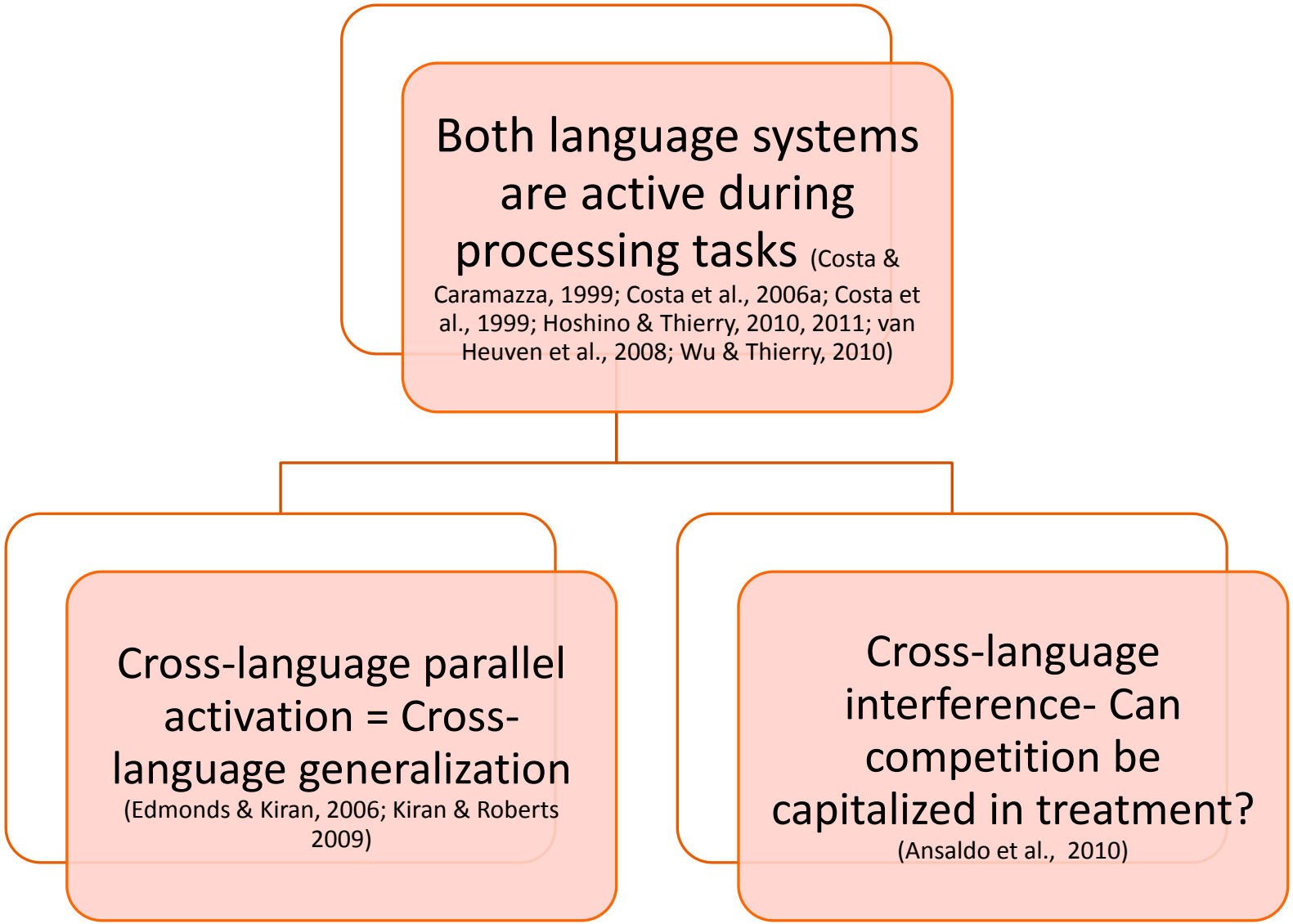
MASSACHUSETTS
GENERAL HOPSITAL

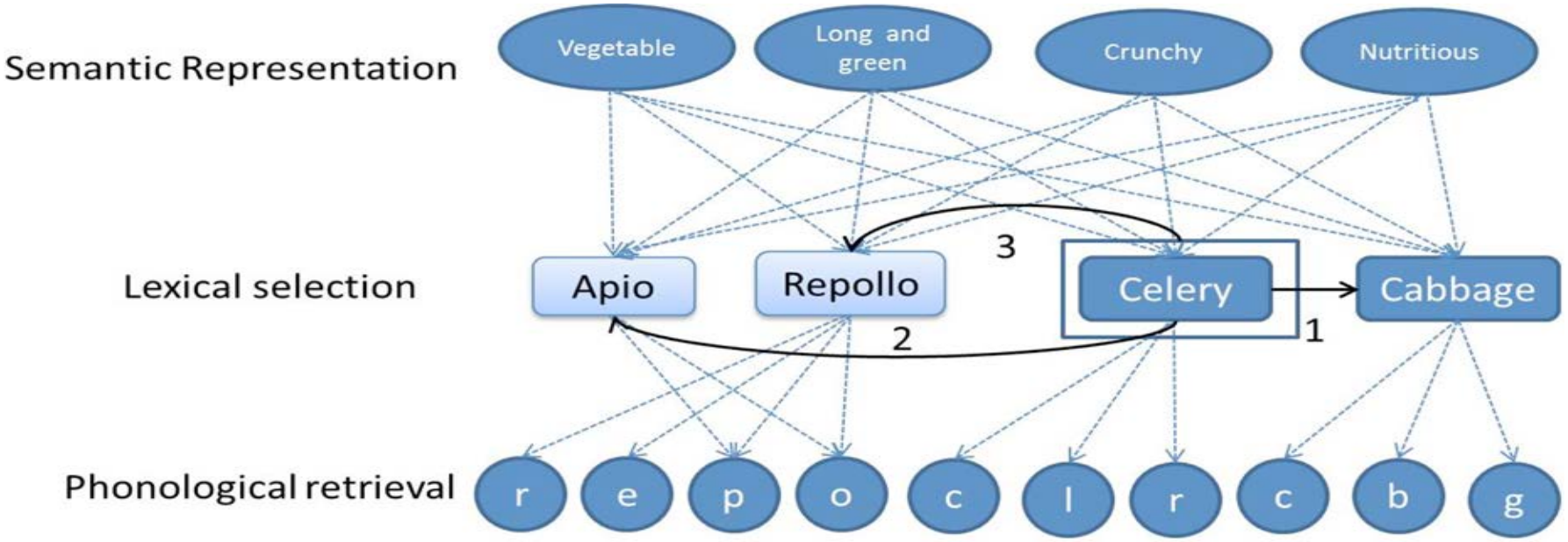
Domain specific and domain general language and cognitive control in individuals with bilingual aphasia

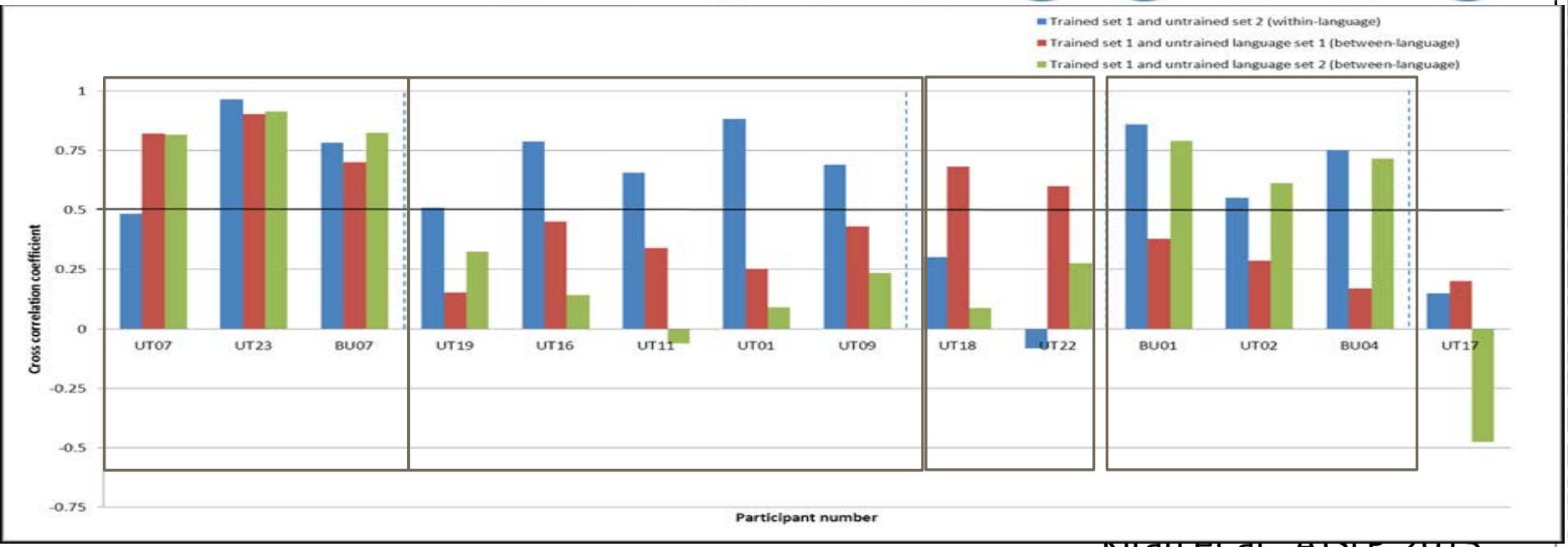
Swathi Kiran
Speech & Hearing Sciences;
Boston University
Department of Neurology;
Massachusetts General Hospital

