Bilingual Education and Linguistic Flexibility[1]

A bilingual education can have cognitive advantages, over and above those directly associated with knowledge of a second language. There is now evidence that such 'additive' bilingualism requires certain environmental and cognitive conditions, and there is some indication of the cognitive benefits it produces. Bilinguals are said to have 'cognitive flexibility' (Lambert, 1977, p.16). The object of the small study reported in this paper is to identify the linguistic and meta-linguistic components of bilinguals' cognitive flexibility--their linguistic flexibility. Bilinguals' linguistic flexibility is contrasted with that of a monolingual control, and that of another monolingual group trained in linguistic analysis.

The environmental factors influencing the effect of a bilingual education have been well charted. In the St. Lambert experiment (Lambert & Tucker, 1972), English mother tongue students who did all their primary schooling in French had higher grades than their monolingual peers, and than those taught French by traditional methods, by the age of 12 to 13 (Lambert & Tucker, 1972; Tucker, 1975). These 'immersion' students differ from those who characteristically suffer from education in a second language, such as migrant groups in many countries, or indigenous groups like the Australian aborigines, in so far as their mother tongue is of high status, and in so far as their parents are typically of high socio-economic status (SES) and encourage their children's bilingualism (Lambert & Tucker, 1975; Cummins, 1984).

Cummins (1976;1984) clarifies the cognitive pre-requisites for additive bilingualism. According to his *Development Interdependence Hypothesis*, the level of cognitive development in the home language can affect the acquisition of a second language. Furthermore, there is a *Threshhold* of achievement in a second language which must be achieved if there are to be cognitive benefits of bilingualism.

The cognitive benefits of bilingualism are also well charted. As early as 1969, Lambert and Anisfield measured the verbal and non-verbal intelligence of French mother tongue bilinguals in Quebec, and found that they scored significantly higher than their monolingual peers. Doyle et al (1978) report that bilingual 3 to 4 year olds are more 'liguistically expressive' than monolingual children, although bilinguals acquire vocabulary more slowly than those concentrating on only one language. Ianco-Worrall (1972) shows that bilinguals recognize the distinction between the acoustic form of the word and its content--its sound and its sense--some 2 to 3 years earlier than monolinguals. Lambert cites the unpublished work of Scott, showing that immersion students

> were substantially higher scorers [in tests of divergent thinking] than the monolingual group with whom they had been equated for IQ and social class background at the 1st grade level (Lambert, 1977, p.17).

In the Ottawa immersion programs, students had significantly greater skills with concepts and problem solving, and higher verbal creativity scores than monolinguals (Swain & Lapkin, 1982, ch.5). 'Cognitive flexibility' or 'mental flexibility' (Ben-Zeev, 1977, p.30) are used as general terms to describe these effects.

A description of bilinguals' cognitive flexibility is not yet an aetiology. Ben-Zeev (1977) gives an outline of an explanation of additive bilingualism. She relates the mental flexibility of bilingual children to the effort involved in avoiding interference between the two languages. She considers that bilingual children have greater abilities to analyse language than monolingual. In the course of her discussion, she operationalizes the notion of flexibility in language use, notably in terms of *symbol substitution tests*. Children are

asked to substitute one English word for another, or to use nonsense words which have been dubbed with a particular meaning. For instance, a child may be told

'This is a *lad*. What are these?' (Answer: *lads*)

or to suppose that 'clean' means 'into' and then told

'Mary went clean the house.' Did the house get any cleaner? (Answer: 'no')

Symbol substitution tests measure both syntactic and semantic command of a language. Children use syntactic generalization, such as pluralisation using '-s' in the first example above, and must recognize that sound is distinct from sense. The second example is particularly difficult, since subcategorization rules are violated. Bilinguals perform significantly better than monolinguals on symbol substitution tests.

Such tests give a sophisticated and readily assessed measure of skills in dissassociating sense and sound. Ben-Zeev points out that she measures 'active analysis of representation' (1977, p.33), whereas in Ianco-Worralls's (1972) study subjects were asked to 'state the principle that names are arbitrarily assigned to things' (Ben-Zeev, 1977, p.33). However, Ianco-Worrall's question

Could *cow* mean *dog*?

is a *metalinguistic* question, at a different level from that asked by Ben-Zeev. Bilingualism appears to develop both the active use of syntactic and semantic principles related to the distinction between sound and sense, and the metalinguistic recognition of those principles.

