Trilingual reading: The effect of cognates, 'false friends', and language proficiency

Lectura trilingüe: El efecto de cognados, 'falsos amigos' y la competencia ligüística. Leitura Trilíngue: O efeito de cognatos, 'falsos amigos' e a competência lingüística.

Bernhard Angele[1], Pâmela Freitas Pereira Toassi[2], Timothy J. Slattery[1] and Elisângela Nogueira Teixeira[2]

[1]Bournemouth University, [2]Federal University of Ceará

60th Annual Meeting of the Psychonomic Society, Montreal, Friday, November 15, 2019

Introduction

- How do bilinguals represent the words they know in all their languages?

Introduction

- ▶ How do bilinguals represent the words they know in all their languages?
  - ▶ One possibility: Two separate lexicons; bilinguals (mostly) access meaning by accessing their L1 (Revised Hierarchical Model, Kroll & Stewart, 1994)
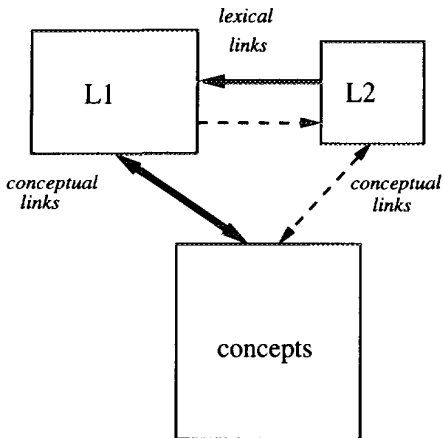
Revised Hierarchical Model

FIG. 3. Revised hierarchical model of lexical and conceptual representation in bilingual memory.

(figure from Kroll & Stewart, 1994)

Introduction

- ▶ Alternative: Lexicons are not separate. Bilinguals can activate all their lexical representations at any time. Task demands determine which words are responded to (BIA+, Dijkstra & van Heuven, 2002)

Bilingual Interactive Activation+ model
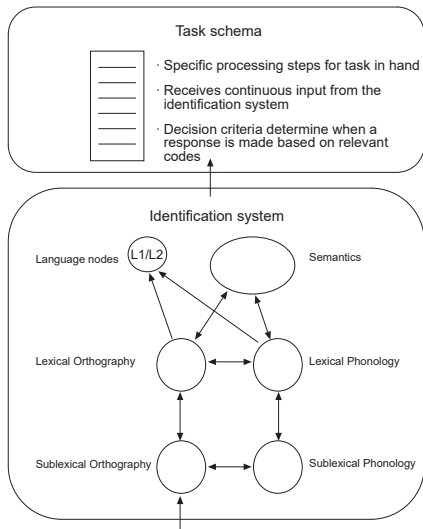
(figure from Dijkstra & van Heuven, 2002)

Past results

- From behavioural studies:

Past results

- ▶ From behavioural studies:
    - ▶ not much evidence for separate lexicons and selective access

Past results

- ► From behavioural studies:
  - ► not much evidence for separate lexicons and selective access
    - ► Cognate facilitation effects: e.g. for EN and ES/PT bilingual speakers: "error" processed faster than "mistake"

Past results

- From behavioural studies:
  - not much evidence for separate lexicons and selective access
    - Cognate facilitation effects: e.g. for EN and ES/PT bilingual speakers: "error" processed faster than "mistake"
    - Interlingual homographs ("false friends") cause interference: e.g. "sensible" vs. "sensitive" for EN and ES/PT speakers

Past results

- From behavioural studies:
  - not much evidence for separate lexicons and selective access
    - Cognate facilitation effects: e.g. for EN and ES/PT bilingual speakers: "error" processed faster than "mistake"
    - Interlingual homographs ("false friends") cause interference: e.g. "sensible" vs. "sensitive" for EN and ES/PT speakers
  - This suggests there are more direct connections between L2 words and meaning than there should be according to the Revised Hierarchical Model

Past eye movement results

- Libben & Titone (2009): Cognates facilitate processing and interlingual homographs (false friends) interfere with processing in both early and late L2 reading measures compared to control words

Past eye movement results

- Libben & Titone (2009): Cognates facilitate processing and interlingual homographs (false friends) interfere with processing in both early and late L2 reading measures compared to control words
- Cognates processed faster in L2 reading (Cop, Dirix, Van Assche, Drieghe, Duyck, 2017) compared to control words

It's not just monolingual vs. bilingual

- In many parts of the world, multilingualism is the norm

It's not just monolingual vs. bilingual

- In many parts of the world, multilingualism is the norm
- The Revised Hierarchical Model cannot properly account for multilingualism

It's not just monolingual vs. bilingual

- ▶ In many parts of the world, multilingualism is the norm
- ▶ The Revised Hierarchical Model cannot properly account for multilingualism
    - ▶ How would it work? L3 -> L2 -> L1 -> Concepts?

