the bilingual subjects in "positive" and "negative" studies, it is necessary to consider the language acquisition contexts in which these two types of studies have been carried out.

Lambert (1975) has suggested that "positive" and "negative" studies can be distinguished in terms of the "additiveness" and "subtractiveness" of the bilingual learning conditions under which subjects acquired their two languages. Many of the earlier "negative"

studies involved bilingual subjects from language minority groups whose first language (L_1) was gradually being replaced by their second language (L_2, usually the dominant and more prestigious language). The bilingualism of these subjects is termed "subtractive" in that the bilingual's competence in his two languages at any point in time is likely to reflect some stage in the subtraction of the L_1 and its replacement by the L_2. Thus, it is not surprising that many of these earlier studies produced evidence of a "balance effect" (Macnamara, 1966) in language learning, i.e., that a bilingual paid for his L_2 competence by a lowering of L_1 competence. The lower levels of verbal intelligence of the bilingual subjects in these studies may be a reflection of the fact that many of them are likely to have had less than native-like competence in both their languages.

Recent "positive" studies, on the other hand, have generally involved middle or upper class subjects whose first language is dominant, or at least prestigious, and in no danger of replacement by their second language. In other words, as Lambert (1975) points out, these children are adding another language to their repertory of skills. The evidence from bilingual education programs in such "additive" settings indicates that children generally achieve high levels of L_2 competence at no cost to their L_1 (e.g., Cohen, 1975; Lambert & Tucker, 1972; Swain, 1974).

A combination of the methodological differences and differences in language acquisition contexts between "positive" and "negative" studies leads to the conclusion that there exist qualitative differences in the linguistic competence attained by bilingual subjects in each of these two types of studies. The balanced bilingual subjects in "positive" studies carried out in additive environments are likely to have achieved a high level of L_2 competence at no cost to their L_1. Many of the bilingual subjects in "negative" studies, carried out in subtractive environments, on the other hand, may have had less than native-like skill in both their languages.

This analysis suggests that the level of competence a bilingual child achieves in his two languages may mediate the effects of his bilingual learning experiences on cognition. Developing this idea in the context of immersion education programs, Cummins (1976a, 1977a) has suggested that there may be a threshold level of linguistic competence which a bilingual child must attain both in order to avoid cognitive deficits and allow the potentially beneficial aspects of becoming bilingual to influence his cognitive growth.

The form of the threshold hypothesis which seems to be most consistent with the available data is that there is not one, but two thresholds (Cummins, 1976a; Skutnabb-Kangas & Toukomaa, 1977). The attainment of a lower threshold level of bilingual competence would be sufficient to avoid any negative cognitive effects but the attainment

of a second , higher, level of bilingual competence might be necessary to lead to accelerated cognitive growth. This possibility is expressed in Figure 1.

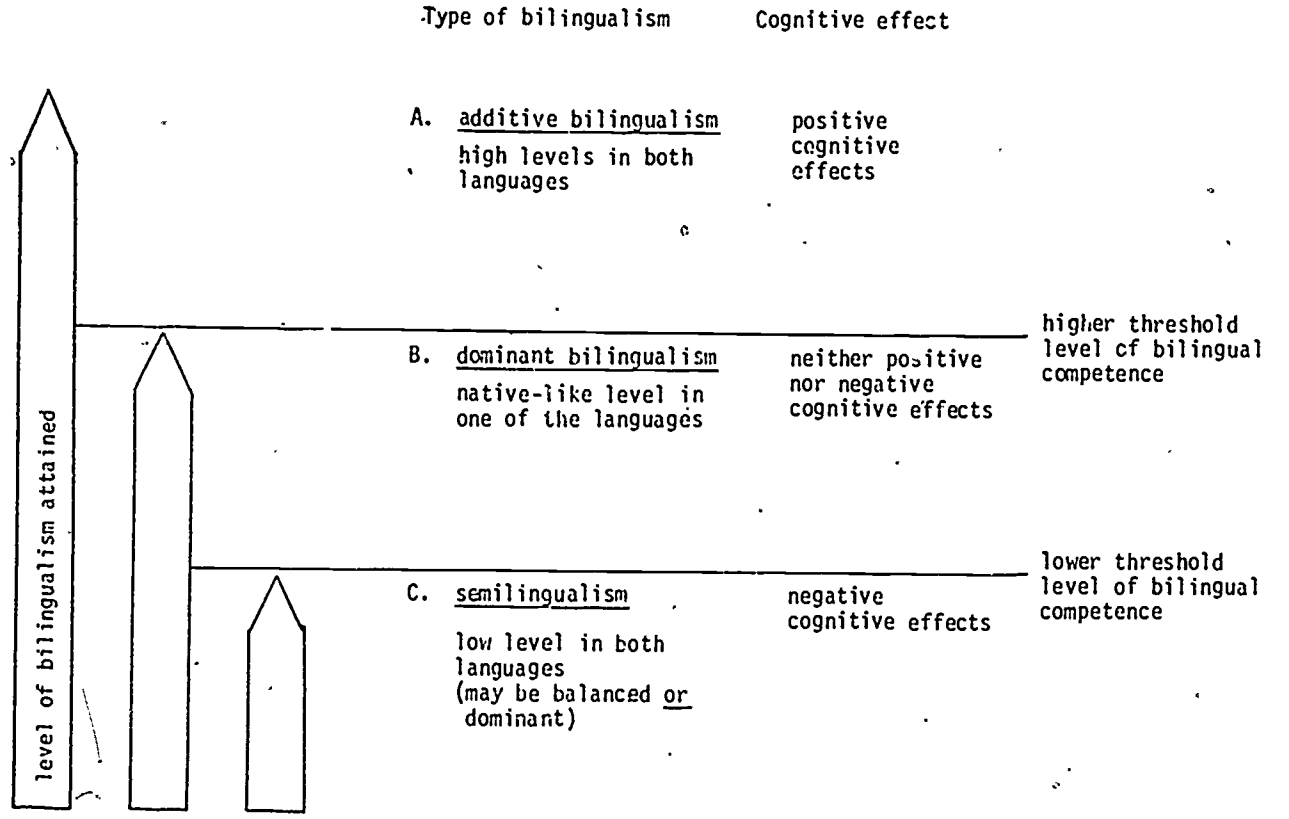

Figure 1: Cognitive Effects of Different Types of Bilingualism (adapted from Skutnabb-Kangas and Toukomaa 1977)

The term "semilingualism" (Paulston, 1976; Skutnabb-Kangas & Toukomaa, 1977) refers to low levels of competence in L1 and L2. There is evidence that semilingualism is likely to result when L1 skills are inadequately developed at the time when intensive exposure to L2 begins. In other words, as Skutnabb-Kangas and Toukomaa (1977)suggest, adequate L1 development is the basis for attaining the lower threshold level of bilingual competence.