Rehabilitation studies in bilingual aphasia

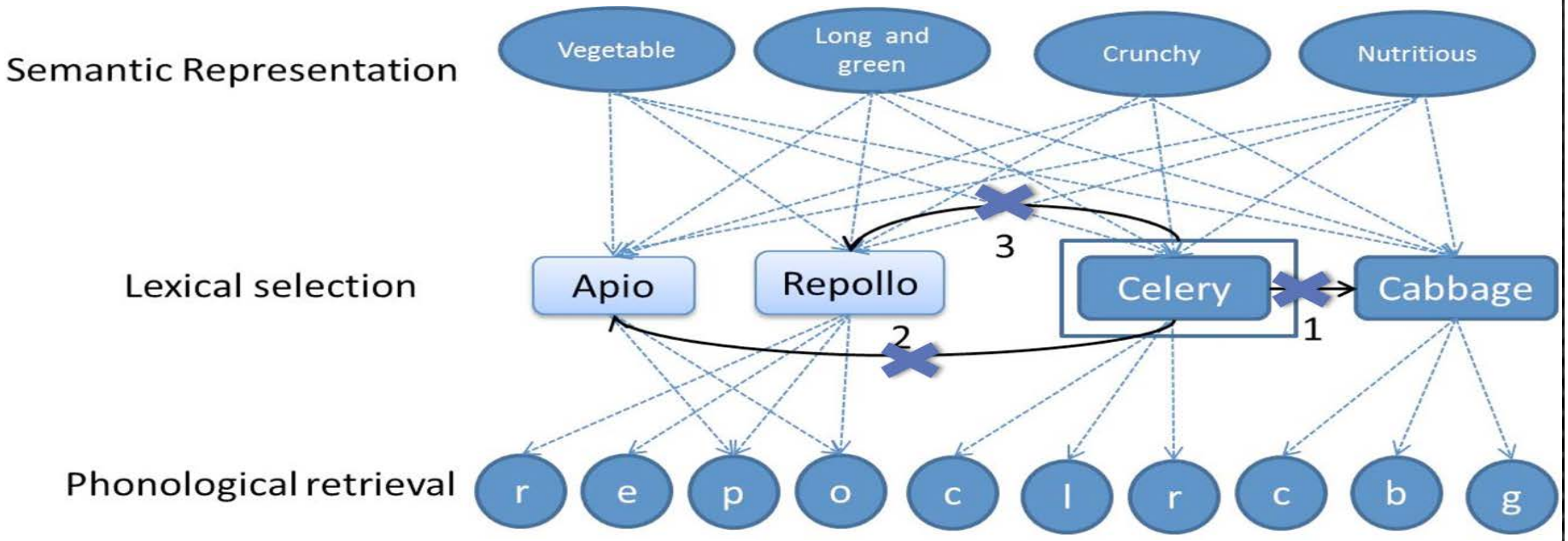


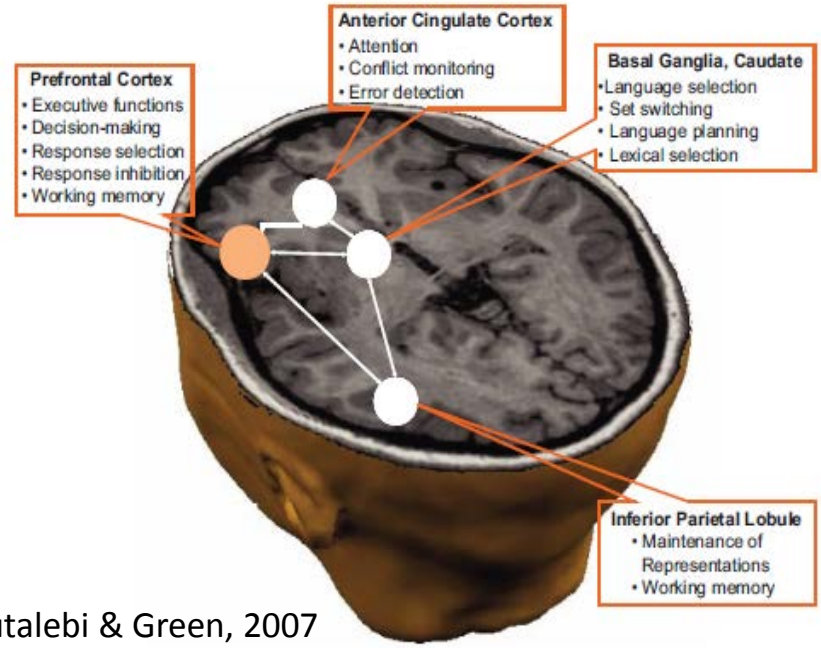
Between and within language generalization



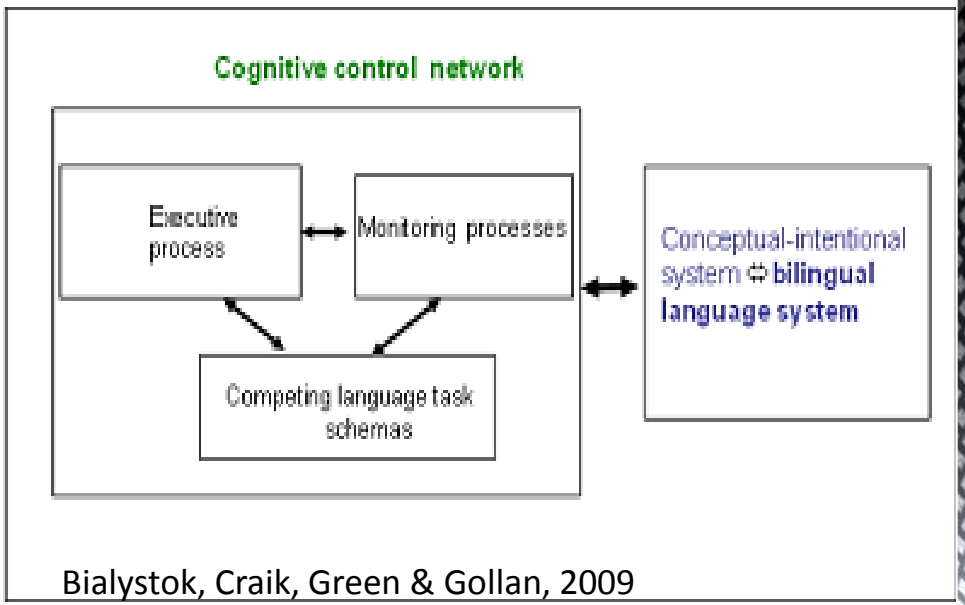


No language generalization, interference





Abutalebi & Green, 2007



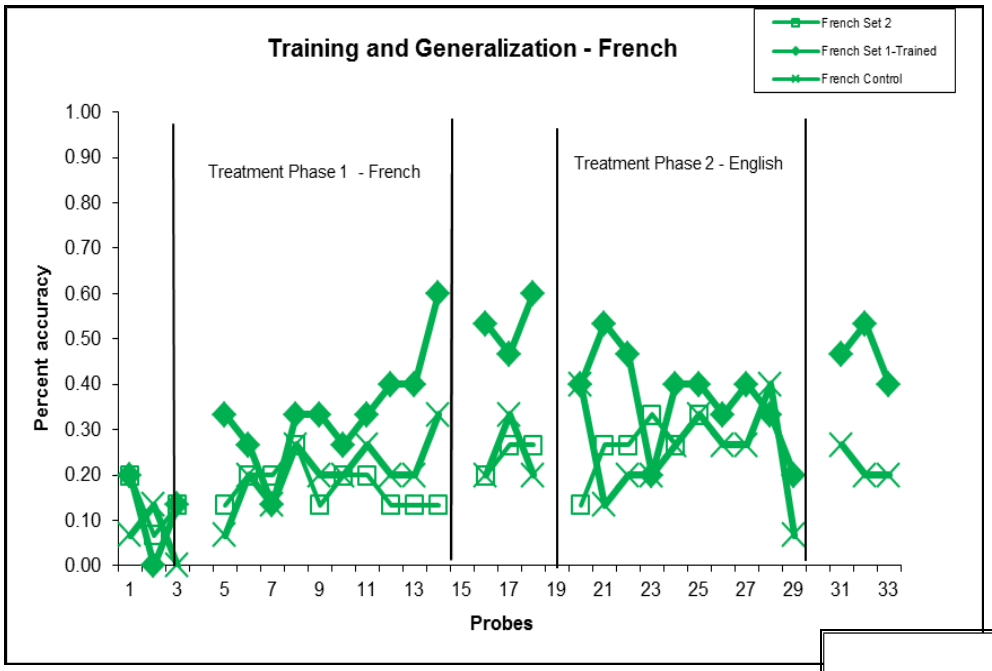
Bialystok, Craik, Green & Gollan, 2009

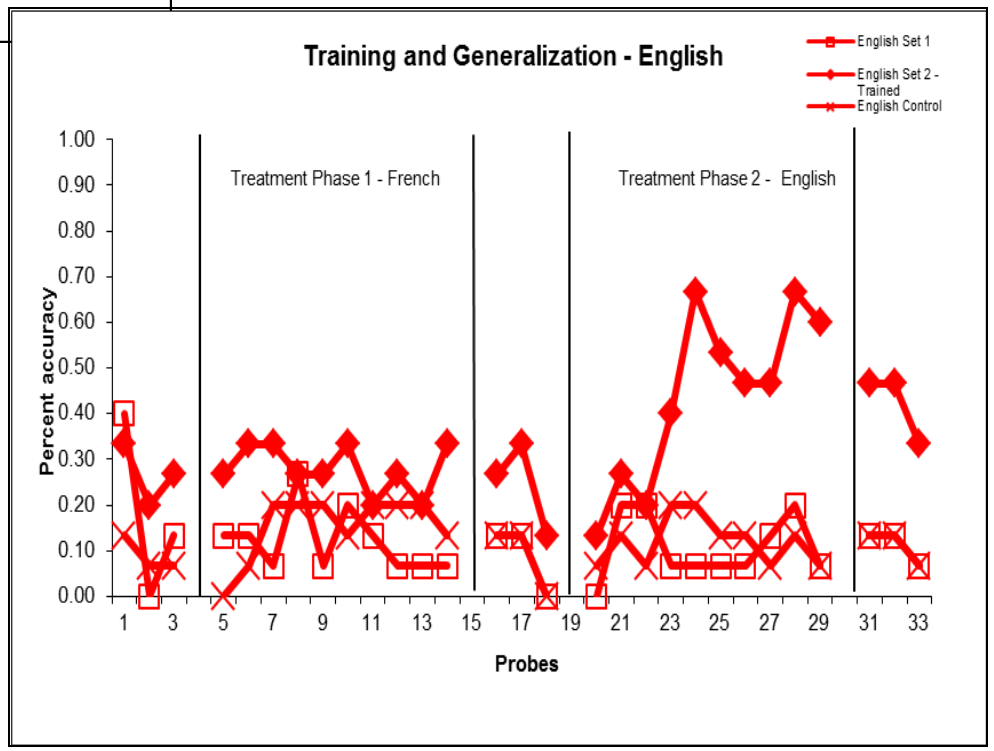
How pervasive are interference effects in rehabilitation?

