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**Constraint Induced Language Therapy for
Aphasia**

Presented By:
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Moderated By:
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Live Expert eSeminar

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EARNING CEUS

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• **Contact:** Amy Natho at
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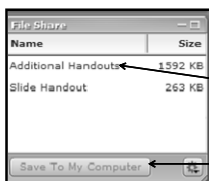


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*Constraint Induced Language Therapy
for Aphasia*

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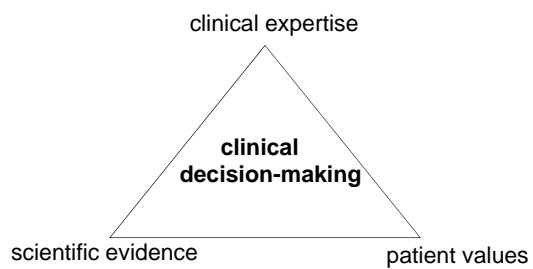
Acknowledgments:

Leora Cherney, Rehabilitation Institute of Chicago

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Tobi Frymark, Tracy Schooling, & Rob Mullen, American
Speech-Language-Hearing Association

Principles of Evidence Based Practice
(Sackett et al., 2000)



Evidence resources

Academy of Neurologic Communication Disorders and Sciences (ANCDS)
www.ancds.org

ASHA Compendium of Clinical Practice Guidelines and Systematic
Reviews www.asha.org/members/ebp
(Current 'ASHA Guidelines' documents are not 'Practice Guidelines')

Evidence-Based Review of Stroke Rehabilitation
(Teasell et al.) www.ebrsr.com

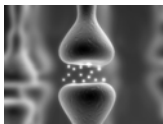
Psychological Database for Brain Impairment Treatment Efficacy
www.psycbite.com

Cochrane Reviews www.cochrane.org

Experience-dependent Neuroplasticity

An enriched experience changes the brain
(Rosenzweig & Bennett 1996; Petrosini et al., 2009)

We must understand ways to amplify the experiences in therapy to *maximize*
benefits and *minimize* counterproductive effects



Principles of Neuroplasticity: Animal Models

Kleim & Jones, JSLHR 2008

- Use it or Lose it: degradation of function (and neural representation) may occur with disuse
- Use it and Improve it: training can lead to enhancement of a function (and neural correlates)
- Specificity: the nature of the training experience influences the functional changes
- Repetition Matters: much repetition necessary
- Intensity Matters: intensive training necessary

**Principles of Neuroplasticity:
Animal Models**
Kleim & Jones, JSLHR 2008

- Time Matters: differential effects over recovery
- Salience Matters: experience must be meaningful
- Age Matters: younger is better
- Transference: training of one behavior can generalize to other behaviors
- Interference: training on one behavior can impede improvement of another

		Dependent Variables: Outcome Measures					
		Acquisition	Generalization /Transference	Interference	Maintenance	Neural Effects	
Indep. Variables: Treatment Conditions	Timing						
	Intensity						
	Quantity						
	Salience						
	Treatment Variables						
	Neural Conditions						
Language Domain		Semantics	Phonology	Orthography	Morphosyntax	Pragmatics/Discourse/Social	

