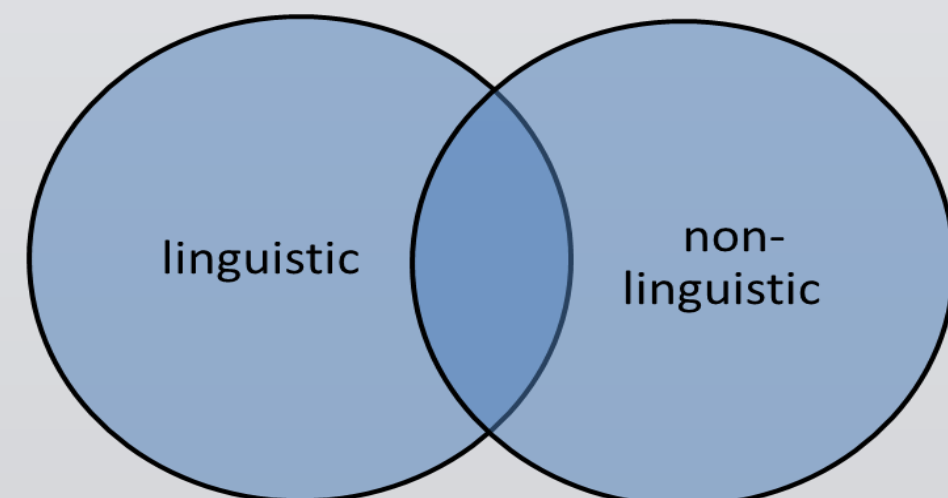


## INTRODUCTION

- Recent research has identified the complex interplay between language and cognitive control in normal bilingual individuals (Costa, 2008; Luk, 2010; Paap, 2013).
- Evidence shows that bilingual individuals can effectively inhibit non-linguistic and linguistic information.
- In bilingual aphasia we see language control impairments (e.g. pathological codeswitching, asymmetrical translation ability); however, it is not clear whether bilingual patients have a domain specific or domain general cognitive impairment.
- No study yet has systematically examined cognitive control in bilingual aphasia to determine whether deficits in language inhibition are specific to the language domain or are indicative of a more general cognitive deficit.

Domain Specific vs. Domain General Cognitive Control in Bilingual Aphasia



## OBJECTIVES

Determine whether deficits in language control are specific to the language domain or are indicative of a more general cognitive deficit.

**Specific Aim 1:** Examine the nature of cognitive control requiring inhibition in a non-linguistic task.

- Do Spanish-English neurologically healthy bilingual adults and Spanish-English bilingual adults with aphasia exhibit similar patterns on the Flanker task (Erickson and Erickson, 1974)?

**Specific Aim 2:** Examine the nature of language control in a linguistic task that requires active inhibition of the non-target language.

- Do neurologically healthy bilingual adults and bilingual adults with aphasia will exhibit similar patterns on a semantic interference task that requires language control?

**Specific Aim 3:** Examine the effect of language proficiency on language processing.

- How does language proficiency for Spanish-English neurologically healthy bilingual adults and Spanish-English bilingual adults with aphasia effect speed of processing on translation and non-translation conditions that vary by semantic relationship?

## Hypotheses

- Neurologically healthy bilingual adults will complete both tasks successfully (intact cognitive control).
- Bilingual adults with aphasia will perform more poorly on the linguistic task compared to the non-linguistic task (evidence for domain specific cognitive control) OR bilingual adults with aphasia will perform poorly on both tasks (evidence for domain general cognitive control).
- Language proficiency will effect response time outcomes on the linguistic task.

## PARTICIPANTS

30 neurologically healthy Spanish-English bilingual adults (NHBA) (21 women, M=48; SD=14).

