



Cognitive Rehabilitation of Attention

1



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7/6/2019





RDoC: Candidate Domains/Constructs and Units of Analysis (v. 1.0)

3

v. 3.1, 6/30/2011	DRAFT RESEARCH DOMAIN CRITERIA MATRIX							
	----- UNITS OF ANALYSIS -----							
DOMAINS/CONSTRUCTS	Genes	Molecules	Cells	Circuits	Physiology	Behavior	Self-Reports	Paradigms
Negative Valence Systems								
Acute threat ("fear")								
Potential threat ("anxiety")								
Sustained threat								
Loss								
Frustrative nonreward								
Positive Valence Systems								
Approach motivation								
Initial responsiveness to reward								
Sustained responsiveness to reward								
Reward learning								
Habit								
Cognitive Systems								
Attention								
Perception								
Working memory								
Declarative memory								
Language behavior								
Cognitive (effortful) control								
Systems for Social Processes								
Imitation, theory of mind								
Social dominance								
Facial expression identification								
Attachment/separation fear								
Self-representation areas								
Arousal/Regulatory Systems								
Arousal & regulation (multiple)								
Resting state activity								

Construct: A concept summarizing data about a specified functional dimension of behavior (and implementing genes and circuits).

Some Modern Cognitive Models

- Attention/Arousal
- Working memory/
representationally guided behavior
- Information processing/sensory gating
- Synchrony of thought/cognitive
dysmetria

Cognitive Rehabilitation

1. Cognitive remediation (CR) therapy



2. Compensatory approaches/Strategy Training



What Is CET?

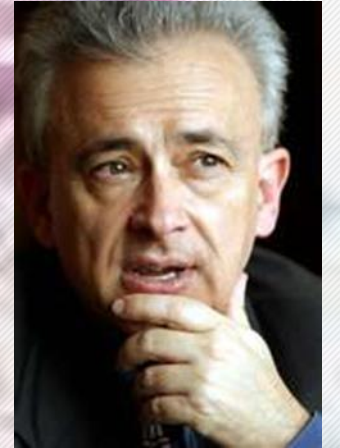
- CET is a performance based, comprehensive, developmental approach to the rehabilitation of social cognitive and neurocognitive deficits. Participants work at recovery through structured group and computer exercises. CET is designed as a recovery phase intervention for symptomatically stable persons with severe mental illness, who nonetheless remain socially and vocationally disabled. CET is the culmination of more than 30 years of clinical experience and research in schizophrenia treatment. Overall, CET attempts to increase mental stamina, active information processing, and the spontaneous negotiation of unrehearsed social challenges. It does so with a focus on enhancing perspective taking, social context appraisal, and other components of social cognition.

Does It Work?

- CET has been shown to have remarkable and enduring effects in a two year randomized study of 121 persons with schizophrenia or schizoaffective disorder treated with either CET or Enriched Supportive Therapy (EST). Once CET subjects completed the social cognitive groups, highly significant effects were observed for CET on five composite measures (Neurocognition, Processing Speed, Cognitive Style, Social Cognition, and Social Adjustment) at two years. See Figure 1 (Hogarty et al. Archives of General Psychiatry, 2004;61:866-876. Reprinted with permission).

What is Cognitive Rehabilitation?

- A brain injury often dismantles the capacity for or at least timing and coordination of various brain functions
- Antonio Damasio -
- “In the brain, timing is everything!”
- Cognitive rehabilitation follows a process of:
 - Identifying areas of impairment
 - Facilitating compensatory mechanisms to rapidly improve some function
 - Challenging the brain to restore function



A Brief History

- **Three traditions** –Retraining - Compensation – Holistic Rehabilitation
- **Egyptians** – Medical problems are either treated, contended with, or not treated. Aphasia was not treated. Many still believe that it is not possible to treat cognitive deficits after TBI or stroke.

Retraining – “Re-education”

- Sheppard Ivory Franz (1924) – Studied long-term changes in aphasia and hemiplegia recovery after long-term “nervous and mental re-education”.
- **Wars** – Walter Poppelreuter (1917), Kurt Goldstein (1942), Oliver Zangwill (1947), Alexander Luria, (1948)/63), Yahuda Ben-Yishay, and Leonard Diller (1983).