Initial research findings (Barik & Swain, 1976; Cummins, 1977a, 1978) are consistent with the threshold hypothesis. For our present purposes the hypothesis seems to go some way towards resolving the apparent inconsistencies between the results of "positive" and "negative" studies and provides a framework within which the research findings can be presented in detail and evaluated. In examining these studies, our aim is to discover which findings stand up to critical analysis and consequently require explanation. Recent studies which have reported a negative association between bilingualism and cognitive or academic progress will be considered first.

Studies Reporting Negative Effects

Several comprehensive reviews exist of studies conducted prior to 1960 (Darcy, 1953; Jensen, 1962; Macnamara, 1966; Peal & Lambert, 1962) and consequently these studies need not be considered here. Although the majority of these early studies had serious methodological defects, taken together they seemed to indicate that bilinguals suffered from a language handicap when measured by verbal tests of intelligence (Darcy, 1953; Peal & Lambert, 1962).

Several recent studies seem to support the position that some bilingual children experience difficulties in using language effectively as an instrument of thought. Macnamara, (1966) reported that Irish primary school children, whose home language was English but who were instructed through the medium of Irish, were eleven months behind in problem arithmetic relative to other Irish children taught through the medium of English. No differences were evident between

the groups on a mechanical arithmetic test whose items were expressed in arithmetical symbols rather than in sentences. Although Macnamara's study has had a considerable amount of influence in promoting a "negative theory of bilingualism" (Stern, 1973), his findings do not stand up to critical scrutiny. Macnamara administered an Irish version of the problem arithmetic test to children who were instructed through Irish (group 5) despite the fact that Irish was a weaker language for the vast majority of these children. Thus, group 5 children were tested through their weaker language while comparison groups were tested through their stronger language. As Cummins (1977b) points out, Macnamara's study confounds bilinguals' competence in arithmetic with their ability to demonstrate this competerce when tested through their weaker language.

Tsushima and Hogan (1975) report that grade 4 and 5 Japanese-English bilinguals performed at a significantly lower level on measures of verbal and academic skills than a unilingual group matched on non-verbal IQ. The bilingual group was comprised of children whose mothers were Japanese and whose fathers were born and raised in the United States. All the parents of children in the unilingual group were born and raised in the United States. Tsushima and Hogan report that the bilingual children had been exposed to both English and Japanese in the home from infancy. However, they give no details of the present pattern of bilingual usage in the

home nor of the bilinguals' relative competence in both languages. Thus, while this study provides evidence of an increasing deficit in verbal skills among bilingual children between grades 3 and 5, it fails to provide any information about the bilingual learning conditions under which such a deficit might occur.

The same criticism can be made of a study conducted in Singapore by Torrance et al. (1970), who report that bilingual children in grades 3, 4 and 5 performed at a significantly lower level than unilingual children on the fluency and flexibility scales of the Torrance Tests of Creative Thinking. Although the study involves more than a thousand subjects, it suffers from limitations similar to those of many other studies. Little detail is given regarding the comparability of bilingual and unilingual groups in terms of IQ or SES and we are told nothing about the level of bilingualism of the bilingual subjects. The authors attribute the lower scores of the bilingual group on the fluency and flexibility scales to the interference of associations in bilingualism. The lower scores on these scales may also reflect a lower level of vocabulary (see Ben-Zeev, 1977b and Doyle, Note 3 below). In Torrance et al's. study, the direction of the trend was reversed for the originality and elaboration scales and differences in elaboration in favor of the bilingual group were significant. The failure of the authors to provide information on the linguistic competence of the bilingual

group comes into focus when one compares their findings with those of Cummins (1977a).

Cummins reports that grade 6 non-balanced bilinguals (i.e. those who had remained very dominant in L_1 despite six years of immersion schooling) performed at a lower level than a unilingual control group (matched on IQ and SES) on fluency and flexibility measures of divergent thinking, whereas balanced bilinguals performed at a higher level than the unilinguals on the originality scale. The parallelism in the results of these two studies suggests that the lower levels of fluency and flexibility observed in the Torrance et al. study may be attributable only to those bilinguals who had failed to overcome difficulties in coping with two languages. By the same token, only those bilinguals who had overcome linguistic difficulties may have been at an advantage in originality and elaboration skills. The relationship between the results of these studies and the threshold hypothesis is obvious and suggests the potential fruitfulness of including the bilinguals' level of linguistic competence as an independent variable in assessing the cognitive consequences of bilingualism.

Both Ben-Zeev (1977b) and Doyle (Note 3) report that the young bilingual children they studied performed at a significantly lower level than control groups of unilinguals on the Peabody Picture Vocabulary Test. This finding is not regarded as

surprising by these investigators. Since the bilingual's language experience is divided between two languages he has less opportunity for experience with the vocabulary of either. As we shall see Ben-Zeev's studies suggest that the bilingual's linguistic experience can have many positive effects on his cognitive processes.

In summary, several recent studies add to the evidence that, under certain conditions, bilingual children fail to overcome difficulties in coping with two languages and, as a result, show lower levels of some cognitive skills. The major problem with these studies is that they generally fail to specify the language learning conditions and the linguistic characteristics of the bilingual subjects. This is a serious omission since, as was pointed out above, the level of competence attained by a bilingual child may be an important intervening variable in determining whether his bilingual learning experiences have positive or negative effects.

Studies Reporting Positive Effects

These studies have examined the effects of bilingualism on four main aspects of cognitive functioning. These aspects are: (a) general intellectual development, (b) divergent thinking, (c) orientation to language and (d) sensitivity to feedback cues. There is a certain amount of overlap between these areas and several studies are concerned with the effects of bilingualism on more than area. Before examining these "positive" studies some methodological

issues need to be briefly considered.

