SYSTEMIC EEG BIOFEEDBACK FOR TRAUMATIC BRAIN INJURY
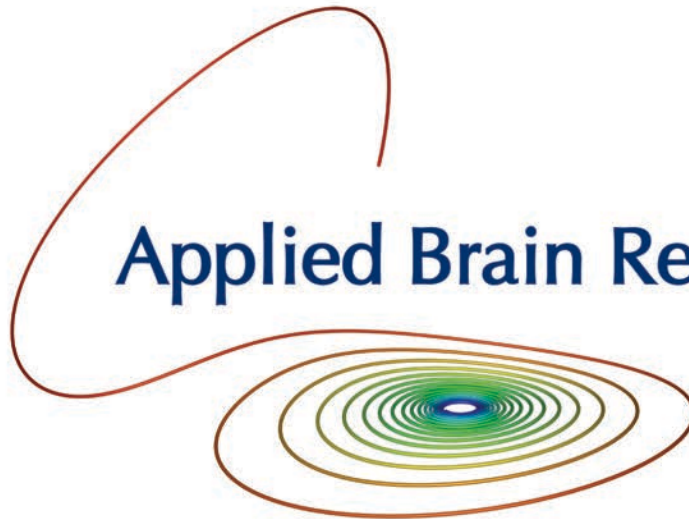
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The Plan for Today

- Some context

- Some data

- What I think I've learned

The Roots of this Work

- The "Chemobrain" Study
- Two SLPs (one a breast cancer survivor):
  - "These symptoms are nearly identical to TBI symptoms"

    If neurofeedback "works" with chemobrain, would it also work with TBI?

Post-Cancer Cognitive Impairment (PCCI)

- Involves
  - short-term memory
  - attention/concentration
  - word finding
  - multitasking
  - mental processing speed
- Also frequently present:
  - sleep impairment
  - fatigue
  - emotional symptoms

Concussion/TBI

- Involves
  - various aspects of learning and memory
  - attention/concentration
  - impairments of language and communication (including word finding)
  - multitasking
  - mental processing speed
  - executive function
  - behavioral self-regulation
  - social cognition
  - metacognition
  - awareness of internal states

- Also frequently present:
  - sleep impairment
  - fatigue
  - emotional symptoms
  - headaches
 - sensitivity to light and/or sound

DATA

- Mark
  - Age 30
  - 2 auto accidents within one month
  - Diagnosis: concussions
  - Symptoms: headaches, memory issues
- SLP did assessment: "Things look pretty normal—he's around the 50th percentile."

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- SLP did assessment: "things look pretty normal—he's around the 50th percentile"
- After 8 sessions of neurofeedback, many scores >90th percentile

	8/20/2011	11/11/2011 After 8 sessions	12/30/2011 After 15 sessions
FACT-Cog*			
Perceived Cognitive Impairment	39%	86%	89%
Impact on QOL	0%	81%	88%
Comments from Others	100%	100%	100%
Perceived Cognitive Abilities	36%	64%	75%
FACIT-Fatigue*	50%	67%	50%
PSQI Sleep Summary**	14 of 21	6 of 21	5 of 21
BSI-18			
Somatization**	6 (T=63)	4 (T=58)	1(T=48)
Depression**	18 (T=78)	8 (T=65)	12 (T=69)
Anxiety**	12 (T=70)	6 (T=61)	1 (T=47)
Global Severity Index**	36 (T=72)	18 (T=63)	14 (T=61)