The use *metalinguistic* differs from that of Cummins (1978), who tests referential skills by having subjects use nonsense words, and then asks questions about the relation of reference between names and the objects they refer to. In the terminology used here, these tests have both an active and a metalinguistic component. Metalinguistic skills are those which require stepping outside lanuage and assessing the principles which govern it. Cummins also tests subjects' command of contradiction and tautology. While such skills are meta-level skills, they are not purely linguistic, since they also require logical skills.

Ben-Zeev and Ianco-Worrall also test children's ability to classify and reclassify objects consistently. Ianco-Worrall reports no significant differences between bilinguals and monolinguals, whereas Ben-Zeev finds that bilinguals perform better than monolinguals. One difficulty in assessing classification skills lies in the nature of the task. Classifications, apart from natural kinds, are largely language dependent: how we slice up the world *linguistically* determines non-natural kinds. Yet knowledge of classification schemes is largely empirical. Skill in reclassification depends not only on flexibility of mind, but also with familiarity with language and with suitable principles of classification. Any experiment designed to test the former must avoid complexity in classification schemes. With these provisos, bilinguals might be expected to reclassify more readily than monolinguals, since acquiring a second language involves learning new classifications. At a meta-level, bilinguals might be expected to recognize principles of classification and, in particular, language dependent classifications.

Eckstein (1986) adopts a task for assessing whether students from a German-English partial immersion program were better able than their monolingual peers to use alternative language structures. Science students are asked to describe objects or processes for which they lacked precise terms. Bilinguals performed better than monolinguals. The task requires both flexibility in the use of syntactic structures and semantic matching skills. An explanation of bilinguals superior semantic matching skills, along the lines of

Ben-Zeev's account, might be that in learning a second language children become aware of fine semantic structure. This hypothesis should properly be tested with semantic concepts so simple as to be familiar to all subjects, and not, for instance, with empirically weighted scientific concepts. Again, bilinguals might or might not acquire a meta-level recognition of principles governing synonymy.

Ben-Zeev, Ianco-Worrall and Eckstein operationalize the linguistic components of the cognitive flexibility attributed to bilinguals, in terms of *classification, semantic matching* and *symbol substitution* skills. These skills, together with the meta-linguistic recognition of the principles involved, constitute the notion of *linguistic flexibility* used here. Linguistic flexibility could encompass other skills, such as phonetic adaptability. This definition has been tailored to the pattern of skills attributed to bilinguals. A major component of the cogitive benefits associated with a bilingual education is lingistic flexibility so defined.

It is no easy matter to distinguish linguistic and metalinguistic components of any skill. Direct metalinguistic questions, such as Ianco-Worral's (1972, p.1394) 'Could *cow* mean *dog*?' can be used. Cummins (1978) uses direct questions about the meaning of nonsense words. To ask for the reasons for a judgment of synonymy or ambiguity is a more sophisticated question of this type. In terms of the distinction drawn here, symbol substitution is primarily a test of active skills, semantic matching primarily tests metalinguistic skills and classificatory skills are active skills, but the justification of those skills is metalinguistic.

Ben-Zeev suggests an explanatory scheme for bilinguals' symbol substitution skills, which has here been extended to include classificatory and semantic matching skills and the corresponding meta-level skills. There is a question whether such skills are uniquely attributable to bilinguals, or whether other training might issue in them. In this study, the question is raised with respect to the Philosophy for Children program, devised by Lipman. In this program, children are taught analytic and reasoning skills. One component, a one or two year course of 2 to 4 hours a week, is particularly concerned with philosophy of language (Lipman, 1981,1982). Such issues as the proper use of names are discussed. The course is not designed to teach linguistic flexibility as such, but it may be a by-product. Practice in thinking about language as an object of discussion should particularly develop metalinguistic skills.