Although recent "positive" studies are more adequate methodologically than earlier "negative" studies in that almost all have controlled for such factors as SES, sex, and age, it can still be objected that these controls provide inadequate protection against bias. Specifically, the studies of Davé (1963) and Wolf (1966) have shown that an index of SES based on parental occupation is likely to account for only a relatively small proportion of differences in children's home environments. The simplest way of controlling for general environmental differences between groups is to match on a global measure of cognitive development such as IQ, in addition to SES, age, and sex, and many studies which have reported positive effects have done so. However, this option has not been available to several studies (e.g. Cummins & Gulutsan, 1974a; Peal & Lambert, 1962) in which intellectual abilities have been used as dependent measures. Consequently, because of their failure to demonstrate that bilingual and unilingual groups have been adequately matched on environmental variables, the findings of these studies can be regarded only as suggestive.

A second point to bear in mind when considering "positive" studies is that these studies, for the most part, have involved balanced bilinguals and have been carried out in "additive" environments, i.e. with bilingual subjects who have been adding

a prestigious second language to their repertory of skills rather than replacing their first language with a second. Thus, the findings of these studies relate only to those bilingual children who have attained relatively high levels of second language skills at no cost to their first language. The consequences of bilingualism for children who fail to resolve difficulties in coping with two languages are likely to be much less positive than in these studies.

General intellectual development. The best known of recent studies relating bilingualism and cognition is that of Peal and Lambert (1962) conducted with middle-class French-English bilinguals in Montreal. Within the context of previous studies Peal and Lambert's findings were startling. Not only did the group of balanced 10 year old bilinguals show a higher level of non-verbal intelligence than the unilingual control group, they also performed at a higher level on measures of verbal intelligence - a complete reversal of previous findings. Factor analysis of cognitive measures revealed a more differentiated subtest profile among the bilingual group, suggesting to the authors that bilingualism might lead to a more flexible cognitive structure. The Peal and Lambert findings can be regarded only as suggestive because of the possibility of uncontrolled environmental differences between the groups and also because there may have been some slight bias in the procedure for selecting balanced bilinguals (see

Cummins (1976a).

However, subsequent studies aimed at replicating and extending the Peal and Lambert findings have done so (Balkan, 1970; Cummins & Gulutsan, 1974a; Liedke & Nelson, 1968). Cummins and Gulutsan (1974a, 1974b), report that a group of 61 grade 6 balanced bilinguals matched with 61 unilinguals on SES, sex and age performed at a significantly higher level on measures of both verbal and nonverbal ability. As with the Peal and Lambert study, this study is subject to the limitation that an index of SES based on parental occupation is unlikely to control all relevant environmental differences between bilingual and unilingual groups.

Another western Canadian Study (Liedke & Nelson, 1968) found that bilingual grade 1 children performed significantly better on a Piagetian concept formation task than a unilingual group matched for age, SES, sex and IQ. The authors hypothesize that the bilingual child is exposed to a wider range of experiences due to the greater amount of social interaction involved in learning two languages as compared to one.

A study conducted in Switzerland by Balkan (1970) set out to investigate Peal and Lambert's suggestion that bilingualism is associated with increased cognitive flexibility. Balkan states that in Peal and Lambert's study "flexibility" was confounded

with intelligence and claims that his results show that flexibility is a correlate of bilingualism independently of intelligence. Balkan matched bilinguals and unilinguals on nonverbal intelligence and found that the bilingual group performed significantly better on two variables which he claims measure cognitive flexibility. One of these tests was similar to the Embedded Figures Test, and involved an ability to restructure a perceptual situation (Figures Cachées). The other test required a sensitivity to the different meanings of words (Histoires). Balkan also divided his bilingual group into early (those who learned their second language before the age of four) and late (those who learned their second language between four and eight) bilinguals and found that the superiority of the early bilinguals over their matched unilingual counterparts on these tests was much more pronounced than the superiority of the late bilinguals. Balkan suggests that the habit of switching from one language to another leads to a greater degree of cognitive flexibility in blingual children.

Several points are worth noting in relation to this well-controlled study. Although the label "flexibility" is not particularly useful, having been applied by different investigators to a variety of cognitive tasks which have very little in common; (see Cummins & Gulutsan 1974a) differences between bilinguals and unilinguals have been noted on tasks similar to those used by Balkan

as measures of "flexibility". Bruck, Lambert and Tucker (in press), for example, found large differences between experimental and control groups in the St. Lambert project at the grade 6 level on the Embedded Figures Test and Ianco-Worrall (1972) has reported that bilinguals were more sensitive than unilinguals to the semantic aspects of words. However, Cummins and Mulcahy (Note 2) failed to replicate Ianco-Worrall's finding.

Using longitudinal data from Ottawa and Toronto immersion programs Barik and Swain (1976) have recently examined the usefulness of the threshold hypothesis as a framework for investigating the cognitive consequences of bilingualism. No differences were found between immersion and control groups at the grade 3 level when scores were adjusted for initial IQ and age differences. However, further analysis of the data showed that high French achievers scored significantly higher on two of the three Otis-Lennon subtests than low French achievers even when scores were adjusted for initial IQ and age differences between these two groups. There is no evidence that the low French achievers suffered any cognitive disadvantages since their IQ scores remained unchanged over the three year period. However, the IQ scores of the high French achievers increased over the three year period, suggesting that the attainment of high levels of L_2 skills is associated with greater cognitive growth. The significant differences between high and low French achievers on IQ measures, which are probably less sensitive than

many other cognitive measures to the effects of bilingualism, suggests that the threshold hypothesis warrants further investigation.

Bain (1975, Note 1) has reported several studies related to the influence of bilingualism on both "contemplative" and "participative" cognition. The latter studies will be considered in a later section. Bain (1975) found significant differences between ten grade 1 balanced bilinguals and ten unilinguals on a rule discovery task at the grade 1 level. Bilingual and unilingual groups were matched for SES, sex, IQ and developmental level of operations. Although in the same direction, differences at the grade 6 level did not reach significance.

