# EFFECTS OF TRAINING SENTENCE TO PICTURE MATCHING AND OBJECT MANIPULATION TO IMPROVE SENTENCE COMPREHENSION IN APHASIA: ACQUISITION AND GENERALIZATION

Swathi Kiran [1], David Caplan [1,2], Sarah Villard[1], Carrie Des Roches[1], Elsa Ascenso[1], & Gloria Waters[1]

[1] Speech and Hearing Sciences, Boston University, [2] Neuropsychology Laboratory, Massachusetts General Hospital

## INTRODUCTION

➢ In a previous study (Kiran, Caplan, et al., 2012), two treatments, one based on sentence to picture matching (SPM) and the other based on object manipulation (OM), that train patients on the relationship between syntactic structure and the meanings of sentences were developed.

➢ We found the treatment to be effective in improving sentence comprehension of trained structures in fifteen patients with aphasia.
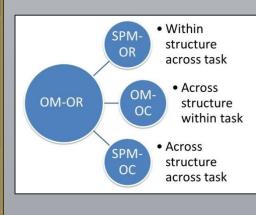
➢ More patients improved on the OM task than SPM task.

## OBJECTIVES

➢ In this study, we compare acquisition of trained structures and generalization to untrained structures and tasks across the two treatment approaches (SPM/OM).

➢ Cross structure and cross task generalization is examined

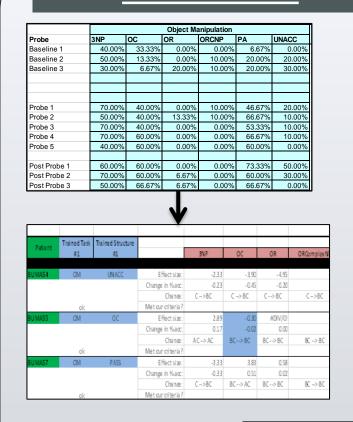➢ We also examine effects of treatment on a broader array of sentences.

## METHODS

➢ N = 19 persons with aphasia

➢ Participants were identified on the basis of two screening tests for syntactic comprehension (SPM & OM) with sentence structures ranging from object relative to active sentences.

➢ A single subject multiple baseline design with order of task and structure counterbalanced across participants.

➢ Sentence comprehension was trained on the affected sentence type in one task-related protocol generalization was examined to other structures.
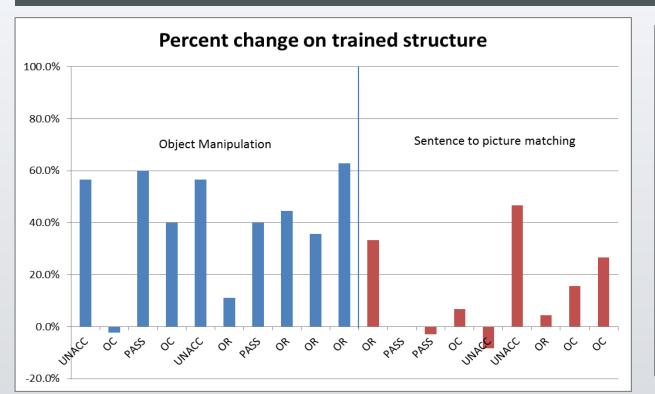
| OM | SPM |
|---|---|
| Object Relative | Object Relative |
| Object Cleft | Object Cleft |
| Passive | Passive |
| Unaccusative | Unaccusative |
| ORCNP | ORCNP |
| 3NP | 3NP |


- Within structure across task
- Across structure within task
- Across structure across task

## DATA ANALYSIS
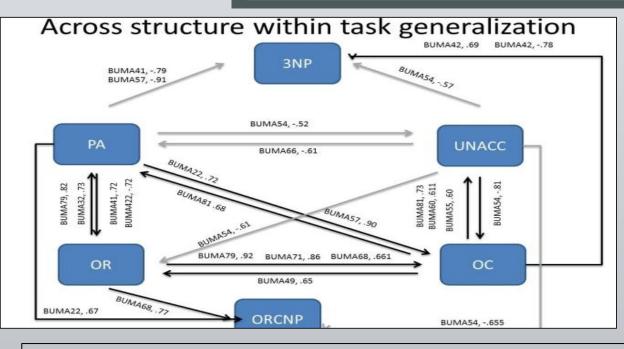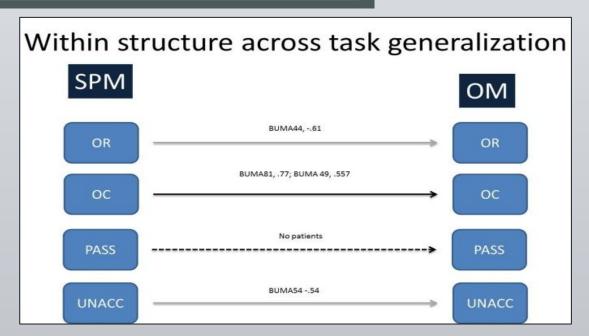


## RESULT 1: Which treatment is more effective (Tx Data)


Percent change on trained structure

- All patients improve as a function of treatment (p= 8.2E-05)

- OM treatment more effective than SPM (NS for effect size, but significant for % change (p= 0.00917)