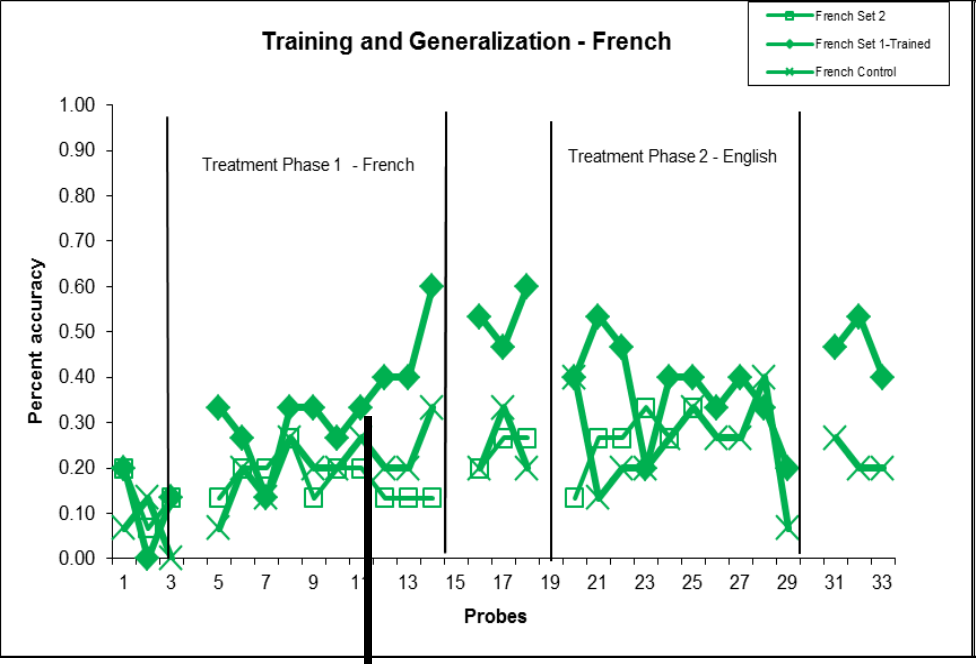
- Trilingual- Amharic-French-English
- 59 years old
- At the age of 55, a left frontal grade II oligoastrocytoma
- Post surgery- left frontal infarct affecting Lbasal ganglia.

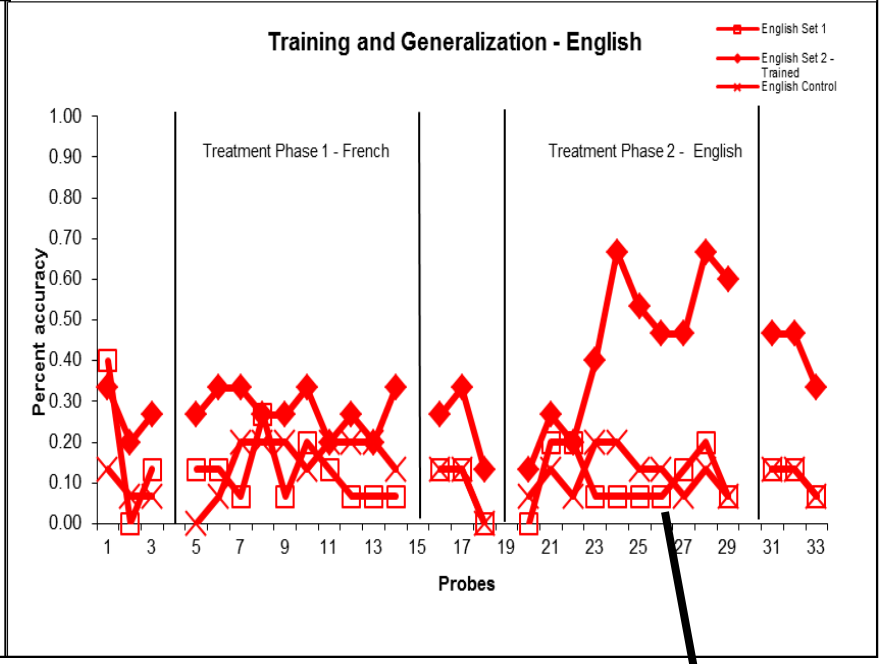
- Treatment provided in French first and then in English

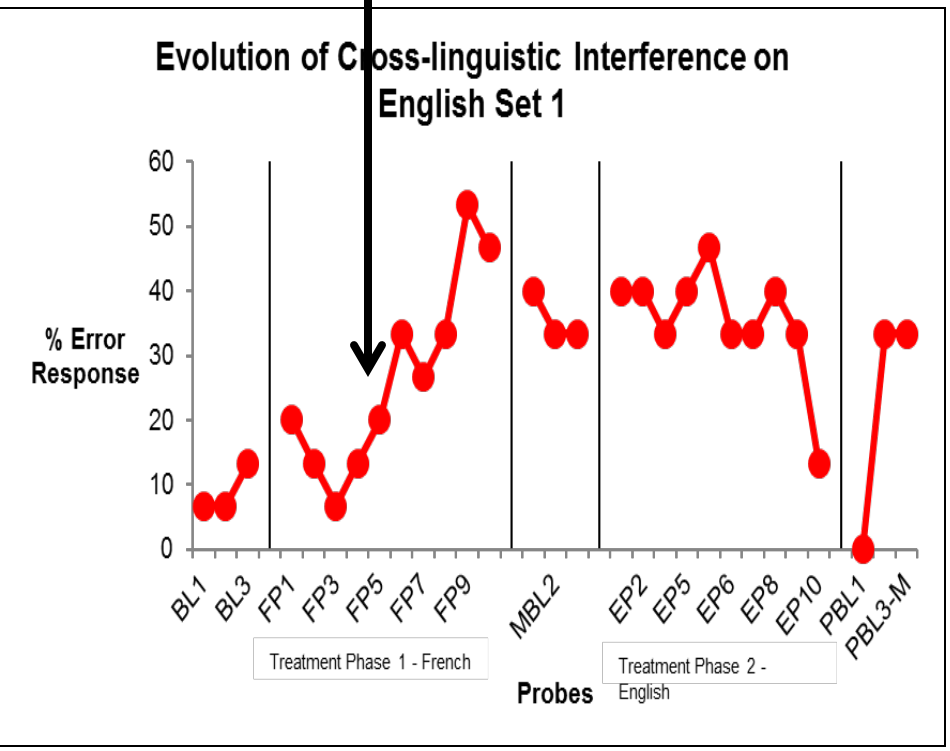
Keane & Kiran, under revision, Cognitive Neuropsychology

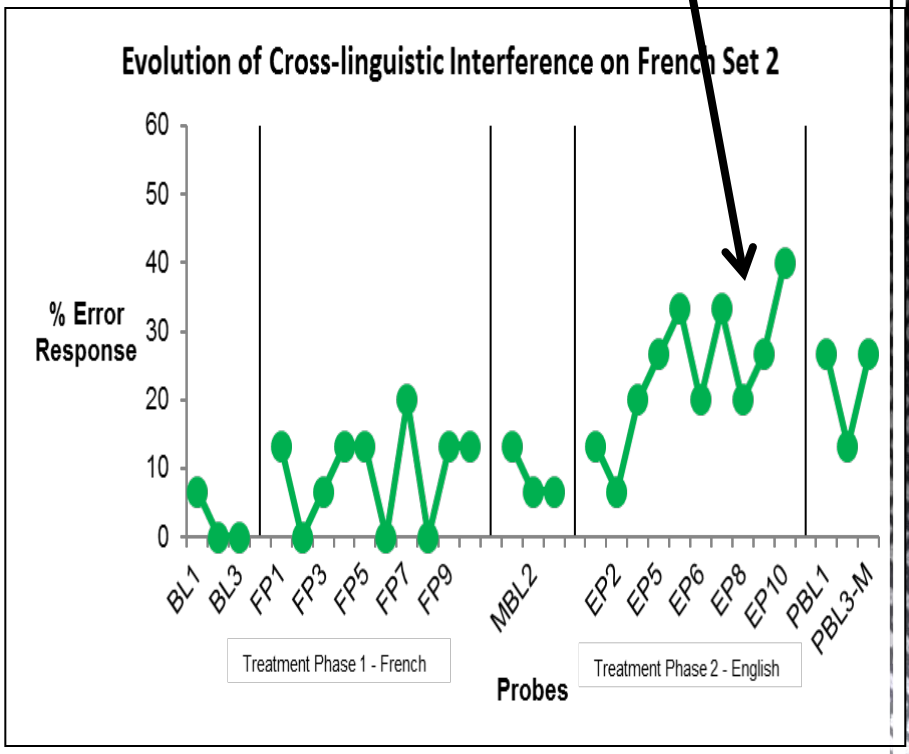

Training and Generalization - French
French Set 2
French Set 1-Trained
French Control
Treatment Phase 1 - French
Treatment Phase 2 - English
Percent accuracy
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33
Probes