A second study (Ba..., Note 1) examined differences between bilingual and unilingual grade 1 and grade 3 children from several different cultural settings on ability to extinguish the Uznadze kinesthetic illusion. Extinction of the Uznadze kinesthetic illusion is conceptualized by Bain in terms of "body-flexibility" i.e. a subject's ability to distantiate himself from the realm of immediate experience[2]. Evidence that extinction of the Uznadze illusion is indeed indicative of cognitive processes is provided by Cummins (1976c). Using 660 children from Canada, Italy and West Germany, Bain compared the performance of three types of children categorized as (a) disruptive bilingual, (b) unilingual and (c) creative bilingual. The defining characteristic of each of these types of children, according to Bain, is the effectiveness

of their language as a tool for enticing its users to be cognitively open to experience, "creative" bilinguals being the most open and "disruptive" bilinguals least open. In Bain's study children of Italian immigrant workers in Canada and West Germany provided examples of "disruptive" bilinguals and Canadian and West German children in immersion programs fulfilled the operational definition of "creative" bilinguals. Five unilingual groups from the three countries were used as controls. Bain reports significant differences between children representative of the three speech types in ability to extinguish the illusion, the "creative" bilinguals being the quickest and the "disruptive" bilinguals the slowest to attain veridical perception.

The finding of differences between "disruptive" and "creative" bilinguals is consistent with the pattern of previous research conducted in subtractive and additive language acquisition contexts. However, Bain's study (Note 1) suffers from the same limitations as several of the other studies that have been considered. Although "disruptive" and "creative" bilingual groups were compared with unilingual control groups of the same general SES level, an index of SES based on parental occupation provides inadequate control over possible environmental process differences between groups. Thus, differences in "body-flexibility" between "creative" bilingual, "disruptive" bilingual and unilingual groups cannot unequivocably

be attributed to variations in speech or language patterns between these three groups.

Cummins and Gulutsan (1975) using grade 6 balanced bilinguals have reported findings which appear inconsistent with those of Bain (Note 1). No differences were found between bilingual and unilingual groups on extinction of the haptic form of the Uznadze illusion. Neither were differences found between balanced and non-balanced bilinguals. Thus, speech variations were not related to ability to extinguish the illusion. Cummins and Gulutsan suggest that these findings are inconsistent with the "switching hypothesis" put forward by several investigators (e.g., Balkan, 1970; Peal & Lambert, 1962). Extinction of the Uznadze illusion requires subjects to switch a set or change an established mode of response. The hypothesis that switching languages leads to a more flexible response mode would clearly predict superior performance by bilinguals on the illusion task. However, while Cummins and Gulutsan's findings are inconsistent with the switching hypothesis, Bain's (Note 1) results support it, though Bain himself does not invoke it as an explanatory construct.

In summary, the evidence from these studies suggests that, under certain conditions, access to two languages can accelerate aspects of general cognitive development. Virtually all these studies involved middle or upper-middle class bilingual subjects

who had attained a relatively high level of competence in both languages. However, some of the findings of these studies can be regarded only as suggestive due to failure to demonstrate that all relevant environmental process variables have been controlled. This failure is inevitable in some studies since IQ-type measures have been used as dependent variables and thus bilingual and unilingual groups could not be matched on IQ. However, despite this limitation, the results of the majority of studies are consistent with one another and suggest that there is a phenomenon which requires explanation.

Divergent Thinking. In several recent studies an association has been reported between second language learning and divergent thinking (Carringer, 1974; Cummins & Gulutsan, 1974a; Landry, 1974; Scott, Note 4; Torrance et al., 1970). Landry (1974) reports that grade 6 children, attending schools where a FLES program (i.e. between 20 and 45 minutes of second language instruction per day) was operative, scored significantly higher than a unilingual control group on both the verbal and figural parts of the Torrance Tests of Creative Thinking. Differences between FLES and non-FLES schools at the grade 1 and grade 4 levels were non-significant. Landry argues from these results that learning a second language in elementary school might increase divergent thinking skills. Certain limitations in this study render this contention somewhat tentative.

First, there is the problem of controlling extraneous differences between the groups. Although pupils in both schools came from the same social milieu and no differences in divergent thinking were evident between the grade 1 samples, it is quite possible that there may have been intelligence differences between the grade 6 FLES and non-FLES samples. Also, no data are presented regarding the level of second language competence attained in the program or the relationship between second language achievement and divergent thinking.

Cummins and Gulutsan (1974a) reported highly significant differences between balanced bilingual and unilingual grade 6 children on a verbal originality measure. When intelligence was partialled out the level of significance was reduced but the difference was still significant. However, no differences were found on four other measures of divergent thinking. Further analysis of the data (Cummins, 1977a) suggested that only those bilinguals who had attained a relatively high level of second language competence performed at a higher level on the verbal originality task while children who remained very dominant in their home language were at a disadvantage, in relation to unilingual children, on verbal fluency and flexibility skills. As mentioned previously these findings suggest an interpretation of Torrance et al.'s finding that bilingual children in Singapore performed at

a lower level than unilingual children on the fluency and flexibility scales but at a higher level on originality and elaboration scales of the Torrance Tests of Creative Thinking. Torrance et al. did not assess the level of second language achievement of their unilingual subjects. Cummins' data suggest that had they done this, they might have found large differences between high and low achievers on the four scales.

The Torrance et al. and Cummins (1977a) studies suggest that bilingualism might differentially affect different aspects of divergent thinking. As Torrance et al. suggest, interference of associations may inhibit fluency and flexibility skills; however, when bilinguals overcome the interference of one language or another and establish two separate linguistic sets, their access to two languages might promote originality and elaboration skills. Clearly, this is speculative, yet it does indicate the potential heuristic value of the threshold hypothesis.

Scott (Note 4) analyzed data from the St. Lambert project in Montreal and reported that the French speaking skills of the experimental children at the grade 6 level were significantly predicted by earlier (grade 3) divergent thinking abilities. Scores on a nonverbal measure of intelligence did not significantly predict French speaking skills. Scott also analyzes data which suggest that divergent thinking may have been positively affected

by the immersion program and concludes that higher levels of divergent thinking may be either an effect or a causal element in the attainment of functional bilingualism.

A study conducted in Mexico by Carringer (1974) reported that 24 Spanish-English balanced bilinguals performed at a significantly higher level than 24 Spanish-speaking unilinguals on several measures of divergent thinking. These findings, however, are not convincing since neither IQ nor SES appears to have been adequately controlled. A final study (Anisfeld, 1964) found no differences between bilinguals and unilinguals on measures of divergent thinking.

