

# A Test of Constraint-Induced Therapy for Aphasia: Verb Production



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## Key References

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## Appendix

### Treated Verbs

#### Optional 2-place

bite  
drink  
eat  
juggle  
paint  
shave  
watch

#### Obligatory 2-place

brush  
chop  
close  
cover  
dry  
fold  
kick  
open  
pinch  
sharpen  
shine  
Stir  
weigh

### Untreated Verbs

#### Obligatory 1-place

crawl  
cry  
dive  
hop  
laugh  
pray  
sit  
sleep  
smile  
snore  
Optional 2-place  
climb  
shoot  
stop

#### Obligatory 2-place

catch  
erase  
lick  
light  
measure  
scare  
tickle

#### Optional 3-place

deliver  
drop  
hang  
lift  
pick  
pour  
read  
sew  
spill  
throw

- Constraint-Induced (CI) Movement Therapy was developed for improving function in paretic limbs<sup>1</sup>. CI principles have been applied to aphasia therapy<sup>2</sup> with reported success. Three principles of CI therapy are

1. constraining the client to use only the impaired system
2. intensive practice over a short period and
3. use of therapy activities that are relevant to everyday life.

- This study tested the efficacy of CI therapy for impaired verb production in agrammatic aphasia. Impaired access to verbs may be a factor in sentence production deficits<sup>3,4</sup>. Models of sentence production and lexical access emphasize the role of the verb in assigning lexical items to positions in the syntactic frame, supporting a connection between verb retrieval and sentence production deficits<sup>5,6</sup>.
- Studies targeting verb production in Broca's aphasia<sup>7,8</sup> have reported mixed results on generalization to sentence production. Other studies targeting the sentence level<sup>9,10</sup> have not shown clear generalization to comprehension or narrative language.
- *Verb production was treated using CI therapy and generalization to sentence production, narrative, and sentence comprehension was tested. This intensive treatment should facilitate access to the lexical representation for trained verbs, including the verbs' argument structure, thematic role, and subcategorization frame properties. This may facilitate sentence production.*

## Participant (P1)

- Female, 35 yrs, right-handed, university education
- Left hemisphere CVA, 2 partial temporal lobe resections for epilepsy
- Right central facial paresis and hemiparesis, right homonymous hemianopia, external rotation of left eye

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### Western Aphasia Battery

Aphasia Quotient	48.7
Fluency	4.0
Comprehension	6.3
Repetition	4.8
Naming	4.3

### Northwestern University Verb Production Battery for Aphasia

Comprehension	90%
Confrontation Naming	27%

### Apraxia Battery for Adults-2

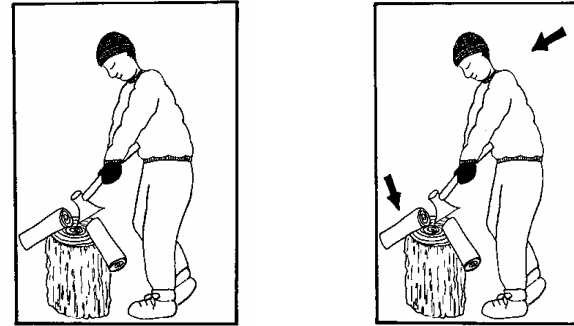
Moderate-severe apraxia of speech
Moderate oral apraxia

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## Stimuli

Set 1: 50 B&W line drawings of 1-, 2-, and 3-place verbs

Set 2: same 50 pictures, arrows to arguments to elicit sentences  
Verbs controlled for frequency of occurrence, length, pictureability



## Primary Dependent Variables

1. naming accuracy (any morphological form)
2. naming latency (msec)
3. accuracy in production of target verb and arguments in a sentence

## Design and Treatment

Single subject multiple baselines design across behaviors

Three baseline tests

- naming the action for each picture in Set 1
- generating a sentence for each picture in Set 2

A cued sentence production condition using Set 2 was administered during Baseline 3 - the written form of the verb was provided

Ten treatment sessions were 3 hrs a day, 5 days a week, for 2 weeks

## Treatment

- Twenty 2-place verbs trained
- Tasks: repetition followed by picture naming, reading aloud, barrier tasks, and word-to-picture matching, in random order
- Each verb was elicited 11-17 times a session. Use of 3rd person singular inflection was encouraged.