*Higher percentages signify better QOL

**Lower numbers signify better QOL
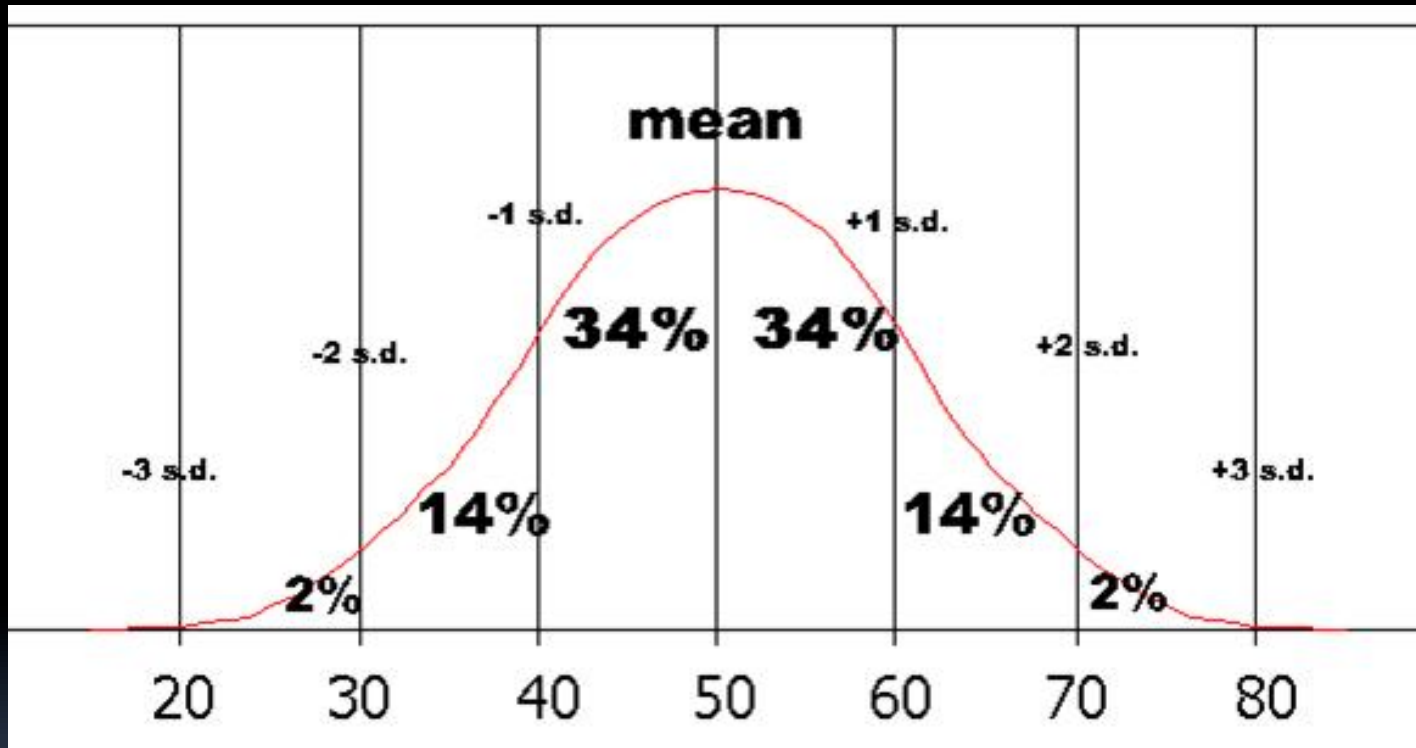
Mark

Comprehensive Trail-Making (CTMT)

Trail	percentile 8/20	percentile 10/29
1	27	98
2	35	>99
3	58	93
4	54	54
5	42	95
Composite	43	96

Mark

Wisconsin Card Sort

	%ile score 8/20	%ile score 10/29
Total # correct- 53		
Total # of errors	53	
Perseverative Errors	61	97
Nonperseverative Errors	34	93
Conceptual Level Responses	47	94
# of Categories Complete	>16	
Trials to complete 1st category	11-16	

Test of Memory and Learning (TOMAL-2)

Subtest	%ile 8/20	%ile 10/29
Memory for Stories	37	50
Facial Memory	75	91
Word Selective Reminding	63	91
Abstract Visual		75
Visual Sequential Memory		63
Paired Recall		75
Memory for Stories Delayed		75
Word Selective Reminding Delayed		75

Luisa

- 3 years post fall down flight of stairs (at work)
- Had plateaued in traditional therapies
- Unable to return to work

Luisa	10/19/2012	11/29/2012
		After 10 sessions
FACT-Cog*		
Perceived Cognitive Impairment	10%	69%
Impact on QOL	0%	88%
Comments from Others	31%	88%
Perceived Cognitive Abilities	11%	75%
FACIT-Fatigue*	2%	69%
PSQI Sleep Summary**	12 of 21	6.5 of 21
BSI-18		
Somatization**	T=77	T=50
Depression**	T=79	T=40
Anxiety**	T=71	T=38
Global Severity Index**	T=81	T=42