## RESULT 2: Generalization to untrained structures and tasks (Tx Data )


Across structure within task generalization


Within structure across task generalization
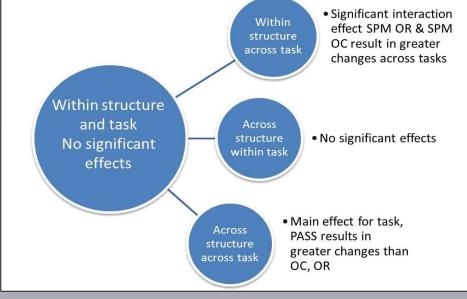
- Across structure within task generalization: Between OR <-> OC, OR <-> PASS, PASS <-> OC, OC -> UNACC.
- Within structure across task generalization: From SPM OC -> OM OC

## RESULT 3: Generalization to untrained sentence types (Screener Task)



| BUMA54 OM-UNACC / SPM-PA | pre-tx | | post-tx | |
|---|---|---|---|---|
| | SPM | OM | SPM | OM |
| TOTAL | 46.4% | 30.9% | 41.8% | 29.1% |
| 3NP | 60.0% | 20.0% | 0.0% | 20.0% |
| active | 40.0% | 70.0% | 70.0% | 40.0% |
| raising NP | 50.0% | 30.0% | 40.0% | 70.0% |
| object cleft | 40.0% | 50.0% | 40.0% | 40.0% |
| object control | 60.0% | 20.0% | 60.0% | 10.0% |
| object relative | 40.0% | 20.0% | 50.0% | 0.0% |
| OR complex NP | 40.0% | 0.0% | 20.0% | 0.0% |
| passive | 50.0% | 50.0% | 60.0% | 20.0% |
| pronoun | 70.0% | 30.0% | 60.0% | 30.0% |
| reflexive | 30.0% | 0.0% | 10.0% | 0.0% |
| subject control | 40.0% | 60.0% | 50.0% | 50.0% |
| unaccusative | 40.0% | 0.0% | 40.0% | 50.0% |

| BUMA55 OM-OC / SPM-OR | pre-tx | | post-tx | |
|---|---|---|---|---|
| | SPM | OM | SPM | OM |
| TOTAL | 60.9% | 47.3% | 68.2% | 54.5% |
| 3NP | 80.0% | 100.0% | 80.0% | 100.0% |
| active | 90.0% | 80.0% | 100.0% | 90.0% |
| raising NP | 50.0% | 30.0% | 40.0% | 20.0% |
| object cleft | 40.0% | 20.0% | 20.0% | 10.0% |
| object control | 50.0% | 0.0% | 70.0% | 80.0% |
| object relative | 40.0% | 20.0% | 40.0% | 0.0% |
| OR complex NP | 40.0% | 20.0% | 80.0% | 0.0% |
| passive | 100.0% | 50.0% | 80.0% | 70.0% |
| pronoun | 50.0% | 20.0% | 90.0% | 70.0% |
| reflexive | 100.0% | 40.0% | 100.0% | 90.0% |
| subject control | 20.0% | 30.0% | 30.0% | 10.0% |
| unaccusative | 70.0% | 100.0% | 100.0% | 100.0% |

Patients improved on their respective trained structures from pre-tx to post-tx screeners: (T=4.276, p<.001)


- Significant interaction effect SPM OR & SPM OC result in greater changes across tasks
- No significant effects
- Main effect for task, PASS results in greater changes than OC, OR

1. Greater changes from SPM to OM
2. Greater effects of treatment PASS to OC and OR

PCA analysis (24 structures) Factors 1-5 explain 65% of variance

- Factor #1: OMobjectcleft, OMpassive, OMpronoun (OM simple noncanonical)
- Factor #2: OM-3NP, OM-active, OM-objectcontrol, OM-subjectcontrol (OM canonical)
- Factor #3: SPM passive
- Factor #4: OM-objectrelative, OM-ORCNP (OM most complex)
- Factor #5: SPM pronoun
- Factor #6: SPM reflexive
- Factor #7: SPM3NP, SPMORCNP, OMreflexive
- Factor #8: SPMactive
- Factor #9: OMraisingNP

Factor analysis on percent change: subcomponents reveal similarity in structure

## CONCLUSIONS

- 19 patients underwent treatment.
  - 10 received OM treatment, 9 received SPM
- Patients improve as a function of treatment although OM appeared to be more successful than SPM training.
  - Differences emerge between the two tasks (Salis & Edwards, 2009)
- Across structure with task generalization
  - Between OR <-> OC, OR <-> PASS, PASS <-> OC, OC -> UNACC
  - Between different structures
- Within structure across task generalization
  - No generalization from OM -> SPM
  - From SPM -> OM, for OC only.
- Generalization to untrained structures on post-pre screener task
  - Results support the monitoring generalization effects
  - Training SPM results in greater cross task generalization than OM
- Factor analysis reveals 9 components with eigenvalues > 1 and with significant correlations among components.
  - Of these Factors 1-5 explain 65% of the variance
  - Factors reveal structures with similar structure and movement tend to change together as a function of treatment

## REFERENCES

Kiran, S., Caplan, D., Sandberg, C., Levy, J., Berardino, A., Ascenso, E., Villard, S., & Tripodis, Y. (2012). Development of a Theoretically Based Treatment for Sentence Comprehension Deficits in Individuals With Aphasia. American Journal of Speech Language Pathology, 21(2), S88-102. PMC3348417.

Salis C., & Edwards, S. (2009). Tests of syntactic comprehension in aphasia: An investigation of task effects. Aphasiology, 23, 1215-1230.

## ACNKOWLEDGEMENT & CONTACT