THE EFFECT OF SYNTACTIC CONSTRAINTS ON PARALLEL ACTIVATION OF WORDS IN THE BILINGUAL'S TWO LANGUAGES

Jason W. Gullifer
Penn State University

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Outline

- Introduction
  - Background
  - Prior Research
- Current Study
  - Out of context norming
  - RSVP in context
- Summary and Conclusions

Words may overlap across languages

Interlingual cognates:
hotel (English) – **hotel** (means *hotel* in Dutch)

Interlingual homographs (false cognates):
room(English) – **room** (means *cream* in Dutch)
gift (English) – **Gift** (means *poison* in German)

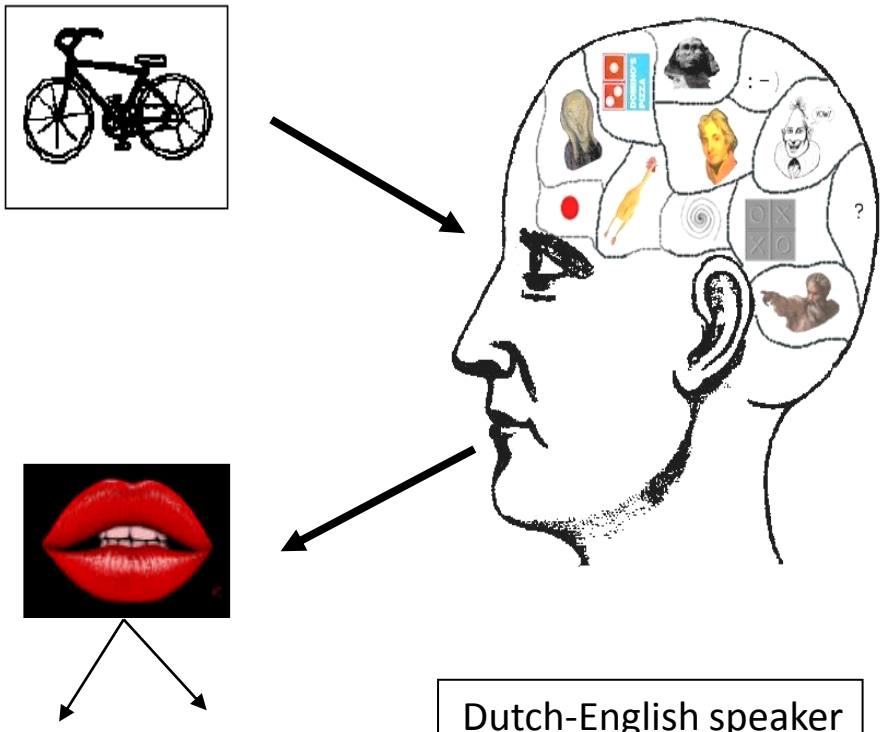
If a bilingual can function as two monolinguals in one, then performance in one language alone should be independent of the reading of the word in the other language.

Prior research

- Words with cross-language overlap as a tool
  - Cognates typically processed faster than noncognate controls
  - Homographs processed more slowly
  - Gradient processing depending on the amount of word form overlap (e.g., Schwartz ,Kroll, & Diaz, 2007)
- Bilinguals are influenced by the other language
  - Influence seen from L1 to L2 and from L2 to L1 (Grainger & Dijkstra, 1992)
  - L3 can influence L1 (van Hell & Dijkstra, 2002)
- Both phonology and orthography remain active (Jared & Kroll, 2001 ; Marian & Spivey, 2003)
  - Regardless of script (e.g., Gollan, Forster, & Frost, 1997)
- Proficiency plays a role, but even highly proficient bilinguals cannot shut off the other language
  - Lower proficiency L2 learners may translate (e.g., Sunderman & Kroll, 2006) and even relatively proficient bilinguals may access the translation equivalent (e.g., Thierry & Wu, 2007)
  - All L2 speakers show some form of co-activation

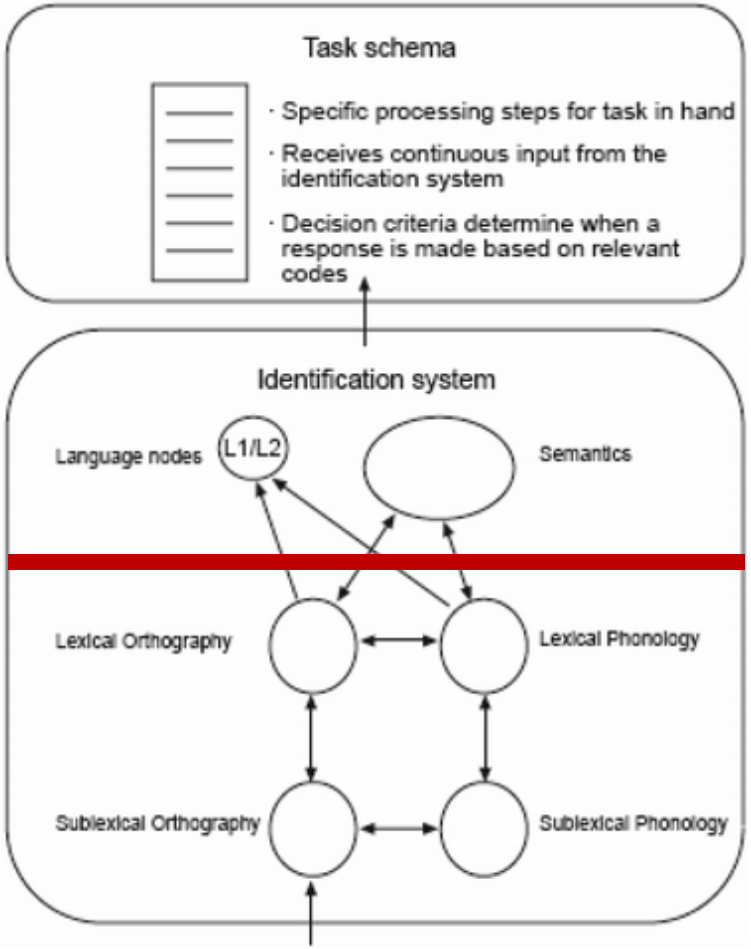
How is reading or speaking in one language possible?

- Bilinguals seem fundamentally open to cross-language similarity
- Yet, they rarely make errors
- What allows the bilingual to control cross-language activation?



BIA+ Model (Dijkstra& van Heuven, 2002)

- Model for reading
  - Adapted from McClelland and Rumelhart's Interactive Activation model
  - Shared lexicon between languages
- Modularized
  - Task schema vs. identification
  - Language nodes
  - Prior expectations about language cannot activate lexical nodes
- Language identification occurs in a bottom up manner



bike

Caution!