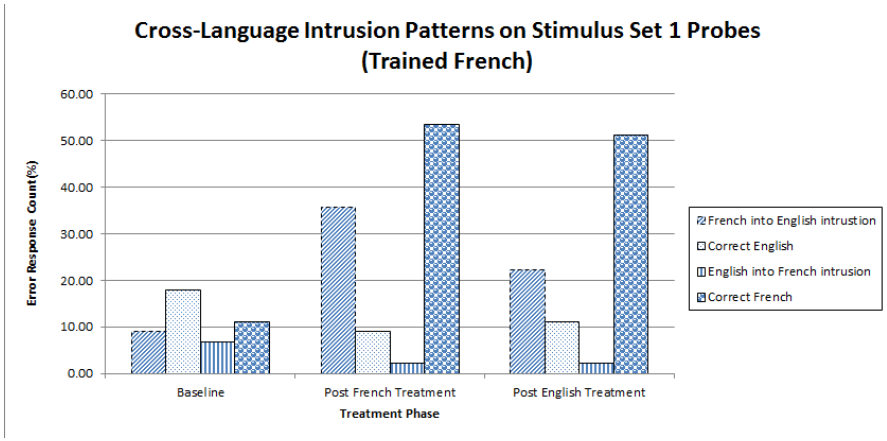

Training and Generalization - English
English Set 1
English Set 2 - Trained
English Control
Treatment Phase 1 - French
Treatment Phase 2 - English
Percent accuracy
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33
Probes

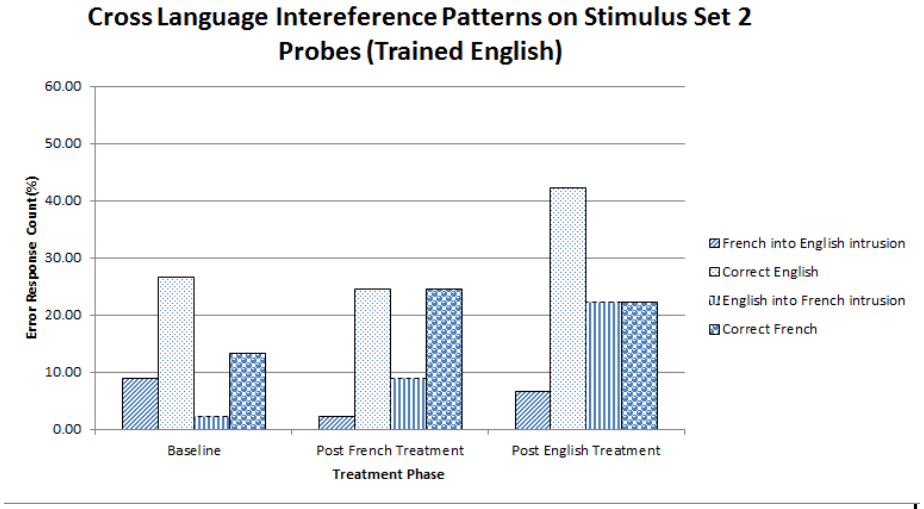

Training and Generalization - French
French Set 2
French Set 1-Trained
French Control
Percent accuracy
Treatment Phase 1 - French
Treatment Phase 2 - English
Probes


Training and Generalization - English
English Set 1
English Set 2 - Trained
English Control
Percent accuracy
Treatment Phase 1 - French
Treatment Phase 2 - English
Probes


Evolution of Cross-linguistic Interference on English Set 1
% Error Response
BL1
BL3
FP1
FP3
FP5
FP7
FP9
MBL2
EP2
EP5
EP6
EP8
EP10
PBL1
PBL3-M
Treatment Phase 1 - French
Treatment Phase 2 - English
Probes


Evolution of Cross-linguistic Interference on French Set 2
% Error Response
BL1
BL3
FP1
FP3
FP5
FP7
FP9
MBL2
EP2
EP5
EP6
EP8
EP10
PBL1
PBL3-M
Treatment Phase 1 - French
Treatment Phase 2 - English
Probes



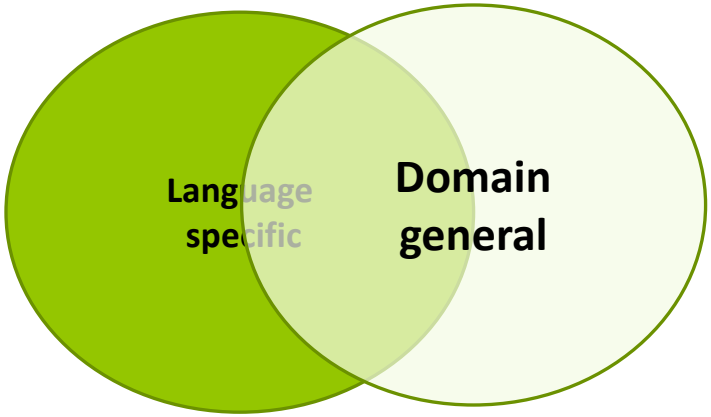


Performance on non-linguistic flanker task

	Pre-treatment		**Post-treatment**	
	Congruent	Incongruent	Congruent	Incongruent
Accuracy	50%	55%	45%	50%
Response Time	1533.7	1720.9	1081.7	1051

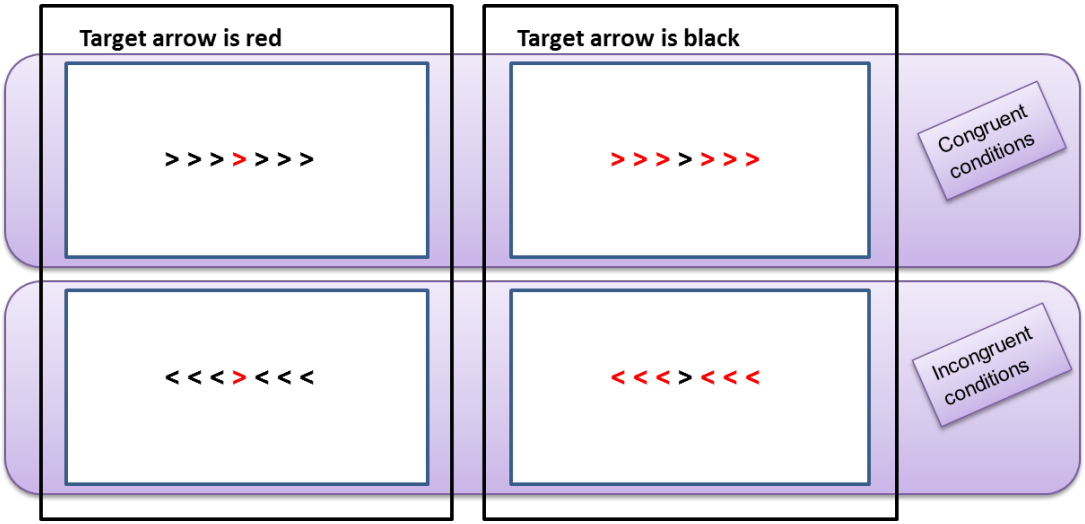
Keane & Kiran, under revision, Cognitive Neuropsychology,

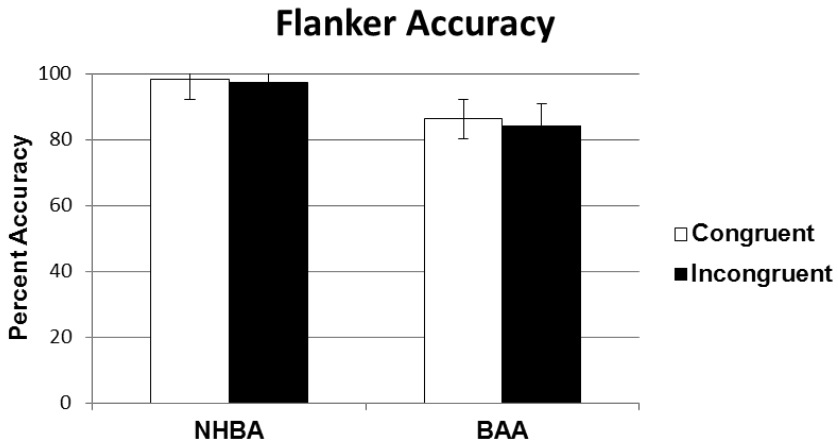
Is cognitive control and its impairment in post-stroke adults domain general or language specific?