## Probes

- Acquisition of the 20 trained 2-place verbs was measured at the beginning of every session
- Experimental probes, identical to baseline, were given after the 5th and 10th treatment session to measure generalization to untrained verbs and sentence production. Cued sentence production was probed after the 10th therapy session only.
- Maintenance was tested 1 and 6 weeks post-treatment
- Generalization to sentence comprehension and narrative production was tested 1 week post-treatment

**Hypothesis 1:** CI therapy principles will increase accuracy and speed of verb production for trained 1-place verbs, but not untrained 1-, 2-, and 3-place verbs

**Findings:** ✓ Accuracy for trained verbs improved  
 ? Median latency was decreasing, but > normal level

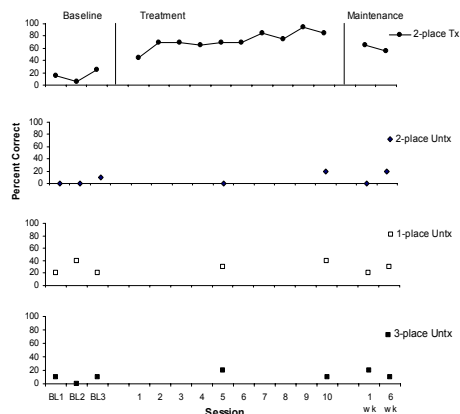


Figure 1. Acquisition, generalization, and maintenance of trained (Tx) and untrained (Untx) verb production

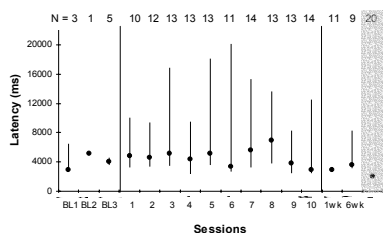


Figure 2. Median latency of naming responses for trained 2-place verbs. Error bars show the first and third quartiles. Grey bar represents healthy control subjects

**Hypothesis 2:** CI therapy principles will generalize to improved sentence production with trained verbs, but not untrained verbs

**Findings:** ✗ No improvement in correct sentence production with 0% correct pre- and post-treatment  
 Error analyses revealed slight changes

Grammatical Function	BL1	BL2	BL3	Probe 1	Probe 2	1wk maint.	6wk maint.
Subj. verbal	0	0	1	1	0	3	0
Obj. verbal	1	0	2	2	2	1	4
Subj+Obj verbal	0	0	0	0	1	0	0
Subj. fingerspelled	0	0	0	0	7	10	0
Subj. fingerspelled	0	0	0	0	1	0	0
Subj+Obj fingerspelled	0	0	0	0	2	2	0

**Hypothesis 3:** CI therapy principles will not generalize to active sentence comprehension or narrative production

**Findings:** ✓ Comprehension of active semantically reversible sentences was at-chance pre- and post- treatment  
 ✓ No generalization to narrative production (see table)

Linguistic variables	Pre	Post	F/Up	Normal	
				M	SD
Number of utterances	45	76	56	23.6	(7.1)
Number of sentences	6	8	7	---	---
Mean length of utterance in morphemes	2.33	1.88	2.23	14.5	(2.2)
Number of bound morphemes produced	1	11	3	---	---
% grammatical sentences/ total sentences	17	25	14	90	(8)
% simple sentences/ total sentences	100	75	71	43	(17)
% formulaic sentences/ total utterances	31	45	48	---	---
% nonsentences/ total utterances	42	39	30	---	---
Open : closed class words	2.43	1.12	2.00	0.91	(0.1)
Noun : verb ratio	3.33	2.0	2.75	1.21	(0.3)
Total verbs produced	6	5	4	---	---
% of verb types used:					
-Copula	67	80	25	12	(3)
-Obligatory 1 place	17	20	0	10	(4)
-Obligatory 2 place	0	0	25	17	(3)
-Optional 2 place	17	0	50	17	(4)

## Conclusions

Positive effects were

- ↑ accuracy, and possibly speed, of production for trained verbs
- Maintenance of the treatment effect
- Some change in sentence production ability using trained verbs

Several factors may have contributed to the minimal generalization of treatment effects to sentence production

- insufficient time in therapy
- ↑ verb naming latency - verb production may need to be more automatic before generalization to sentence production will occur
- a lexical retrieval deficit for nouns
- concomitant motor speech deficits

CI therapy may not be feasible for some individuals

- CI Movement Therapy currently is not recommended for individuals with severe impairment
- P1 has a severe speech and language production impairment. She was unwilling to abandon a successful augmentative system of finger-spelling and had low tolerance for the intensive format