Influence of Kurt Goldstein

- Long-term treatment and follow-up
- Variability in behavior is the rule not the exception.
- Psychometric monitoring
- Importance of fatigue
- Need to train compensation strategies
- The importance of therapeutic transfer

Influence of Alexander Luria

- Study of the organizational structure to the brain. CRT involved reorganizing the brain.
- Use of drugs to stimulate recovery.
- Focus on areas of the brain that remained intact.

Influence of Yehuda Ben-Yishay

- Holistic rehabilitation – Work with the entire human rather than specific deficits.
- Patients given behavioral and cognitive templates to direct behavior.
- The problem of awareness

Lessons Learned

- Recovery is a slow arduous process requiring motivation, repetition and sustained practice (Franz, Goldstein). Recovery is seldom 100%.
- The most practical rehabilitation efforts involve teaching patients to compensate (Goldstein, Luria).
- The best practice is one that treats the person holistically and for whom the effects carry over to the real world (Goldstein, Ben-Yishay).
- Recovery does not occur without awareness (Prigatano).

Cognitive Rehabilitation

- Based on model used for clients with brain injury.
- Predominant focus of the Occupation Based Cognitive Rehabilitation Curriculum for Mental Health introduced in 2013.
- Model involves:
 - Education – on the brain
 - Process training –to relieve or remediate cognitive impairment
 - Strategy training – teaching means to compensate for impairment
 - Functional activities training – generalizing training to everyday life.

Definitions ... *changing*

Cognitive remediation therapy for schizophrenia is:

2010 “a behavioral training based intervention that aims to improve cognitive processes (attention, memory, executive function, social cognition or metacognition)” Cognitive Remediation Experts Workshop, 2010 cited in Wkyes et al. (2011)

2012 “an intervention targeting cognitive deficits using scientific principles of learning with the ultimate goal of improving functional outcomes. Its effectiveness is enhanced when provided in a context (formal or informal) that provides support and opportunity for improving everyday functioning” Cognitive Remediation Experts Working Group, 2012 cited in Medalia & Saperstein, 2013



Retrain the brain from the bottom up

- Brain stem: wakefulness, internal self-regulation, attentional control, basic sensory coordination
- Compensation: Routine and daily structure, managing energy, checking in with oneself, balanced rest and activity
- Goldilocks as role model
- Challenge: Constant striving for balance, improve internal awareness, mindfulness, meditation, and increased focused, sustained and challenged attention
- Physical balance is very important; also basic coordination of eyes, vestibular system and body in motion



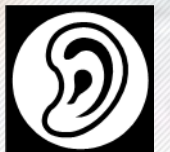
Retrain the brain from the bottom up

- Diencephalon: Thalamus, hypothalamus and radiating pathways for basic brain activation
- Control of stimulation, sleep, hormonal control and regulation of complex internal states, emotional control
- Compensation: Breathing and other relaxation, daily schedule, external control of drives, adapt environment to needs, “retreat,” accept feedback from others, general stress management
- Challenge: Gradual building of stimulation tolerance, controlled increase of behavioral control, shift from supervision to self-control, learn from mistakes, discover chain of acceleration to problems



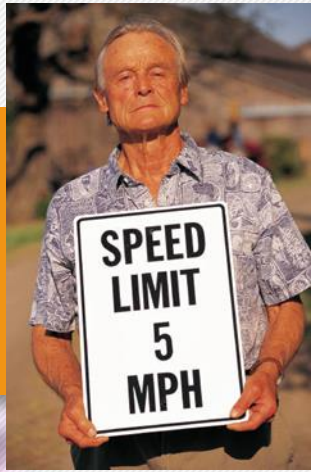
Retrain the brain from the bottom up

- Sensory functions: Accurate perception of somatosensory, auditory and visual stimuli as it builds from simple to complex
- Compensation: Simplify input, increase ease of perception, use external feedback to check for accuracy
- Challenge: Gradual building of accuracy and speed with simple stimuli to more complex integration of information, activate both hemispheres, complex aspects of nonverbal and verbal communication, complex nonverbal visual discrimination and written material, academic and intellectual capabilities, and integration with memory The focus of much of cognitive rehabilitation



Retrain the brain - then top down

- Executive functions: Directing attention, motor control, thinking, complex language, behavioral activation and control
- Compensation: SLOW DOWN, stop and think, accept and learn from feedback on errors
- Challenge: Maintain goal focus despite distraction, divide attention, activate and shift set with task demands, complex thinking (abstract, divergent thinking, inductive and deductive reasoning...), monitor and predict performance
- Another major area of focus in cognitive rehabilitation