9 Spanish-English bilingual adults with aphasia (BAA) (4 women, M=54, SD=14).

Patient	P1	P2	P3	P4	P5	P6	P7	P8	P9
MPO	124	96	26	197	32	30	16	31	12
Age	63.4	63	43	38.9	67.3	76.4	35	55.6	48.4

- BAA completed the Pyramids and Palm Trees Test (PPT), Bilingual Aphasia Test (BAT) in Spanish and English, The Boston Naming Test (BNT).

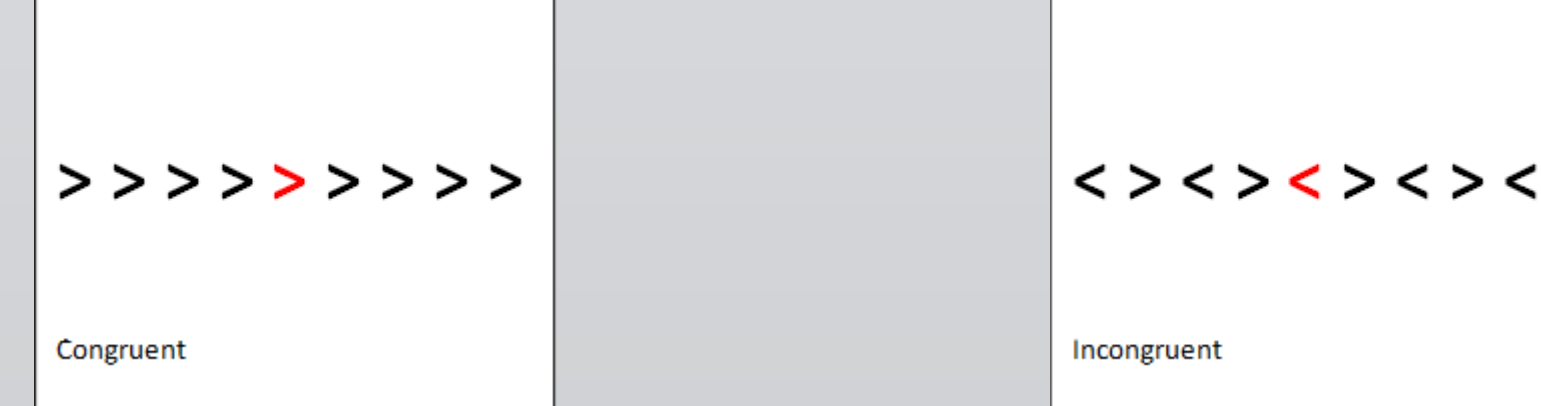
	PPT	BNT-English	BNT-Spanish	BAT-Comprehension English	BAT-Comprehension Spanish	BAT-Semantic English	BAT-Semantic Spanish	BAT-Word Recognition: English into Spanish	BAT-Word Recognition: Spanish into English	BAT-Translation: English into Spanish	BAT-Translation: Spanish into English
Patients	85 (14.0)	21 (28.1)	21 (22.1)	58 (28.1)	68 (22.7)	45 (21.5)	53 (18.8)	69 (23.3)	71 (26.8)	11 (22.1)	19 (21.5)

- NHBA and BAA completed the Language Use Questionnaire (LUQ): language ability rating (LAR), lifetime exposure, current exposure, hours report, education history and confidence, family proficiency.
  - Established language dominance for each participant from LUQ Language Ability Rating (LAR) self-report: LAR English \*minus\* LAR Spanish.

