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SPEED AND ACCURACY OF CALL SIGN RECOGNITION IN MONOLINGUAL AND BILINGUAL AIR TRAFFIC ENVIRONMENT

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Vzlet povolený, OM711
(Cleared for take-off, OM711)
What did he say?
AVN71
OM711

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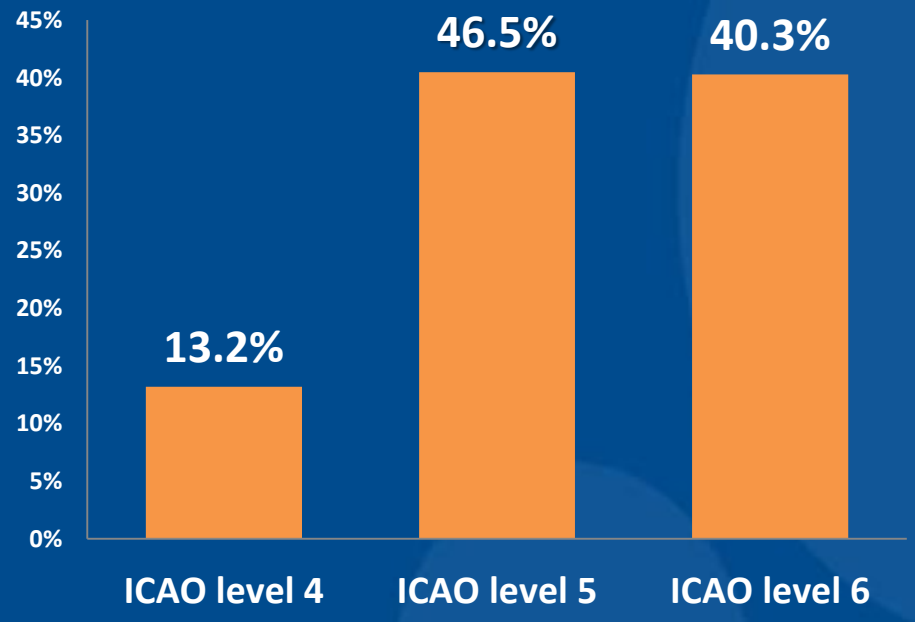
Bilingualism & Aviation

- English Language Proficiency Requirements (LPRs); ICAO, initiative started in 1998; implementation due date was in 2011



ICAO English language proficiency level of non-native English speakers (Survey)

