

## Bilingualism: an overview

- The code-switching hypothesis is one explanation of these benefits. Switching languages gives children practice being flexible in thinking.
- This theory is problematic because there's no evidence that bilinguals code-switch **during** cognitive tasks.

## Diaz and Klinger: interaction between bilingualism and cognitive development

- Learning a second language in childhood is associated with cognitive gains
  - We need an explanatory model explaining how or why bilingualism leads to cognitive gains.
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- What's a good substitution?
  - Any explanation of the interaction between bilingualism and cognitive development must
    - be formulated, developed, and tested within a specific theoretical framework
    - needs to be constrained by the available data

## Vygotsky

- proposes the diversity of linguistic experiences has differing effects on cognitive abilities
- proposes the relationship between language and thought changes over the course of development
- emphasizes increasing executive control over language
- discusses the relationship between language and social processes

- Hakuta and Diaz (1985) showed correlation between degree of proficiency and performance on the Raven Progressive Matrices.
  - this made contribution showing how degree of bilingualism and intelligence are correlated
  - examined the direction of causality
- Diaz (1985)
  - bilingualism and analogical reasoning, using the Stanford-Binet Intelligence Subtest
  - degree of bilingualism only explained the variance for the low second language proficiency group
  - differences in analogical reasoning disappeared at time 2, demonstrating that the students caught up. This could be due to their proficiency increasing in their second language.

Five different sets of findings regarding the relationship between bilingualism and cognitive development:

- (1) Cognitive advantage; the relationship between bilingualism and intelligence

### Two paradigms

- comparison between bilinguals and monolinguals, matched on other criteria
- within-bilingual design, where proficiency is the independent variable
  - or alternately,
- seeing if cognitive ability predicts performance in a given language

- Diaz and Padilla (1985)

-Degree of bilingualism predicted performance on classification and story-sequencing, but not block-building.

(2) Bilingualism and metalinguistic abilities: objective control over and awareness of linguistic variables

-All children become aware of language as an arbitrary sign system, but there is a bilingual advantage to the acquisition speed.

-Metalinguistic awareness is a crucial stage of cognitive development because of its relation to language ability.

- There is a difference between tasks that demand analysis of language knowledge and control of linguistic processing, such as ability to switch back and forth between tasks.

Ben-Zeev (1977) gave children a symbol-substitution task, and bilinguals performed significantly better.

- The specific sort of metalinguistic processing required affects performance; bilinguals do not necessarily do better on all tasks.

(3) Additive and subtractive situations

- Additive: both languages develop in parallel
- Subtractive: loss of the first language as mastery increases in the second language
  - In subtractive bilingualism, children have academic difficulties and cognitive disadvantages, but there are frequently confounding variables.
  - The positive effects of bilingualism have predominantly been found in samples of additive bilingualism.

- Cummins (1976) proposed the threshold hypothesis. Positive effects only occur after a certain degree of proficiency is reached in both languages.

However, policy has thus far appears to advocate replacement of one language rather than supplementing a child's primary language.

#### (4) Timing of positive effects

- In Hakuta's (1987) longitudinal study, he found that bilingualism predicts younger children's cognitive ability but not older children's.
  - This could mean the effects of bilingualism are mediated by age, and an effect is only found in the early grades
  - Alternately, cognitive effects could be demonstrated due to degree of proficiency in the second language instead of age.
  - These findings do not suggest the bilingual advantage "washes out", only that the advantage does not continue to increase due to proficiency.

#### (5) Bilingual private speech

- Outcome vs. process
- Diaz, Padilla, and Weathersby examined bilingual's private speech of 3 to 6 year old additive bilinguals of differing proficiencies.
  - They found very little spontaneous code-switching, and thus rejected the hypothesis that children code-switched during cognitive tasks.
  - As proficiency increased, frequency and quality of private speech also increased, although this was not statistically significant.

- Diaz (1985) found evidence for the degree of proficiency being the key factor. Only before a certain threshold would bilingualism affect cognitive ability.
  - This theory is difficult to evaluate because this threshold has not been determined, and it is not determined if it is true for both additive and subtractive bilingualism.
- Code-switching can be ruled out
  - Apparently children don't spontaneously use it in cognitive problem solving
- Bilinguals' metalinguistic awareness and private speech suggests that the advantage is related to issues of executive control rather than language knowledge.

- Vygotsky suggests thought and language originate separately, and language becomes a tool for thought.
  - As children get older, they develop a focus of attention through the use of language by internally regulating it.
  - It is the awareness of regulating power that lead children to rely on speech for cognitive function.
- Vygotsky's proposed connection between metalinguistic awareness and self-regulation could be the key to the framework needed to understand bilingual cognitive development.

- Exposure to two languages leads to an early objective awareness of language, both communicative and noncommunicative properties.
- This awareness leads to increased use of language as a tool for thought.
- This use of language as a tool will give children a cognitive advantage both in verbal and non-verbal tasks.

#### Future work:

- features of the bilingual experience that characterize it as additive
- how these additive features actually increase awareness of language
- research on awareness of bilingual processing
- relation between language awareness and control
- relation between private speech and cognitive activity

## Questions from the online discussion:

- How can language learning be subtractive?
- Why does bilingualism affects some processes and not others?
- What do all the tasks share where there is an advantage? What don't they share where there is no advantage?
- If the bilinguals are experts at symbol manipulation, would possessing two languages which have very disparate grammars make them more expert?
- Were any of the tests used culturally biased?

# Consequences of Bilingualism for Cognitive Development: Bialystok

- We should investigate the effect of bilingualism on cognitive processes rather than an inquiry into the general domain development.
- Overall, bilingual children are more advanced at problems that require inhibition of misleading information. Bilingualism appears to accelerate general executive cognitive function.
  