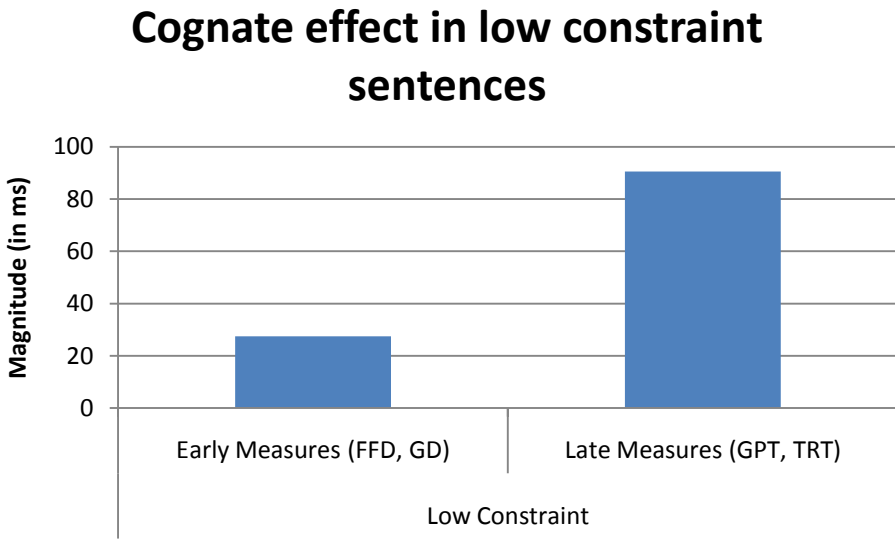
- Most evidence for parallel activation comes from isolated word presentation
- Language typically occurs in a rich context
- Parallel activation invented by psychologists?
  - Relevant contextual cues have been removed

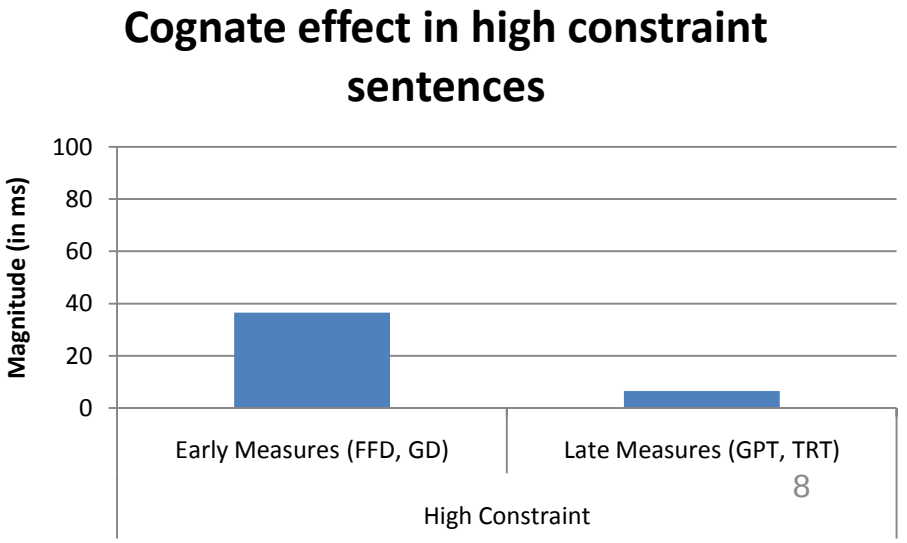
- Two questions emerging from past literature
  - Can bilinguals exploit linguistic context to effectively allow selective access?
    - If yes: effects should go away in sentence context
  - How might semantics constrain non-selectivity?
    - Allow the bilingual to focus on a restricted set of candidates

Libben and Titone (2009)

- Eye-tracking
- French-English bilinguals read sentences in English
  - Target cognates and homographs
  - Matched controls
- Manipulated semantic constraint (predictability)

Type	Sentence
Low Constraint	Because they owned a lot of property around the world, the expensive divorce was a disaster.
High Constraint	Because of the bitter custody battle over the kids, the expensive divorce was a disaster.





Convergence across tasks

RSVP + Translation

(van Hell & de Groot, 2008)

- Dutch bilinguals read sentences in either English or Dutch
  - Translate the target word into the other language
  - Cognate effect in low constraint sentences
  - Magnitude was decreased in high constraint sentences

RSVP + Naming

(Schwartz & Kroll, 2006)

- Spanish-English bilinguals in L1 and L2
- Low Constraint
  - Cognate facilitation
- High Constraint
  - No cognate facilitation

Result: Parallel activation of two language even in sentence contexts

Semantically constrained sentences may reduce or eliminate activation

Reliability of semantic constraint effects debated

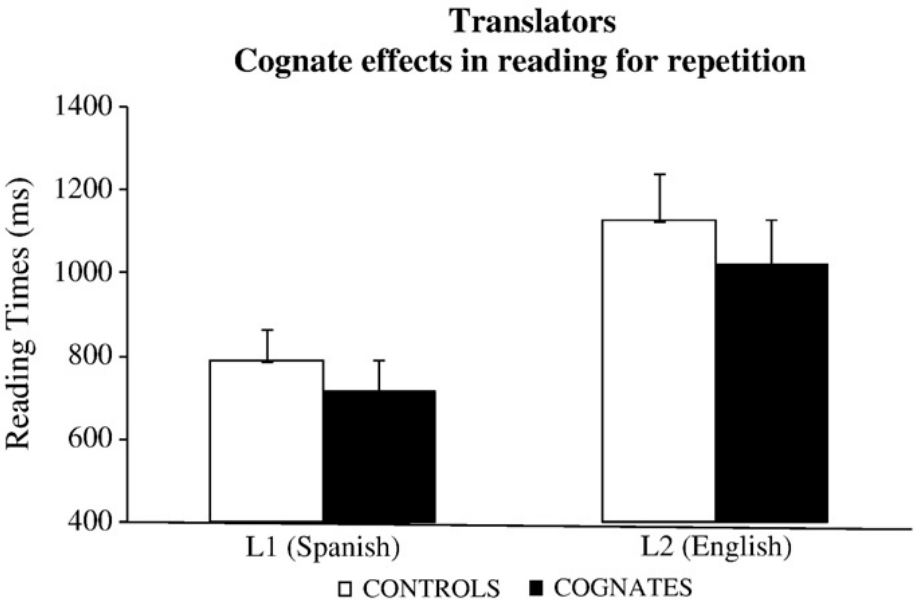
- Van Assche et al. (2010) fail to find semantic constraint effects
- Claim that linguistic context has little to no influence on word recognition
  - Constraint effects are task dependent
  - They are hypothesized to be a consequence of processing speed
- Eliminating non-selectivity is not accomplished easily