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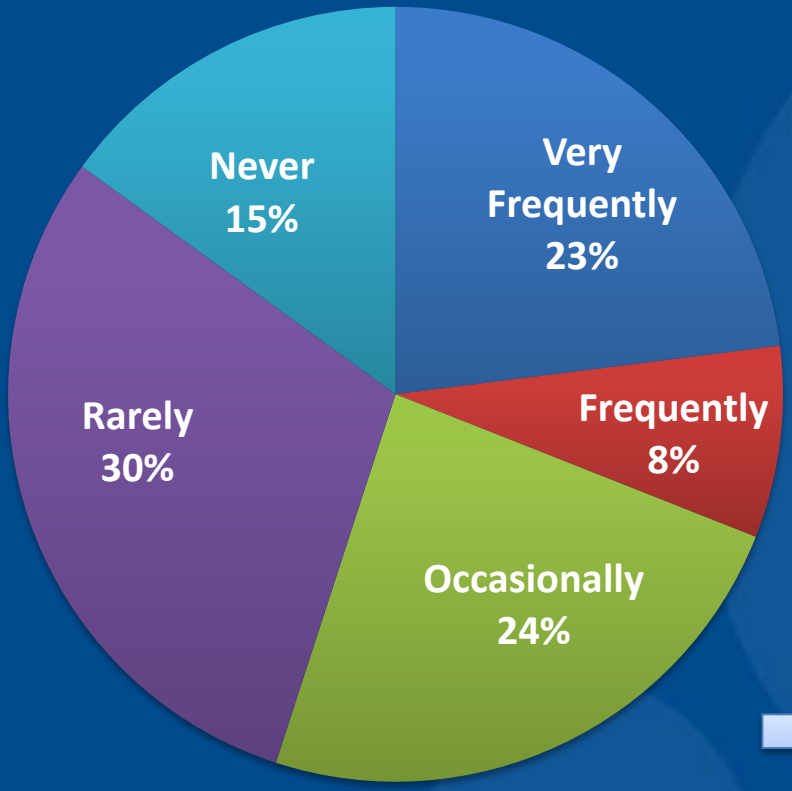
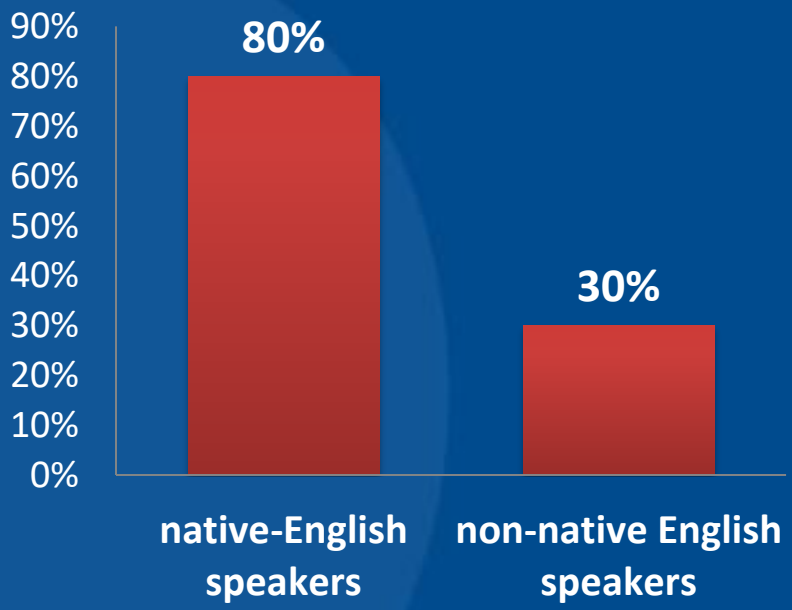
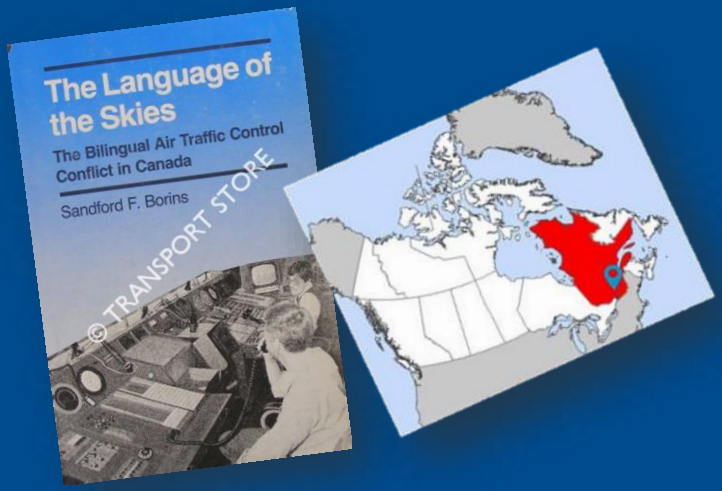
Survey

Bilingual air traffic was experienced:





Decreased situation awareness



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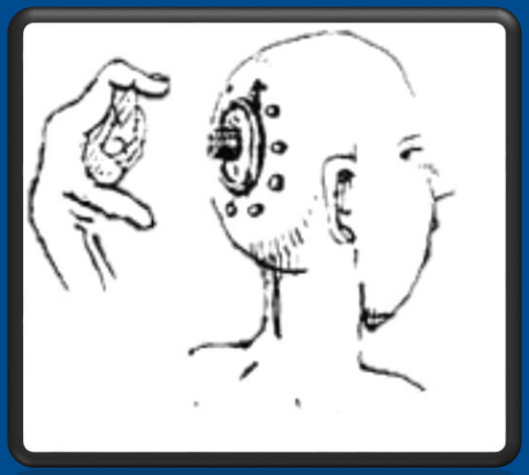
Bilingualism & Aviation