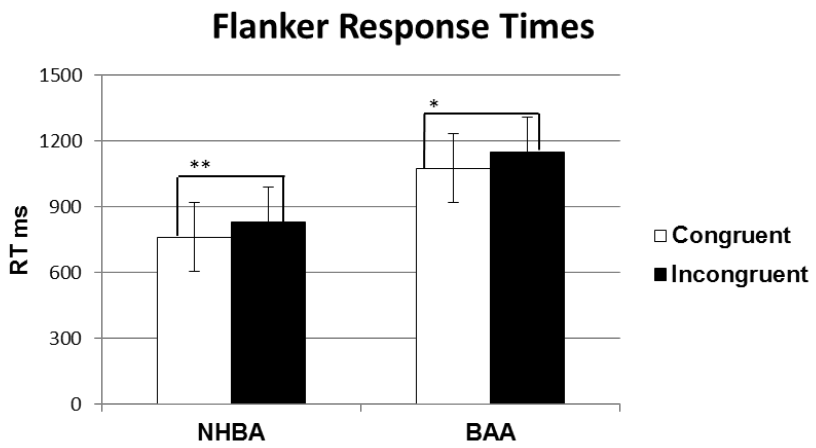


Domain Specific/
Language specific

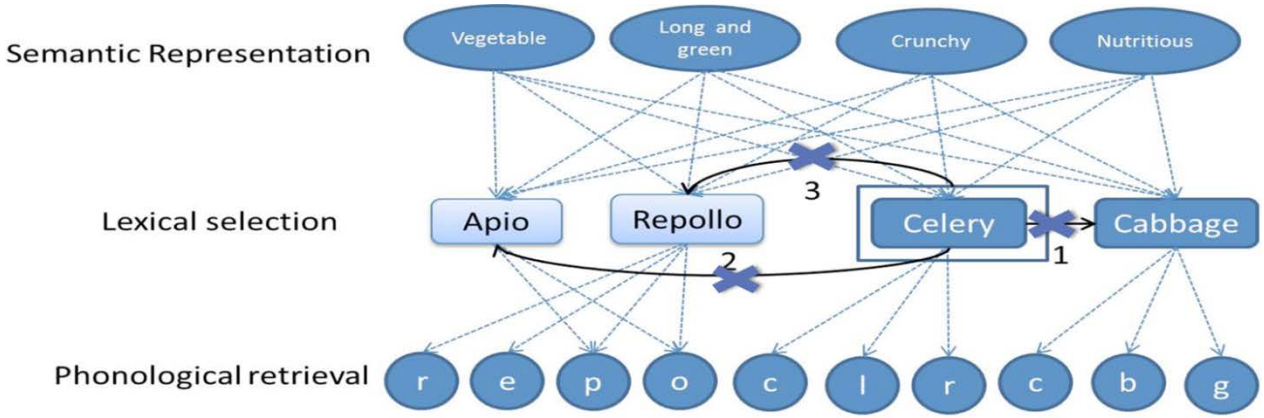
Domain General/
Resource General

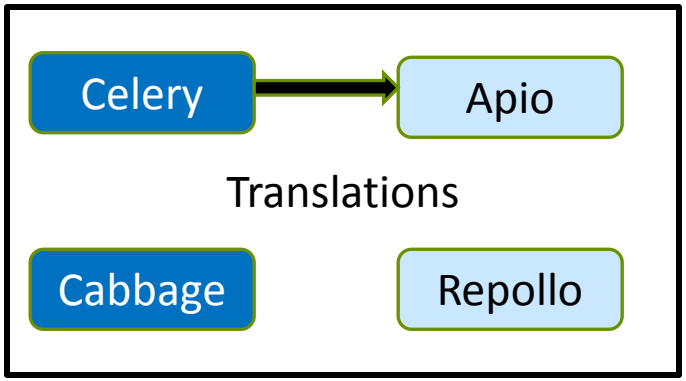


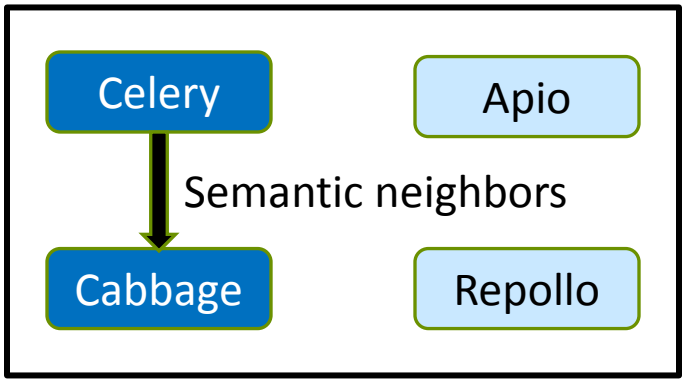


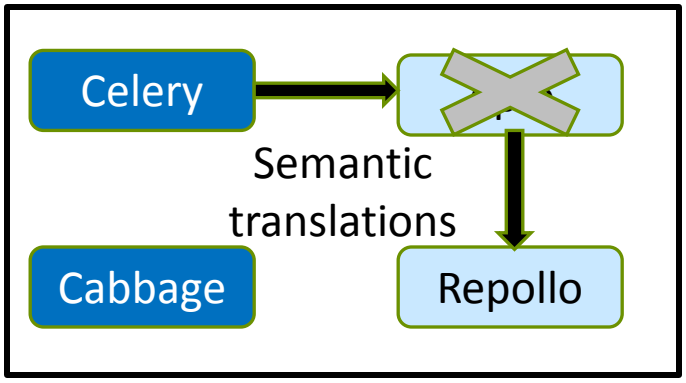


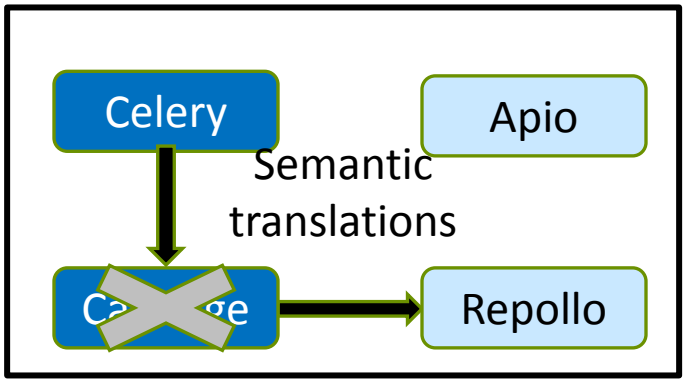
Gray & Kiran, under revision, BLC

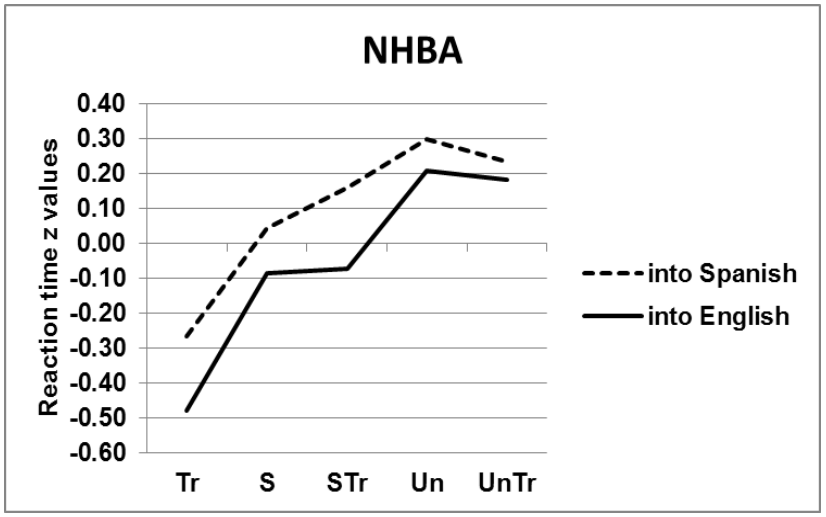

Semantic Representation
Vegetable
Long and green
Crunchy
Nutritious
Lexical selection
Apio
Repollo
Celery
Cabbage
3
2
1
Phonological retrieval
r
e
p
o
c
l
r
c
b
g


Celery
Apio
Translations
Cabbage
Repollo


Celery
Apio
Semantic neighbors
Cabbage
Repollo


Celery
Semantic translations
Cabbage
Repollo


Celery
Apio
Semantic translations
Repollo



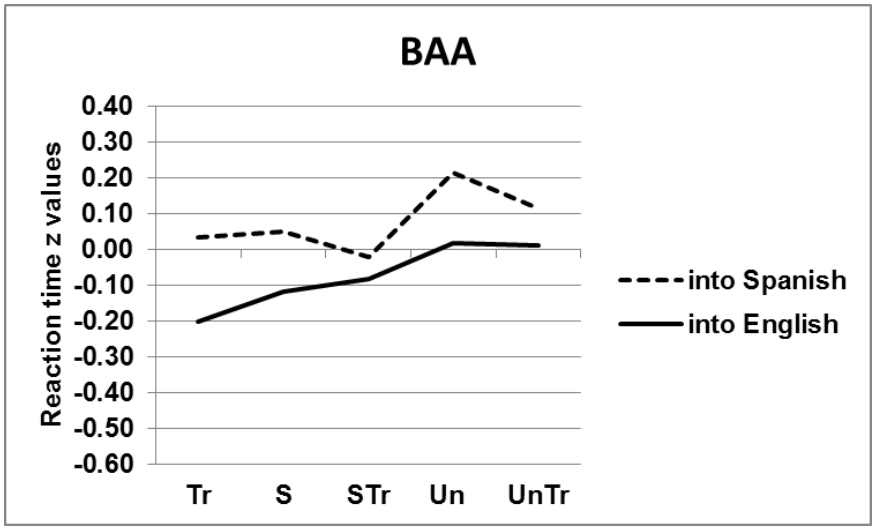


Figure 4. BAA Response Time Profiles.

a. translating into English

	fastest				*slowest*
BAA03	**Tr**	STr	Un	UnTr	**S**
BAA05	**UnTr**	Tr	Un	STr	**S**
BAA06	**STr**	S	Tr	Un	**UnTr**
BAA07	**STr**	Tr	UnTr	S	**Un**
BAA08	**STr**	Tr	UnTr	S	**Un**
BAA09	**STr**	Tr	UnTr	Un	**S**
BAA01	**Un**	S	UnTr	STr	**Tr**
BAA02	**S**	Tr	UnTr	Un	**STr**
BAA04	**STr**	S	Tr	Un	**UnTr**
BAA10	**Tr**	S	Un	STr	**UnTr**

b. translating into Spanish

	fastest				*slowest*
BAA03	**UnTr**	Un	S	Tr	**STr**
BAA05	**UnTr**	S	STr	Tr	**Un**
BAA06	**UnTr**	Tr	S	STr	**Un**
BAA07	**S**	STr	UnTr	Tr	**Un**
BAA08	**STr**	Un	S	Tr	**UnTr**
BAA09	**Tr**	S	UnTr	STr	**Un**
BAA01	**STr**	Un	Tr	S	**UnTr**
BAA02	**Tr**	STr	Un	S	**UnTr**
BAA04	**Tr**	STr	S	UnTr	**Un**
BAA10	**S**	STr	UnTr	Un	**Tr**

Note. BAA = bilingual adults with aphasia; Tr = direct translation; S = semantic; STr = semantic translation; Un = unrelated; UnTr = unrelated translation.

some BAA benefit from within-language conditions and exhibit interference from between-language conditions