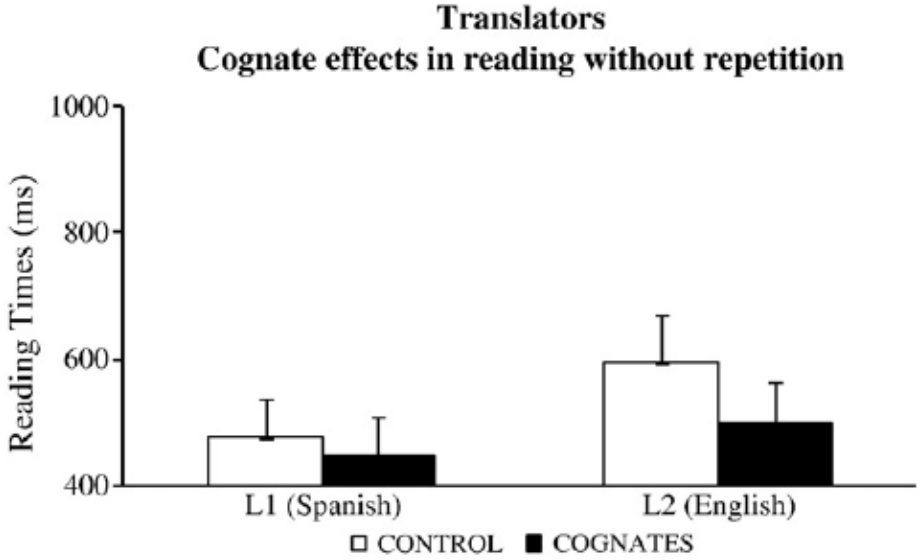
Ibáñez, Macizo, and Bajo (2010)

- Spanish-English bilinguals and professional translators read sentences in both languages
- Some read for comprehension, others read for repetition

Translators

- Cognate effects in both conditions

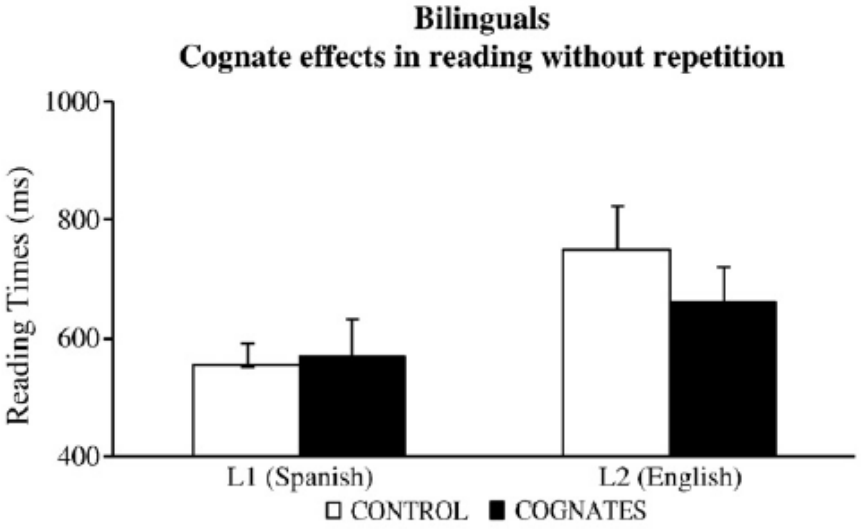




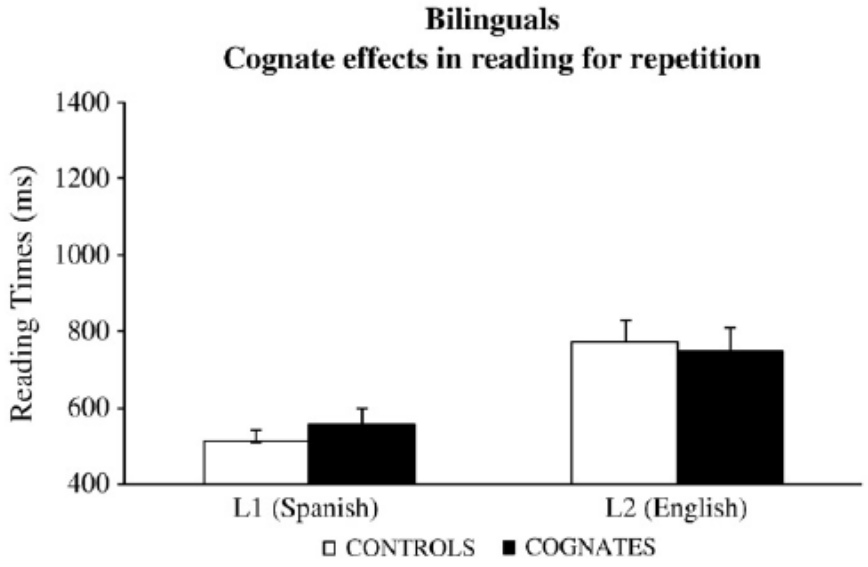
Ibáñez, Macizo, and Bajo (2010)

Bilinguals

- Cognate effect in the L2 for typical reading
- No cognate effects for repetition



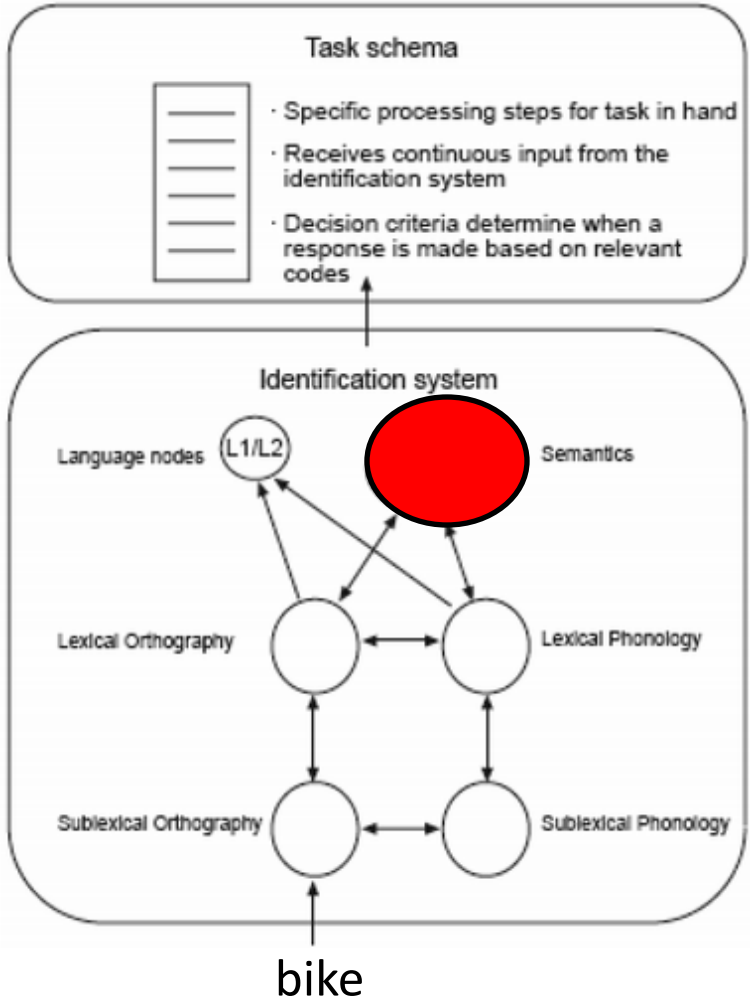
- Modulation of the non-selectivity by memory demands
  - Loss of a beneficial aspect of the bilingual system?