## METHODS

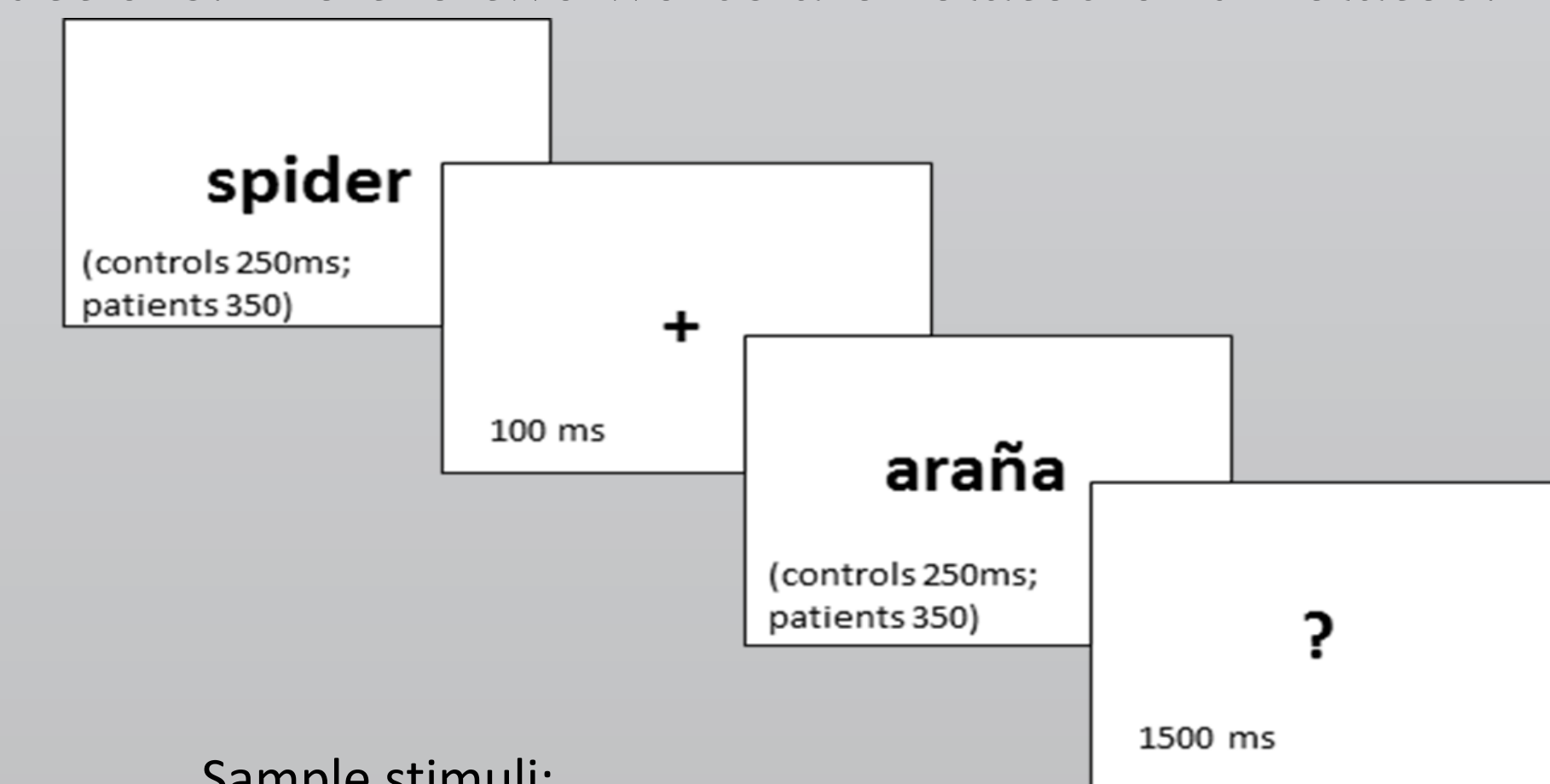
### Flanker Task

Instructions: Is the red arrow pointing left or right?



### Linguistic Task

Instructions: Are the two words are related or unrelated?



