Consequences of bilingualism: Focus on language co-activation and cognitive control

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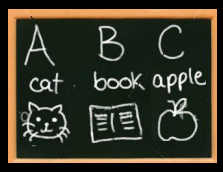
lab

life



What is bilingualism?

Defining Bilingualism

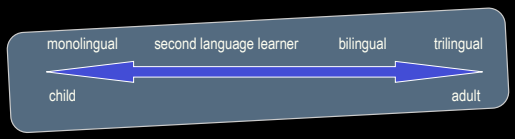
Any definition follows an interpretation that is either…

lenient

strict

General Issues

- dichotomy or continuum?
- languages balanced?



Are bilinguals two monolinguals 'rolled into' one?

Overview

- historical perspective on bilingualism research
- bilingual mental lexicon
- language co-activation
- language control and cognitive control

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Historical Overview I

- lower IQ scores for bilinguals (Gould, 1981)
- IQ deficits found for bilingual children (Saer, 1924)
- IQ tests administered verbally in English
- bilingual populations mostly 'fresh' immigrants to the USA

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Historical Overview II

- enhanced mental flexibility (Peal & Lambert, 1962)
- communicative sensitivity (Ben-Zeev, 1977)
- verbal divergence & divergent thinking (e.g., Cummins, 1977)
- increased language awareness (Cenoz & Valencia, 1994)
- overall literacy boosted (Shwartz et al., 2005; Zaunbauer et al., 2005)

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Psycholinguistic Research

production & comprehension tasks

picture naming		"fiets"
word naming	fiets	"fiets"
word translation	bike	"fiets"

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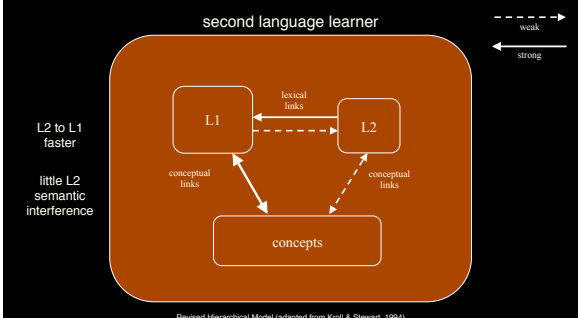
Word Retrieval & Translation



Revised Hierarchical Model (adapted from Kroll & Stewart, 1994)

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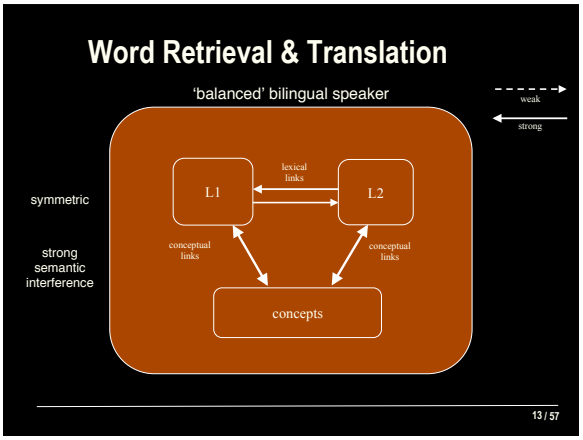
Word Retrieval & Translation



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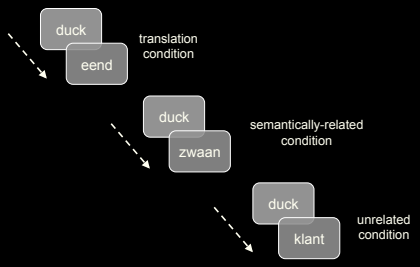
Translation Recognition Task



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Predictions for Beginning Learners

If conceptual link is weak, then…

- semantically-related and unrelated will not differ

If the conceptual link is stronger, then…

- semantically-related will be slower than unrelated

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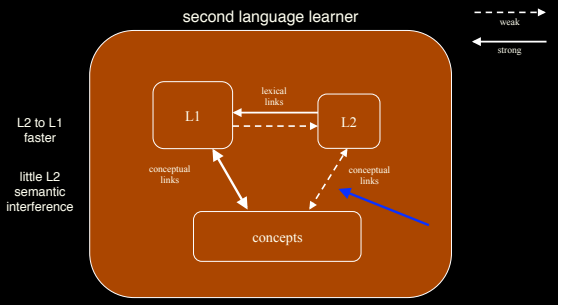
Word Retrieval & Translation



Revised Hierarchical Model (adapted from Kroll & Stewart, 1994)

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Evidence

Importance of context of L2 learning on word mapping

(cf. Kroll, Van Hell, Tokowicz, & Green, in press; Poarch & Van Hell, in prep.)