In summary, while the studies considered above do provide some evidence of an association between divergent thinking and bilingualism they do not unambiguously indicate whether the relationship is positive or negative or one of cause or effect. Perhaps the most interesting findings are those of Torrance et al. regarding the different effects of bilingualism on the fluency and flexibility scales on the one hand and originality and elaboration scales on the other. Although the study suffers from several limitations (e.g. failure to control for IQ and SES) which might affect the absolute scores attained by bilingual and unilingual groups, the reversal in trends is less likely to be affected by these limitations. More research is needed to assess the nature of the

association between bilingualism and divergent thinking and the conditions under which this association is found to occur. The design of this research should include the level of linguistic competence attained by the bilingual subjects as an independent variable.

Orientation to language

The studies which will be examined in this section (Ben-Zeev, 1977a, 1978; Cummins, 1978; Cummins & Mulcahy, Note 2; Feldman & Shen, 1971; Ianco-Worrall, 1972) have investigated hypotheses derived from observations of the early language development of bilingual children. Perhaps the best known of these observational studies is that conducted by Leopold (1949) on the simultaneous acquisition by his daughter of English and German. On the basis of his observations, Leopold argued that bilingualism accelerates the separation of sound and meaning or name and object, and that bilinguals who constantly hear two words for the same object are "compelled to pay more attention to the meaning expressed than to the word used to express it" (1949, p.188). Imedadze (1960, 1967), on the basis of a similar observational study also asserts that bilingualism accelerates the separation of name and object and can focus the child's attention on certain aspects of language. Similar sentiments are expressed by Vygotsky (1962, Note 5) who argued that being able to express the same thought in different languages will enable the child to "see his language as one particular system

among many, to view its phenomena under more general categories, and this leads to awareness of his linguistic operations (1962, p.110). In an earlier paper directly concerned with multilingualism in children, Vygotsky (Note 5) argued that bilingualism could have both positive and negative effects. When child bilingualism developed spontaneously, i.e. outside the influence of training, Vygotsky admitted that it could inhibit the child's mental development through interference of concepts and associative processes. However, when the application of sound pedagogical principles ensured that each language had an independent sphere of influence, bilingualism could orient the child towards more abstract thought processes "from the prison of concrete language forms and phenomena".

These hypotheses are supported by the studies cited above. Feldman and Shen (1971), for example, reported that 5-year old bilingual Head Start children were superior to unilinguals in their ability to switch names and in their use of common names and nonsense names in relational statements. Bilingual and unilingual groups, however, were not matched on IQ or other cognitive measures and thus the results must be considered tentative.

Ianco-Worrall's study involved 30 Africaans-English bilinguals drawn from the 4 - 6 and 7 - 9 age levels. Each bilingual child was matched with two unilingual children, one Africaans-speaking and the other English-speaking. Her study supported Leopold's (1949) observations by showing that bilingual children, brought up in a

one-person, one-language home environment, were significantly more sensitive than unilingual children to semantic relations between words and were also more advanced in realizing the arbitrary assignment of names to referents. Unilingual children were more likely to interpret similarity between words in terms of an acoustic rather than a semantic dimension (e.g. cap-can rather than cap-hat) and felt that the names of objects could not be interchanged.

The fact that, in Ianco-Worrall's study, bilinguals agreed more often that names of objects could be interchanged is capable of another interpretation. There were three pairs of names: dog, cow; chair, jam; book, water. Children were first asked "could you call a dog 'cow' and a cow 'dog'?" Because high school children tended to answer 'no' to this question, since they felt there were social and linguistic conventions regarding names which could not be broken, a second question was added. This question was "suppose you were making up names for things, could you then call a cow 'dog' and a dog 'cow'?" High school children invariably agreed that, in principle, this could be done. Ianco-Worrall's assertion that bilinguals were more aware of the arbitrary nature of word-referent relationships is based on the fact that at both the 4 - 6 and 7 - 9 age levels a significantly higher proportion of bilinguals fell into this 'no - yes' category. However, there is evidence, which will be considered in the next section, that bilingual children are more sensitive to feedback cues. The change in the form of the question may have provided cues to children which would cause them to change

their response from 'no' to 'yes' and bilingual children may have been more sensitive to these cues. Thus, since children were not required to justify their responses, Ianco-Worrall's findings are inconclusive as to whether the bilingual children in her sample were in fact more aware of the arbitrary nature of word-referent relationships or whether they were just more sensitive to feedback cues.

Cummins (1978) reported data from Irish and Canadian (Ukrainian-English) bilingual programs. Both studies were designed to investigate the influence of bilingualism on children's orientation to language and on their ability to analyze linguistic input. Two groups of children attending a Ukrainian-English bilingual program in Edmonton, Canada were compared with unilingual control groups matched for IQ, SES, sex, age and school at both grade 1 and 3 levels. One group of bilingual children had extensive Ukrainian at home and were judged by their teachers to be relatively fluent in Ukrainian. The second group had little or no Ukrainian at home and were judged by teachers to have little fluency in Ukrainian. It was found that the fluent bilingual (FB) group was significantly better able than either the non-fluent bilinguals (NFB) or unilinguals (U) to analyze ambiguities in sentence structure (see Kessel, 1970 for a description of the task. No differences were found between NFB and U groups. There was also a trend at the grade 3 level for the FB group to perform better than the U group on a measure of class inclusion ($p < .10$,

two-tailed t test) which requires semantic analysis in addition to general reasoning.

The pattern of results in this study (FB > NFB and U groups) provides direct support for the threshold hypothesis. However, the study failed to replicate Ianco-Worrall's finding that bilingual children were more semantically oriented than unilingual children. In fact, at the grade 1 level, the NFB group was significantly more acoustically (and less semantically) oriented than the U group. This difference disappears by grade 3 and is probably due to the necessity to "train one's ear" and pay attention to phonetic similarities and dissimilarities in the initial stages of the bilingual program.