Sample stimuli:

Type	Direction	Stimuli
congruent	1. Tr	E-S spider-araña
	2. Tr	S-E ojo-eye
	3. S	E-E spider-ant
	4. S	S-S ojo-oreja ("ear")
	5. STR	E-S spider-hormiga
	6. STR	S-E ojo-ant
incongruent	7. Un	E-E spider-church
	8. Un	S-S ojo-rama ("branch")
	9. UnTr	E-S spider-iglesia ("church")
	10. UnTr	S-E ojo-branch

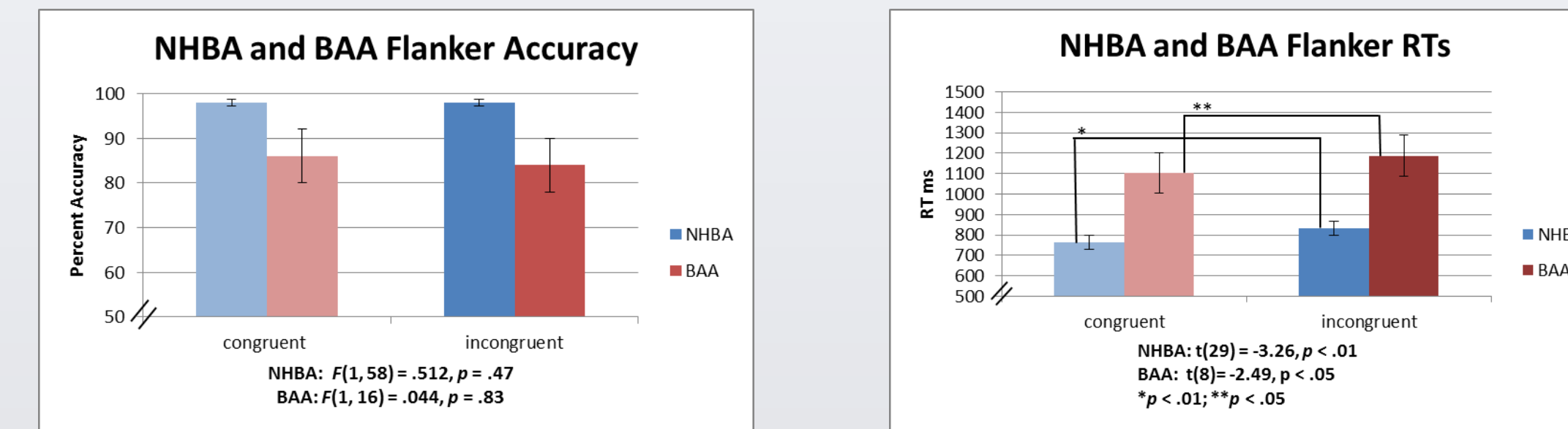
Key: Tr=translation; S=semantic; STR=semantic translation; Un=unrelated; UnTr=unrelated translation; E=English; S=Spanish

- Stimuli consist of word pairs with various relationships (e.g. direct translation, semantic, unrelated) and language directionality (e.g. English-English, Spanish-Spanish, English-Spanish and Spanish to English).
- All stimuli were controlled for frequency and cognates.