It's not just monolingual vs. bilingual

- In many parts of the world, multilingualism is the norm
- The Revised Hierarchical Model cannot properly account for multilingualism
  - How would it work? L3 -> L2 -> L1 -> Concepts?
- The BIA+ could be extended more easily: just add more words and additional language nodes

Predictions from an extended BIA+ model

- ▶ Multilingual cognates should be processed faster than bilingual cognates (activation from more orthography nodes)

Predictions from an extended BIA+ model

- ▶ Multilingual cognates should be processed faster than bilingual cognates (activation from more orthography nodes)
- ▶ Multilingual "false friends" (i.e. a letter string that is a cognate in two languages but not in the third, e.g. "sensible" in ES/PT vs. EN) should generate more interference than bilingual "false friends".

Predictions from an extended BIA+ model

► Multilingual cognates should be processed faster than bilingual cognates (activation from more orthography nodes)
► Multilingual "false friends" (i.e. a letter string that is a cognate in two languages but not in the third, e.g. "sensible" in ES/PT vs. EN) should generate more interference than bilingual "false friends".
► Toassi, Mota, & Teixera (2017): Effect of triple cognates (Portuguese/Italian/German). Trilinguals process triple cognates faster than double cognates

Current study

- Following up on Toassi, Mota, & Teixera (2017)

Current study

- ▶ Following up on Toassi, Mota, & Teixera (2017)
- ▶ Additional questions:

Current study

- ▶ Following up on Toassi, Mota, & Teixera (2017)
- ▶ Additional questions:
  - ▶ Is the cognate effect stronger in the presence of visual noise (more top-down processing?)

Current study

- ► Following up on Toassi, Mota, & Teixera (2017)
- ► Additional questions:
  - ► Is the cognate effect stronger in the presence of visual noise (more top-down processing?)
    - ► In other words, is it easier to process a cognate in the presence of visual noise than a control word?

Current study

- Following up on Toassi, Mota, & Teixera (2017)
- Additional questions:
  - Is the cognate effect stronger in the presence of visual noise (more top-down processing?)
    - In other words, is it easier to process a cognate in the presence of visual noise than a control word?
  - For triple cognates, does it help you if you are good at all three languages or are two sufficient for the cognate effect?

Method

- ▶ Participants: 41 Portuguese-Spanish-English trilinguals in Ceará, Brazil reading 100 *English* (L3) sentences with embedded cognates/false friends or control words

Method

- ▶ Participants: 41 Portuguese-Spanish-English trilinguals in Ceará, Brazil reading 100 *English* (L3) sentences with embedded cognates/false friends or control words
- ▶ Target words: 50 true cognates, 50 false friends

Method

- Participants: 41 Portuguese-Spanish-English trilinguals in Ceará, Brazil reading 100 *English* (L3) sentences with embedded cognates/false friends or control words
- Target words: 50 true cognates, 50 false friends
- All false friends with English were true cognates between Spanish and Portuguese

Method

- ▶ Participants: 41 Portuguese-Spanish-English trilinguals in Ceará, Brazil reading 100 *English* (L3) sentences with embedded cognates/false friends or control words
- ▶ Target words: 50 true cognates, 50 false friends
- ▶ All false friends with English were true cognates between Spanish and Portuguese
- ▶ Visual noise manipulation

Example cognates

English	Portuguese	Spanish	English word frequency (per million)	False friend
actor	ator	actor	22.0	no
cereal	cereal	cereal	4.7	no
error	erro	error	41.2	no
piano	piano	piano	20.3	no
origin	origem	origen	31.9	no
security	segurança	seguridad	148.5	no
lecture	leitura	lectura	17.8	yes
advertising	advertência	advertencia	45.0	yes
computer	computador	computadora	144.5	yes
support	suporte	soporte	309.6	yes
date	data	dato	171.6	yes

Example experimental stimuli

Cognate/False friend condition	False friend?
Carl argued that his father's error was similar to his own.	FALSE
Bob saw that the piano was beautiful.	FALSE
They said that the origin could not be determined.	FALSE
The neighbors said that the destruction came as a complete surprise.	FALSE
They thought that their assumption would never be questioned.	FALSE
They said that the inspector was nervous during the trial.	FALSE
Dan needed to call the qualified physician in order to solve his problem.	TRUE
John said that the initial lecture helped with the rest of the research.	TRUE
The boy's finger was hurt after the incident.	TRUE
An old ship carrying a bomb sank deep into the sea.	TRUE
While he was out with Jane, John worried about his actual girlfriend showing up.	TRUE
The missionaries gave alms to the villagers so they could open a workshop.	TRUE