Non-selectivity not a creation!

- Studies all show similar results
  - There is cross-language interaction even in sentence context
    - For both L1 and L2
  - Some factors may reduce/eliminate cross-language activation
    - But this is debated!
- Participants know what language they're reading
  - Especially in blocked language designs
  - Why can't the sentence context be exploited?

BIA+ Model



- Parallel activation in sentence context is consistent with predictions of the model
- No *explicit* mechanism in the model to explain constraint effects or working memory effects
- Semantics shared between languages
  - Restricted Semantics feed down to lexical level → activation of language nodes
  - Perhaps semantic constraint allows the lexical activation to stabilize
  - Does assume that the system will become selective late in processing
- Bilinguals can "select" a language
  - No random errors
  - Can comprehend
- What can readers be able to exploit as they read?

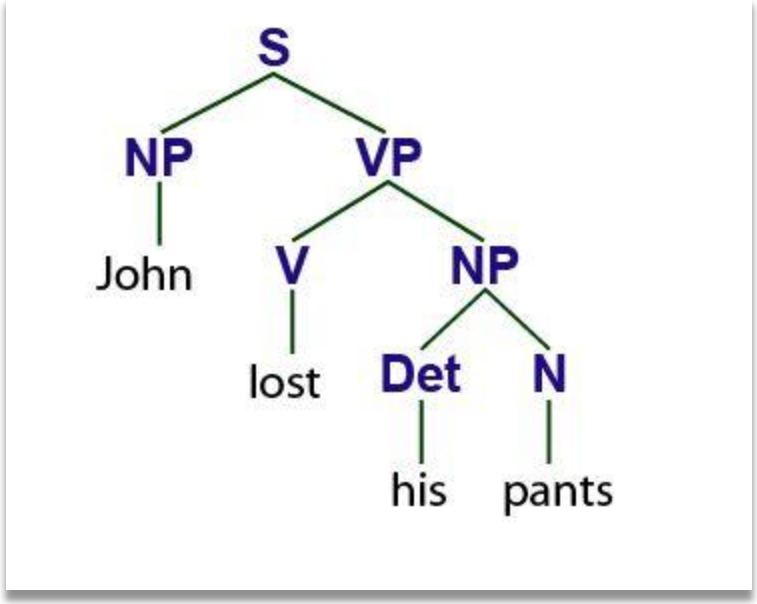
Language-specific context?

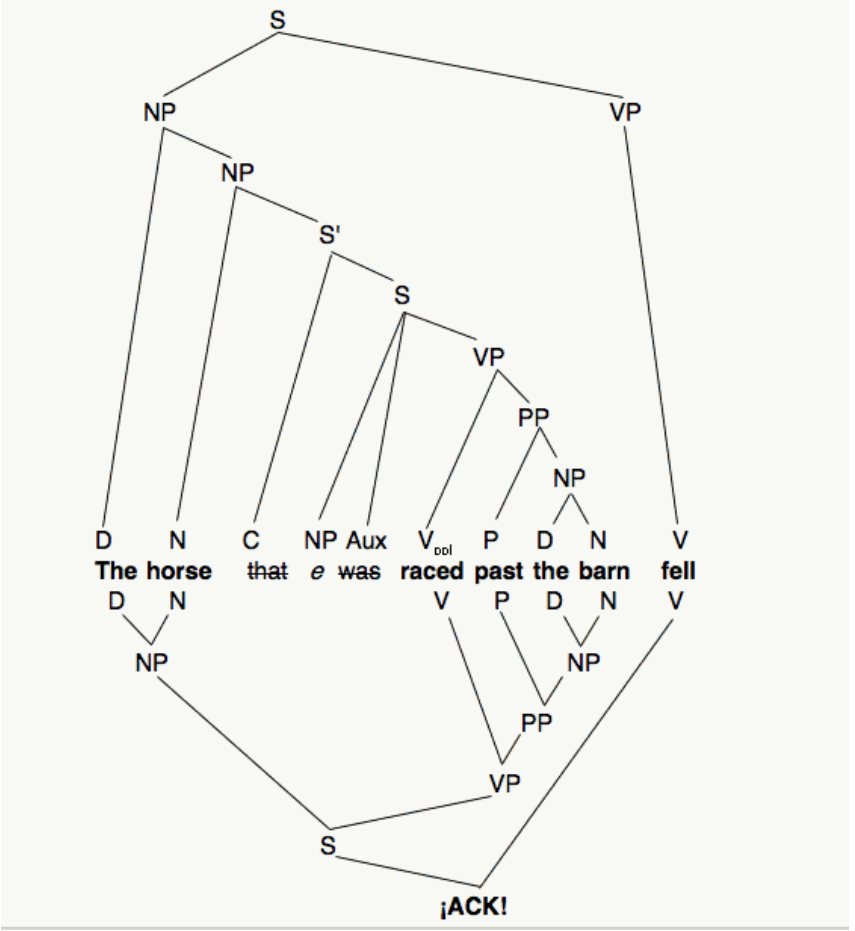
- Researchers have concentrated mainly on the semantics of the sentence
  - Semantic is largely shared across languages
  - Not surprising results are somewhat mixed
- Need to study factors that are more likely than the semantics to provide language-specific cues
- Perhaps the *syntax*!

What is syntax?

- The set of rules or principles that govern sentence structure in a particular language
- While research supports that semantics are typically shared across languages, syntax differs widely
- This obvious feature of sentence processing has been largely ignored in the past literature!