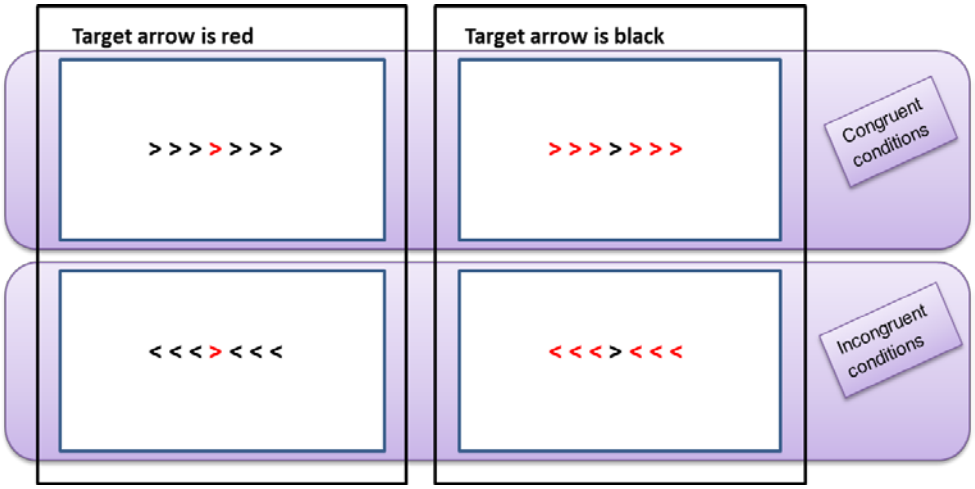
Other BAA show the opposite effect where there is facilitation from between-language conditions and no benefit from staying within-language.

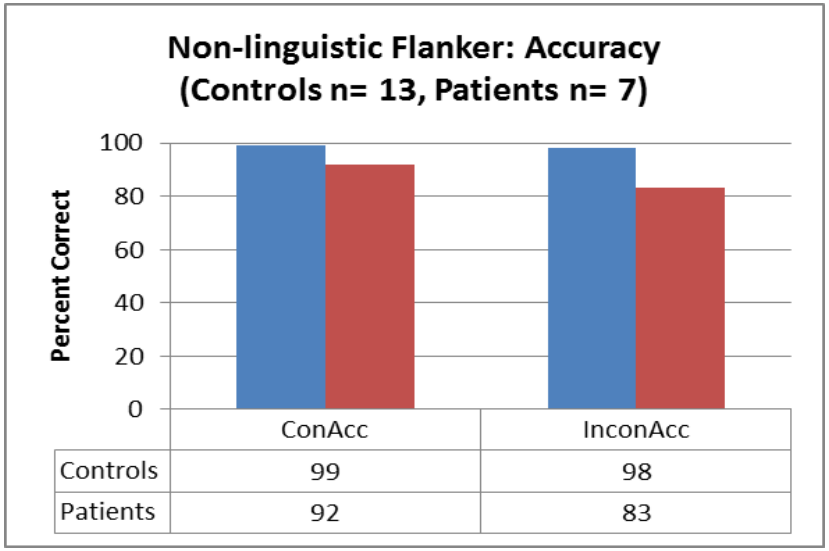
Gray & Kiran, under revision, BLC

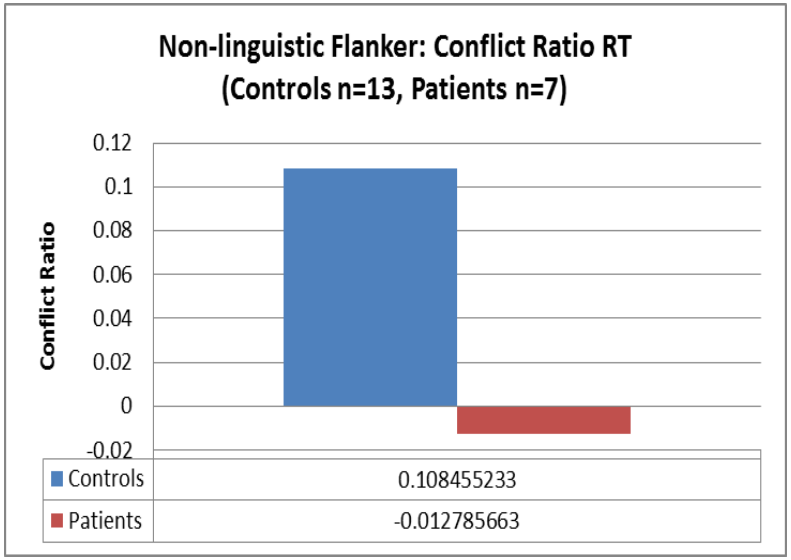
Is cognitive control and its impairment post-stroke domain general or language specific?

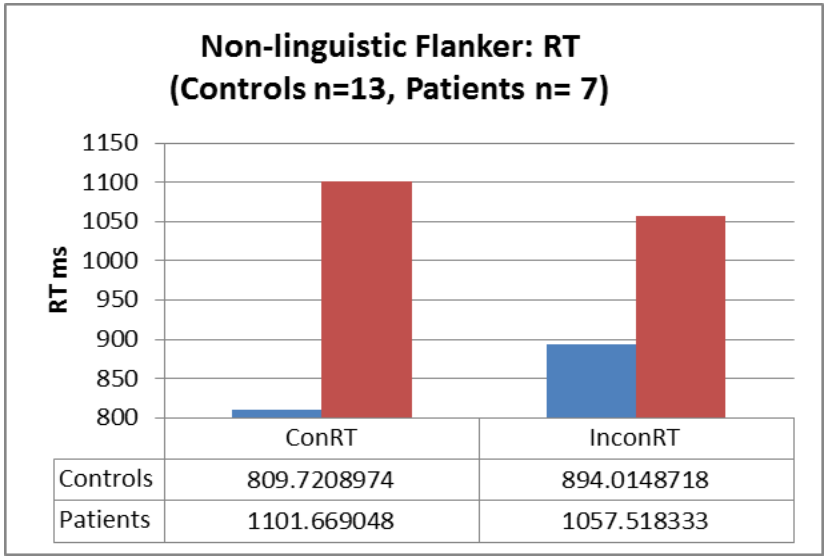
Consistent with the resource reduction theory, Hula, McNeil, & Sung, 2007; Hula & McNeil, 2008