Example control stimuli

Control condition	False friend?
Carl argued that his father's laugh was similar to his own.	FALSE
Bob saw that the bench was beautiful.	FALSE
They said that the winner could not be determined.	FALSE
The neighbors said that the improvement came as a complete surprise.	FALSE
They thought that their friendship would never be questioned.	FALSE
They said that the plaintiff was nervous during the trial.	FALSE
Dan needed to call the qualified gardeners in order to solve his problem.	TRUE
John said that the initial choices helped with the rest of the research.	TRUE
The boy's throat was hurt after the incident.	TRUE
An old ship carrying a gift sank deep into the sea.	TRUE
While he was out with Jane, John worried about his lovely girlfriend showing up.	TRUE
The missionaries gave saws to the villagers so they could open a workshop.	TRUE

Hypotheses

- ▶ If lexical access occurs across languages (as suggested in BIA+):

Hypotheses

- If lexical access occurs across languages (as suggested in BIA+):
  - Target words that are more *visually familiar* (cognates/false friends) should be processed *faster* than those that are *less familiar* (control words)

Hypotheses

- If lexical access occurs across languages (as suggested in BIA+):
    - Target words that are more *visually familiar* (cognates/false friends) should be processed *faster* than those that are *less familiar* (control words)
- If processing is influenced by the degree of *semantic overlap* (or lack thereof):

Hypotheses

- If lexical access occurs across languages (as suggested in BIA+):
  - Target words that are more *visually familiar* (cognates/false friends) should be processed *faster* than those that are *less familiar* (control words)
- If processing is influenced by the degree of *semantic overlap* (or lack thereof):
  - Target words that are *false friends* should be *more difficult (slower)* to process than target words that are *true cognates*

Hypotheses

- ► If lexical access occurs across languages (as suggested in BIA+):
  - ► Target words that are more *visually familiar* (cognates/false friends) should be processed *faster* than those that are *less familiar* (control words)
- ► If processing is influenced by the degree of *semantic overlap* (or lack thereof):
  - ► Target words that are *false friends* should be *more difficult (slower)* to process than target words that are *true cognates*
- ► If the presence of visual noise leads to more top-down processing and reliance on memory:

Hypotheses

- ▶ If lexical access occurs across languages (as suggested in BIA+):
    - ▶ Target words that are more *visually familiar* (cognates/false friends) should be processed *faster* than those that are *less familiar* (control words)
- ▶ If processing is influenced by the degree of *semantic overlap* (or lack thereof):
    - ▶ Target words that are *false friends* should be *more difficult (slower)* to process than target words that are *true cognates*
- ▶ If the presence of visual noise leads to more top-down processing and reliance on memory:
    - ▶ The effects of *visual familiarity* and of *semantic overlap* should be *stronger* in the presence of *visual noise*.

Hypotheses

- ▶ If lexical access occurs across languages (as suggested in BIA+):
    - ▶ Target words that are more *visually familiar* (cognates/false friends) should be processed *faster* than those that are *less familiar* (control words)
- ▶ If processing is influenced by the degree of *semantic overlap* (or lack thereof):
    - ▶ Target words that are *false friends* should be *more difficult (slower)* to process than target words that are *true cognates*
- ▶ If the presence of visual noise leads to more top-down processing and reliance on memory:
    - ▶ The effects of *visual familiarity* and of *semantic overlap* should be *stronger* in the presence of *visual noise*.
- ▶ If there is a greater *advantage for triple cognates* and a greater disadvantage for "double false friends":
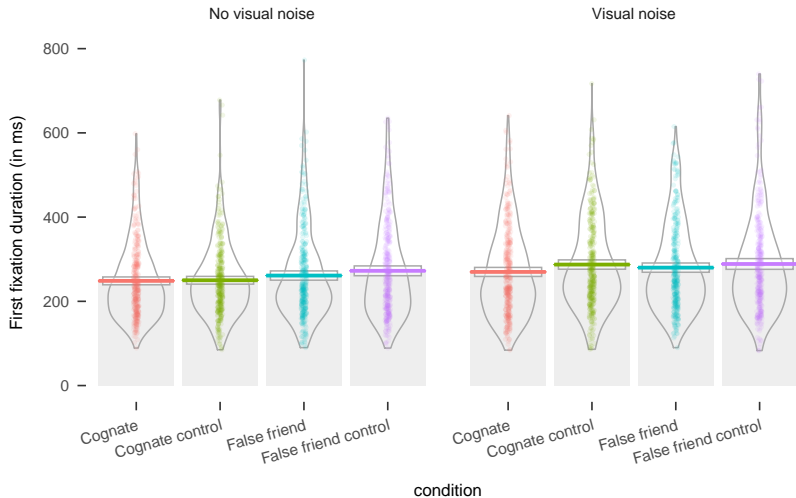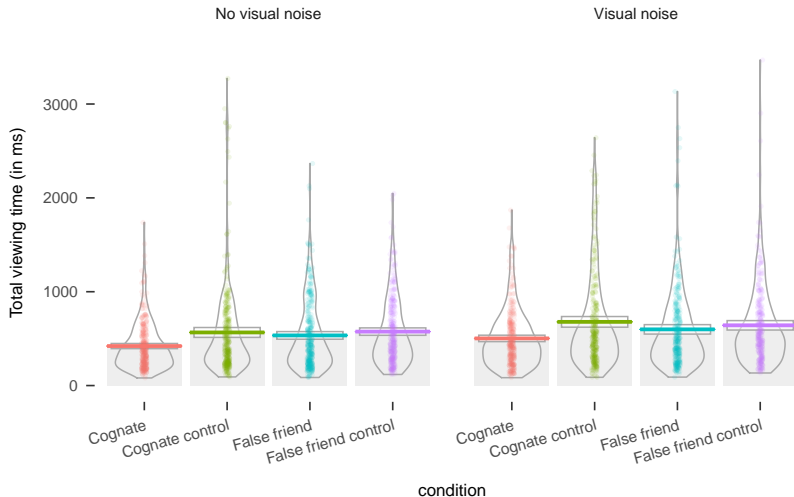
Hypotheses