Retrain the brain - then top down

- Cerebellum: “Software library” of skills and habits, judgment, timing and coordination of thinking/action with situation
- Compensation: errorless learning, frequent small practice, evidence of results, build behavior chains, use routines to compensate for effortful thinking problems
- Challenge: Increase speed while maintaining accuracy, go up skill difficulty ladder, learn a new skill





Evidence

Computerized cognitive rehabilitation:

Cognitive Rehabilitation: Evidence

- Source: Keith Cicerone et al., *Arch Phys Med Rehabil*, 2000, 2005, 2011
- Beta version of evidence-based *Cognitive Rehabilitation Manual* (Edmund Haskins, 2011) through American Congress of Rehabilitation Medicine www.acrm.org

Table 1: Definition of Levels of Recommendations

Practice Standards	Based on at least 1, well-designed class I study with an adequate sample, with support from class II or class III evidence, that directly addresses the effectiveness of the treatment in question, providing substantive evidence of effectiveness to support a recommendation that the treatment be specifically considered for people with acquired neurocognitive impairments and disability.
Practice Guidelines	Based on 1 or more class I studies with methodologic limitations, or well-designed class II studies with adequate samples, that directly address the effectiveness of the treatment in question, providing evidence of probable effectiveness to support a recommendation that the treatment be specifically considered for people with acquired neurocognitive impairments and disability.
Practice Options	Based on class II or class III studies that directly address the effectiveness of the treatment in question, providing evidence of possible effectiveness to support a recommendation that the treatment be specifically considered for people with acquired neurocognitive impairments and disability.

Cognitive Rehabilitation: Evidence

- **Attention**

- Practice standard for remediation of attention after brain injury
- Practice option for computerized attention training with therapist involvement and intervention

- **Visual-spatial/praxic functions (selected)**

- Practice standards for remediation of left neglect in right brain stroke and gestural strategies for apraxia with left brain stroke
- Practice options for systematic training of visuospatial deficits and visual organization skills and for computerized training to expand visual fields

Computerized Cognitive Training

- www.neuropsychonline.com
- 6 domains, 12 graded tasks/domain, 3-4 difficulty levels per task
- Students trained to assist



- Attention
- Executive functions
- Memory
- Visuospatial skills
- Problem solving
- Verbal/nonverbal communication

Other cog rehab programs do exist!

DN Training



DN Sustained attention

The screenshot shows a web browser window displaying a task interface. The browser's address bar shows the URL: www.neuropsychonline.com/npo/ona/treatment/cr/track01/task01/r01t01.php?reload=564283&pid=undefined&lname=undefined&fname=undefined&tid=undefined&ttlg=f&prflg=t&lvflg=1

The main content area is titled "Track 1 : Attention Skills" and "Task 01 : Simple Visual Reaction - Fixed Point". Below the title, it says "Name: Preview Mode" with a text input field.

On the right side, there is a button labeled "Enlarge Instructions". Below it, a text block provides instructions: "The screen will turn black. Focus your eyes on the center of the screen and do not let your eyes move until the exercise is over. At random intervals you will see a red square displayed at the center of the screen. When you see the square, you should try to turn it off as quickly as possible by clicking your mouse button. When you are fast enough and consistent enough, with your clicks, the square will begin to turn colors to become orange, then yellow and finally green. When it is green you are making very good responses. If you can keep it green then you will be advanced to the next level automatically. There are four levels to master! Focus, relax, breathe easily and respond quickly." Below this text is a button labeled "Topics for Discussion".

At the bottom of the main content area, there is a label "Choose which hand you will use:" followed by two radio buttons: "Left Hand" and "Right Hand".

At the very bottom of the interface, there are two large buttons: "Start" and "Stop".

The browser's taskbar at the bottom shows several open applications: "Microsoft PowerPoint...", "Neuropsychonline E...", "Track 01 : Attention ...", "Documents", and "Document1 - Micro...". The system clock in the bottom right corner shows "11:56 PM".