The research reported here addresses two questions about linguistic flexibility as defined above:

1. Does bilingual education promote linguistic flexibility?
2. Can other training develop linguistic flexibility?

Specific test of classification, semantic matching and symbol substitution were given to pairs of subjects, who were asked to justify their answers and to give a joint response. Discussions were taped, giving an indication of how subjects justified and articulated their grasp of the principles used in the tests. This provided a rough measure of subjects' metalinguistic skills.

SUBJECTS

The study was conducted in Canberra, Australia, in the third term of 1986. Four pairs of grade 3 (8-9 years) girls from three groups were considered. In each pair, the two girls were of the same academic level, as assessed by the teacher. Each pair was in turn matched with a corresponding pair from the other two groups, by academic achievement. Thus there was a pair from the top 10% in overall academic achievement (an A pair), from the next 20% (a B pair), and the next 20% (a C pair) and from the next 20% (a D pair), in each group. The remaining 30% in each group were not tested, because the

bilinguals at this level were not functionally bilingual, and hence had not achieved the threshhold Cummins (1976) considers necessary for additive bilingualism. Groups were matched for overall academic achievement. Schools and students were matched for SES.

The BILINGUAL Group **B** consisted of four pairs of students from the bilingual program at the Telopea Park Primary School, in which half of the syllabus is taught in French, and half in English. All subjects were English mother tongue and of high SES. Pairs are labelled $\mathbf{B_a}$,$\mathbf{B_b}$,$\mathbf{B_c}$,$\mathbf{B_d}$ corresponding to the A standard bilingual pair, the B standard bilingual pair and so on.

The CONTROL Group **C** consisted of four ranked pairs of matched students from the Canberra Church of England Girls' Grammar School (CCEGGS) Primary, $\mathbf{C_a}$,$\mathbf{C_b}$,$\mathbf{C_c}$,$\mathbf{C_d}$. None were bilingual, and all were of high SES.

The PHILOSOPHY Group **P** consisted of four ranked, matched pairs of students from CCEGGS Primary, each of whom had spent 2 hours a week for one term studying philosophy of language. They were monolingual, of high SES and are labelled $\mathbf{P_a}$,$\mathbf{P_b}$,$\mathbf{P_c}$,$\mathbf{P_d}$.

METHOD

Experiment I: CLASSIFICATION

The classification task was aimed primarily at linguistic classification skills. Subjects were introduced to the notion of reclassifying with a selection of highly colored babies' toys--blocks, tubes and beakers, which could be classified either by color or shape. The experimental sample consisted of a large bright pink plastic paper clip, a silver bobbie pin, a silver dress ring, a red plastic key ring, a silver earring, a large bulldog clip, a small pink paper clip, a drawing pin, and a silver colored sewing pin. Subjects were asked to classify them in as many ways as they could.

One mark was assigned for a consistent classification in terms of color, size, or other phenomenological classifications; two for functional classifications ('for wearing', 'for using at the office') and two for the linguistic classification into rings, pins, and clips. Note was separately taken of this final classification, of the level of discussion, and of the metalinguistic skills evident in it. Uniform prompts were offered, if required, and half marks were given for prompted classifications. Bilingual students were expected to outperform the control, as were the philosophy group. In brief, the hypothesis was that **B>C; P>C** on test I.

Experiment II: SEMANTIC MATCHING

The semantic matching test was designed to test subjects' skill in assessing sameness of meaning and at articulating their grasp of semantic principles. It is based on a test designed by Lipman (unpub) but of a type which had not been encountered by the philosophy group. Pairs of sentences, each containing the word 'wrong'--a word familiar to all the subjects in its major senses--are presented and subjects must decide whether 'wrong' has the same or different meaning in the two sentences. So, for instance, in the first two pairs of sentences:

1. I dialed Mary, and I got the wrong number.
   It's wrong to break a promise.

and

2. What's wrong with wearing socks that don't match?
   What's wrong with eating peas with a knife?

'wrong' appears to have different meanings in the first pair (the wrong number is a mistake, whereas breaking promises is morally culpable), and the same meaning in the second pair (inappropriate).