- ▶ If lexical access occurs across languages (as suggested in BIA+):
    - ▶ Target words that are more *visually familiar* (cognates/false friends) should be processed *faster* than those that are *less familiar* (control words)
- ▶ If processing is influenced by the degree of *semantic overlap* (or lack thereof):
    - ▶ Target words that are *false friends* should be *more difficult (slower)* to process than target words that are *true cognates*
- ▶ If the presence of visual noise leads to more top-down processing and reliance on memory:
    - ▶ The effects of *visual familiarity* and of *semantic overlap* should be *stronger* in the presence of *visual noise*.
- ▶ If there is a greater *advantage for triple cognates* and a greater disadvantage for "double false friends":
    - ▶ Participants who are *strong in all three languages* should show a *greater advantage for cognates* and a *greater disadvantage for false friends* than those who are strong in only one of the languages

Results: First fixation duration

Results: Total viewing time

▶ Target words that are *visually familiar (cognates/false friends)* are indeed processed *faster* than those that are *less familiar (control words)* in both early and late measures

Hypotheses revisited: Part 1

▶ Target words that are *visually familiar (cognates/false friends)* are indeed processed *faster* than those that are *less familiar (control words)* in both early and late measures

▶ *Semantic overlap effects* (false friend interference) *do not occur in the early measure of FFD*

Hypotheses revisited: Part 1

- ▶ Target words that are *visually familiar (cognates/false friends)* are indeed processed *faster* than those that are *less familiar (control words)* in both early and late measures
- ▶ *Semantic overlap effects* (false friend interference) *do not occur in the early measure of FFD*
- ▶ *Visual noise slows down processing in general*, but it *doesn't* seem to *increase top-down* reliance on lexical memory

Participant proficiency
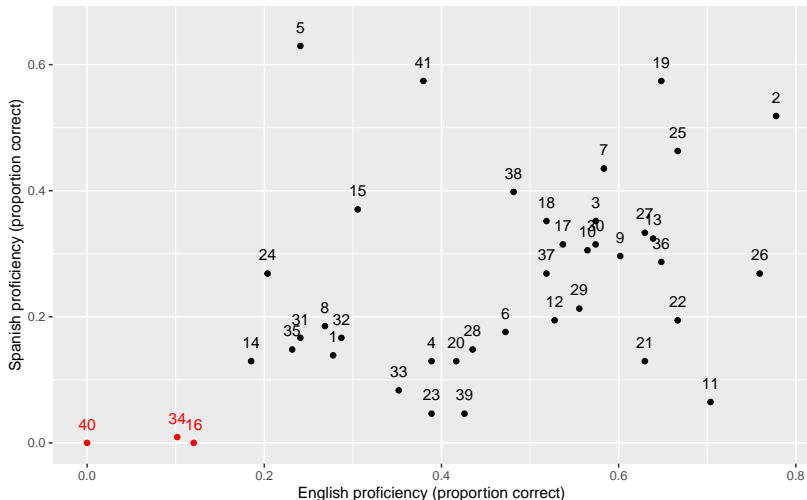
We excluded participants 16, 34, 40 because of very low English and Spanish proficiency

Effect of English proficiency: Total viewing time
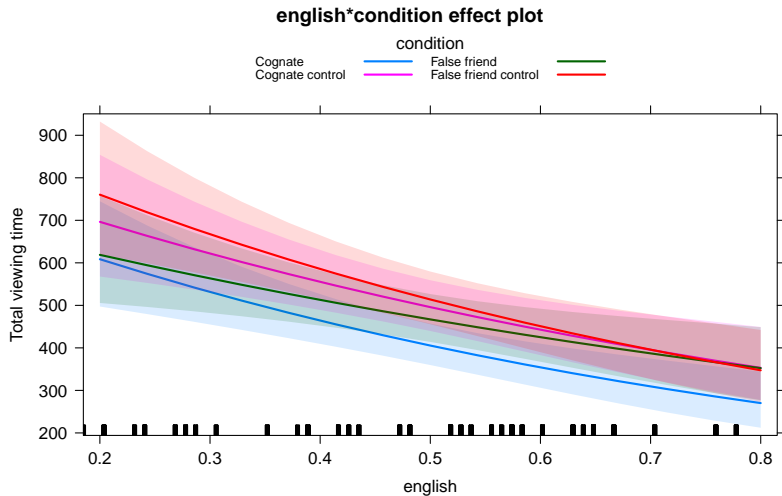
english*condition effect plot