More Complex = More Difficult

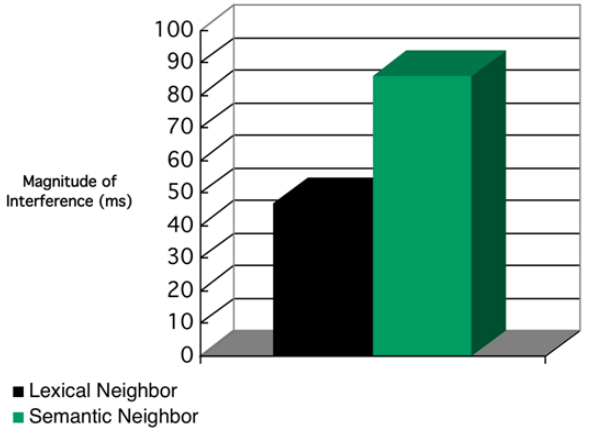




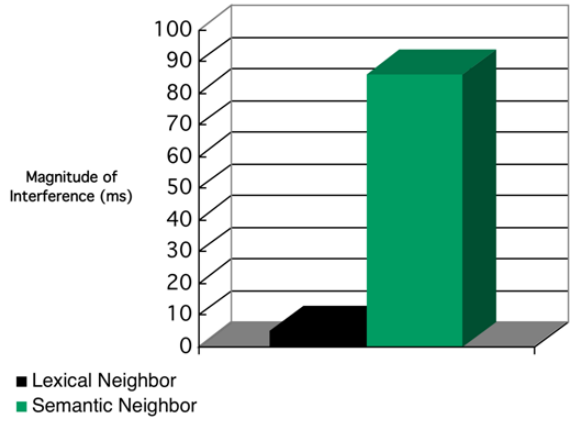
Evidence that syntax could be exploited?

- Grammatical class differences (i.e., noun vs. verb) can reduce lexical form interference of unintended language (Sunderman & Kroll, 2006)
  - Translation recognition with lexical form (e.g., *mano-man*) and semantic distractors (e.g., *mujer-man*)
- Baten et al. (2010) find convergent results in eye-tracking in sentence context

Same grammatical class



Different grammatical class



Cross-linguistic differences

- Languages can differ in the way they form sentences (e.g., word order)
- Spanish-Specific Syntax
  - **(a)** indirect objects can be mentioned redundantly with a proclitic, “le,” and its corresponding noun phrase
  - **(b)** the grammatical subject of an object relative clause does not need to be expressed overtly.
  - For the speaker, these differences provide a potential cue to the language in use

Example

Las monjas le llevaron las mantas que Ø habían bordado a la directora del orfanato.

The nuns Ø took the quilts that they had embroidered to the director of the orphanage.

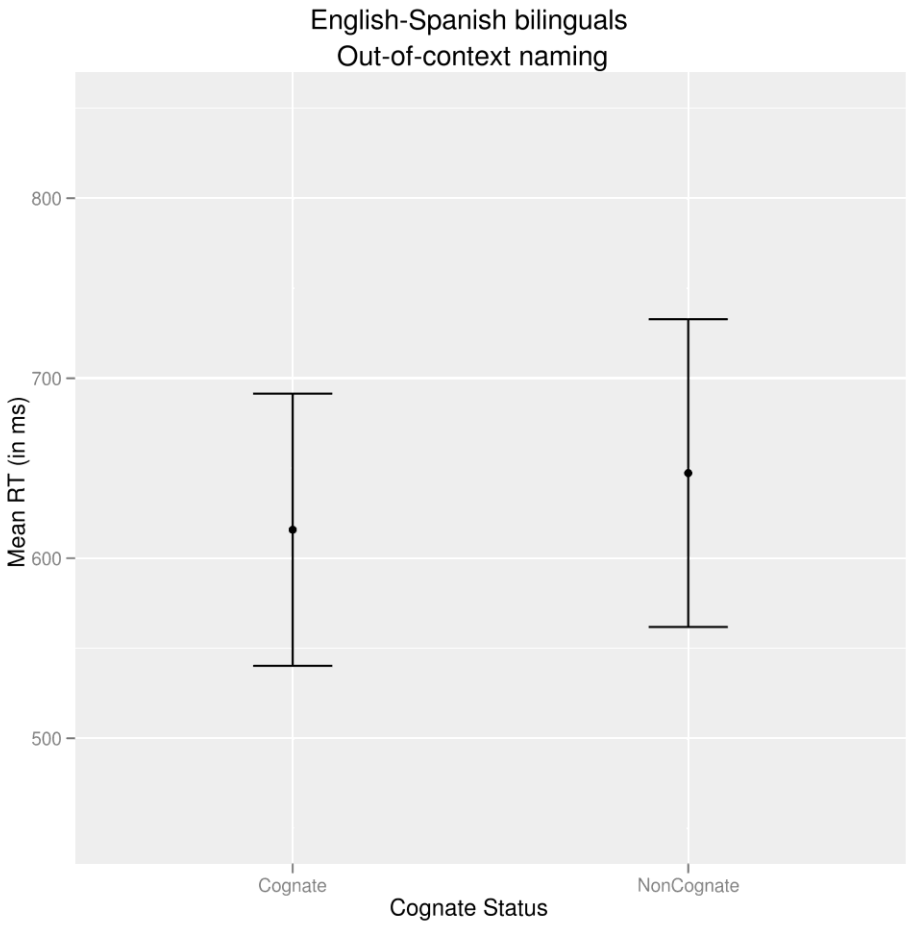
Current Study / Predictions

- Further examine the effects of sentence context on parallel activation in Spanish-English bilinguals
  - Replicate cognate effects in sentence context

- Will language-specific syntax eliminate the effects of cross-language activity the way semantic constraints / working memory demands did in the past studies?
  - Will language specific syntax reduce the cognate effect?
    - Yes: Cognate effects should be reduced following language-specific syntax
    - No: Cognate effects persist in specific condition