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	8/6/2012	1/22-24/13
	Pre-neurofeedback	Post-nf (13 sessions)
Wechsler Memory Scale		
Logical Memory I	T=37	T=53
Logical Memory II	T=43	T=63
Verbal Paired Associates	T=47	T=67
Digit Span	T=57	T=57
Spatial Span	T=60	T=60

Rose 47 yrs post-injury (concussion, skull fracture; 2 weeks in coma)

	6/20/2013	8/8/2013 After 8 sessions
FACT-Cog*		
Perceived Cognitive Impairment	68%	82%
Impact on QOL	81%	94%
Comments from Others	100%	100%
Perceived Cognitive Abilities	93%	93%
FACIT-Fatigue*		
	4 of 21	2 of 21
PSQI Sleep Summary**	w otc	w/o otc
BSI-18		
Somatization**		
Depression**		
Anxiety**		
Global Severity Index**		

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Rose's comments:

- #2: There's a difference

- #3: Things feel "crisper"

- #4,5: Remembering names for first time in years. Also, I have quick comebacks to my husband's jokes and teasing.

- #10: I'm talking a lot more— don't need to wait for thoughts to form, words to appear

Brian 11 yrs post-severe TBI	6/26/2012	1/14/2013	8/5/2013
		After 24 sessions	After 40 sessions
FACT-Cog*			
Perceived Impairment	60%	82%	75%
Impact on QOL	19%	94%	75%
Comments	50%	81%	94%
Perceived Abilities	54%	86%	75%
FACIT-Fatigue*	40%	83%	60%
PSQI Sleep Summary**	9 of 21	4 of 21	6.5 of 21
BSI-18			
Somatization**	1 (T=48)	0 (T=42)	0 (T=42)
Depression**	14 (T=71)	0 (T=42)	4 (T=59)
Anxiety**	12 (T=69)	2 (T=48)	4 (T=53)
Global Severity**	27 (T=68)	2 (T=45)	8 (T=53)

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What I Think I've Learned

- Working with TBI using NeurOptimal

- Using NeurOptimal with clients with "medical issues"

Working with TBI using NeurOptimal

- The "perfect" TBI client:
  - One who is on the cusp of improvement
  - One the therapist keeps expecting to normalize… and yet it doesn't happen
  - One who can *almost* return to work or school…and yet doesn't seem to be quite ready
  - Are we "facilitating connections"?
- Also interesting, but harder to assess:
  - The severely impaired client
    - May see improvements in affect
    - May see subtle changes in memory
    - Are we "waking the brain up"?

Timing

- SLPs often feel there is a "sweet spot" for improvement: 6 months to 1-2 years post-injury

- I have had wonderful success in that time period, but also much later:
  - 3 years
  - 11 years
  - 47 years

Typical Changes in Cognition

- Frequently, a striking improvement within 8-10 sessions, followed by a more gradual ongoing improvement

- "Perceived Cognitive Impairment" and "Impact on QOL" generally show more impairment than "Comments from Others", and are the place to look for earliest, strongest improvement

- "Perceived Cognitive Impairment can be thought of as a *leading indicator* of change, and "Perceived Cognitive Abilities" as a *trailing* or *lagging indicator.*

Maybe most interesting:

cognitive processing speed

SLPs do not have good tools for nudging this forward. This may be the most significant contribution we can make to the recovery of TBI clients.
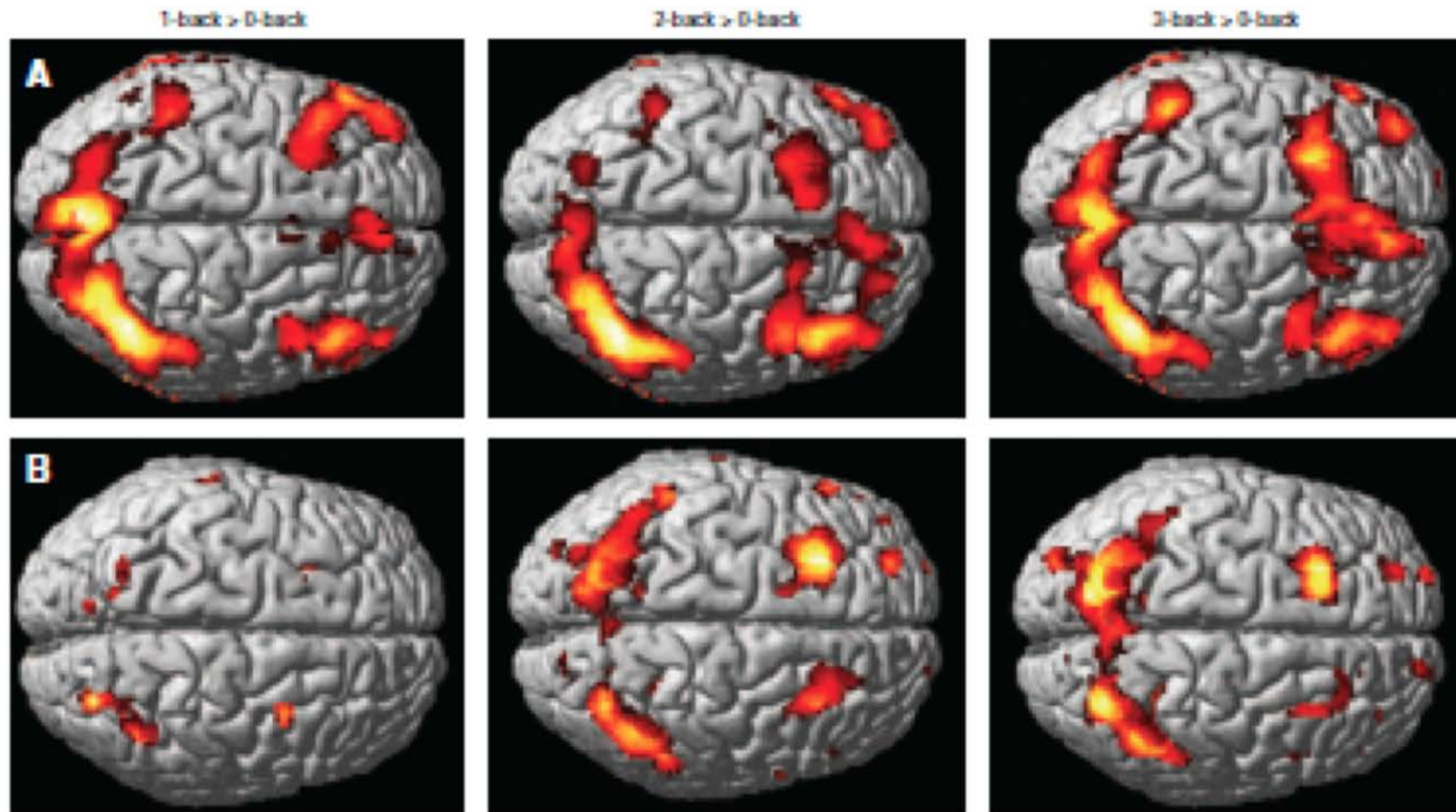
Fig 2. Functional magnetic resonance images of 60-year-old identical twins during a working memory task with incrementally increasing levels of difficulty (left to right). Colored regions denote increased brain activation during working memory relative to a simple vigilance task. (A) Twin treated with chemotherapy; (B) twin who did not receive chemotherapy. Note the expanded spatial extent of cortical activation in the chemotherapy-treated twin.

Ferguson, et al., JCO, 2007

Typical Changes
on Emotional Scales

- Generally, I see Anxiety change before Depression

- Frequently, there's a sharp improvement in emotional scales over the first 8 sessions, followed by a more gradual ongoing improvement over the next 8

- This pattern is similar to that seen by Janet McCulloch with PTSD clients…coming up this afternoon

Using NeurOptimal with "Medical Issues"

- Follow the symptoms:
  - PCCI...TBI...MS

    These have VERY similar symptom clusters, though the causes seem very different. In my experience, all are responsive to NeurOptimal...and so, I tend to be very interested when anyone with cognitive impairment contacts me.

- Trust your intuition ("this feels like…", "this reminds me of…", "I wonder whether…)
  - Blepharospasms…spasmodic dysphonia
    - Dystonia
    - Basal ganglia
    - Treated with botox
  - PCCI…TBI…MS
    - Demyelination
    - fMRI scans

"Medical discoveries are always based on hunches."

Russ B. Altman, MD
Stanford Medical School