Non-linguistic Flanker

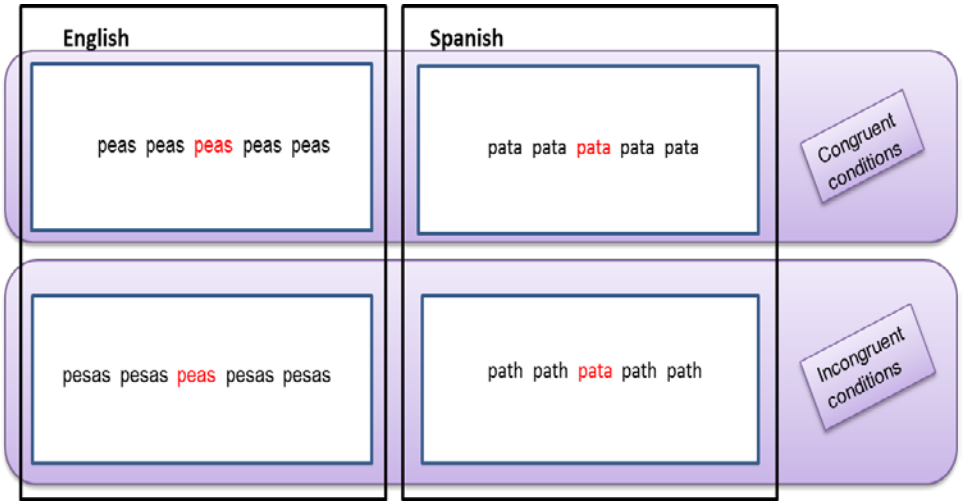


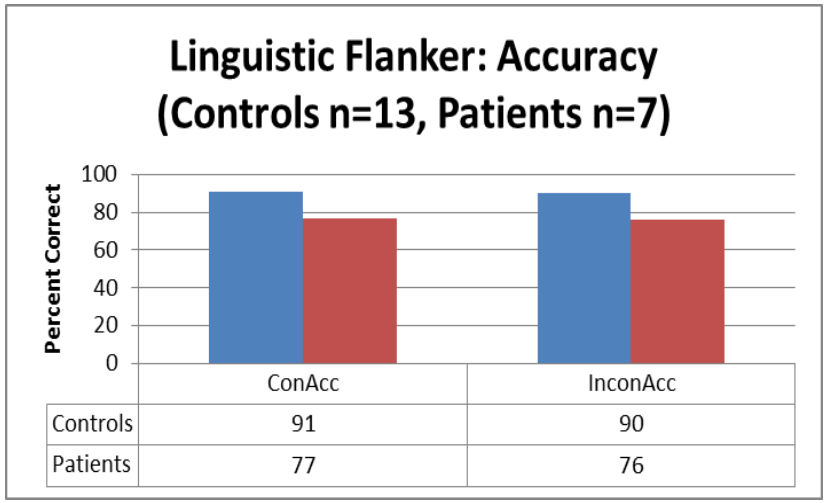




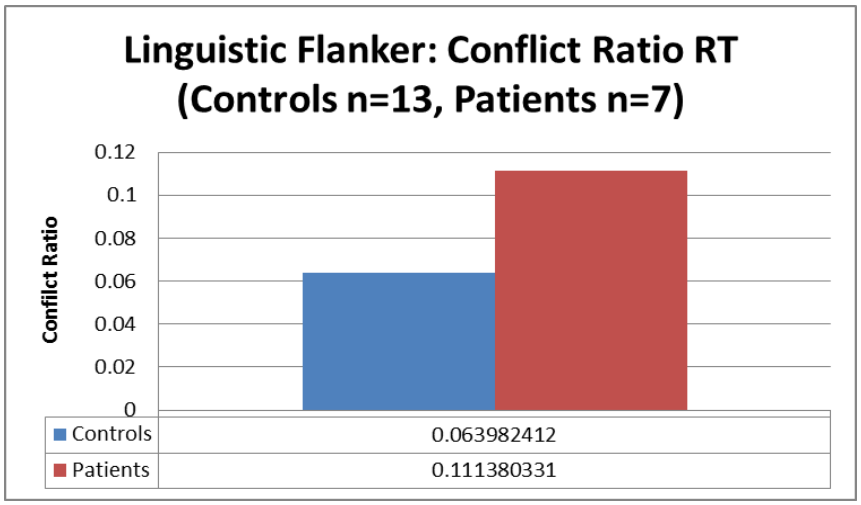


Linguistic Flanker

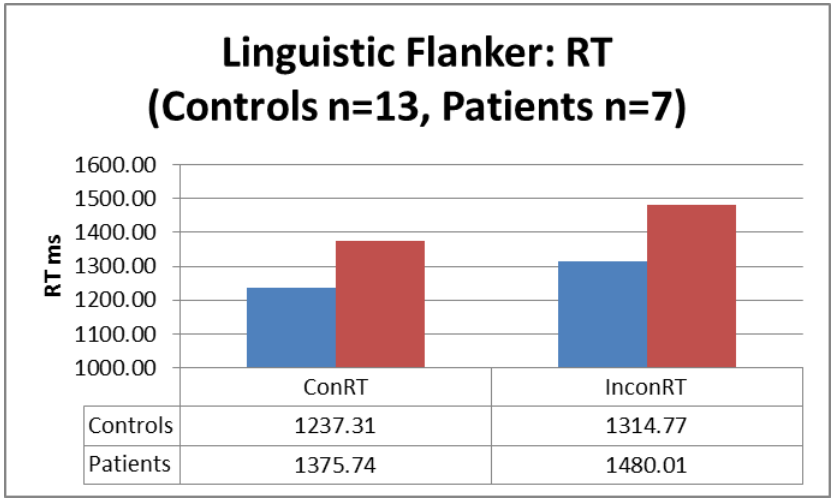




	ConAcc	InconAcc
Controls	91	90
Patients	77	76

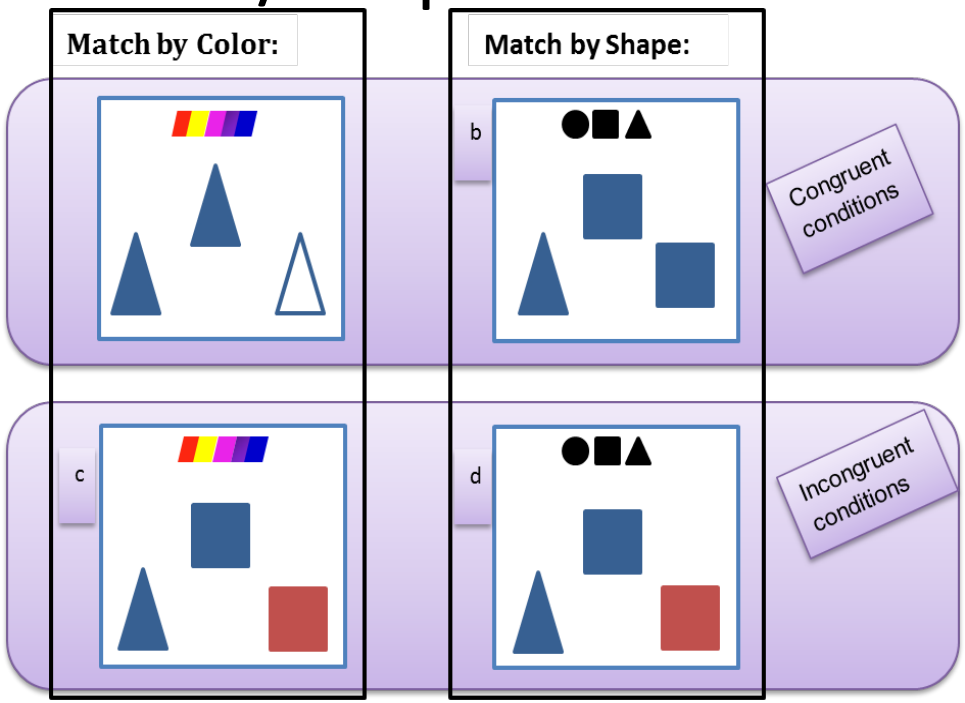


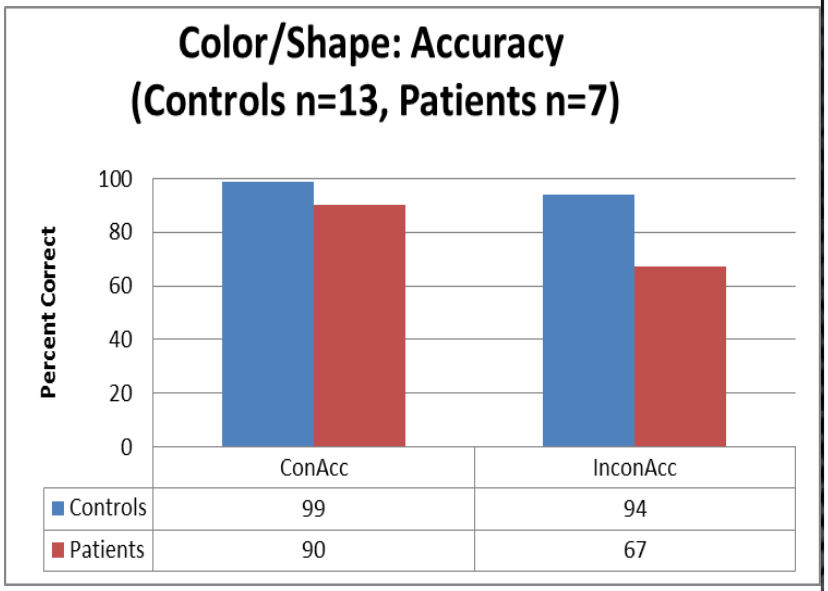
Controls	0.063982412
Patients	0.111380331

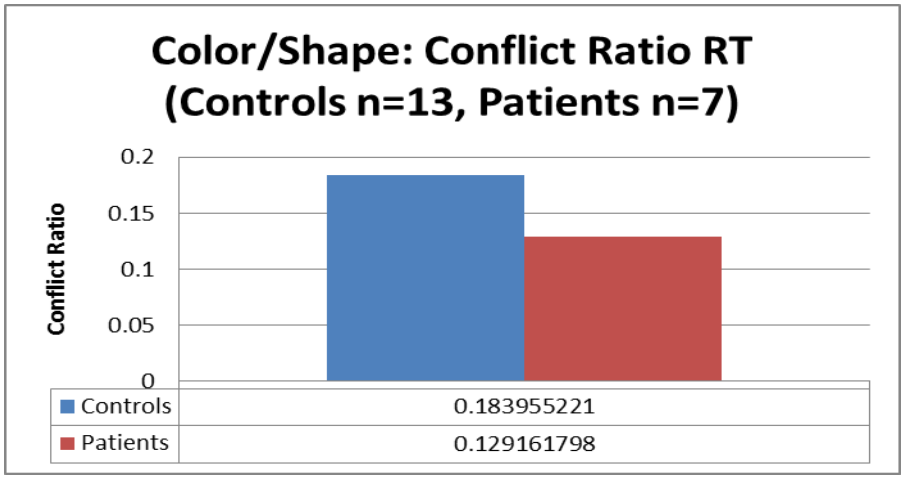


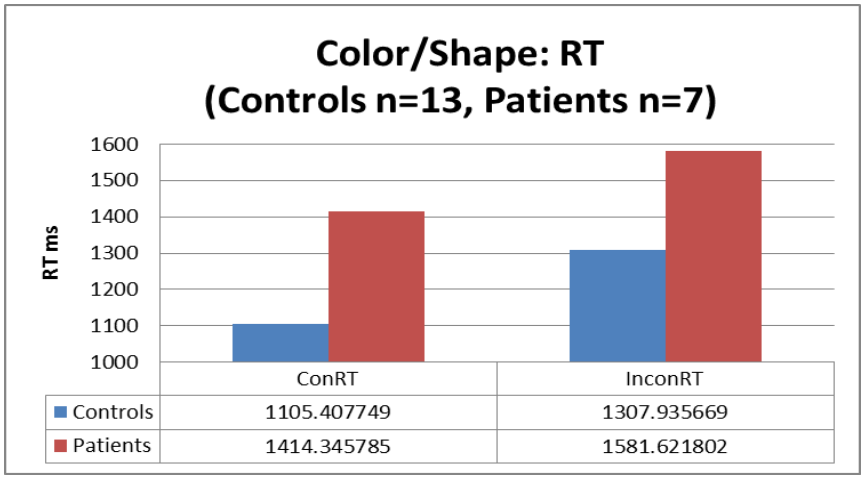
	ConRT	InconRT
Controls	1237.31	1314.77
Patients	1375.74	1480.01