Task 01 - Simple Visual Reaction - Fixed Point - Right Hand

Variable	Level 1	Level 2	Level 3	Level 4
Start Date	2011-01-15	0000-00-00	0000-00-00	0000-00-00
Submissions	14	0	0	0
Restarts	0	0	0	0
Total Time on Task (minutes)	33	0	0	0
# Clicks (baseline)	39	0	0	0
Aver. RT (last 5 - baseline)	295	0	0	0
Aver. RT (overall - baseline)	421	0	0	0
Variance (last 5 - baseline)	8582.00	0.00	0.00	0.00
Variance (overall - baseline)	94201.00	0.00	0.00	0.00
# errors (baseline)	5	0	0	0
# Clicks (most current)	50	0	0	0
Aver. RT (last 5 - most current)	295	0	0	0
Aver. RT (overall - most current)	372	0	0	0
Variance (last 5 - most current)	6382.00	0.00	0.00	0.00
Variance (overall - most current)	31563.00	0.00	0.00	0.00
# errors (most current)	4	0	0	0
Date (most current)	2011-07-25	0000-00-00	0000-00-00	0000-00-00
Total Clicks (overall)	433	0	0	0
Consecutive Passes	0	0	0	0
Total Passes	1	0	0	0
Total Fails	13	0	0	0
Grade - most current	f			

Neuropsychonline Cognitive Rehabilitation Therapy Preview Panel

(LEVEL 1) Simple Visual Reaction - Fixed Point

Track 1 Attention Skills	Track 2 Executive Skills	Track 3 Memory Skills	Track 4 Visuospatial Skills	Track 5 Problem Solving Skills	Track 6 Communication Skills
1. 1 2 3 4	1. 1 2 3 4	1. 1 2 3 4	1. 1 2 3 4	1. 1 2 3 4	1. 1 2 3 4
2. 1 2 3 4	2. 1 2 3 4	2. 1 2 3 4	2. 1 2 3 4	2. 1 2 3 4	2. 1 2 3 4
3. 1 2 3 4	3. 1 2 3 4	3. 1 2 3 4	3. 1 2 3 4	3. 1 2 3 4	3. 1 2 3
4. 1 2 3 4	4. 1 2 3 4	4. 1 2 3 4	4. 1 2 3 4	4. 1 2 3 4	4. 1 2 3 4
5. 1 2 3 4	5. 1 2 3 4	5. 1 2 3 4	5. 1 2 3 4	5. 1 2 3 4	5. 1 2 3 4
6. 1 2 3 4	6. 1 2 3 4	6. 1 2 3 4	6. 1 2 3 4	6. 1 2 3 4	6. 1 2 3 4
7. 1 2 3 4	7. 1 2 3 4	7. 1 2 3 4	7. 1 2 3 4	7. 1 2 3 4	7. 1 2 3 4
8. 1 2 3 4	8. 1 2 3 4	8. 1 2 3 4	8. 1 2 3 4	8. 1 2 3 4	8. 1 2 3 4
9. 1 2 3 4	9. 1 2 3 4	9. 1 2 3 4	9. 1 2 3 4	9. 1 2 3	9. 1 2 3 4
10. 1 2 3 4	10. 1 2 3 4	10. 1 2 3 4	10. 1 2 3 4	10. 1 2 3 4	10. 1 2 3 4
11. 1 2 3 4	11. 1 2 3 4	11. 1 2 3 4	11. 1 2 3 4	11. 1 2 3 4	11. 1 2 3
12. 1 2 3 4	12. 1 2 3 4	12. 1 2 3 4	12. 1 2 3 4	12. 1 2 3 4	12. 1 2 3

Back to Administration Panel

NEUROPSYCHOLOGICAL ASSESSMENT

- Demographic predicted ability = 86th %ile, AM-NART estimated = 93rd %ile
 - Blessed and Folstein mental status tests (some items analyzed separately)
 - **Attention** - *Digit span, Trail Making, Letter-Number Sequencing, Digit-Symbol Coding*
 - **Learning-Memory** - Logical Memory story, California Verbal Learning Test
 - **Language** - Boston Naming, Letter fluency (FAS), Category fluency (animals, vegetables), Token Test (substituted Rule Governed Drawing)
 - **Visual-spatial** - Block Design
 - Geriatric Depression Scale
 - **Added physical** - full-tandem standing time and 12-foot walking speed
 - **Added behavior/QOL** - Frontal Systems Behavior Scale (FrSBe) and Mayo-Portland
- Z-scores compared to age norms as possible; change compared to baseline

Base = raw of total or Z-score
 ++ Z-score improvement of 1+
 + Improve (or – worse) 0.5-1.0
 -- Z-score worsening of 1-

