Parallel language activation during word processing in bilinguals: Evidence from word production in sentence context

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Question:

Do bilinguals co-activate the non-target language during word production in the target language?

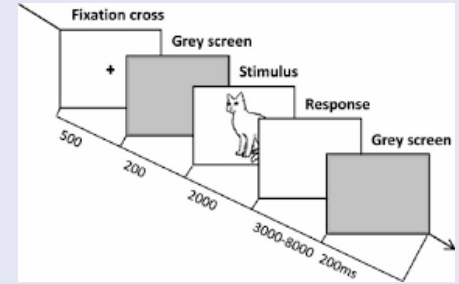→ Focus on word production in sentence context

Background 🔊

- **Cognate**: translation pairs that, in addition to sharing meaning, largely or completely share form between a bilingual's two languages (e.g., English: is, & German: ist)

- **Language-nonselective processing**: means that bilinguals can't switch off the contextually inappropriate language.

- **Picture naming task:** a task in which an individual is required to name what's presented in a picture. Typically, the time duration between picture onset and the moment the participant initiates (vocal) response is registered as response time.

Background - Picture Naming Trial 🔊

Example of pictures one might see in picture naming trials

A fixation point (a "+" sign) might be presented in the center of the screen for 500ms.

Next, the picture. The picture might remain on the screen until the participant responded or until 2500ms pass.

Then a blank screen for another 500ms.

The experimenter might then type in a code indicating whether the response was correct or false, or whether the voice key had malfunctioned. So, if an error is made, the experimenter might provide the participant with the name.

Previous findings 🔊

Word Recognition

- Word Recognition studies have shown to suggest non-selective processing during *visual word recognition* (i.e. non-target language is co-activated with target language)

- There is also evidence for language-nonselective processing with regards to recognition of *spoken words*.

Word production in isolation

- All word-production studies as far as we know that addressed the question about non-selectivity of bilingual processing, have looked at word production in *isolation*.

- Studies have suggested that bilingual processing is nonselective.

Authors' Purpose

→ To see if language processing in bilinguals is language- nonselective by examining cognate effects during word production in sentence context.

Method – Participants & Materials
(Experiment 1→ Picture naming in isolation)

- 46 bilingual students from the University of Amsterdam participated

  - Bilinguals were more fluent in Dutch (native language) than English (second language)

  - 23 in Condition Dutch and 23 in Condition English

- 100 pictures selected

  - 50 served as critical pictures

    - Names of 25 were Dutch-English cognates (7=identical & 18 non-identical)

    - Names of remaining 25 were Dutch-English non-cognates

  - Remaining 50 were all non-cognate names & served as fillers

- The experiment was performed using Presentation software - Version 9.90, '*www.neurobs.com*.'

Procedure - Experiment 1

- All communication with participants was Dutch in Condition Dutch, and English in Condition English.

- The participants first looked at a booklet to familiarize with experimental material i.e., all pictures (critical and filler), and their names.
- After, they did the picture-naming trials i.e., participants were asked to name pictures as quickly and accurately as possible (trial were done as described in background section on picture naming trial).

  - Randomized presentation sequence for each participant & pictures were presented in 4 groups with breaks between groups.

  - This started with presentation of 20 warm-up trials (with filler pictures)

Results - Experiment 1

- The effect of language was shown to be significant. English responses took longer than Dutch responses. Effect of cognate status was also significant, as pictures with cognate names were named faster than pictures with non-cognate names.

Table 2. *Participant mean reaction times (in milliseconds) per condition and error percentages (in parentheses) for Experiment 1.*

Condition	Cognates	Non-cognates	Cognate effect
Dutch	719 (4.2)	754 (3.7)	35°;♦
English	848 (7.8)	999 (10.3)	151°;◊
Language effect	129	245	

Discussion - Experiment 1

- The experiment showed a clear effect of cognate status both when bilingual participants named pictures in Dutch and English (since pictures with cognates were named faster than pictures with non-cognate names).

  → The interaction between language and cognate status was shown to be significant. The effect was larger when the pictures were named in English than when they were named in Dutch, but both effects were still significant.

