Effect of Chinese Verb Network Strengthening Treatment (VNeST) in Mandarin-English Bilinguals with Aphasia

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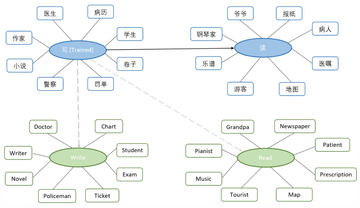
Introduction

- *Bilingual aphasia:* the loss of skills in one or both languages due to brain injury (e.g., stroke, TBI, etc.).
- Challenges in bilingual aphasia treatment:
  - Clinicians do not always speak both languages that a patient speaks
  - Most prior research has focused on Indo-European languages (e.g., Edmonds & Kiran, 2006)
- Cross-language generalization: mixed findings (Kohnert, 2009).
- Limited models in bilingual verb access.
- *Verb Network Strengthening Treatment* (VNeST; Edmonds et al., 2009; Edmonds & Babb, 2011)

Figure 1. Schema of hypothesized mechanism of VNeST treatment in Mandarin-English Bilinguals with Aphasia.



Current Study

To adapt VNeST in Mandarin Chinese, and investigate whether training in Chinese VNeST will:

1) Improve lexical retrieval of trained items
2) Generalize to untrained items in the trained language (within-language)
3) Generalize to the untrained language (cross-language)
4) Generalize to other standardized language tasks
5) Change speech error patterns over time

Methods

Participants

Pt	Aphasia Type	AOS	Sex	Age (yrs)	Edu (yrs)	MPO	Handed-ness before stroke	L2 AoA (yrs)	Proficiency (%)		Language Use (%)	
									CH	EN	CH	EN
1	Broca	Moderate	F	73	18	86	R	16	100	100	4	96
2	Anomic	N/A	M	71	20	140	R	10	100	100	33	67

AOS: Apraxia of Speech; MPO: months post onset; R: Right; AoA: age of acquisition; CH: Chinese; EN: English

Standardized Language Assessments

Chinese Assessments		P1	P2	English Assessments		P1	P2
ABC AQ		38.2	80.8	WAB AQ		52.6	89.9
BNT (30)		2	21	BNT (60)		8	47
Connected Speech (picnic scene)	Total # of Utterance/MLU	3/2.7	6/9	Connected Speech (picnic scene)	Total # of Utterance/MLU	11/2.3	5/7.4
	% CIU/CIU per min	60/5	89/48		% CIU/CIU per min	68/8	94/60
	% complete utterance	0	83		% complete utterance	0	100
NAVS (VNT + ASPT Total)		N/A	N/A	NAVS (VNT + ASPT Total)		12	44
CLQT (composite)		N/A	N/A	CLQT (composite)		2.6	3.2

ABC AQ: Aphasia Battery in Chinese Aphasia Quotient (Gao, 1993); WAB AQ: Western Aphasia Battery-R Aphasia Quotient (Kertesz, 2006); BNT: Boston Naming Test (Kaplan et al., 2001; Chen et al., 2014); NAVS: Northwestern Assessment of Verbs and Sentences (Thompson, 2011); VNT: Verb Naming Test; ASPT: Argument Structure Production Test; CLQT: Cognitive Linguistic Quick Test (Helm-Estabrooks, 2001); MLU: mean length of utterance; CIU: content information unit.

Treatment Protocol (Over Video-Conference)

Baseline	Treatment	Post-treatment	Maintenance
○ *Standardized Assessment* ○ *3 probe sessions (CH, EN)*	○ *2 hours / session; 2 sessions / week over 10 weeks* ○ *Probe per session*	○ *Standardized Assessment* ○ *3 probe sessions (CH, EN)*	○ *One month post-treatment* ○ *1 probe session*

Treatment Stimuli

- 18 pairs of semantically-related, single-character, transitive Chinese verbs
- Matched for: *word frequency, imageability, familiarity, number of characters/syllables* (Coltheart 1981; Liu et al., 2007).

Set 1	Set 2
扔 (throw)	接 (catch)
量 (measure)	称 (weigh)
吃 (eat)	喝 (drink)
举 (lift)	拎 (carry)
拉 (pull)	推 (push)

Probe Tasks

Sentence task *n* = 36

宝宝喝牛奶/ baby drink milk

Control task *n* = 10

球在盒子里/ ball in box

Treatment Steps

Step 1: Generate scenarios around the target verb

Step 2: Participants read the triads aloud

Step 3: Expand one scenario with *wh*-questions (*i.e.,* when, why, where)

Step 4: Make semantic judgments on sentences

Step 5: Produce target verb independently

Step 6: Repeat Step 1 without providing cues

Treatment Fidelity Check
- Conducted by 2nd author
- 25% of treatment protocol (P1: 94%; P2: 100%)
- 25% of probe response accuracy (P1: 99%; P2: 94%)

Scoring for correct response
- Correct agent, verb, and patient
- One phonemic error per lexical item
- Appropriate alternative agent/patient
- One prompt for general word (*e.g.,* woman, man)

Data Analysis

Treatment Outcomes

- Logistic regression (P1); Logistic mixed-effects model (P2)
- Dependent variable: response accuracy (0, 1)
- Independent variables:
  - Sentence conditions: Chinese trained, Chinese untrained, English trained, English untrained, Chinese control, English control
  - Number of probe sessions
  - Session-by-condition interaction
- Random intercept: probe items
- Treatment effect sizes (ES): $d = (M_2 - M_1)/\sigma_1$ (if pre-treatment was 0, pooled SD from the trained and untrained scores was used)
  - Pre- to post-treatment
  - Pre-treatment to maintenance

Error Analysis

Error coding: 1) Phonological; 2) Semantic; 3) Morphosyntactic; 4) Neologism; 5) Lexical; 6) No response (NR); 7) Cross-language.