RESULTS TO DATE

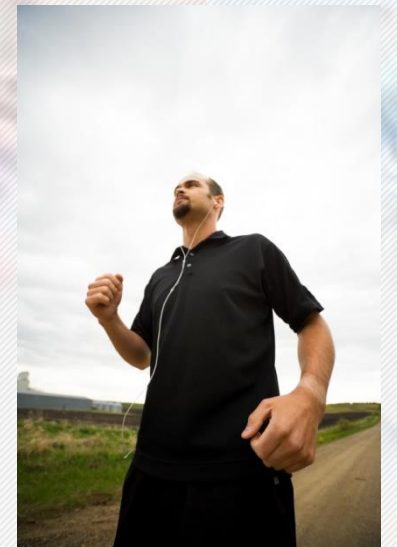
Ability	June 2010 test baseline	A	Jan 2011 assess	B	Sep 2011 assess	A	Jan 2012 assess	B
Mental Status	Folstein 22 of 30		0		-		-	
Attention	Blessed ment. control		0		+		+	
“ ”	Serial 7s - 3 of 5		+		+		0	
“ ”	Digit span 8F, 5B		++		+		+	
“ ”	Trails A Z= -7.3		+		0		0	
“ ”	L-N Seq Z= -2.3		0		+		+	
“ ”	Digit sym Z= -2.7		0		0		0	

Mental status – worse but orientation not trained

Attention – some sustained improvement in attn capacity and working memory

Conclusions

- The brain is plastic and can improve even despite severe injury
- Computers are one method to facilitate training
- Gains will be modest and may sustain
- Need lots of practice
- Focus training on attention, some executive skills
- Include fun/easy as well as challenge



A recipe for cognitive training

- 25% challenge - hard - perhaps 75% correct or worse
- 50% enjoyable - modest - 85-90% or better correct
- 20% speed - easy but do quickly at 90% or better correct
- 5% new learning - pull everything together periodically to learn something new

Three component frame work of Posner and Rothbart”selective, sustain, attentional control or switching”

- Attention is what allows one stream of information from the internal or external environment to be selected over others and therefore pervades almost any thought or action we take in the daily life.

Efficacy vs Effectiveness?

Efficacy is the potential for beneficial change.

How well the treatment works in a laboratory.

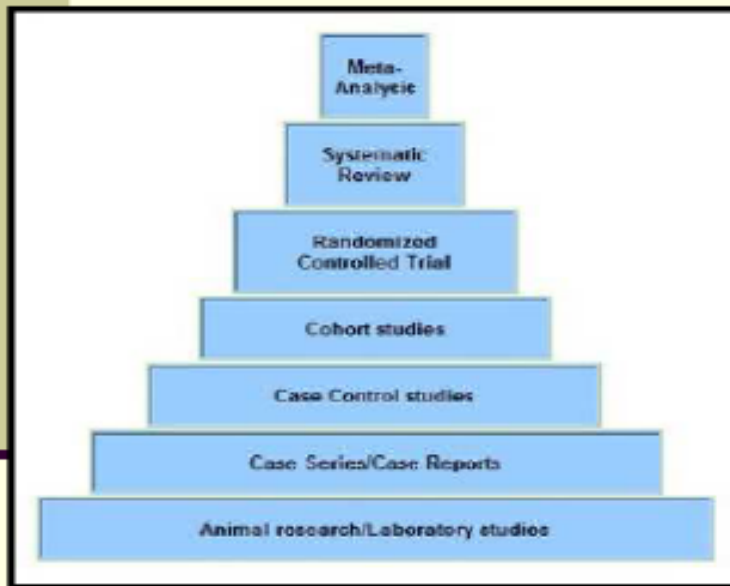
Effectiveness is the practical utility of the treatment

How well a treatment works in the practice of medicine.

Hierarchy of Research Evidence

After Rohling et al., 2011

What is the hierarchy of research studies suggesting the order of scientific reliability?