Dutch child L2 learners

Exposed to meaningful and context-rich L2 learning environment

Adult L2 classroom learners

Less rich and meaningful L2 learning environment

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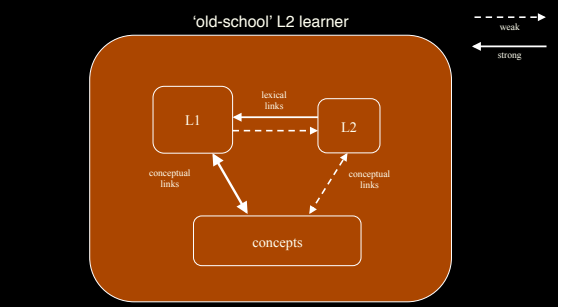
Word Retrieval & Translation



Revised Hierarchical Model (adapted from Kroll & Stewart, 1994)

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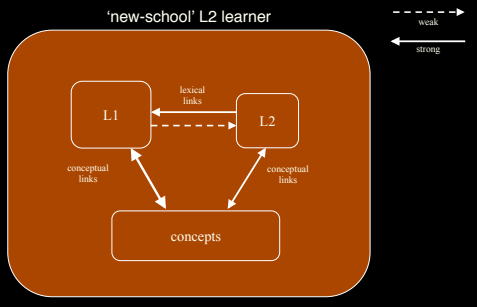
Word Retrieval & Translation

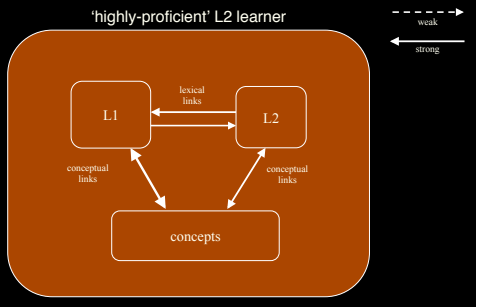
'new-school' L2 learner



Supplemented version of the Revised Hierarchical Model (adapted from Kroll & Stewart, 1994)

Word Retrieval & Translation

'highly-proficient' L2 learner



Conclusion Mental Lexicon

Activation and access depend mainly on:

- frequency of retrieval,
- linked information during retrieval process,
- **manner** and **quantity** of input.

Overview

- historical perspective on bilingualism research
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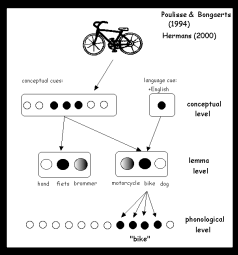
Bilingual Language Control

When bilinguals speak, they need to …

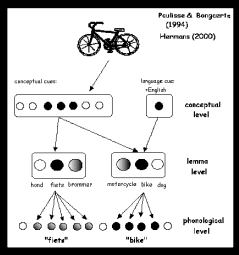
- 'choose' target language,
- 'disengage' or 'disregard' nontarget language,
- depending on context and interlocutor.

Lexical Production in Bilinguals

language selective activation
(activation of target language words only)



language non-selective activation
(activation of both target and nontarget words)



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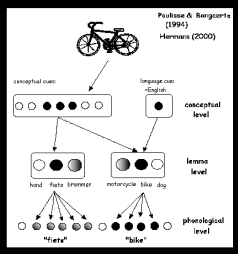


Language Co-Activation

Evidence so far suggests that…

- both languages are always active = co-activated,
- which leads to cross-language effects
- in, for example, phonology and lexical retrieval

e.g., Costa et al. 2000; Poarch & Van Hell, in revision.