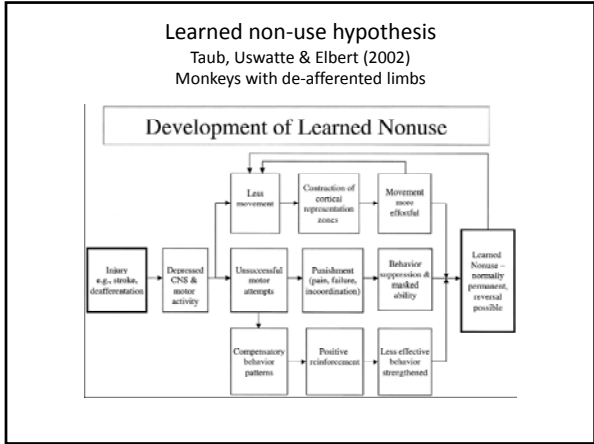
Raymer et al., 2008

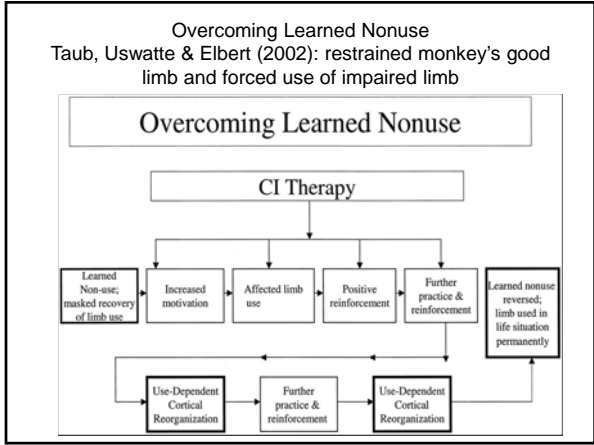
Principles of experience-dependent plasticity in aphasia rehabilitation

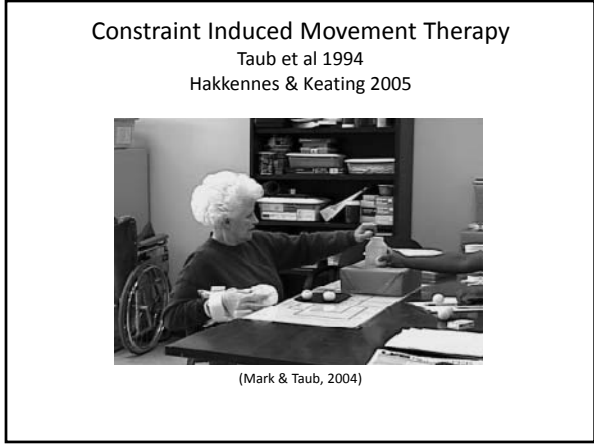
- Use it to improve it
- Intensity matters

Kleim & Jones, 2008

The case of Constraint Induced Aphasia Therapy (CILT)
Pulvermuller et al 2001







Constraint Induced Language Therapy-CILT
Pulvermuller et al 2001

- Forced verbal language use
 - Verbalization required; Compensatory strategies prohibited
- Intensive treatment schedule
 - 3 hrs/day 5 days/week 2 weeks
 - Massed practice
- Shaping verbal responses
 - Begin with words or short phrases
 - Move to longer and more complex utterances
 - Barrier games
 - Go Fish-like activity: pictures selected for individual participants; response components predetermined

Initial publication: Pulvermuller et al. (2001) Constraint-Induced Therapy of chronic aphasia after stroke. *Stroke*, 32, 1621-1626.

Constraint Induced Language Therapy (CILT)
(Pulvermuller et al., Stroke, 2001)

Barrier activity with dyad of patients
Verbal games

Compared intensive CILT and traditional nonintensive therapy

Results: Forced language group > traditional tx group in overall language battery, auditory comp and naming

Are the results due to forced language use or intensive treatment schedule?

Forced Language Use?
CILT versus PACE: Intensive
Maher et al. JINS 2006

CILT: N = 4 PACE: N=5

TX: 4 days/week, 3 hours/day, 2 weeks = 24 total TX hours

WAB improved: 3/4 CILT, 1/5 PACE

BNT improved: 3/4 CILT, 0/5 PACE

ANT improved: 2/4 CILT, 1/5 PACE

*Intensity also plays a role

ASHA N-CEP (National Center for Evidence Based Practice): Facilitating Series of Evidence Based Systematic Reviews

- criteria for prioritizing topics
 - Incidence/prevalence
 - Risk/potential harm
 - Public policy or reimbursement issues
 - Importance to clients consumers
 - Answerable question
 - Representation of diverse areas of practice
 - Existence of other systematic reviews/guidelines
 - Level of interest among ASHA membership
 - Existence of studies currently underway

First Systematic Review:
Constraint Induced Language Therapy (CILT) for Aphasia (Cherney et al., 2008) (updated 2010)

- Public policy or reimbursement issues
 - Of considerable importance to funding agencies, third party payors
 - Several CILT clinics have been established across the country
 - Private clinics charging out-of-pocket
- Importance to clients/consumers
 - CILT has been (incorrectly) described as the only aphasia treatment with evidence
 - It has an internet presence