- Spain, Barcelona, 2012; incident: Brussels (SN-3695) and Iberia (IB-716), loss of separation on final approach
- France, Paris, 2000; accident: Air Liberté (IJ 8807) and Streamline Aviation (SSW 200), runway collision
- Long-lasting bilingual air traffic conflict in Canada, Quebec, resulted in conversion from monolingual English to bilingual French-English air traffic system in 1979
- 67% of bilinguals converse with their colleagues in their native language when they are not communicating by radio



Language switching

- Language control is a process that makes bilinguals communicate in the intended language (target language)
- Language switching is an experimental approach for analysing language control
- Language switching allows examining the differences in performance (= *switch costs*) between monolingual trials and trials in which two languages are switched

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Simulation exercises, Canada, 1977-78

Language switching studies

What were the stimuli ?

En route ATC
Listening watch
Terminal operation in exceptional situations

Pictures, phonemes, non-words, degraded words, simple sounds, etc.

How they were presented?

Visually & Auditorily

Visually

What kind of response was measured?

Language production & language perception

Language production

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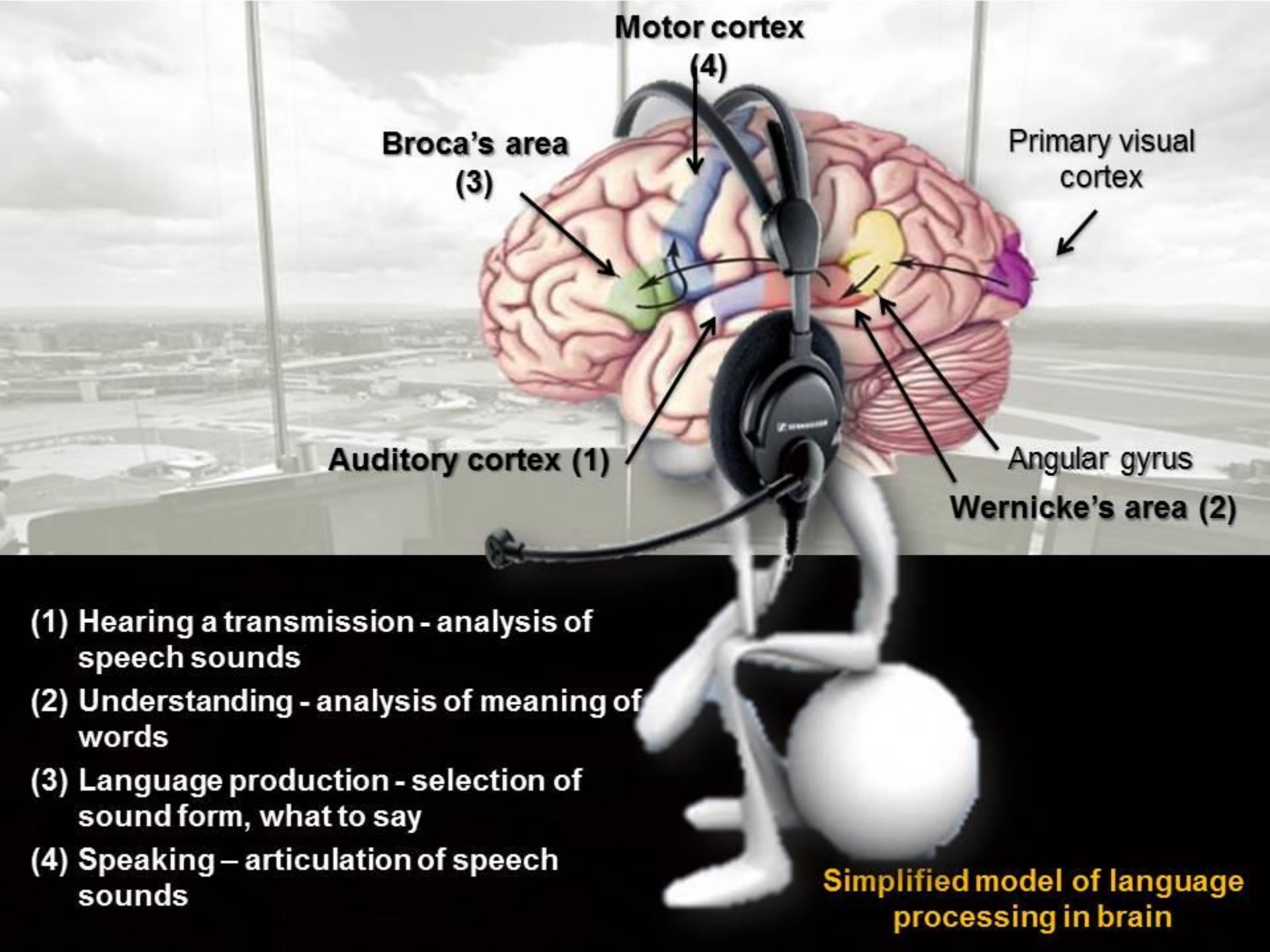