Some would argue that 'wrong' in English is univocal, but that it has different shades of meaning in different contexts. It is not germane to this paper whether the different senses of 'wrong' are distinct meanings or shades. What is at issue is how subjects categorize meanings and how they justify their choices. In French, 'wrong' in the first, but not the second pair, would be translated by different words. It might be expected that bilinguals would categorize accordingly. Note was taken of whether the same word for 'wrong' could be used in French translations of each pair of sentences, and of whether subjects' responses were consistent with the French.

Scoring of the semantic matching was on the basis of the consistency and sophistication of semantic reasoning used. The following reasons are in ascending order of sophistication:

a. collocation test: the use of a word in a particular context is taken to guarantee synonymy e.g., the pair who argued that 'wrong' has the same meaning in 2. above because 'if something's wrong with one thing, and something's wrong with another thing, then they mean the same thing' (C_a).

Although 'wrong' does mean the same, the reasoning is faulty. It is not sufficient for words to mean the same that they occur in the same context. In 'It's hot today' and 'It's cold today' *hot* and *cold* would mean the same by the collocation test.

b. truth value test: the truth of a sentence is taken to determine the meaning of the words e.g., 'What's wrong with eating peas with a knife? You might cut yourself. What's wrong with wearing socks that don't match? Nothing. So they're different' (C_d).

Again, an unreliable test, since *hot* means the same even though 'It's hot in summer' is true and 'It's hot in winter' is false.

c. translation test: translation into another language, or paraphrase in the home language, as in the explanations of the meaning of 'wrong' in 1. and 2. above, can be reliable. However, since synonymy is itself a language relative concept, it may be misleading. A successful use of translation is 'the wrong number is a mistake, but breaking a promise is bad' (P_b).

d. the Frege test: in which meaning consists in the contribution of a word to the truth conditions of the sentences in which it occurs. This is a sophisticated criterion, and was used only once, by P_c of 2., saying that 'they were different, but the meaning of *wrong* is the same'.

The hypothesis was that the philosophy group would outperform the bilinguals, and they in turn the control. In short **P>B>C**. This is because the major component of the task was metalinguistic.

Experiment III: SYMBOL SUBSTITUTION

The task was introduced to students with the simple example:

> Suppose *hot* means *cold*. What does 'It's hot today' mean? (Answer: 'It's cold today')

A written sheet was distributed, with a series of increasingly complex tasks, from

> Let's say *cat* means *dog*. What do we call baby cats? to
> Let's say *hat* means *run*. What does 'John and Mary hat to school' mean? How do we say the same thing if John goes on his own? (Answer: 'John hats to school')

One mark was allocated for simple substitution and two more when substitution was

One mark was allocated for simple substitution and two more when substitution was across concurrence boundaries. Successful use of syntactic generalizations, as in the present 3rd person singular, *-s* ending on *hats* above, also received marks. The hypothesis was that bilinguals would outperform the philosophy group, and they in turn the control group. In short, **B>P>C**. The metalinguistic component was informally assessed, in terms of the discussion. Table 1 summarizes the hypothesis.

Table 1: Linguistic Flexibility

Hypotheses and Results

	I CLASSIFICATION	II SEMANTIC MATCHING	III SYMBOL SUBSTITUTION
H_o	**B=P=C B=P=C**	**B=P=C**	
H_1	**P>B**	**P>B**	**B>P**
	P>C*	**P>C**	**B>C***
	B>C	**B>C**	**P>C**
Order of Total Scores	**P>B>C**	**P>B>C**	**B>P>C**

B = Bilingual, **P** = Philosophy, **C** = Control
Read **B>P** as the bilingual group outperform the philosophy group
* indicates that the results showed the relation is significant, by the Wilcoxon matched pairs test ($p<.05$)

Table 2 gives the marks allocated in the tests.