EBSR Committee

Volunteer Evidence Panel

Leora Cherney, Ph.D., CCC-SLP,
BCNCD-A
Rehabilitation Institute of Chicago
Chicago IL

Janet Patterson, Ph.D., CCC-SLP
VA Medical Center,
Hayward CA

Anastasia Raymer, Ph.D., CCC-SLP
Old Dominion University
Norfolk VA

Staff: ASHA's National Center for Evidence-Based Practice in Communication Disorders

Tobi Frymark, M.A. CCC-SLP

Tracy Schooling, M.A., CCC-SLP

Beverly Wang, B.S.

Cherney et al 2008: ASHA EBSR Process

- Identify evidence panel
 - selected by N-CEP based on
 - *input from ASHA Special Interest Divisions*
 - *input from ASHA National Office staff*
 - *review of who has published on this topic*
- Define clinical questions & search parameters
- Conduct literature search
 - NCEP Information manager
- Critically appraise the evidence
- Evaluate & synthesize evidence
- Write EBSR summary

Framing the clinical question

- ◎ Two principles of CILT are intertwined
 - Constraint
 - Intensive/Massed practice
- ◎ PICO (Population-Intervention-Comparison-Outcome)
 - P = stroke-induced chronic aphasia, stroke-induced acute aphasia
 - I = CILT and intensive aphasia treatment
 - C = contrasting treatment or no treatment
 - O = measures of language impairment, communication activity/participation (WHO ICF)

CILT Questions

- For stroke-induced chronic aphasia, what is the influence of constraint-induced language therapy on measures of language impairment? measures of communication activity/participation?
- For stroke-induced acute aphasia, what is the influence of constraint-induced language therapy on measures of language impairment? measures of communication activity/participation?
- For stroke-induced chronic aphasia, what treatment outcomes are maintained following constraint-induced language therapy?

Intensity Questions

- For stroke-induced chronic aphasia, what is the influence of treatment intensity on measures of language impairment?
measures of communication activity/participation?
- For stroke-induced acute aphasia, what is the influence of treatment intensity on measures of language impairment?
measures of communication activity/participation?
- For stroke-induced chronic aphasia, what treatment outcomes are maintained following intensive language treatment?

Search Parameters: Original Review

- Inclusion:
 - Peer-reviewed literature from 1990 to 2006
 - Written in English
 - Adults ages 18 years or older
 - Stroke-induced aphasia
 - Direct comparison of CILT with other treatment approach or no treatment; or direct comparison of two treatment intensities
- Exclusion:
 - Studies including individuals with underlying cognitive deficits
 - Other primary medical diagnoses
 - Pharmacological intervention as comparison treatment
 - Mixed treatments

Search Parameters: Updated 2010 Review

- Same as earlier review
- Peer-reviewed literature from
January 2006 – August 2010

Of 26 studies rated, 18 examined CILT

2008 Review:	2010 Update:
Pulvermuller et al., 2001	Breier et al., 2006
Meinzer et al., 2004	Meinzer et al., 2006
Meinzer et al., 2005	Breier et al., 2007
Pulvermuller et al., 2005	Meinzer et al., 2007
Maier et al., 2006	Meinzer, Streiftau, & Rockstroh, 2007
	Meinzer et al., 2008
	Richter et al., 2008
	Szafarski et al., 2008
	Breier et al., 2009
	Farooqi-Shah & Virion, 2009
	Goral & Kempler, 2009
	Meinzer et al, 2009
	Kirmess & Maher, 2010

Rating the Evidence

- ASHA's Levels of Evidence Scheme
 - Developed by ACEBP & N-CEP
 - Evaluates state of the evidence by methodological quality & stage of research
- 2 reviewers clinically sifted studies for inclusion
 - Blind reviewers
 - 91% agreement
- 2 reviewers appraised studies for quality
 - Blind reviewers
 - One article authored by committee member (AMR) was reviewed by two other reviewers (JP, LC)
 - All disagreements resolved by consensus
- 3 reviewers determined stage of research

Evaluating the Evidence - Methodological Quality

ASHA Levels of Evidence Scheme (Mullen, 2007)
 Similar to PEDRO scale (Maier et al., 2003)