Ianco-Worrall's finding that bilinguals were more aware of the arbitrary nature of word-referent relationships was also investigated in Cummins' Irish and Ukrainian studies. Unlike Ianco-Worrall's procedure children were required to justify their responses and the justifications rather than the actual responses were scored correct or incorrect. In the Irish study there were significant differences between bilingual and unilingual groups in favor of the bilinguals at both grades 3 and 6 but the Ukrainian study found no group differences either at grade 1 or grade 3. The equivocal nature of the findings may be a reflection of the relative crudeness of the measurement instruments. The phenomenon of "metalinguistic awareness" is still very inadequately understood and the literature is

devoid of instruments whose construct validity has been demonstrated.

The Irish study (Cummins, 1978) also reported that grade 3 and 6 bilingual children were better able than unilingual children matched for IQ, SES, sex and age to evaluate nonempirical contradictory statements (e.g. "The poker chip (hidden) in my hand is blue and it is not blue - True, False or Can't Tell?). Children were required to justify their responses and, as in the Arbitrariness of Language task, justifications rather than actual responses were scored correct or incorrect. These findings are consistent with the findings of the Ukrainian study and suggest that bilingualism can promote an analytic orientation to linguistic input.

Ben-Zeev's studies (1977a, 1978) are also consistent with this hypothesis. Ben-Zeev (1977b) argues that in order to overcome interlingual interference bilinguals develop strategies of linguistic processing which can promote cognitive growth. She proposes four different mechanisms by means of which the bilingual child attempts to resolve the interference between his languages. These mechanisms are (1) analysis of language; (2) sensitivity to feedback cues; (3) maximization of structural differences between languages and (4) neutralization of structure within a language. The first two mechanisms are best supported by the empirical evidence and are more related to cognitive processes than the last two. Ben-Zeev's studies on the analysis of language will be considered here and sensitivity to feedback cues will be considered in the next section.

Ben-Zeev used a symbol substitution task to investigate children's ability to play with words. For example, children were asked "How do we say 'They are good children'" substituting "Spaghetti" for "They". The Hebrew-English bilinguals were significantly superior on this task than their unilingual controls. There were no differences between the Spanish-English bilinguals and their controls on this task. However, Ben-Zeev reports that the Spanish-English bilinguals made significantly fewer errors of a global, primitive type i.e. simply uttering the substitute word in place of the entire sentence. This type of error, she argues, is indicative of inability to treat the sentence analytically. Ben-Zeev claims that the symbol substitution task requires a grasp of the basic idea that the structure of a language is different from the phonological representations and meaningful words in which it is embodied. Success on this task is indicative of ability to analyze language as an abstract system.

Although bilinguals were better able to treat sentence structure analytically, in both studies they had significantly lower vocabulary scores and the Spanish-English bilinguals made significantly more grammatical mistakes on a story-telling task. Ben-Zeev concludes that the relative lack of experience with each language probably has some limiting effect on knowledge of standard grammatical rules as well as vocabulary.

The vocabulary deficit of the bilingual children probably

affected their performance on a word association task administered in both Ben-Zeev studies. Although bilinguals in both studies tended to give more paradigmatic responses, the latency of these responses was higher for the bilingual children, indicating task difficulty. Ben-Zeev suggests that although the bilingual children lack the vocabulary to make optimal use of an internal semantic feature system, they seem to be making efforts in this direction and resisting the tendency to give the easier sequential or syntagmatic responses characteristic of younger children.

Ben-Zeev's word association findings were partially replicated in the Ukrainian study discussed above (Cummins & Mulcahy, Note 2). Although there were no differences between fluent bilingual and unilingual children in number of paradigmatic responses, the fluent bilinguals took significantly longer to respond than did the unilinguals. The latency differences between the groups were greater for paradigmatic than for syntagmatic or "clang" responses.

The results of non-verbal tests administered in the Ben-Zeev studies were interpreted (Ben-Zeev, 1977b) as evidence for the generalization of bilinguals' analytic strategy towards language to other kinds of structures. The Spanish-English bilinguals performed better on classification and reversal shift tasks than their unilingual controls. It is worth noting, however, that Ianco-Worrall found no differences on similar tasks between her bilingual and unilingual groups. Ben-Zeev also reports a tendency for both groups

of bilinguals to be better able to name the underlying dimensions on a matrix transposition task.

In summary, the studies discussed in this section consistently support the hypothesis that bilingualism promotes an analytic orientation to language. The hypotheses that bilinguals are more semantically oriented than unilinguals and have a greater awareness of certain properties of language are supported in some studies but not in others. There was also some evidence from response latencies that bilinguals may experience some difficulty in generating word associations. However, the nature of this difficulty is as yet unclear. Pending replication and extension the findings in this section should be interpreted with caution since the construct validity of many of the dependent measures used has not been demonstrated.

Sensitivity to feedback cues. Ben-Zeev's (1973) Spanish-English study included several different measures to test sensitivity to cues. The rationale for including these measures was that bilinguals may develop greater sensitivity to linguistic, perceptual and interpersonal cues as a way of accommodating to the extra demands of their linguistic environment. Increased attention to feedback cues has adaptive significance for the bilingual child in that it might help him understand the communication of others, make him aware of mistakes in his own speech, possibly due to interference, and provide him with information regarding the appropriate times

for switching languages.

Ben-Zeev reports that Spanish-English bilinguals were significantly better able to use hints as cues to successful restructuring on classification tasks and scored significantly higher on the WISC Picture Completion subtest, presumably due to extra scanning of the details of the presented pictures. In both Spanish-English and Hebrew-English studies, Ben-Zeev reports that bilinguals were significantly more susceptible to the verbal transformation illusion (Warren & Warren, 1966). In this task a nonsense word is repeated continuously by means of a tape loop and adults typically perceive the verbal stimulus as repeatedly changing. Ben-Zeev interprets the fact that bilinguals perceived a higher number of auditory changes as indicating increased processing effort on their part and increased attention to cues from linguistic input in order to achieve satisfactory closure. However, this interpretation is questioned by Cummins and Mulcahy (Note 2) who found no differences between bilinguals and unilinguals on the verbal transformation illusion.