The hierarchy of studies reflecting the order of scientific reliability and is generally viewed as follows from the top as the most reliable & then down each level to the bottom. Met-analysis is considered the highest level of evidence.

e style

Problems With Interpretation

- **A “deep literature” but shallow data base of usable articles.**
- **Over-reliance on pre-post test designs for estimating effect size.**
- **Ecological validity of the measures used in the studies.**
- **Few studies of symptom validity, motivation, and incentive effects.**
- **Few replications**

Efficacy of CRT

Several Systematic Studies of CRT Efficacy

- **“A Deep Literature” 655 articles through 1997 and an additional 315 published from 1998 to 2002 plus 50-150 recent articles through 2017**
- Binder, L. M., Rohling, M. L., & Larrabee, G. J. (1997). A review of mild head trauma. Part I: Meta-analytic review of neuropsychological studies. *Journal of Clinical and Experimental Neuropsychology*, 19, 421-431
- Cicerone, K.D., Dahlberg, C., Kalmar, K., Langenbahn, D.M., Malec, J.F., Bergquist, T.F., Felicetti, T., Giacino, J.T., Harley, J.P., Harrington, D.E., Herzog, J., Kneipp, S., Laatsch, L., & Morse, P.A., (2000). Evidence-based cognitive rehabilitation: recommendations for clinical practice. *Archives of Physical Medicine and Rehabilitation*. 81(12), 1596-1615.
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- Cicerone K.D., Dahlberg, C., Malec, J.F., Langenbahn, D.M., Felicetti, T., Kneipp, S., Ellmo, W., Kalmar, K., Giacino, J.T., Harley, J.P., Laatsch L., Morse, P.A., Catanese, J. (2005). Evidence-based cognitive rehabilitation: updated review of the literature from 1998 through 2002. *Archives of Physical Medicine and Rehabilitation*. 86(8), 1681-1692.
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- Park, N. W. & Ingles, J. W. (2001). Effectiveness of attention rehabilitation after an acquired brain injury: A meta-analysis. *Neuropsychology*, 15, 199-210.
- Robey, R. R. (1998). A meta-analysis of clinical outcomes in the treatment of aphasia. *Journal of Speech, Language, and Hearing Researcher*, 41, 172-187
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- Rohling, M. L., Binder, L.M., Demakis, G. J., Larrabee, G. J. Ploetz, D. M. & Langhinrichsen-Rohlin, J. (2011). A Meta-analysis of neuropsychological outcomes after mild traumatic brain injury: re-analysis and reconsiderations of Binder et al. (1997), Frencham et al. (2005 and Pertab et al. (2009). *The Clinical Neuropsychologist*, 25(4) 608-623.

- 
- Are some treatment modalities more efficacious than others?
 - □ Are some types of cognition more amenable to recovery with CRT?
 - □ What variables moderate the recovery process and the efficacy of CRT?
 - □ Does efficacy translate into effectiveness?

Meta-Analysis of 24 Recent Attention Studies (Rebecca Bernard)

Overview of Results

Meta-analysis of 24 studies of attention since 2005.

Significant corrected effect size for pre-post change in treatment group.

Small but significant ES for control group pre-post change.

Meta-Analysis of 24 Recent Attention Studies (Rebecca Bernard)

ESs largest for studies of selective attention.

ES largest in stroke populations and smallest but least variable in TBI populations.

Systems of CRT

- Stimulation therapy
 - Process training
- Attention/Concentration Training
 - Strategy Training
- Nutrient and Drug Treatment
- Prosthetic-Orthotic Device
- Domain-Specific Training
 - Invisible Aids

CRT (Delahunty and al, 1999)

44

- Paper-and-pencil exercises in individual sessions for ambulatory patients to rehabilitate psychosocial insertion
- To also improve executive functions (cognitive flexibility, working memory and planification)
- Exercises are given at the end of each session to be done at home.