Table 2: Linguistic Flexibility Scores

Teachers' Ranking	Test I	Test II	Test III	Totals etc.	Pins, clips consistent with French	
B	7	7	9	23	-	4
B_a	6	7	8.5	21.5	-	2
B_b	5	6	6.5	17.5	yes	1
B_c	7	7	9	23	-	3
B_d						
Average	6.25	6.75	8.25	21.25		2.5
S.D.	.957	.5	1.19	2.6		1.29
C	7	7	6	20	yes	3
C_a	6	6.5	7	19.5		3
C_b	4	5.5	2.5	12		3
C_c	5.5	6.5	4.5	16.5	yes	2
C_d						
Average	5.625	6.375	5	17		2.75
S.D.	1.25	.629	1.96	3.67		.5
P	8	8	7	25	yes	2
P_a	8	6.5	7	19.5	yes	3
P_b	9	9.5	8.5	27		2
P_c	7	4	4	15	yes	4
P_d						
Average	8	7	6.625	22.5		2.75
S.D.	.816	2.35	1.89	5.43		.957

Read B_a as the A standard Bilingual pair, *i.e.* an academically matched pair of bilingual girls, from the top 10% of their class; B_b is a pair from the next 20%, and so on (see 'Subjects').

RESULTS

Experiment I: CLASSIFICATION

Scores for the philosophy group were higher than those of the control for all matched pairs (Wilcoxon rank test $p<.05$). In general, scores were consistent with the hypothesis with total scores ordered **P>B>C**, although not at significant levels (see Tables 1 and 2). Three of the four philosophy pairs recognized the linguistic classification without prompting, indicating metalinguistic grasp, whereas only two control pairs did, and one bilingual pair (see penultimate column on table 2).

Experiment II: SEMANTIC MATCHING

Measured on consistency and sophistication of responses, the philosophy students outperformed the bilinguals, who in turn outperformed the control (see Table 1). Curiously, the bilingual students' responses were least consistent with the classification corresponding to whether French would use one or two words for 'wrong'. Philosophy and control groups scored equally well (see the final column of Table 2).

Experiment III: SYMBOL SUBSTITUTION

The bilinguals scored better than the control on all ranks, hence the bilinguals performed significantly better than the control. Philosophy students performed slightly less well than the bilinguals, and slightly better than the control (see Table 1, Table 2).

COMPARISON ACROSS TESTS

Bilinguals scored better on the symbol substitution test (III) than they did on classification (I), and less well again on semantic matching (II). The philosophy group performed best on classification (I), next semantic matching (II), then symbol substitution (III). The control scored better in semantic matching (II) than they did in classification (I), and least well on the symbol substitution test (III). These results are summarized in Table 3.

Table 3: Comparison Across Tests

BILINGUALS	CONTROL	PHILOSOPHY
III>I>II	II>I>III	I>II>III
III>II*		

III>II is read: the group performs better in test III than in test II.
* indicates statistical significance by the Wilcoxon rank test ($p<.05$).

RANKINGS

Pairs were ranked by academic results, not by IQ. The teachers' rankings were, in all groups, inconsistent with grades on the test. So, for instance, the B_d pair performed as well as the B_a pair and better than the B_b and B_c pairs. Evidently academic achievement is not highly correlated with linguistic flexibility, perhaps because academic scores often depend on factors, such as memory, not measured in tests of linguistic flexibility. It is worth noting here that the results which issue on ranking in terms of the scores of the linguistic flexibility are consistent with those cited above.

DISCUSSION

Numbers in the study are small. 24 subjects were interviewed. This is a considerable constraint. Results are statistically significant only if all 4 pairs of any group are consistently higher (lower) than those in another group. Larger numbers should clarify results.

Given the constraint, the results yield a pattern. The area of linguistic flexibility in which bilinguals significantly outperform the control group and score better than the philosophy group is in symbol substitution skills. This was also the test in which each bilingual pair scored better than they did on other tests. Ben-Zeev also found bilinguals scored significantly better than monolinguals in symbol substitution tests.

This is as we should expect. It is precisely symbol substitution skills which are at the heart of translation. To say this is not to denigrate such skills, for they require the ability not only to dissociate sound from sense, but also to abstract from content, and use

language as a system. The $\mathbb{B}_a$ pair, for instance, in substituting *on* for *mix* translated

> Were the bacon and eggs mixed together? as
> Were the bacon and eggs on-ed together?