9 dimensions	Highest quality
Study Design	Controlled trial
Blinding	Assessors blinded
Sampling	Random sample adequately described
Group Comparability/ Participants described	Groups comparable at baseline or Participants well described
Outcomes	Valid & reliable outcome measure*
Protocol description	Treatment protocol described**
Treatment Fidelity	Evidence provided
Significance	p value reported/calculable
Precision	Effect size & confidence interval reported/calculable
Intention to Treat (controlled trials only)	Analyzed by intention to treat

highest quality indicators across 26 studies
(CILT + Intensity) of the EBSR

- Comparable groups/ Participants well-described # studies 25
- Valid outcomes/Protocol described 24
- Significance calculable 24
- Precision calculable 19
- Design: Controlled trial 7
- *Intention to treat 5/7
- Assessor blinded 6
- Treatment fidelity 5
- Random sample well-described 2

Quality Scores & Effect Sizes (d) CILT Studies
Impairment Outcomes: Aphasia Batteries

	Score	Outcome measure	p	d
Meinzer et al., 2007b	7/10	AAT Profile	<.0001	.45
Maher et al., 2006	6/9	WAB AQ	.004	1.01
Pulvermuller et al., 20016/9	9/9	AAT Profile	.04	2.18
Meinzer et al., 2005	5/9	AAT Profile	<.0001	1.63
Breier et al., 2006	5/9	WAB AQ	n.s.	
Kirmess & Maher, 2010	5/9	NGA		.34
Meinzer et al., 2004	4/8	AAT Profile	<.0001	.34
Faroqi-Shah et al, 2009	4/9	WAB AQ	n.s.	
Meinzer et al., 2008	4/9	AAT Profile	<.0001	.45
Meinzer et al., 2009	4/9	AAT Profile	<.001	.34

Quality Scores & Effect Sizes (d) CILT Studies
Impairment Outcomes: Naming Tests

	Score	Outcome measure	p	d
Meinzer et al., 2007b	7/10	AAT Naming	<.01	.31
Maher et al., 2006	6/9	BNT	.006	-.16
		ANT	.056	.14
Pulvermuller et al., 20016/9	9/9	AAT Naming	<.02	1.12
Breier et al., 2006	5/9	BNT	n.s.	
Faroqi-Shah et al., 2009	4/9	BNT	n.s.	
Kirmess & Maher, 2010	5/9	NGA Naming		.03 .85
Meinzer et al., 2008	4/9	AAT Naming	.004	.34
Pulvermuller et al., 20053/8	8/8	AAT Naming	.05	.25
Meinzer et al., 2007	3/9	AAT Naming	n.s.	

**Quality Scores & Effect Sizes (d) CILT Studies
Impairment Outcomes: Auditory Comprehension**

Score	Outcome measure	p	d
Meinzer et al., 2007b	7/10 Token Test	<.008	.31
	AAT Comprehension	<.009	.31
Pulvermuller et al., 20016/9	TT	<.04	.92
	AAT Comprehension	<.02	1.12
Breier et al., 2006	5/9 WAB Aud Comp	n.s.	
Kirmess & Maher, 2010	5/9 NGA Aud Comp	n.s.	
Meinzer et al., 2008	4/9 AAT Comprehension	.008	.22
Richter et al., 2008	4/9 Token Test	n.s.	
Szaflarski et al., 2008	4/9 BDAE Aud Comp	n.s.	
Pulvermuller et al., 20053/8	AAT Token Test	.03	.25
	AAT Comprehension	.05	.46
Meinzer et al., 2006	3/9 Token Test errors	n.s.	
	AAT Comprehension	n.s.	