Color/Shape Triad

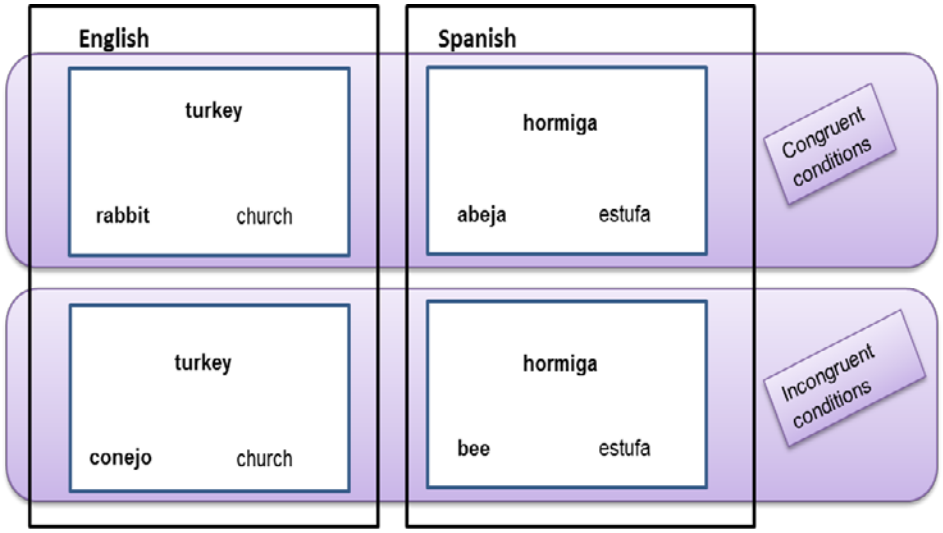




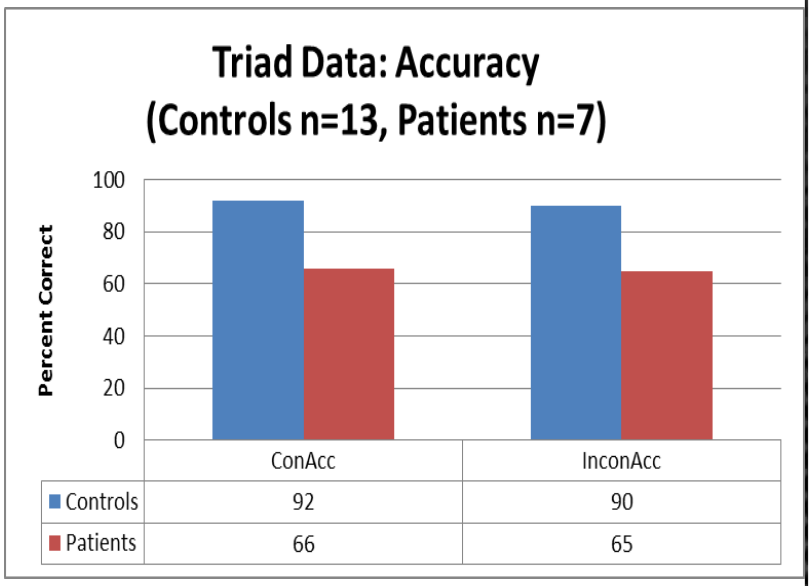


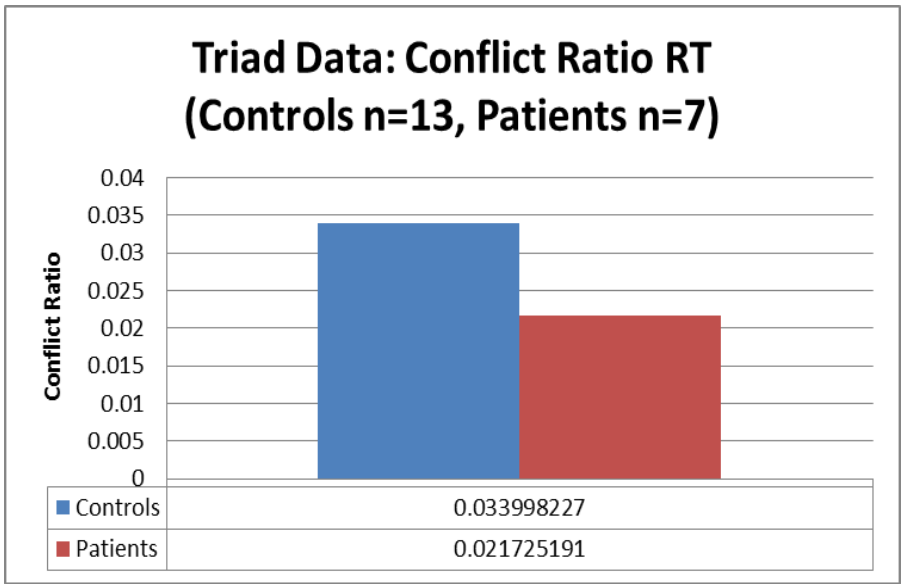


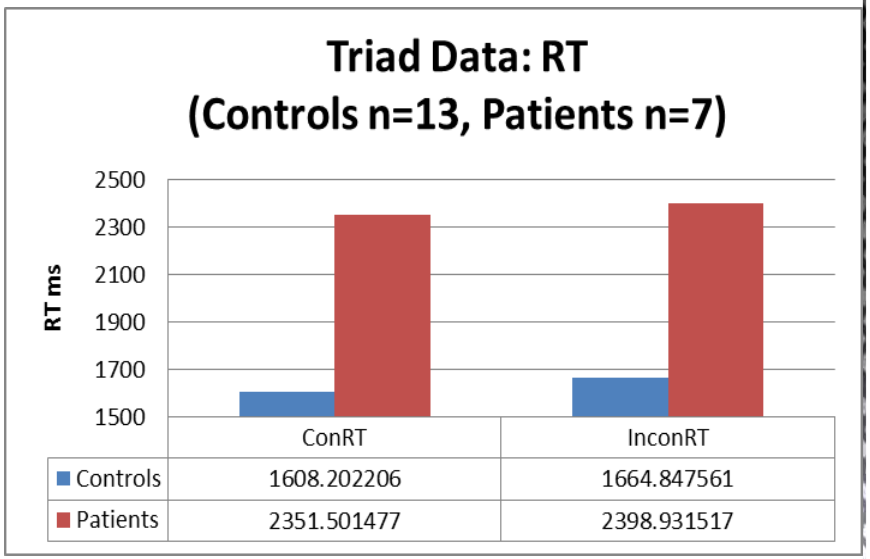
Linguistic Triad



Note: Hormiga = ant, conejo = rabbit, abeja = bee, estufa = stove, bold text = word-pair.







Conclusions

- Evidence for cognitive control deficits for stroke patients apparent in rehabilitation studies
- Not as evident in behavioral tasks
- It may be that as the task demands/resources increase, the cognitive control gets more domain general
- For tasks that require lesser task demands/resources, cognitive control may be more domain specific

- Future work
  - Examine the nature of cognitive control using a combination of imaging and behavioral tasks to see if language and cognitive networks are the same when examining the continuum between domain-specific and domain general cognitive control
  - We are also examining whether training cognitive control improves language control and vice versa

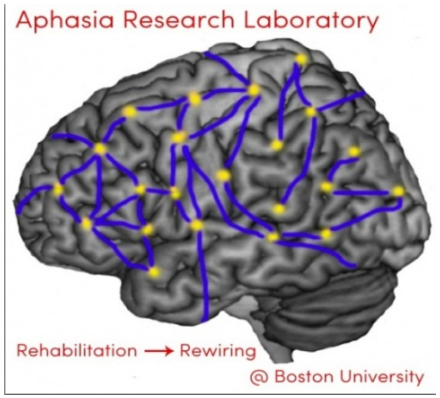
NIDCD/NIH (1K18DC011517, 1P50DC012283, 5F31DC011220-02 (Chaleece Sandberg); 1R21DC009446; 1R21/R33 DC010461-01; R03 DC 6359-01)

- Coulter Foundation for Translational Research
- ASHA foundation Clinical Research Grant
- ASHA foundation New Century Research Schola Grant

APHASIA RESEARCH LABORATORY @BU

Colleagues:

- David Caplan
- Gloria Waters
- Risto Mikkulainen
- Uli Grasemann
- Cindy Thompson/NWU lab
- Dorothee Saur
- Ellen Kester
- Pat Roberts

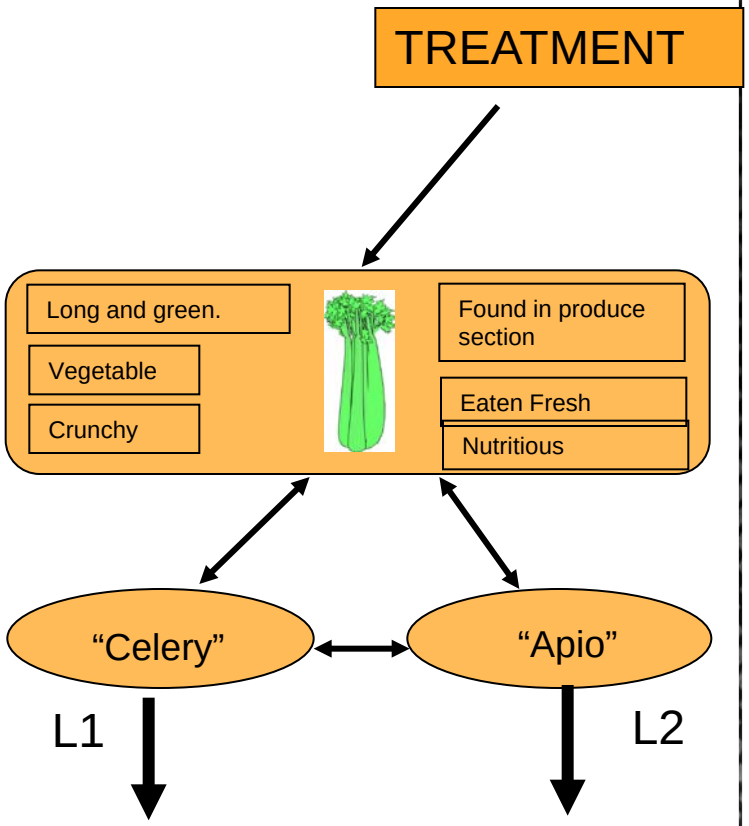


Treatment protocol in Behavioral studies

1. Name picture
2. If incorrect, told correct name
3. Choose 6 correct features from 12 cards
4. Answer 15 yes/no questions about the item
5. Named item again with feedback

- Treatment always provided only in one language (either English/Spanish) and amount of improvement examined

- Generalization (cross language transfer) examined to untrained language



Edmonds & Kiran, 2006; Kiran & Roberts, 2009