Hypotheses revisited: Part 3

▶ Readers who are highly proficient in English *indeed show* much faster processing overall

Hypotheses revisited: Part 3

- ▶ Readers who are highly proficient in English *indeed show* much faster processing overall
- ▶ *However*, highly proficient English readers show a much larger difference between true cognates and false friends in later reading measures than English readers with low proficiency

Hypotheses revisited: Part 3

- ▶ Readers who are highly proficient in English *indeed show* much faster processing overall
- ▶ *However*, highly proficient English readers show a much larger difference between true cognates and false friends in later reading measures than English readers with low proficiency
- ▶ *No effect* of Spanish proficiency (in general or on false friends)

Conclusions

- ▶ Trilinguals' performance when reading triple cognates seems to be mostly influenced by their *proficiency* in the *language they are reading*, not their other non-native language.

Conclusions

▶ Trilinguals' performance when reading triple cognates seems to be mostly influenced by their *proficiency* in the *language they are reading*, not their other non-native language.

▶ In early processing and for low proficiency readers, visual familiarity (across languages) seems to be most important

Conclusions

- Trilinguals' performance when reading triple cognates seems to be mostly influenced by their *proficiency* in the *language they are reading*, not their other non-native language.
- In early processing and for low proficiency readers, visual familiarity (across languages) seems to be most important
- For highly proficient readers, *semantic overlap* becomes much more important in later processing

Conclusions

- Trilinguals' performance when reading triple cognates seems to be mostly influenced by their *proficiency* in the *language they are reading*, not their other non-native language.
- In early processing and for low proficiency readers, visual familiarity (across languages) seems to be most important
- For highly proficient readers, *semantic overlap* becomes much more important in later processing
- Visual noise has an overall effect but does not seem to affect cognate facilitation or false friend interference.

Thank you very much.

- Muchas gracias.

Thank you very much.

- Muchas gracias.
- Muito obrigado.

Thank you very much.

- Muchas gracias.
- Muito obrigado.
- *Merci beaucoup.*

Thank you very much.

- ▶ Muchas gracias.
- ▶ Muito obrigado.
- ▶ *Merci beaucoup.*
- ▶ Questions? Preguntas? Perguntas?

Results: Gaze duration
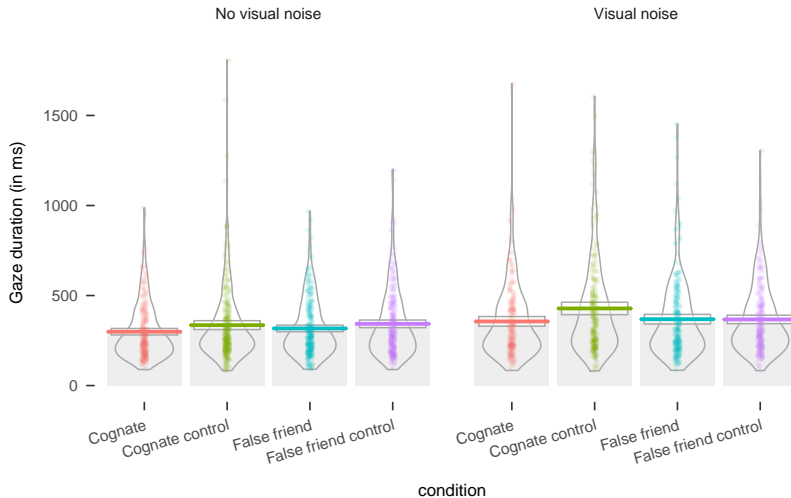
Effect of cognate condition and noise: First fixation duration (target word)

Effect	b	SE	t	df	p
Intercept	5.53	0.03	177.47	37.87	$< .001$
ConditionCognate vs Control	0.04	0.02	2.19	2,734.01	.029
ConditionCognate Control vs False Friend Control	0.03	0.02	1.78	275.92	.075
ConditionTrue Cognate vs False Friend	0.00	0.01	0.24	2,733.92	.812
Noise	0.04	0.01	6.98	2,713.80	$< .001$
ConditionCognate vs Control by Noise	0.03	0.02	1.63	2,723.48	.103
ConditionCognate Control vs False Friend Control by Noise	-0.03	0.02	-1.79	2,715.25	.073
ConditionTrue Cognate vs False Friend by Noise	0.02	0.01	1.71	2,716.95	.088