How People Learn

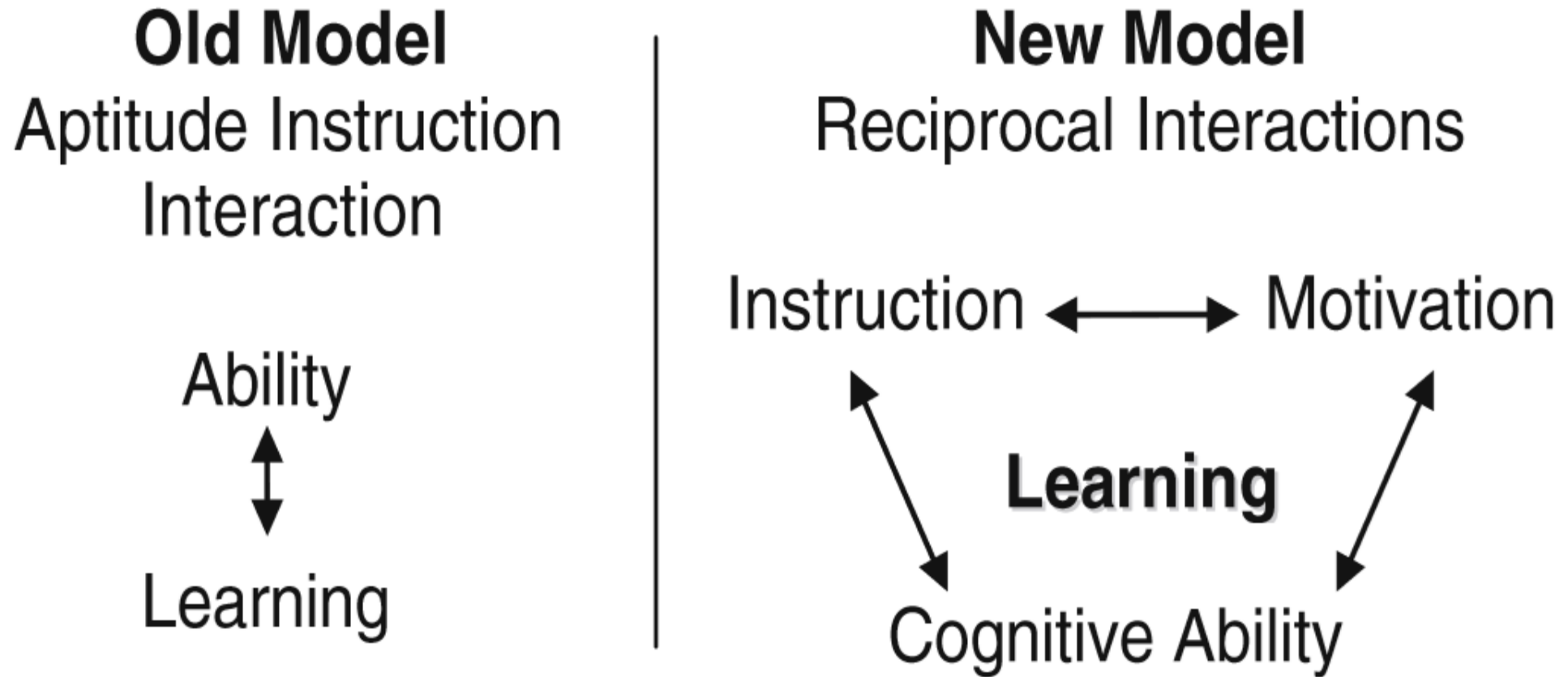


Fig. 2 Model of reciprocal interactions to understand the heterogeneity of response to cognitive remediation in schizophrenia

Principles Of Cognitive Remediation :

- **Progressive, “Bottom-up”**
- **Repetition, and Practice.**
- **Individualized** to patient’s cognitive style, ability and progress
- **Stress Free, Success oriented and Strategic, Top-Down**
- **Motivation, Focus on Intrinsic motivation**

TABLE 1.

Typical Components of a Cognitive Remediation Program

Components of assessment

Determination of need and referral for treatment

Assessment of baseline cognition

Cognitive goal setting for recovery goal attainment

Components of treatment

Establish small group of 3-8 clients

Conduct sessions 2-3 times weekly for 3-4 months

Rolling admission

Computer-based drill and practice exercises with strategy coaching

Bridging activities linking computer-based exercises to real-life tasks

Progress assessment

Determine advancement on the computer-based exercises

Measure improvement on objective cognitive tests

Determine recovery goal attainment



Cognitive Remediation

- Treatment of cognitive deficits characterized by two approaches:
 - Cognition enhancing
 - Compensatory
- Cognition enhancement approach based on neuroplasticity model of brain development
 - Cognition enhancement training
 - Cognitive remediation therapy
 - NEAR approach

Pre-post training gains noted in global cognition, executive, occupational and social functioning

Implications of Research for Therapists

- **Targeted specific interventions are more effective than comprehensive non-targeted interventions.**
- **Interventions that target language and attention likely to produce greatest improvement.**
- **Stroke patients will likely recover faster and more completely relative to TBI patients.**

Definitions

- **Cognitive remediation** : an intervention which engages the participant in **learning activities** that improve cognitive skills (Medalia & Choi, 2009, Medalia et al, 2009)
- **Cognitive skills**: the skills that allow one to **recognize, acquire, comprehend, and respond** to information (Medalia & Revehiem, 2002).
- **Metacognition**: thinking about thinking



Cognitive Rehabilitation Intervention

The aim of treatment is to improve the person's ability to carry out **everyday tasks**.