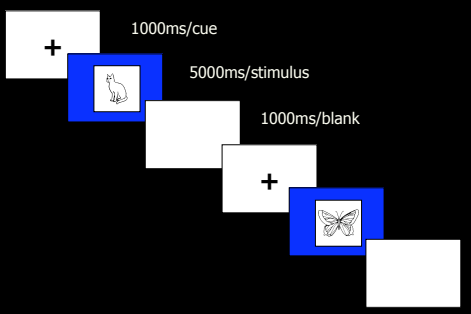
Language Co-Activation

Phonology Pink Panther

Language Co-Activation

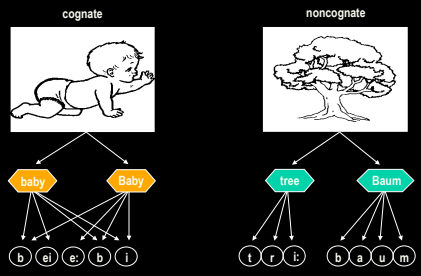
during lexical retrieval while picture naming

Picture Naming



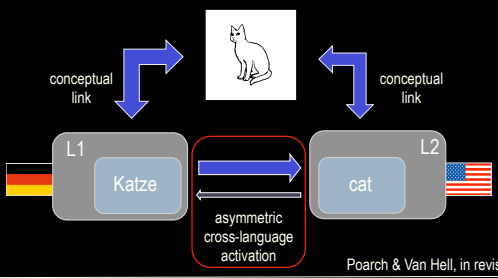
Bilinguals and Picture Naming

e.g., Costa et al. (2000); Kroll et al. (2008); Poarch & van Hell, in review.



Language Co-Activation I

Cognate Effects during Picture Naming (L2 learners)



Poarch & Van Hell, in revision

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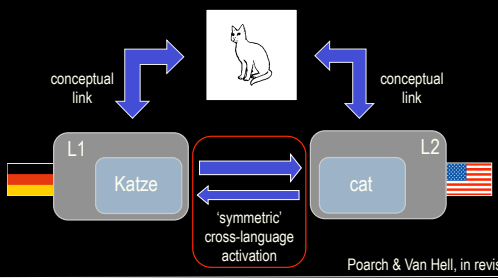
Language Co-Activation II

Cognate Effects during Picture Naming (bilinguals)



Poarch & Van Hell, in revision

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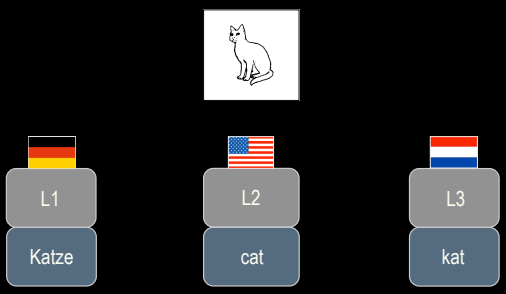
Trilingual language co-activation?



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Bilingual 'Disadvantages'

Using two languages also leads to …

- smaller vocabulary in each language,
- slowed word access & retrieval,
- reduced verbal fluency.

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Overview

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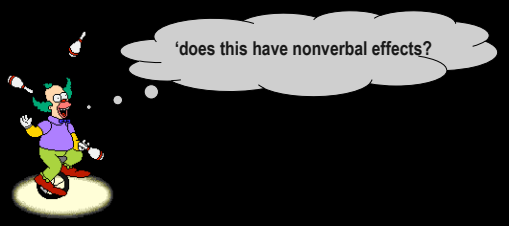
Language Control

If two or more languages need to be juggled…



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Cognitive Control in Bilinguals

Bilinguals need to control their languages

- possible mechanism = inhibition/selective attention,
- results in extensive, daily practice with inhibitory control,
- leads to bilinguals' nonverbal executive control advantages.

e.g., Bialystok, 2001; Green, 1998 (but see Finkbeiner et al., 2006)

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Testing Cognitive Control

Two behavioural approaches:

- Simon Task (e.g., Bialystok et al., 2004)
- Attentional Networks Task (e.g., Costa et al., 2008)

both tasks exploit control mechanisms responsible for

- **task switching** and
- **cognitive control processes**.