## RESULTS

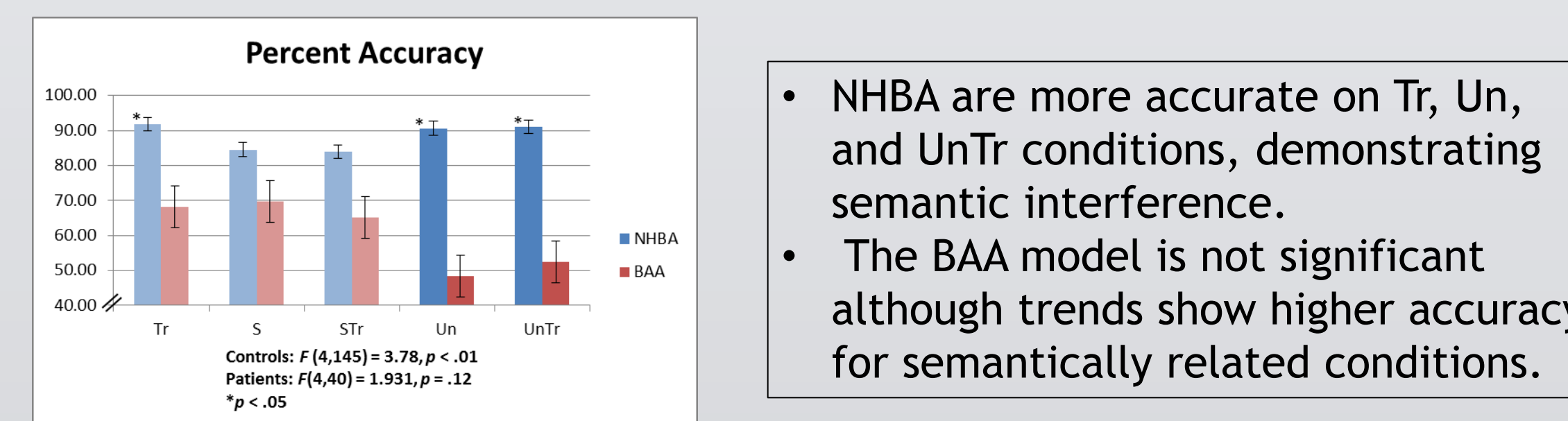
### Specific Aim 1: Flanker Task

Controls and patients exhibit the congruency effect: longer RT on incongruent condition compared to the congruent condition.



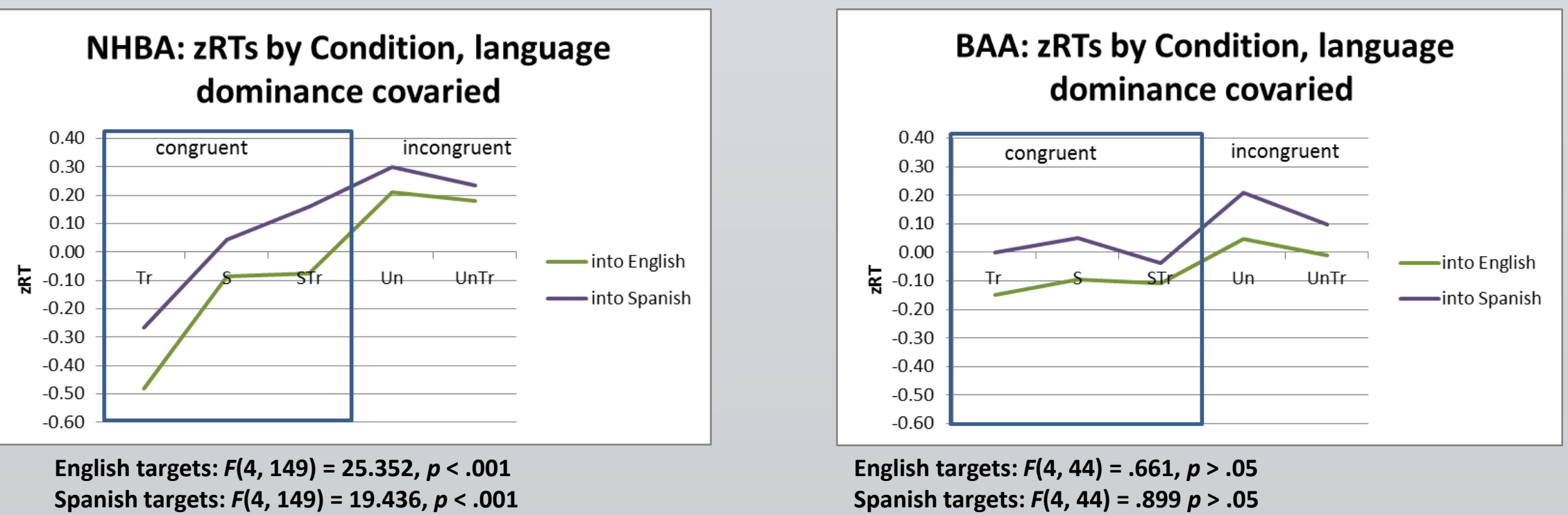
### Specific Aim 2: Linguistic Task

#### Accuracy



- NHBA are more accurate on Tr, Un, and UnTr conditions, demonstrating semantic interference.
- The BAA model is not significant although trends show higher accuracy for semantically related conditions.