(1) Hearing a transmission - analysis of speech sounds

(2) Understanding - analysis of meaning of words

(3) Language production - selection of sound form, what to say

(4) Speaking – articulation of speech sounds

Simplified model of language processing in brain

Simulation exercises - findings

- Transmissions were slightly longer in French than in English language
- The number of errors on the bilingual days was 8% higher than on monolingual days
- Authors concluded that the overall findings suggested no particular differences between monolingual and bilingual days

Evidence

L1 = Native language (Chinese)

L2 = English as second language

Mix = both L1 & L2 (bilingual language condition)

The research question

How readily are call signs recognized in monolingual and bilingual air traffic environment?

Experiment 1

- Task:

  Participants were listening to speech stimuli and their task was to press “yes” for the target and “no” for distractors

- Stimuli:
  - 3-digit numbers spoken by female voice
  - 16 targets and 34 distractors in one language condition
- Independent variables:
  - Language conditions (L1, L2, Mix)
  - Call sign confusion
  - Inter-stimuli interval, ISI (1sec, 4sec, 9sec)

Call sign confusion

Example:

- Target: 531

- No confusion: 684
- Confusion 1: 597
- Confusion 2: 536

Experiment 1

- Independent variables:
  - Language conditions (L1, L2, Mix)
  - Call sign confusion
  - Inter-stimuli interval, ISI (1sec, 4sec, 9sec)
- Dependent variables:
  - Response time
  - Errors
- English language proficiency:

  IELTS listening self-reported test scores

Method

- Participants:
  - Chinese-English bilinguals
  - *N* = 34 (19 males, 15 females)
  - *M*age = 23.94
- Statistical analysis:

  3x4x3 ANOVA

我 = I

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Results

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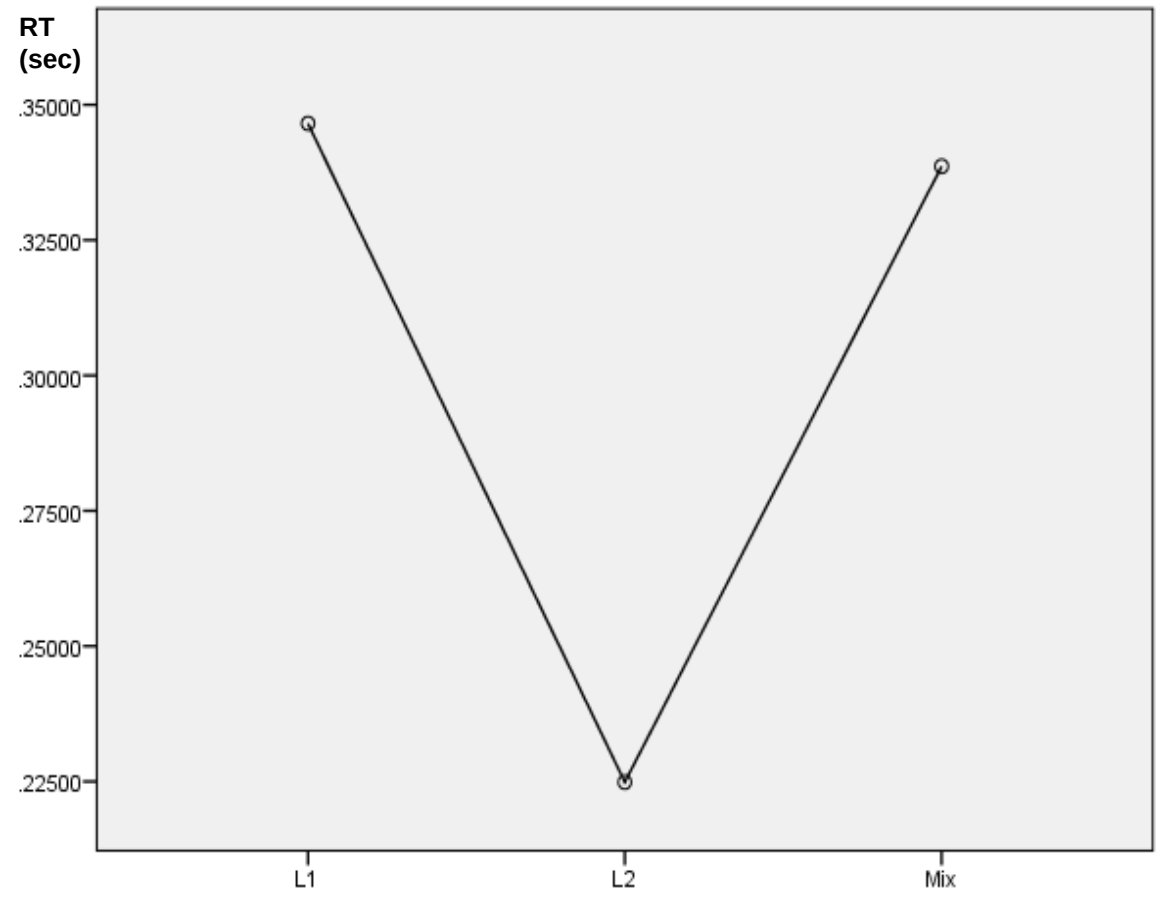
Performance speed