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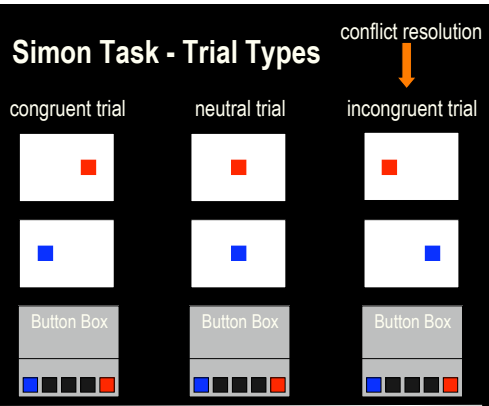
Simon Task - Trial Types



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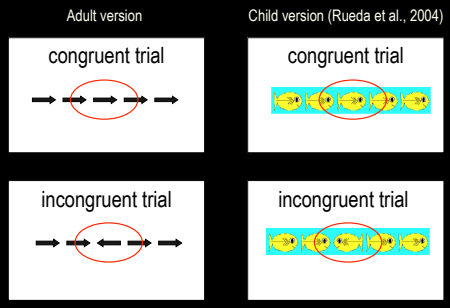
Attentional Networks Task



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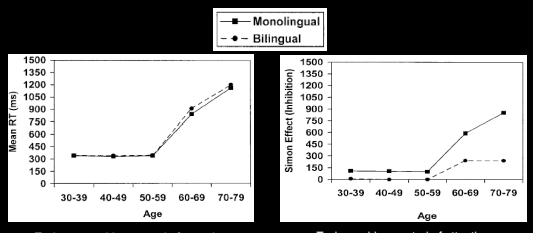
Bilinguals & Cognitive Control I

e.g., Bialystok et al., 2004, 2005; Martin-Rhee & Bialystok, 2008

- bilinguals show more effective processing (children & older adults);
- attributed to more developed conflict resolution mechanism.



Task not requiring control of attention

Task requiring control of attention

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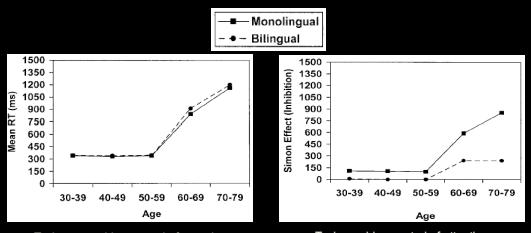
Bilinguals & Cognitive Control I

Being bilingual may keep your mind young

Juggling two languages as a child can slow mental decline



Task not requiring control of attention

Task requiring control of attention

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Bilinguals & Cognitive Control II

Costa et al., 2008; Costa et al., 2009 (ANT with adults)

- bilinguals faster on both congruent and incongruent trials;
- bilinguals suffer less interference in incongruent trials.

Kovacs & Mehler, 2009 (eye-tracking with infants)

- 7-month-old bilingual infants showed cognitive gains;
- higher efficiency with two conflicting structural regularities.

Our Research Questions

What about trilinguals?

- even more 'daily practice' = even better cognitive control?

What about early second language learners?

- does their growing L2 proficiency affect cognitive control?

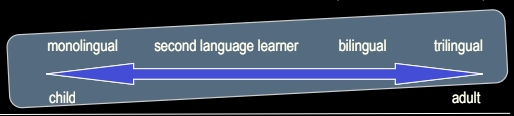
Focus of Study

Extension of earlier research with a focus on

- children aged 5-8 and 11-12,
- early and late second language learners,
- bilinguals and trilinguals.

Aims

- tap into developing language systems & multiple languages,
- control for **socio-economic status** (Carlson & Meltzoff, 2008).