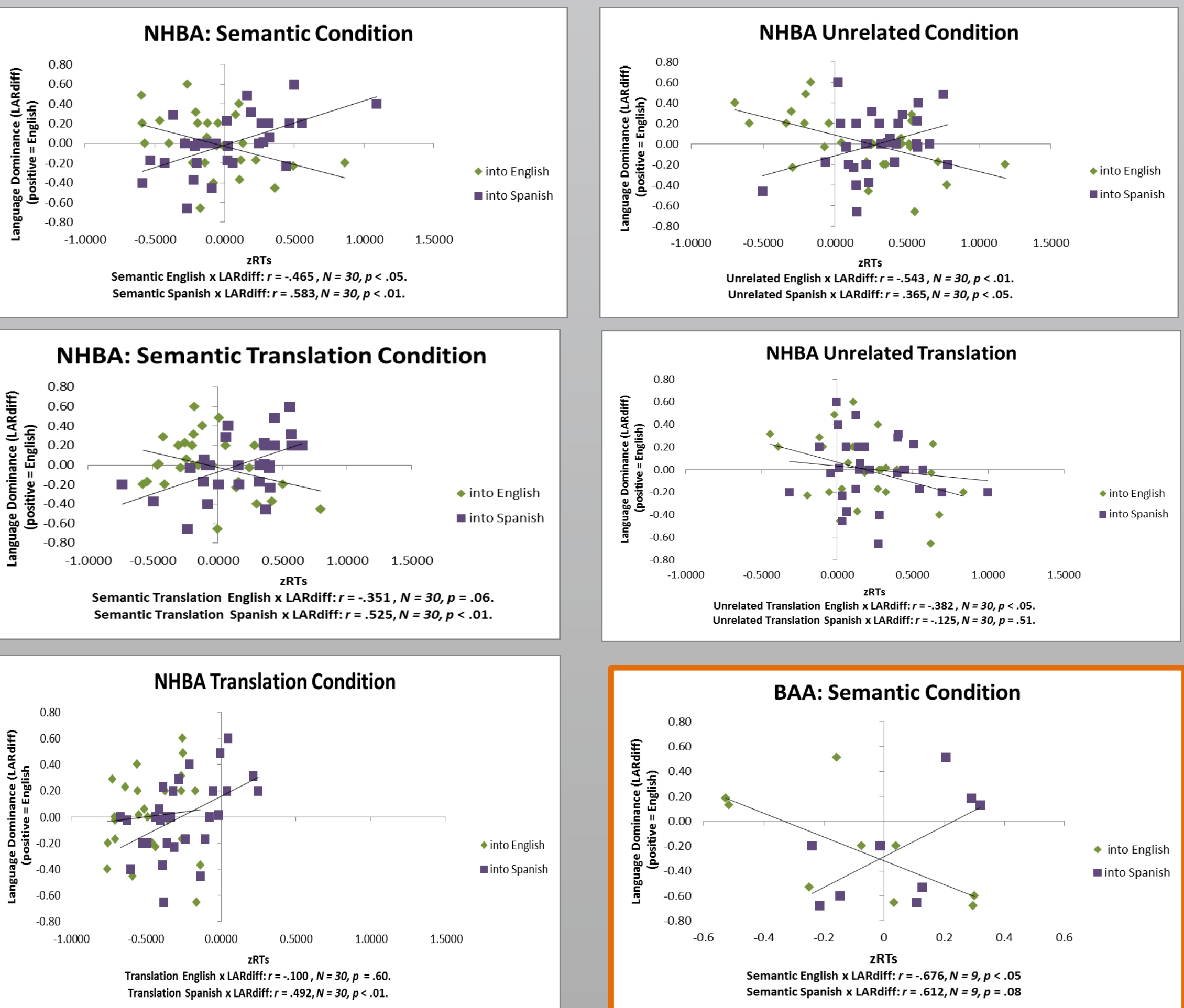
#### Response Times



### Specific Aim 3: Effect of Language Proficiency

NHBA: RT is related to language dominance on non-translation (congruent and incongruent) conditions. RTs on direct Translation are faster than on Unrelated Translation. The Semantic Translation trend is that RTs are shorter when translating into the dominant language.

BAA: Language dominance effects RT on the Semantic non-translation condition.



## CONCLUSIONS

### Flanker Task

NHBA and BAA exhibit the congruency effect, thus demonstrating non-linguistic cognitive control.

### Linguistic Task

#### NHBA:

##### Accuracy & Response Time

NHBA are more accurate on Tr, Un, and UnTr conditions indicating that NHBA exhibit semantic interference on accuracy. However, NHBA are fastest on congruent conditions (Tr, S, STR) indicating an RT processing benefit from semantic information.

#### BAA:

##### Accuracy & Response Time

BAA do not show an interfering or facilitory effect from processing semantic information, suggesting inefficient linguistic processing. Although individual RT analysis does reveal that the majority of BAA do show faster RTs for semantically related conditions.