This shows remarkable sensitivity to precise symbol substitution rules. Sensitivity of this type is required in the use of rules in axiomatic systems, and to a lesser degree in algebra. The skill is one which may well be correlated with high achievement in mathematics.

Ben-Zeev also reports than bilinguals outscored monolinguals in tests of reclassification. This did not occur at significant levels in this study. The philosophy group did significantly outscore the control, however. The philosophy group had been trained for only 2 hours a week for a term, roughly one sixth of the time allocated for the philosophy of language component of the Philosophy for Children course, and much less than the 3 or 4 years of bilingual education. While a bilingual education might improve classification skills, it does so much less efficiently than other types of education. There is a clue to why this may be so in the fact that fewer bilinguals than the control, and much fewer than the philosophy group, spontaneously recognized the *linguistic* classification of objects into *rings*, *clips*, and *pins*. This was not because they failed to recognize the English terms, since they each used the classification when prompted. If Ben-Zeev were correct, and bilinguals had greater abilities to analyze langauage than monolinguals, we might expect rapid recognition of a classification which depends on language. The hypothesis of this paper is that the bilingual group did not exercise the metalinguistic components of linguistic flexibility: the abilities to see the language as a system, over and above using language as a system.

The metalinguistic form of linguistic flexibility was introduced using Ianco-Worrall's meta-level question 'Could *cows* be *dogs*?' She found that 4 year old bilinguals were readier than monolinguals to answer affirmatively, but by 7 to 9 years, monolinguals were equally ready. The groups tested here had hence reached this watershed, and could dissociate sound from sense. Cummins (1978) found that the grade 3 level bilinguals showed no greater referential skills than the monolinguals, but that the grade 6 level bilinguals did. It is possible that the grade 3 level is a plateau in metalinguistic skills. Whether this is so or not, it is evident that minimal training in philosophy can develop metalinguistic skills, whereas bilingual training at grade 3 level does not.

The bilinguals' failure to use metalevel analysis is also evident in the semantic matching test. Curiously, the bilinguals appear not to draw on the semantic networks of their second language, French, in identifying synonymy and ambiguity, since their decisions were less consistent with the French than either the control or philosophy groups' decisions. In the introduction, it was suggested that bilinguals' reclassification and paraphrasing skills might be attributed to a semantic sensitivity, resulting from exposure to two distinct semantic networks. The insensitivity of bilinguals to classification in French in the semantic matching test suggests that this explanation is too simple. At the very least, comparison of the semantic networks of familiar words is not part of bilinguals' conscious assessment of their meaning. This is in accordance with the view that competent bilinguals are, in Weinreich's (1953) terms, 'coordinate bilinguals', and have separate semantic networks for each language. But it suggests that it is unlikely that bilinguals withdraw from the semantic networks of the languages they speak, and assess them metalinguistically.

Measures of the reasoning used in the semantic matching test confirm this hypothesis. There were no significant relations in the ordering, **P>B>C**, and only in the philosophy group was reasoning of the greatest level of sophistication apparent. Bilinguals appeared to be only marginally more sensitive than the control, and marginally less than the philosophy group, to the considerations which govern synonymy and ambiguity in

languages. If bilinguals develop skills in analyzing languages, as Ben-Zeev suggests, then it appears to be active skills, not the metalevel skills which treat language itself as a system to be investigated, which are developed.

This should not discourage supporters of a bilingual education. The advantages of a bilingual education do not consist merely in the linguistic flexibility it confers. Speaking a second language is an advantage in itself, which may, in certain cases, be essential to the maintaining of a culture. The results here merely suggest that some claims as to the benefits of a bilingual education have been overstated.

Eschewing exaggeration, it is true to say that a bilingual education has, as a spinoff, certain skills which would not otherwise be acquired unless taught separately. Any improvement in linguistic flexibility from a program which also teaches a second language is a boon. Other teaching methods, such as the teaching of philosophy of language, may be more efficient in promoting linguistic flexibility, but that is not the aim of a bilingual education. Acquisition of a second language is.

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NOTES

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> Is it bilingualism *per se*, however, that provides these advantages? Perhaps one could suggest that learning music or chess or any other abstract form of interaction might give students a similar cognitive advantage. (p. 136)

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