Method – Participants & Materials
(Experiment 2→ Picture naming in context)

- The exact same as experiment 1, but a different set of 46 bilingual students (with Dutch as their native language and English as their second language).

- The same 50 critical & 50 filler pictures as experiment 1. However, now pictures were embedded in visually presented sentences

  - Each critical picture would be presented twice in each language condition, once in a high-constraint condition and once in a low-constraint condition.

  - So, a total of 200 critical sentences i.e., 100 per language condition were constructed. (100 filler sentences were also created for each language condition & were also used to allow participants to recover from an error and to restore the normal processing routine following a question).

    - Of the 100 per language condition, 50 were the low constraint condition, and the other 50 were high-constraint condition.

      - Within each group of 50: 25 embedded a cognate, and remaining 25 embedded a non-cognate.

Method – Experiment 2 cont.

- Examples of sentences that were used:

Table 3. *Examples of critical sentences used in Condition English in Experiment 2. The word in parentheses is presented in the form of the picture to be named.*

Sentence type	Stimulus type	Example sentence
High-constraint	Cognates	Popeye the sailorman has a tattoo of an (ANCHOR) on his arm.
		She went to the library to borrow a (BOOK) so she could study it at home.
	Non-cognates	The alpinist climbed the highest (MOUNTAIN) because he loved challenges.
		The goods were delivered in a cardboard (BOX) which I could barely carry upstairs.
Low-constraint	Cognates	In the middle of the square was an (ANCHOR) with a thick chain attached to it.
		I was deeply moved by the (BOOK) in which she described her youth.
	Non-cognates	Along the route we have to go around the (MOUNTAIN) because we cannot cross it.
		On the little black table was a (BOX) with the logo of the company on it.

Procedure - Experiment 2

- Participants were familiarized the same as Experiment 1 (warm-up trials).
- The trial also followed a similar format. For each sentence, first the fixation point (a "+" sign) was presented in the center of the screen. Then participants would press a space bar, and the fixation point would be replaced by the first word of the sentence. After, they'd press the space bar again, and the word on the screen would be replaced by the next word of the sentence. This process would continue until upon pressing the space bar the picture instead of a word appeared. The participant then named the picture in either Dutch or English, depending on the language condition.

- If they gave a wrong answer, a blank screen would be presented for 500ms , then the word "Wrong!" would be presented for 1s in the language of the condition. After which the next sentence was presented.

Results - Experiment 2 🔊

- The effect of language was significant. Participants in condition English responded more slowly than those in condition Dutch.

- Participants also responded faster in the high-constraint condition than in the low-constraint condition. Participants responded faster in cognate condition than in non-cognate condition. The combined cognate effect for the Dutch and English conditions was absent in the high-constraint condition but present in low-constraint condition. The combined cognate effect for the high-constraint and low-constraint condition was absent in Dutch and present in English

Discussion of experiments

- So, in experiment 2, an effect of cognate status when Dutch-English bilingual participants named pictures in sentence context, was found. The participants named pictures that had Dutch-English cognate names faster than pictures with Dutch-English non-cognate names.

- The authors combined both experiments' results, and explained participants were slower naming pictures in isolation than in a sentence context. In conclusion, pictures were named faster in Dutch than in English. For each language, pictures were named faster when presented in a low-constraint context than when presented in isolation. The pictures with cognate names were named faster than pictures with non-cognate names, and this cognate effect was seen to be the largest when the pictures were presented in isolation and had to be named in English.

Conclusion 🔊

→ Results suggest that language processing in bilinguals is language-nonselective.

Starreveld et al., reason that the cognate effects and response rates from the study can be explained due to:

1. Easier retrieval of cognate names because of extra activation in the relevant output nodes which they receive from the corresponding non-target language's lexical nodes
2. There being stronger connections between the semantic, lexical, and sublexical nodes in the dominant first language (Dutch) than in weaker second language (English)
3. An increase of activation in the target language system because of sentence context.
4. The pre-activation of a part, or all, of the upcoming picture's semantic representation caused by sentence context.

Thank You!