In addition to Ben-Zeev's studies, the findings of several other investigations suggest that bilinguals may be more sensitive to interpersonal feedback and more adept at certain kinds of communication tasks. Genesee, Tucker and Lambert (1975), for example, asked children in total immersion classes, partial immersion classes and a unilingual control group to explain how to

play a game to two different listeners, one blindfolded and the other not blindfolded. The total immersion group was found to be the most sensitive to the needs of listeners and responded most differentially, showing the largest difference between sighted and blindfolded conditions. The authors suggest that the immersion children's school experiences may have made them more aware of possible difficulties in communicating as well as provided them with some experience in coping with such difficulties.

Several studies (Bain, 1975, Note 1; Cummins, 1976b) have examined the influence of bilingualism on children's sensitivity to facial expressions. Bain (1975) reports significant differences between balanced bilingual and unilingual children at grades 1 and 6 on the Portrait Sensitivity Test (Bain, 1973) in which children are required to identify the facial expressions on a series of 24 portraits painted by famous artists. Bain interprets the bilinguals' superior performance "in light of Vygotsky's notion that the child's entire psycho-social world expands and is led by the specific language-educational experience of the child" (1975, p. 16), the bilingual experience being qualitatively different from that of the unilingual.

Cummins (1976b) also reports significant differences in favor of bilingual children at the grade 6 level on the Portrait Sensitivity Test. Additional data available for both groups made it possible to reject the hypotheses that the group difference in sensitivity to facial expressions was a function of differences between bilingual and unilingual children in present cognitive or linguistic structure or in cultural level of the home. Thus, Cummins interprets the findings in the light of Macnamara's (1972) theory of language acquisition i.e. that infants learn their language by first determining, independently of language, the meaning which a speaker intends to convey, and then working out the relationship between this meaning and the linguistic utterance. In learning two languages, the bilingual child has been exposed to more non-verbal communication than the unilingual and has consequently developed more sensitivity to the meanings of facial expressions. In the light of Ben-Zeev's findings, bilinguals'

sensitivity to facial expressions may be part of a more general sensitivity to different kinds of feedback cues.

Bain (Note 1) has recently added to the evidence that bilingualism can increase children's sensitivity to facial expressions. Using Fields' (1953) Expressive Faces Test, he reports that "creative" bilinguals (i.e. those attending immersion programs in Canada and West Germany) showed significantly more sensitivity to facial expressions than control groups of unilinguals at the grade 1 and grade 3 levels. However, "disruptive" bilinguals (children of immigrant workers) were significantly inferior to unilingual control groups at the grade 3, but not at the grade 1 level. This finding, as well as the entire pattern of previous research in additive and subtractive environments suggests that the enriched linguistic environment provided by parents of high educational and socio-economic level may be an important factor in interaction with bilingualism. However, as mentioned previously, Bain's (Note 1) findings can be regarded only as suggestive due to failure to demonstrate that all extraneous environmental variables have been controlled.

These studies suggest that the effects of bilingualism on children's sensitivity to feedback cues warrants further investigation. Ben-Zeev's (1978) Spanish-English study is especially interesting in that it suggests that even in subtractive environments it is possible to discern some positive effects of bilingualism on children's cognitive processes. It may be that, as Ben-Zeev (1977b) implies, the same

mechanisms are operative in both additive and subtractive environments and that in both settings children react in the same way to overcome interference effects. In both types of environment too, bilinguals may suffer some vocabulary lag and possibly some lag in grammatical competence. The difference may lie in the fact that in additive environments bilingual children seem to succeed in overcoming these deficits (probably aided by parental and educational support). Consequently, the positive effects of their bilingual learning experiences are not masked or inhibited by cognitive disruption. However, in subtractive environments interference and inferior language skills may persist or even deteriorate further as children get caught up in a cumulative deficit situation typical of culturally deprived children. Consequently, the positive effects may be negated by children's linguistic difficulties. It is clear that longitudinal data on the cognitive development of bilingual children in subtractive environments are needed to adequately examine the interplay between these positive and negative influences. Future research is also likely to focus on the interaction between language acquisition contexts and the cognitive consequences of bilingualism.

In summary, recent studies have reported that bilingualism can positively influence four main aspects of cognitive functioning.

These are (a) general intellectual development, (b) divergent thinking, (c) orientation to language and (d) sensitivity to feedback cues. These studies have involved children who became bilingual as a result of school experiences as well as children who acquired their second language at the same time, or soon after, their first language. Apart from the general differences in the effects of additive and subtractive bilingualism, there is insufficient data to make generalizations regarding the cognitive consequences of different types of language acquisition contexts, although Balkan's findings do suggest that early bilingualism may be more efficacious in engendering cognitive flexibility than late bilingualsm. Although not all studies have been equally well controlled, the consistent results produced by a substantial number of well designed studies suggests that there is a need to explain the findings and integrate them into a broader theoretical context.

The Broader Theoretical Context

Here the hypotheses which have been advanced to explain the research findings will be synthesized and their relationship to broader issues in the area of cognitive development briefly considered. The hypotheses which have been advanced to explain the positive association observed between bilingualism and cognition have been classified (Cummins, 1976a) into three basic types, (a) the experiential enrichment hypothesis, (b) the switching

hypothesis and (c) the objectification hypothesis.

The experiential enrichment hypothesis holds that the bilingual child may have been exposed to a wider range of experiences due either to attempts by his parents to compensate for the reduced time he will inevitably spend in each language (Liedke & Nelson, 1968) or because his experiences stem from two cultures (Peal & Lambert, 1962). Although this hypothesis seems plausible in general terms there is no empirical evidence for or against it. It has not been demonstrated that bilinguals are exposed to a wider range of social or cultural stimulation than unilinguals or that, even if they were, this would accelerate their rate of cognitive growth.

The switching hypothesis has been proposed by various investigators (Balkan, 1970; Carringer, 1974; Landry, 1974; Peal & Lambert, 1962) to explain their findings that bilingual children exhibited higher levels of cognitive flexibility or divergent thinking. The hypothesis proposes that bilingual children develop a more flexible learning set as a result of switching languages and making use of two different perspectives. Insofar as extinction of the Uznadze illusions can be taken as indicative of ability to switch an established set, the empirical evidence is inconsistent in relation to the switching hypothesis. Bain (Note 1) reports differences in extinction between bilinguals and unilinguals whereas Cummins and Gulutsan (1975) failed to find differences.