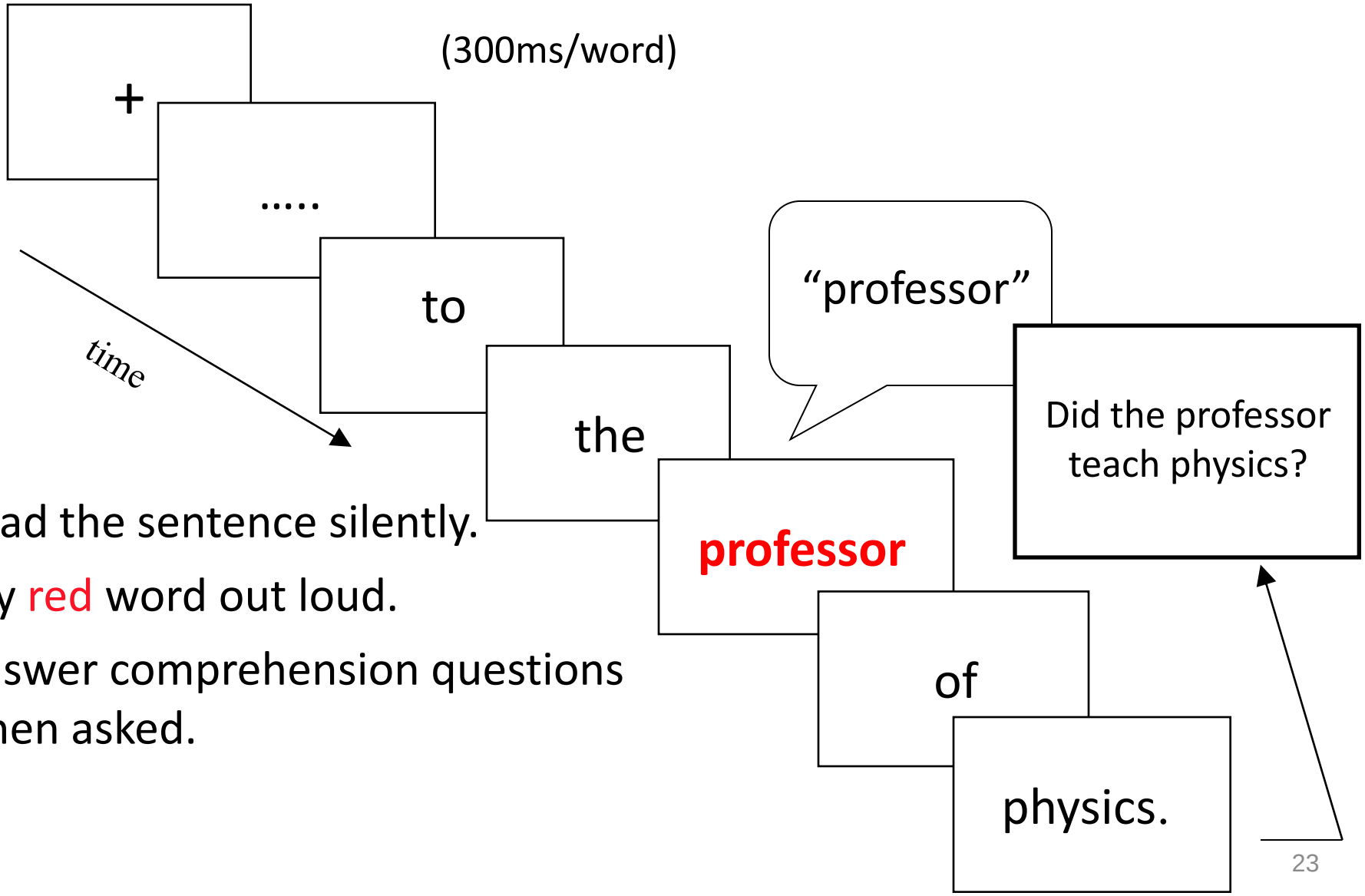
Out of context norming

- Ensure that our stimuli are sensitive to detecting parallel activation
- 15 L2 learners of Spanish
  - Native speakers of English
- Word naming task
  - 64 cognates
  - 64 matched noncognate controls
- Cognates faster than noncognates
  - Parallel activation of English while naming in Spanish
- No monolingual control



t(14) = 4.142, p<0.05
Error bars represent 95% confidence intervals

Task: RSVP



Read the sentence silently.

Say red word out loud.

Answer comprehension questions when asked.

In Context: Materials

- Two language blocks
  - English / Spanish
  - Each participant saw both language blocks
- 64 cognates and 64 noncognate controls
  - Matched for lexical properties to the Spanish cognates
  - 48 fillers
- Sentences contained either Spanish-specific syntax or Spanish-non-specific syntax
  - All sentences were low with respect to semantic constraint
    - Based on past research, the low semantic constraint should yield robust cognate effects if the syntactic information has no effect
  - In the English version, specificity serves as a dummy control
    - Sentences were translated such that they sounded like “normal” English sentences but theoretically, there is no difference between the translation of a Spanish-specific and Spanish-nonspecific sentence

In-Context: Sentences Containing Cognates

Syntax Specific	Spanish	English
	Los estudiantes **le** contaron el cuento que ∅ leyeron el otro día al **profesor** de literatura inglesa	The students recounted the story that they read the other day to the **professor** of English literature
Syntax Non-Specific	Spanish	English
	El taxista que estaba estacionado en la esquina de la panadería llevó al **profesor** a su casa	The taxi driver who was parked at the corner of the bakery took the **professor** to her house

In Context: Participants

- 29 Spanish-English bilinguals
  - 16 from Penn State University (Pennsylvania, US)
  - 14 from University of Texas, El Paso (Texas, US)
- Monolingual control
  - 12 functionally monolingual English speakers (Pennsylvania, US)
  - 8 functionally monolingual Spanish speakers (U Granada, Spain)
  - Monolinguals should exhibit no cognate effects
  - Can provide a window into how the specific syntax is processed
- Individual difference tasks to assess cognitive resources and language proficiency
  - Simon Task
  - Operation Span Task
  - English and Spanish Proficiency Level
  - Self Ratings
  - Grammar Tests

Participant Profile

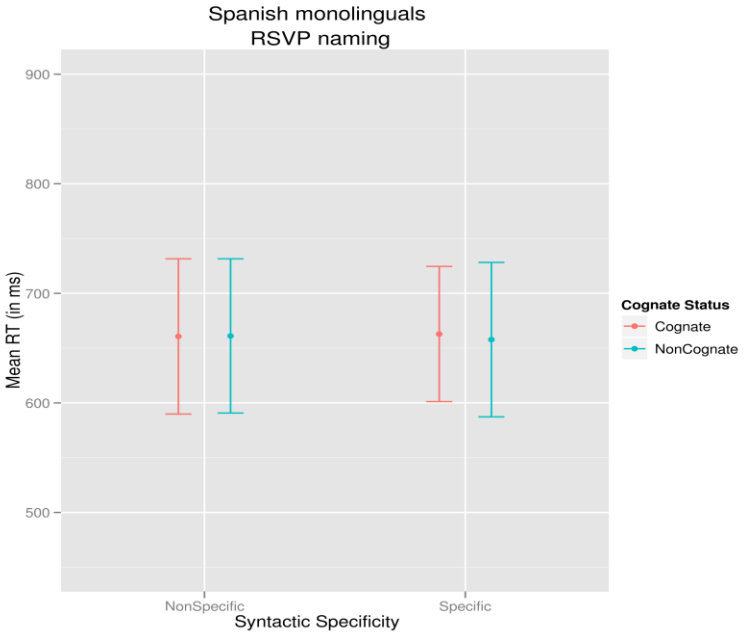
	Bilinguals	Eng Monolinguals	Span Monolinguals
N	15	12	8
Age (years)	24.1 (5.2)	19.9 (3.8)	19 (1.9)
Simon Score	46.1 (17.0)	46.3 (27.4)	53.7 (14.4)
Operation Span (Out of 60)	42.6 (10.6)	46.3 (7.3)	36.6 (7.9)
Picture Naming Accuracy	87% (14%)	96% (2.1%)	NA