Participants - Simon Task

	Language Status	n	Setting
Group 1	**Monolinguals**, (*M* = 6;11), L1 German	20	Primary school
Group 2	**L2 Learners**, (*M* = 7;1), L1 German / L2 English (low proficiency)	18	Kindergarten & primary school 'immersion'
Group 3	**Bilinguals**, (*M* = 6;10), L1 German / L2 English (high proficiency)	18	
Group 4	**Trilinguals**, (*M* = 6;10), L1 German / L3 English (varying proficiency)	18	
Group 5	**L2 Learners**, (*M* = 11;4), L1 Dutch / L2 English (low proficiency)	28	Primary school

Proficiency Measures

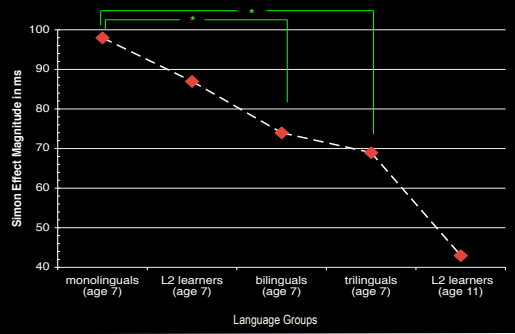
Children - L1 German

- Receptive Grammar Test in English & German (ages 3 to 11) (TROG Bishop, 2003; Fox, 2006)
- British Picture Vocabulary Scale (BPVS)
- Language background questionnaire

Children - L1 Dutch

- L_Lex (Swansea Vocabulary Test - Meara, 1996)
- Language background questionnaire & self-rating of language proficiencies

Magnitudes – Simon Effects



Participants - ANT

	Language Status	#
Group 2	L2 Learners, (*M* = 7;5), L1 German / L2 English (low proficiency)	n=19
Group 3	Bilinguals, (*M* = 7;2), L1 German / L2 English (high proficiency)	n=18
Group 4	Trilinguals, (*M* = 7;2), L1 German / L3 English (varying proficiency)	n=19
Group 5	L2 Learners, (*M* = 11;4), L1 Dutch / L2 English (low proficiency)	n=28

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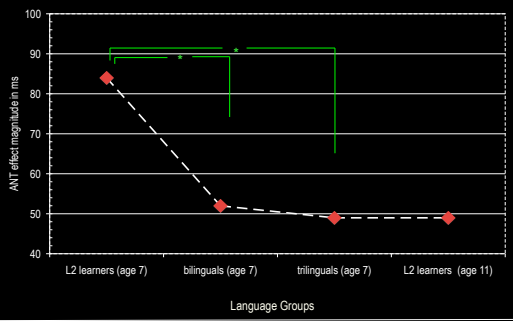
Magnitudes – ANT Effects



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Results

- significant between-group differences in effect magnitudes in both tasks
- **bilinguals and trilinguals** differ significantly from **monolinguals and L2 learners**.

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Conclusion

Early bilinguals & trilinguals show...

- **enhanced executive control**
- **more efficient conflict resolution**
- **more efficient conflict monitoring?**

...compared to both **monolinguals & early L2 learners**!

see Bialystok et al., 2010; Costa et al., 2008, 2009; Poarch & van Hell, in prep.

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Very General Outlook

Future research could focus on...

- **'heavy' vs. 'light' switchers**
  see Festman, Rodriguez-Fornells, & Münte, 2010.
- **switching vs. inhibition**
  see Prior & MacWhinney, 2010.
- **low- vs. high-SES bilinguals**
  see Kempert, Saalbach, & Hardy, in press.

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Overall Conclusions

Bilinguals show...

- enhanced executive control
- more efficient conflict resolution
- Being bilingual may keep your mind young
  Juggling two languages as a child can slow mental decline

SCIENCE | May 31, 2011
The Bilingual Advantage
By CLAUDIA DREIFUS
Among other benefits, the regular use of two languages appears to delay the onset of Alzheimer's disease symptoms.

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Take-Home Messages

Bilinguals ...

- are rarely fully balanced,
- have permanently co-activated languages,
- need to control their languages,
- which has effects on their inhibitory control.

Two or more languages need to be juggled and...

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Collaborating colleagues:

- Janet van Hell
- Judy Kroll
- Gerrit Jan Kootstra
- Julia Festman

Thank you.

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