Explanations of bilinguals' superior cognitive performance which emphasize the positive consequences which result from the interplay between object and word or semantics and phonetics can be subsumed under what Cummins and Gulutsan (1975) term the "objectification" hypothesis. The term objectification is derived from Georgian (U.S.S.R.) psychology and refers to the process whereby objects become the focus of conscious attention. Several investigators (Ianco-Worrall, 1972; Lambert & Tucker, 1972; Leopold, 1949; Peal & Lambert, 1962) have suggested that having two words for the same referent draws the child's attention to semantic aspects of language and makes him more aware of the arbitrary nature of word-referent relationships. The essence of the objectification hypothesis is that the feedback generated by the bilingual child's speech actions on the environment helps direct his attention both to the conceptual features of his environment and to the characteristics of his linguistic operations. The findings of Ianco-Worrall (1972), Cummins (1978) and Ben-Zeev (1977a, 1978) support the objectification hypothesis insofar as they suggest that the bilingual child is more aware of certain properties of language and develops a more analytic orientation to language. It is possible to interpret the superior performance of bilingual children on other cognitive tasks as a generalization of this analytic strategy. Ben-Zeev's suggestion that the bilingual child's increased objectification of language structures arises from his attempt to

overcome interlingual interference will no doubt be further investigated in future studies.

The objectification hypothesis appears to make certain assumptions regarding the developmental inter-relationships between language and thought, e.g. that a bilingual's linguistic experience can positively influence his cognitive growth. At first sight this assumption seems incompatible with the Piagetian position on the role of language in cognitive development. Macnamara (1970) has drawn out the apparent implications of a Piagetian position for the relationship between bilingualism and cognitive growth. He argues that because the development of cognition owes little to the influence of language and linguistic functioning is to a great extent dependent on many sorts of nonlinguistic cognitive functioning "it seems unlikely that bilingualism should have any effect upon the development of the basic, common, cognitive structures" (1970, p. 33).

It is important to examine this issue closely since if the Piagetian position is incompatible with the hypothesis that bilingualism can positively influence the development of cognition, the research reviewed in the present paper could be interpreted as evidence against the Piagetian position. It is interesting to note that the objectification hypothesis emphasizes precisely the same aspect of language as that emphasized by Genevan investigators. For example, Inhelder, Bovet, Sinclair and Smock (1966) point out that "language

training ... operates to direct the child's interactions with the environment and thus to 'focus' on relevant dimensions of task situations" (p. 163). However, since operational thinking derives from action not language, linguistic experience, according to Genevan investigators, is capable of accelerating cognitive growth only to a limited extent. It can prepare an operation and help children pass to an intermediate stage but it cannot effect a full transition from one operational stage to another (Inhelder & Sinclair, 1969).

Thus, there appears to be no incompatibility between Piagetian theory and the assertion that bilingualism like other forms of enriched experience, can accelerate, to a certain extent, aspects of operational thinking. However, although there is no incompatibility between the Piagetian position and the research findings, a Piagetian framework is inappropriate in certain respects for the interpretation of these findings. In the context of Piagetian research, "language" usually refers to specific short-term training procedures. The relative ineffectiveness of "language" in promoting operational growth is due to the fact that operational growth "does not consist in simply incorporating ready-made and readily available data" (Inhelder & Sinclair, 1969, p. 21) but in coordinating the feedback derived from the child's own actions on

the environment.

This view of language as something static and "ready-made" creates a false opposition between language and action, especially in the context of bilingual cognitive development. The bilingual's access to two linguistic codes represents a very different form of linguistic experience from that provided in short-term verbal training sessions. In the first place, the bilingual "training" experience is likely to be undergone over a period of years. Secondly, the "training" does not consist in the bilingual incorporating ready-made data as in Genevan (and other) verbal training experiments, but rather in constantly generating data, through his speech actions on the environment, which provide a qualitatively different form of feedback from that provided by a unilingual's speech activity.

One implication of this qualitative difference is that it may be inappropriate to make any inferences regarding the role of language in cognitive development in a unilingual situation, based on research findings in a bilingual situation, and vice-versa. Research conducted in a bilingual situation may suggest hypotheses regarding language and thought which may be fruitful to investigate in a unilingual situation, but it should not be uncritically assumed that generalization from one situation to another is appropriate. This analysis questions the assumptions underlying

Macnamara's (1970) and Bain's (1975) theoretical analyses. Macnamara generalizes his analysis of language and thought to the bilingual situation whereas Bain bases his inferences regarding language and thought on research relating bilingualism and thought.

In conclusion, the research findings and explanatory hypotheses reviewed in the present paper suggest the need to develop higher-order generalizations regarding the ways in which language, or languages, operate in the development of cognition. Theoretical formulations to date have erroneously regarded unilingualism as the norm and based their generalizations on data gathered in unilingual situations. It cannot be assumed that the same principles will apply in bilingual situations. Even if the basic principles are the same (e.g. the role of language in helping the child objectify aspects of his environment), the ways in which they operate in both bilingual and unilingual situations should be specified. The extent to which Piagetian principles are capable of accounting for the research findings was examined because Piagetian theory takes a conservative position on the developmental interrelations of language and thought. It was concluded that although there was no basic incompatibility, modification of some aspects of the theory seemed necessary to adequately describe how a bilingual's language use interacts with his cognitive development.

Summary

The research evidence suggests that bilingual children in additive environments who attain relatively high levels of L_2 skills benefit cognitively from their bilingual learning experiences. Bilingual children in subtractive environments, on the other hand, whose L_1 is less firmly established, often fail to resolve difficulties in coping with two languages and consequently experience disruption of some cognitive processes. These findings suggest that the extent and quality of a bilingual's competence in his two languages may mediate the effects of his bilingual learning experiences on cognitive growth. Bilinguals who succeed in overcoming difficulties with language show evidence of having developed greater sensitivity to feedback cues and a more analytic orientation to language. These strategies may generalize to other areas of cognitive functioning and promote general intellectual progress. The present review suggests the need for longitudinal studies of bilingual cognitive development in which the bilingual's cognitive growth is investigated as a function of his developing linguistic competence.

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Footnotes

[1]A more detailed discussion of methodological issues related to "balanced" bilingualism can be found in Cummins (1976a).

[2]For a full exposition of the constructs of "body-flexibility" and "distantiation" see Bain (1973).