Statistical analysis:

	Poisson mixed-effects model	Linear mixed-effects model
Dependent Variable	Count of speech errors (non-NRs)	Rating scores (rating scale)
Independent Variables	Session, Type of errors, Sentence condition, Session-by-type, Session-by-condition	Session, Sentence condition, Session-by-condition
Random Structure	Items	Items

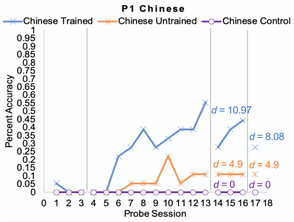
Connected speech

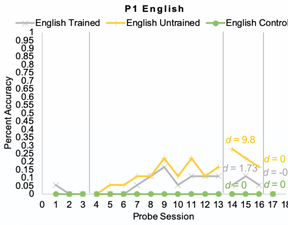
- % CIU and CIUs/minute (Nicholas & Brookshire, 1993)
- Total number of utterances; mean length of utterances
- % of complete utterance (+ complete, + relevance)

Results

Treatment outcomes:

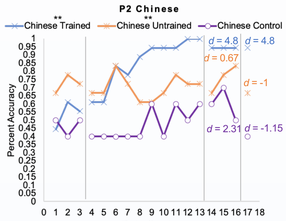
ES (*d*) benchmarks (Edmonds et al., 2014) *Trained:* 2.3 (small), 3.7 (medium), 5.5 (large); *Generalizations:* 1.2 (small), 1.7 (medium), 3.3 (large); ** = $p < .01$.

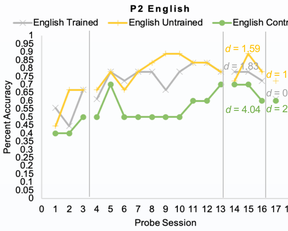




Large ES in Chinese Trained and Untrained (pre to post; pre to maintenance).

Medium ES in English Trained, large ES in English Untrained (pre to post).





Significant main effect in Trained, Untrained; significant session-by-condition interaction in Trained. Medium ES in Chinese Trained and Control (pre to post); Medium ES in Chinese Trained (pre to maintenance).

Medium ES in English Trained, small ES in English Untrained, large ES in English Control (pre to post); Medium ES in English Control (pre to maintenance).

Pre- and Post-treatment language measures:

CS: Connected Speech; ABC: Aphasia Battery of Chinese; AQ: Aphasia Quotient; BNT: Boston Naming Test; NAVS: Northwestern Assessment of Verbs and Sentences; VNT: Verb Naming Test; ASPT: Argument Structure Production Test; CLQT: Cognitive Linguistic Quick Test; MLU: mean length of utterance; CIU: content information unit.

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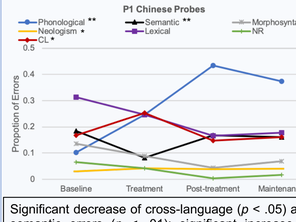
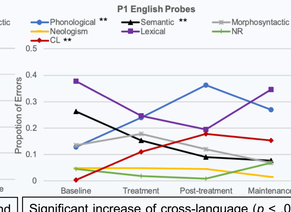
CLQT (composite)		N/A	N/A	N/A	N/A	CLQT (composite)		2.6	3.2	3.2	3.8

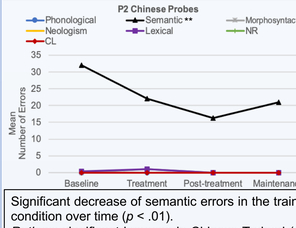
Error Analysis: ** = $p < .01$, * = $p < .05$

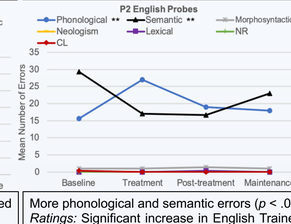




Significant decrease of cross-language ($p < .05$) and semantic errors ($p < .01$); significant increase of neologistic ($p < .05$) and phonological errors ($p < .01$). *Ratings:* significant increase in Chinese Untrained ($p < .05$).

Significant increase of cross-language ($p < .01$) and phonological errors ($p < .01$); significant decrease of semantic errors ($p < .01$).





Significant decrease of semantic errors in the trained condition over time ($p < .01$). *Ratings:* significant increase in Chinese Trained ($p < .01$).

More phonological and semantic errors ($p < .01$). *Ratings:* Significant increase in English Trained ($p < .05$).

Discussions & Future Directions

- Training Chinese verbs in sentence context generalized to untrained semantically-related verbs in Chinese (Edmonds et al., 2009).
- Training Chinese verbs in sentence context improved verb retrieval in English, which was the untrained language.
- Both patients improved in other standardized language measures, in both Chinese and English.
- Increase of cross-language errors in P1's untrained language.
- Decrease of semantic errors over time; Change from more severe to less severe speech errors over time in both Chinese and English.
- Effective in patients with different aphasia severities (Edmonds & Babb, 2011).
- VNeST can be delivered online via video-conference.

Selected References

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Acknowledgments

Study participants; Maria Varkanitsa from the BU Aphasia Research Laboratory for helping with drawing the probe stimuli.
This work was funded by NIH/NIDCD 1U01DC014922 (PI: Dr. Swathi Kiran). This presentation was supported by 2019 NIDCD R13 conference grant awarded to the Academy of Aphasia (PI: Dr. Swathi Kiran).

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