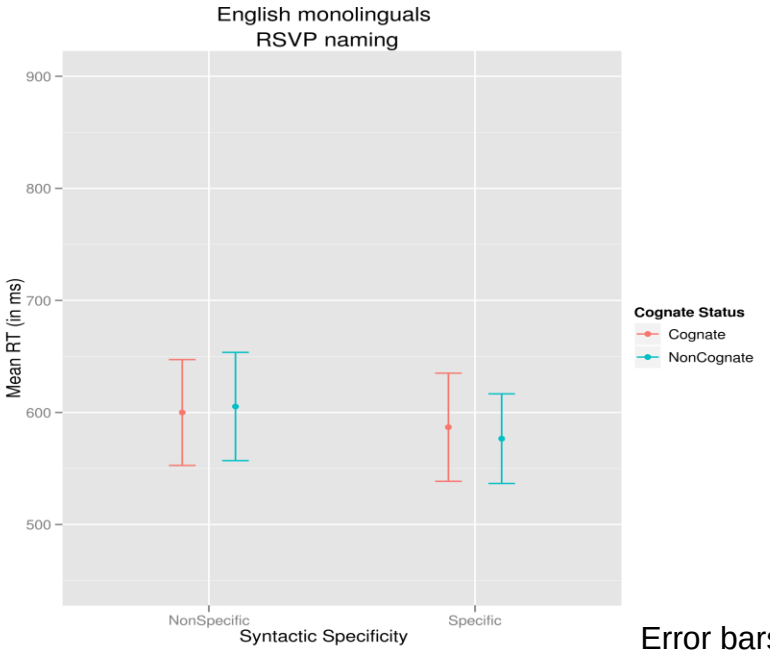
Table 4.1. Language background data and individual difference measures participants in Experiment 2

Self assessed language ratings (out of 10)	English	Spanish
Spanish-English Bilinguals	8.6 (1.6)	9.7 (0.5)
English Monolinguals	9.7 (0.4)	3.1 (1.8)
Spanish Monolinguals	4.4 (1.4)	9.3 (0.6)

Table 4.2. Self-assessed language ratings for participants in Experiment 2

Monolingual controls

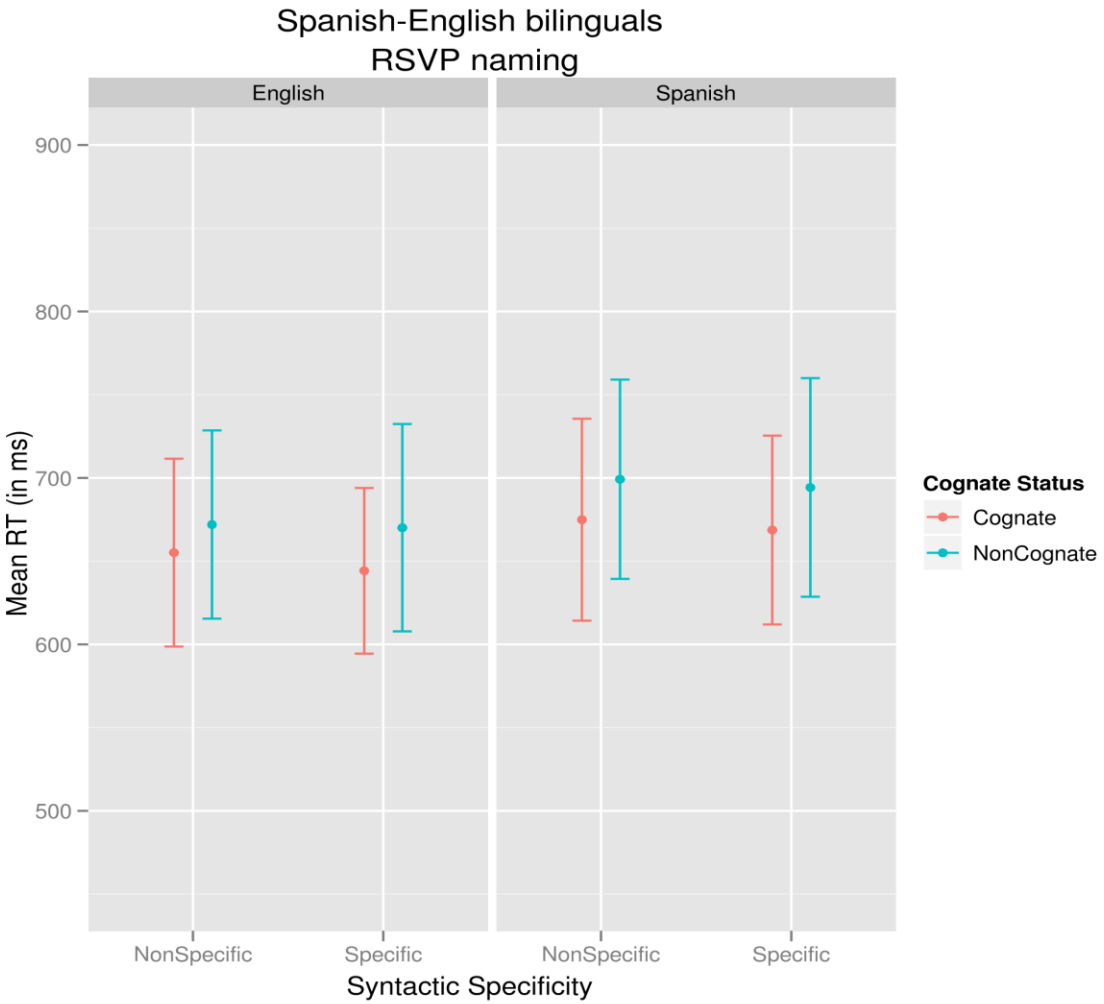




- Spanish monolinguals
  - No significant differences
  - Spanish materials were well controlled
- English monolinguals
  - Main effect of syntactic specificity
    - $F(1,11) = 16.22$, $p<0.05$, $\eta^2_p = 0.596$
  - No other significant differences
  - May be some properties of the materials that were not well controlled in English

Error bars represent 95% confidence intervals

Bilinguals



Cognate Status:
No other effects significant
Error bars represent 95% confidence intervals

- Cognate effects across the board
  - $F(1,28) = 26.269$, $p<0.05$, $\eta^2_p = 0.484$
- Parallel activation of both languages in English and Spanish
- No modulation of the cognate effect by language-specific syntax

Initial summary and conclusions

- Further support for overall non-selectivity
  - Replicated cognate effects in sentence context

- No evidence here that language-specific syntax modulates non-selectivity
  - Cognate effects were not reduced in specific condition
  - Compatible with the BIA+ model
  - Limited usefulness of linguistic context for early word recognition?