Effect of cognate condition and noise: Gaze duration (target word)

Effect	b	SE	t	df	p
Intercept	5.77	0.05	128.14	43.71	< .001
ConditionCognate vs Control	0.12	0.03	4.34	2,003.57	< .001
ConditionCognate Control vs False Friend Control	-0.06	0.04	-1.51	164.80	.133
ConditionTrue Cognate vs False Friend	0.04	0.02	2.03	1,998.68	.043
Noise	0.09	0.01	9.11	2,005.86	< .001
ConditionCognate vs Control by Noise	0.02	0.03	0.89	1,997.10	.376
ConditionCognate Control vs False Friend Control by Noise	-0.06	0.03	-2.42	1,999.27	.016
ConditionTrue Cognate vs False Friend by Noise	0.02	0.02	1.17	1,995.47	.240

Effect of cognate condition and noise: Total viewing time (target word)

Effect	b	SE	t	df	p
Intercept	6.18	0.06	103.73	47.33	< .001
ConditionCognate vs Control	0.20	0.03	7.05	2,397.40	< .001
ConditionCognate Control vs False Friend Control	0.04	0.05	0.72	133.42	.470
ConditionTrue Cognate vs False Friend	0.04	0.02	2.11	2,400.37	.035
Noise	0.09	0.01	8.45	2,398.75	< .001
ConditionCognate vs Control by Noise	0.00	0.03	-0.02	2,396.56	.987
ConditionCognate Control vs False Friend Control by Noise	-0.03	0.03	-1.01	2,393.98	.312
ConditionTrue Cognate vs False Friend by Noise	0.00	0.02	0.08	2,396.56	.937

Proficiency effects: First fixation duration (target word)

Effect	b	SE	t	df	p
Intercept	5.53	0.03	195.12	35.34	< .001
ConditionCognate vs Control	0.03	0.02	1.93	2,744.53	.054
ConditionCognate Control vs False Friend Control	0.03	0.02	1.67	308.90	.095
ConditionTrue Cognate vs False Friend	0.00	0.01	0.16	2,741.93	.876
English	-0.60	0.17	-3.50	34.00	.001
Spanish	0.19	0.19	1.01	34.20	.319
Noise	0.04	0.01	6.81	2,700.10	< .001
ConditionCognate vs Control by English	0.08	0.11	0.72	2,700.13	.471
ConditionCognate Control vs False Friend Control by English	-0.13	0.11	-1.19	2,705.56	.233
ConditionTrue Cognate vs False Friend by English	-0.02	0.08	-0.31	2,707.37	.754
ConditionCognate vs Control by Spanish	0.11	0.12	0.91	2,698.21	.364
ConditionCognate Control vs False Friend Control by Spanish	-0.05	0.13	-0.37	2,700.53	.708
ConditionTrue Cognate vs False Friend by Spanish	0.08	0.09	0.84	2,708.38	.402
English by Spanish	-0.81	1.06	-0.76	34.48	.450
ConditionCognate vs Control by Noise	0.03	0.02	1.41	2,708.53	.160
ConditionCognate Control vs False Friend Control by Noise	-0.03	0.02	-1.72	2,700.23	.086

Effect of proficiency: First fixation duration (continued)

	Effect	b	SE	t	df	p
17	ConditionTrue Cognate vs False Friend by Noise	0.02	0.01	1.23	2,700.60	.218
18	English by Noise	-0.02	0.04	-0.45	2,762.73	.652
19	Spanish by Noise	0.04	0.05	0.90	2,740.06	.369
20	ConditionCognate vs Control by English by Spanish	0.32	0.68	0.47	2,761.99	.638
21	ConditionCognate Control vs False Friend Control by English by Spanish	0.19	0.73	0.25	2,746.48	.800
22	ConditionTrue Cognate vs False Friend by English by Spanish	0.05	0.51	0.09	2,763.90	.926
23	ConditionCognate vs Control by English by Noise	-0.07	0.11	-0.65	2,763.37	.514
24	ConditionCognate Control vs False Friend Control by English by Noise	0.26	0.11	2.33	2,761.60	.020
25	ConditionTrue Cognate vs False Friend by English by Noise	-0.03	0.08	-0.37	2,762.48	.710
26	ConditionCognate vs Control by Spanish by Noise	0.09	0.12	0.77	2,745.54	.439
27	ConditionCognate Control vs False Friend Control by Spanish by Noise	-0.15	0.13	-1.15	2,737.97	.249
28	ConditionTrue Cognate vs False Friend by Spanish by Noise	0.06	0.09	0.63	2,740.46	.528
29	English by Spanish by Noise	-0.17	0.26	-0.68	2,719.76	.498
30	ConditionCognate vs Control by English by Spanish by Noise	0.56	0.68	0.82	2,712.40	.411
31	ConditionCognate Control vs False Friend Control by English by Spanish by Noise	-0.01	0.73	-0.01	2,718.00	.990
32	ConditionTrue Cognate vs False Friend by English by Spanish by Noise	0.75	0.51	1.47	2,706.84	.142