Language conditions



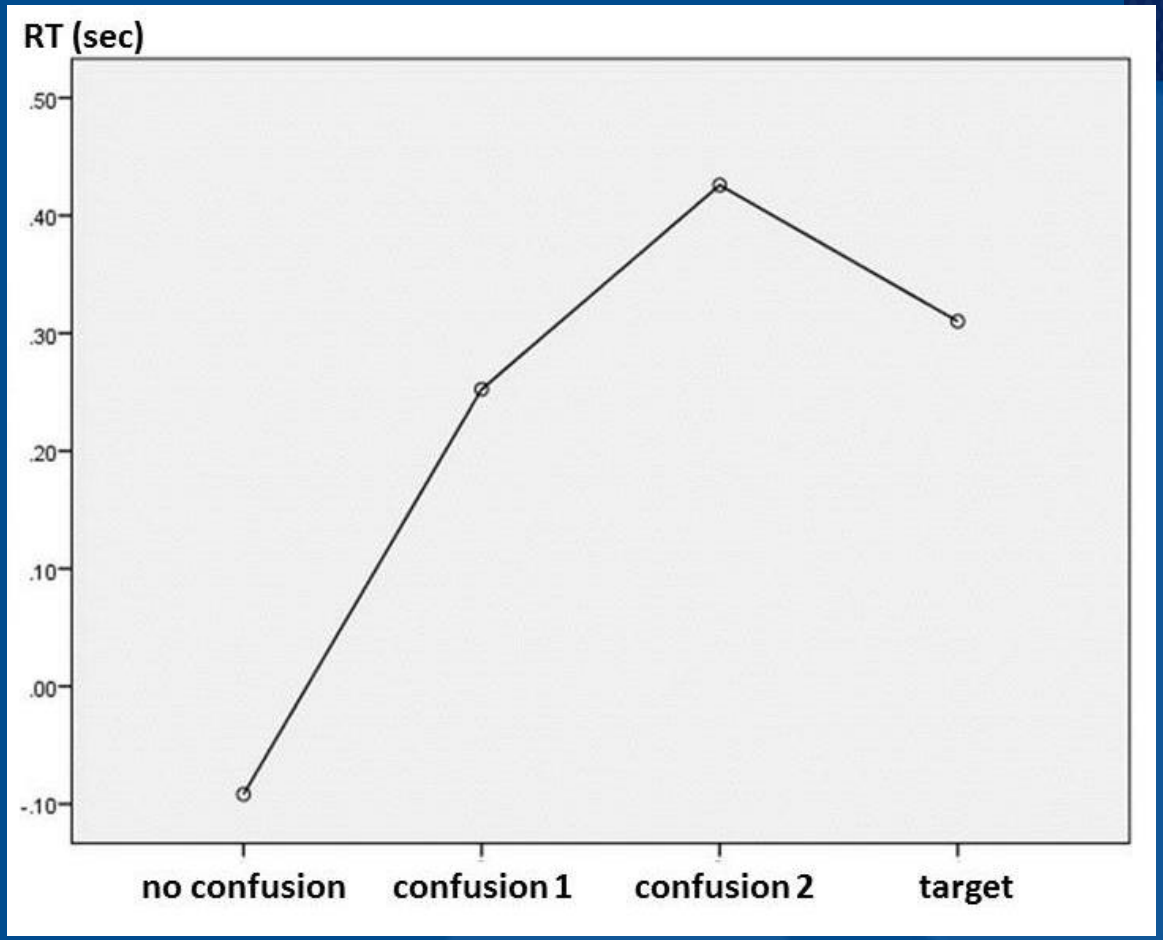
L1 = Native language (Chinese);
M = 0.347 sec

L2 = Second language (English);
M = 0.225 sec

Mix = Bilingual cond.;
M = 0.339 sec

Performance speed

Stimuli confusion



No confusion;

Mdn = -0.113 sec

1 = Confusion 1;

Mdn = 0.251 sec

2 = Confusion 2;

Mdn = 0.444 sec

Target number;

Mdn = 0.366 sec

Performance accuracy

2 types of errors

- False alarms verse Misses: The risk of miss type of error was approx. 3 times the risk of making false alarms.
- False alarms comparison: The risk of making a false alarm on conf. 2 was approx. 9 times the risk of no conf., and approx. 6 times the risk of conf. 1.

	No confusion	Confusion 1	Confusion 2	Target
n errors	3	2	12	26
n stimuli	1836	816	816	1632
%Error	.16	.25	1.47	1.59

Note. The total number of stimuli, N = 5100; %Error - within the number of stimuli in a particular level of confusion

Inter-stimuli interval

- No differences in speed and accuracy attributed to the different inter-stimuli intervals in L2 and Mix. Only in L1, the longer the interval between the stimuli, the longer latencies.

- No differences in speed and accuracy between the English language proficiency levels.

Conclusion (?)

If the advantages of bilingualism are **not** transferred into improved performance, then should a universal language for radio communication be considered which would allow everyone to understand what is said?

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Questions :)

Thank you for your attention

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