**Quality Scores & Effect Sizes (d) CILT Studies
Activity/Participation Outcomes: Communication
Log/Rating Scales**

Score	Outcome measure	p	d
Pulvermuller et al., 2001	6/9 Comm Activity Log		
	Patient	<.001	3.77
	Clinicians	<.012	.64
Meinzer et al., 2005	5/9 Comm Effect. Index	<.0001	1.86
	Comm Activity Log		
	Quantity Pt.	<.0001	1.99
	Quantity Fam.	<.0001	2.35
	Comp. Pt.	<.01	.47
	Comp. Fam.	<.02	1.1
Goral & Kempler, 2009	5/9 Social communication	.003	.43

**Quality Scores & Effect Sizes (d) CILT Studies
Activity/Participation Outcomes: Connected Speech**

Score	Outcome measure	p	d
Maher et al., 2006	6/9 story retelling # wds		-.72
	#utterances	-.82	
	#sentences	-.19	
	mean length utt.	.33	
Breier et al., 2006	5/9 % CIUs Dual card task	.02	.57
	Accuracy task	n.s.	
Goral & Kempler, 2009	5/9 Narrative – words	n.s.	
Kirmess & Maher, 2010	5/9 Dual card task requests	---	.93
Breier et al., 2009	4/9 % CIUs Dual card task	<.05	1.06
Faroqi-Shah et al., 2009	4/9 Cinderella Sentences	.059	.61
	tense	n.s.	
Szaflarski et al., 2008	4/9 Fable Retell – words	.051	.31
	-utterances	n.s.	

Overall Findings - CILT

- 18 studies with 202 participants
- Language impairment measures: CILT resulted in some positive changes – overall aphasia quotients and naming scores; somewhat less for auditory comprehension
- Communication activity/participation measures: mixed results; some large positive favoring CILT; some large positive favoring comparison treatment
- Data available primarily for chronic aphasia. No data speak to the effects of CILT in acute aphasia; some data for subacute aphasia (Kirmess & Maher).
- Maintenance of CILT effects: reported to lead to positive changes; no effect sizes calculable.

CILT and Treatment Intensity

- Observations suggest that there can be complex interactions among intensity of treatment schedule, type of treatment, and type of outcome measure.

Future Research

- Across studies, majority of participants were nonfluent and moderately impaired; therefore generalizability of results is limited for individuals with fluent aphasia and individuals with mild and severe aphasia.
- Future studies need to tease out more carefully the impact of constraint and intensity on outcome.
- Future research must be designed to ensure that they are of highest quality.
- Future studies should address issues of effectiveness and cost effectiveness.

Future Research

- Lillie & Mateer 2006 expressed interest in applying principles of CI in other cognitive domains such as attention and memory
- Overcome 'cognitive nonuse' by restraining strategies and forcing cognitive mechanism to function
- Yet to be investigated

Neuroplastic Changes: Post Intensive CILT

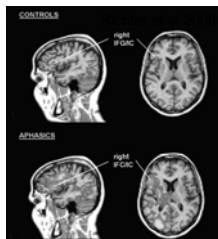


- Left Perilesional Changes – improved patterns of activation
Meinzer et al 2004 MEG Reduced left perilesional slow wave activity
Meinzer et al. 2008 fMRI + MEG – Increased activity in regions of pre-tx slow wave activity
Menke et al. 2009 fMRI – some increases in perilesional temporal regions
- Left Posterior changes
Pulvermuller et al 2005 EEG

Neuroplastic Changes: Post Intensive CILT

Right Frontal changes

- Pulvermuller et al 2005 EEG – increased activity
- Richter et al 2008 fMRI – reduced activity correlated with tx success
- Meinzer et al. 2009 MEG – reduced activity



Right Temporal changes – some increases, some decreases
Menke et al. 2009 fMRI

No changes

- Breier et al 2006 MEG – No signif associations post tx

What determines neural reorganization in left perilesional vs right hemisphere?

- Smaller left hemisphere lesions allow for perilesional mediation
- Larger left hemisphere lesions require more right hemisphere mediation Crosson et al 2007

- Neural mediation may change over time
 - Acute - little activation of perilesional or right
 - Subacute – more right hemisphere mediation
 - Chronic – more left perilesional mediation Saur et al 2006

Translational Neuroscience in Aphasia

We have applied many principles of neuroplasticity to enrich our therapeutic repertoire and evidence base for patients with aphasia

Most research mainly in proof-of-principle stage, with fewer RCTs (7% of studies - Togher et al. 2009)

We need to continue forward to optimize our treatments, lead to the best randomized clinical trials, and best language rehabilitation services possible for our patients