Effect of proficiency: Gaze duration (target word)

Effect	b	SE	t	df	p
Intercept	5.76	0.04	140.66	41.77	< .001
ConditionCognate vs Control	0.12	0.03	4.19	1,985.52	< .001
ConditionCognate Control vs False Friend Control	-0.06	0.04	-1.46	179.91	.145
ConditionTrue Cognate vs False Friend	0.03	0.02	1.60	1,982.16	.110
English	-0.89	0.23	-3.80	33.55	.001
Spanish	0.05	0.27	0.17	33.80	.864
Noise	0.09	0.01	8.90	1,987.90	< .001
ConditionCognate vs Control by English	-0.18	0.17	-1.06	1,972.90	.288
ConditionCognate Control vs False Friend Control by English	0.09	0.17	0.56	1,991.30	.574
ConditionTrue Cognate vs False Friend by English	-0.01	0.12	-0.06	1,970.74	.952
ConditionCognate vs Control by Spanish	0.31	0.19	1.60	1,969.34	.110
ConditionCognate Control vs False Friend Control by Spanish	0.19	0.19	0.98	1,969.42	.329
ConditionTrue Cognate vs False Friend by Spanish	-0.08	0.14	-0.56	1,968.58	.575
English by Spanish	-1.41	1.45	-0.98	34.39	.335
ConditionCognate vs Control by Noise	0.03	0.03	1.05	1,979.78	.296
ConditionCognate Control vs False Friend Control by Noise	-0.06	0.03	-2.04	1,979.43	.042

Effect of proficiency: Gaze duration (continued)

|	Effect	b	SE	t	df	p
17	ConditionTrue Cognate vs False Friend by Noise	0.01	0.02	0.72	1,978.33	.469
18	English by Noise	-0.04	0.06	-0.64	2,012.40	.524
19	Spanish by Noise	-0.04	0.07	-0.57	2,004.05	.571
20	ConditionCognate vs Control by English by Spanish	0.06	1.09	0.05	2,004.42	.959
21	ConditionCognate Control vs False Friend Control by English by Spanish	-0.10	1.11	-0.09	1,983.79	.930
22	ConditionTrue Cognate vs False Friend by English by Spanish	0.49	0.79	0.62	1,999.26	.535
23	ConditionCognate vs Control by English by Noise	-0.13	0.17	-0.74	2,026.23	.459
24	ConditionCognate Control vs False Friend Control by English by Noise	0.22	0.17	1.30	2,011.83	.194
25	ConditionTrue Cognate vs False Friend by English by Noise	0.06	0.12	0.49	2,017.64	.625
26	ConditionCognate vs Control by Spanish by Noise	0.17	0.20	0.88	1,995.50	.380
27	ConditionCognate Control vs False Friend Control by Spanish by Noise	0.06	0.19	0.32	1,992.92	.752
28	ConditionTrue Cognate vs False Friend by Spanish by Noise	-0.01	0.14	-0.11	1,989.29	.915
29	English by Spanish by Noise	-0.26	0.40	-0.65	1,987.99	.515
30	ConditionCognate vs Control by English by Spanish by Noise	-0.58	1.08	-0.54	1,984.93	.590
31	ConditionCognate Control vs False Friend Control by English by Spanish by Noise	-1.09	1.11	-0.98	1,976.31	.328
32	ConditionTrue Cognate vs False Friend by English by Spanish by Noise	0.89	0.78	1.14	1,976.80	.255

Effect of proficiency: Total viewing time (target word)

Effect	b	SE	t	df	p
Intercept	6.18	0.05	116.78	49.19	< .001
ConditionCognate vs Control	0.20	0.03	6.14	2,388.19	< .001
ConditionCognate Control vs False Friend Control	0.04	0.05	0.71	152.46	.482
ConditionTrue Cognate vs False Friend	0.05	0.02	2.06	2,387.31	.040
English	-1.18	0.30	-4.00	35.33	< .001
Spanish	0.41	0.33	1.24	36.20	.224
Noise	0.09	0.01	7.68	2,384.25	< .001
ConditionCognate vs Control by English	0.22	0.20	1.12	2,378.60	.264
ConditionCognate Control vs False Friend Control by English	-0.17	0.20	-0.85	2,378.86	.395
ConditionTrue Cognate vs False Friend by English	0.30	0.14	2.15	2,376.11	.032
ConditionCognate vs Control by Spanish	-0.26	0.24	-1.07	2,390.46	.283
ConditionCognate Control vs False Friend Control by Spanish	0.32	0.25	1.30	2,381.61	.193
ConditionTrue Cognate vs False Friend by Spanish	-0.30	0.17	-1.75	2,386.01	.080
English by Spanish	-2.52	1.83	-1.38	38.11	.177
ConditionCognate vs Control by Noise	0.00	0.03	-0.10	2,387.44	.923
ConditionCognate Control vs False Friend Control by Noise	-0.03	0.03	-0.84	2,375.62	.399