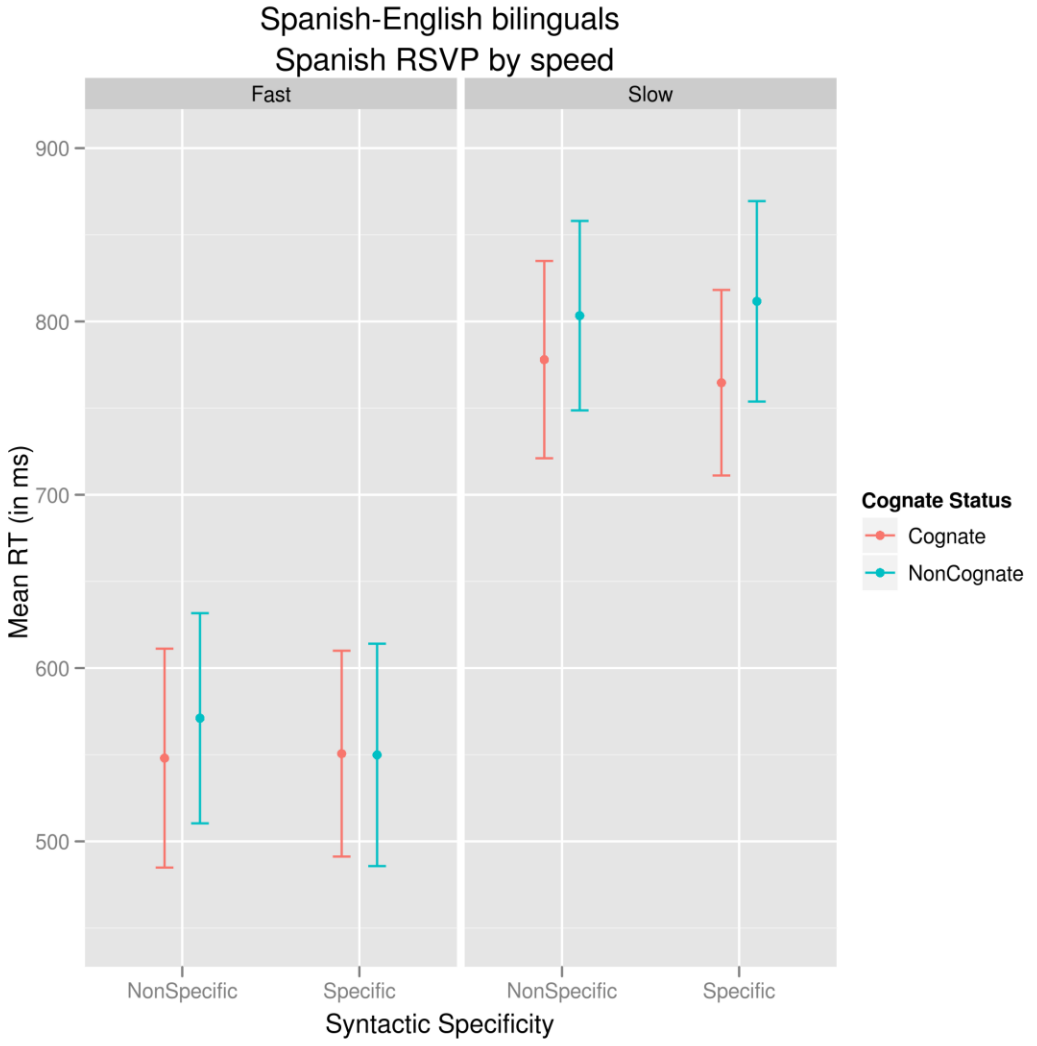
Possibilities for lack of interaction

- Syntax is not a salient language cue as we predicted
  - Evidence from syntactic priming literature for shared syntactic representations across languages (e.g., Schoonbaert et al., 2007)
  - But these the conclusions based on syntactic priming are the result of studying constructions that *overlap* across languages (e.g., ditransitive)

- Participants were not sensitive to the cue
  - Memory demands of participants are exceeded
    - Language-specific material must be held in memory across many words
    - Perhaps this is not the case given the findings in studies in which they must repeat (e.g., Ibáñez et al., 2010) – would expect cognate effects to go away
  - Loss of sensitivity to the syntactic cue
    - E.g., attrition due to English immersion
    - Lack of proficiency for speakers in El Paso

Are there any clues in the data?

- Speed of processing
  - May track proficiency
  - Median split on naming speed
- Bilinguals who named more slowly displayed cognate effects across the board
- Bilinguals who named more quickly showed a modulation in the predicted direction
  - Cognate effects in sentences with language non-specific syntax
  - Eliminated following language-specific syntax
  - May reflect proficiency differences in Spanish



Speed x Specificity x Cognate Status:
$F(1,27) = 5.802$, $p<0.05$, $\eta^2_p = 0.177$

Conclusions and Implications

- Premature to conclude that language specific syntax has no influence on bilingual word recognition
  - Some bilinguals show sensitivity to the syntactic manipulation
  - May need a better independent variable besides the median split

- Role of sentence context for non-selectivity
  - Bilinguals cannot rely on simple cues to select a language
    - Sentence context is not sufficient
  - Require the addition of some other constraint (e.g., semantic, syntactic, or memory related)
  - Bilinguals must also be able to utilize the constraint
    - Assumption: people who process/name faster are more proficient

Implications

- Immersion and Language Dominance
  - Immersed bilinguals can become less sensitive to syntactic features of their L1 (e.g., Dussias 2003, Dussias & Sagarra, 2007)
  - Not all the bilinguals in this sample were sensitive to the syntactic manipulation
    - Prediction: Spanish-English bilinguals immersed in Spain (i.e., their L1) will show the modulation of non-selectivity by Spanish-specific syntax
  - Studying bilinguals who are immersed in the L2 or who have switched language dominance is complicated
    - Influence on processing

Implications

- Zooming in (Elston-Guttler et al. 2005)
  - Given certain contexts, bilinguals can zoom in on the intended language
  - May be influenced by many factors:
    - Proficiency: faster speakers may be more proficient and can zoom in
    - Language environment: English immersion and testing environment may work against the ability to zoom in. Spain?
- BIA+ Model
  - No explicit mechanism to model effect of syntax
  - Syntax encoded lexically? “Le” causes the system to generate predictions about upcoming verbs and objects
  - Predictions are language specific

Future directions

- PIRE visit to Granada, Spain
  - Test our predictions for bilinguals living in a Spanish dominant environment
- If the findings hold:
  - Investigate the implications for code-switching
  - What is the time-course of these effects? Early or late? (i.e., eye-tracking, like Libben and Titone, 2009)
  - Tease apart independent contributions of proclitics and pro-drop
- Integration of translation/repetition literature with word-recognition literature: In the translation/repetition studies, the cognate effect only appears for interpreters or when ordinary bilinguals are preparing to translate. By contrast, in the word recognition studies it is difficult to make the cognate effect disappear.

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