- Over the years, the perspective of how bilingualism affects cognitive functioning has changed. Peal and Lambert (1962) set the current trend, that bilingualism is advantageous in a number of ways.
  - However, documenting this is very complex, as is designing experiments that test these theories.
- As discussed in the Diaz and Klinger article, bilingualism can promote more rapid development of metalinguistic concepts, ease of learning to read.
  - This chapter looks at **nonverbal** consequences. This requires accepting that there's an underlying cognitive mechanism that affects both linguistic and nonlinguistic functioning.

- Addresses research about whether childhood bilingualism alters the course of cognitive development.
- Political problem: early studies were used to reflect societal attitudes.
- It is inevitable that bilinguals are more “cognitively complex” than monolinguals. It is, however, within our ability to manipulate the way bilingualism affects quality and manner of cognitive development.

Bialystok examines three areas to see if they are acquired differently by bilinguals:

- quantity and arithmetic ability
- hierarchical classification in a task-switch paradigm
- theory of mind

### Quantity and arithmetic ability

- Consistent but weak evidence that bilingual adults take longer to solve mental arithmetic problems in their weaker language, although this has been suggested to be due to the linguistic burden of presenting the problem in that language.
- Arithmetic is sensitive to the language in which it is learned.
- It's easier to count in one's first language, as shown with the backwards-counting task.
- Seceda (1991) found that the more balanced bilinguals were, the better they did on the task of solving word problems.

### Task switching and concept formation

- In task switching, bilingual children adapt to a new rule earlier than monolingual children.
- One explanation suggests this occurs because bilinguals have achieved a level of complexity to their rule systems and are aware of these rules.
- Bialystok's explanation is that bilingual children are more adept earlier at selectively attending to and recoding the features of the display.

- Another factor is that language-specific properties affect performance on these tasks.
- General result:
  - It's more difficult for bilinguals to solve problems in their weaker language than in their stronger language.
  - Performance between monolinguals and bilinguals in their primary language did not differ
  - Perhaps this is due to bilinguals having a better sense of cardinality (numbers having quantitative significance) early on, in the face of other misleading evidence.

### Theory of mind

- ToM is the knowledge that other people have independent thoughts, ideas, and beliefs
- Increase in executive function is correlated to increase in ToM development.
- If bilinguals better at one or more of the components that underlie the theory of mind task, they may be better overall at ToM.
  - Bialystok & Senman (2004) found evidence for better performance on ToM tasks in bilinguals. However, this was just one sort of test of ToM.

- According to Bialystok, negative effects of bilingualism (surprisingly) include a disadvantage in receptive vocabulary.
- Overall, although bilinguals are not better at quantitative problems or classifying per se, they generally do show an advantage to deal with conflicting information, across **both verbal and nonverbal** domains.
- Fundamentally, bilinguals appear to become proficient with practicing inhibitory control through language, and this may carry over to processing in other domains.
  - With respect to intelligence, processes that appear to be enhanced by bilingualism are likely to only impact fluid intelligence rather than crystallized intelligence.
  - In a similar manner, these processes may contribute to creativity by allowing bilinguals to ignore misleading information more easily.
- In contrast to bilinguals' increased control, cognitive control of attention is diminished in patients with damage in the frontal lobes, and also declines with normal aging.
- In bilinguals, both languages stay active in the brain during processing, and are connected at least on a conceptual level.
- The neuroimaging evidence is mixed on whether the same parts of the brain are active for each language, although it appears that proficiency plays a role in what areas are activated.
  - How it is possible to really separate out the effects of language on cognition? Some of the studies that Bialystok mentions claim to have removed "the language component of the task" (p. 419).
  - Relatedly, what is the relationship between language and cognition? How do, or do they not, relate in terms of bilingual cognitive processing?
  - For some ToM tasks, we saw equal performance for monolinguals and bilinguals. Is one experiment convincing enough evidence of a ToM advantage for bilinguals?
  - How is a bilingual learning to suppress one word or phrase for another? What is the learning process for this?
  - For bilinguals, superior analysis and control are required, yet have the same "black box" characteristic of many of the psychological theories. How can we break this down further: what goes inside the box? What are the underlying mechanisms?

- Aaaaand...
  - Are researchers are biasing their conclusions to show more gain from bilingualism than actually exists?
- Takakuwa: What's wrong with the concept of cognitive development in bilingualism?

The brief version:

- Participant selection criteria generally do not match for background factors such as student motivation and parental attitude.
- Connecting bilingualism to intelligence is something that needs to be investigated further.
- We need to define cognitive development more consistently when studying bilingualism.

But predominantly,

- There are many, many... many, many, many methodological problems with the studies we've been reading about.

A few highlights...

- Peal and Lambert (did not compare against monolinguals, only used bilinguals of differing proficiency)
- Ianco-Worrall (environment language was acquired was too narrowly defined; results not generalizable; not necessarily measuring what intended to; problems with statistical analysis; experiment 1 and 2 populations have different data distribution even though in theory they should match)

- Ben-Zeev (too strict exclusion criteria for bilinguals and monolinguals; didn't use standardized measures to test; degree of "nonsense" in both languages wasn't the same)
- Diaz's review (the two groups in the reviewed studies simply can't be matched on all of the criteria they need to be; focuses on balanced bilinguals; all studies were correlational, not causal)
- Bialystok (not explicit enough for replication, such as where samples were selected from and how many subjects spoke which language; generalizability of study in question; did the samples from subsequent experiments in the series use the same population; instructions to subjects unclear; potential problems with data analysis)

- Regardless of whether one agrees that all of these problems exist in the specific experiments, the punchline comes through loud and clear:

Methodological design for this sort of population is extremely difficult. We need to carefully analyze the design of studies involving bilingual research, and be careful of this factor in our own research.