Effect of proficiency: Total viewing time (continued)

	Effect	b	SE	t	df	p
17	ConditionTrue Cognate vs False Friend by Noise	0.00	0.02	-0.12	2,386.14	.905
18	English by Noise	-0.01	0.07	-0.15	2,416.92	.881
19	Spanish by Noise	-0.13	0.09	-1.55	2,391.27	.122
20	ConditionCognate vs Control by English by Spanish	0.63	1.39	0.45	2,388.14	.652
21	ConditionCognate Control vs False Friend Control by English by Spanish	0.02	1.43	0.02	2,377.54	.986
22	ConditionTrue Cognate vs False Friend by English by Spanish	-0.45	0.99	-0.45	2,384.57	.649
23	ConditionCognate vs Control by English by Noise	0.02	0.20	0.11	2,429.64	.909
24	ConditionCognate Control vs False Friend Control by English by Noise	0.11	0.20	0.57	2,416.79	.572
25	ConditionTrue Cognate vs False Friend by English by Noise	0.15	0.14	1.06	2,427.10	.290
26	ConditionCognate vs Control by Spanish by Noise	-0.11	0.25	-0.46	2,406.22	.646
27	ConditionCognate Control vs False Friend Control by Spanish by Noise	0.07	0.25	0.28	2,378.01	.778
28	ConditionTrue Cognate vs False Friend by Spanish by Noise	-0.21	0.17	-1.22	2,398.87	.224
29	English by Spanish by Noise	0.09	0.50	0.18	2,390.75	.856
30	ConditionCognate vs Control by English by Spanish by Noise	-0.01	1.42	-0.01	2,406.89	.992
31	ConditionCognate Control vs False Friend Control by English by Spanish by Noise	-0.12	1.43	-0.09	2,376.98	.931
32	ConditionTrue Cognate vs False Friend by English by Spanish by Noise	0.35	1.00	0.35	2,400.84	.728

Effect of Spanish proficiency: Total viewing time
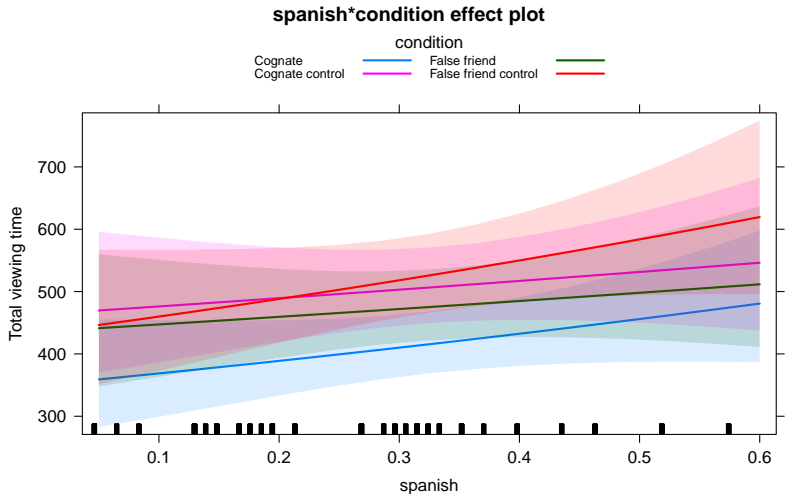
spanish*condition effect plot

Open questions

- ▶ Knowing Spanish does not seem to add much in terms of cognate facilitation with English when you already know Portuguese

Open questions

- ▶ Knowing Spanish does not seem to add much in terms of cognate facilitation with English when you already know Portuguese
  - ▶ Is this true for other language combinations? For example, would an English native speaker benefit more from knowing Spanish when reading in Portuguese?

Open questions

- ▶ Knowing Spanish does not seem to add much in terms of cognate facilitation with English when you already know Portuguese
  - ▶ Is this true for other language combinations? For example, would an English native speaker benefit more from knowing Spanish when reading in Portuguese?
- ▶ False friends may cause more trouble in language production than in comprehension. Will knowing an additional language help or hurt you in production?

Open questions

- Knowing Spanish does not seem to add much in terms of cognate facilitation with English when you already know Portuguese
  - Is this true for other language combinations? For example, would an English native speaker benefit more from knowing Spanish when reading in Portuguese?
- False friends may cause more trouble in language production than in comprehension. Will knowing an additional language help or hurt you in production?
- Is there a trilingual advantage in other cognitive tasks?