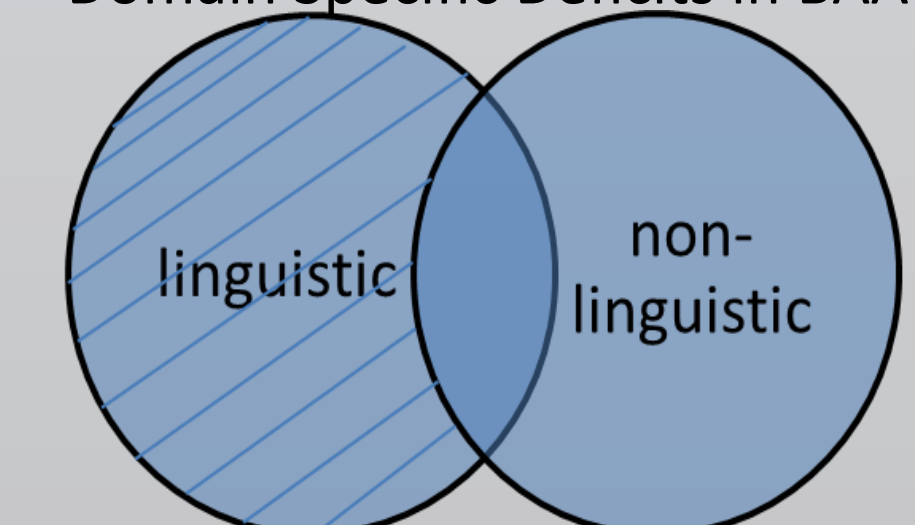
### Effect of Language Proficiency

- NHBA: RT is effected by language dominance on congruent and incongruent non-translation conditions. A similar trend is observed on the STR condition. These results indicate that NHBA exhibit more efficient processing when going into their dominant language.
- BAA: Language dominance influences RT on the semantic non-translation condition only. BAA are efficient with processing semantically related words in their dominant language only.

## IMPLICATIONS

Results suggest that in BAA linguistic control mechanisms are dissociable from non-linguistic control.

Domain Specific Deficits in BAA



## Future Directions

Test additional non-linguistic tasks that require more demanding cognitive control compared to the Flanker Task.

Test two additional linguistic tasks that require varying degrees of lexical access, i.e. word identification and word generation. Identifying different aspects of lexical access and deficits in our patients will allow us to tease apart levels of semantic processing.

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