The process includes **Educating** about the injury and how and why it **effects** them in that way

Re-establishment of **direct skills** through direct retraining.

Use of **compensatory strategies** and external aids

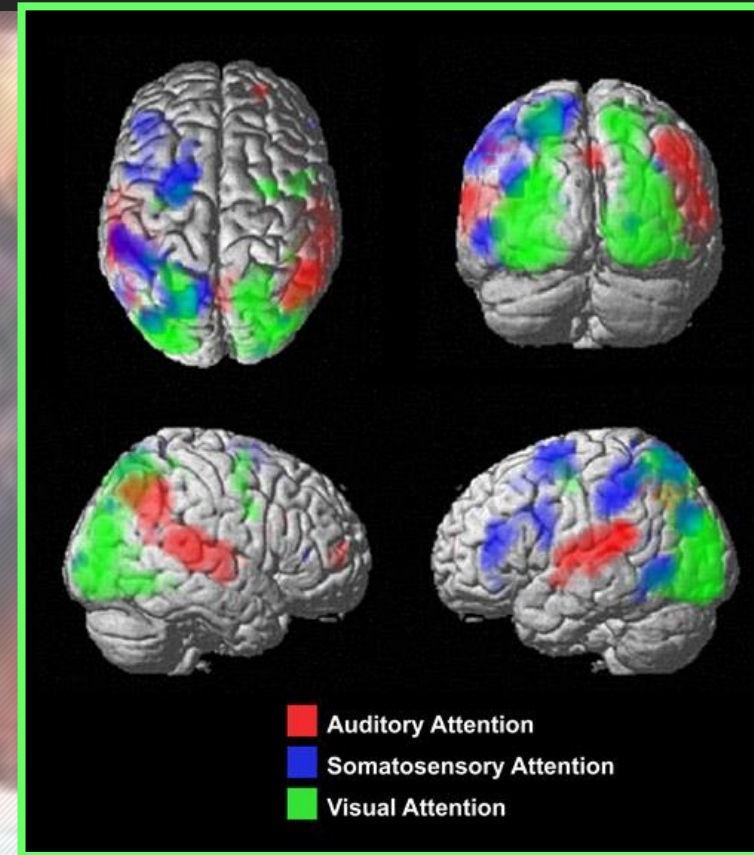
○ Level of human attention states

Selective Attention

Focused Attention

Divided Attention

Sustained Attention



In ATTENTION

- difficulty changing activity
- Hyper focusing
- losing things
- not putting things away
- homework

- **Inattention**

Inability to **sustain attention**, particularly for **repetitive, structured,** and **less enjoyable** tasks

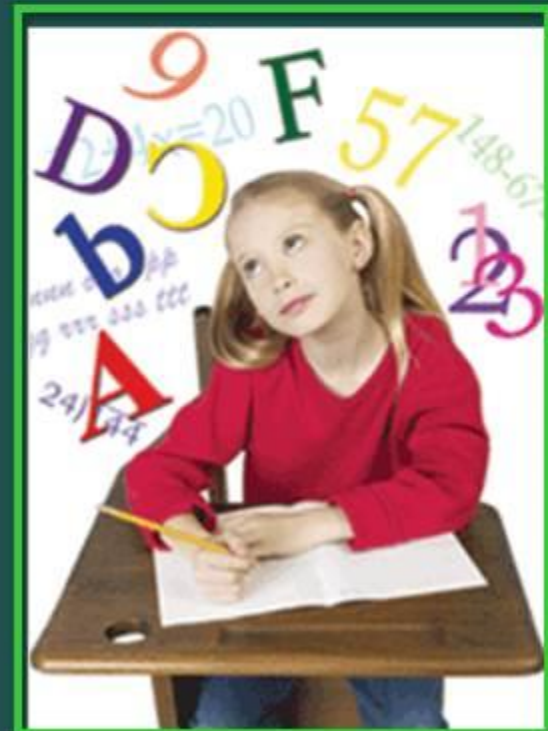
Deficits may be seen in one or more types of attention

Attentional **capacity**

Selective attention

Distractibility

Sustained attention/**vigilance** (a core feature)



Selective Attention

Easily distracted

Need the environment to be quiet

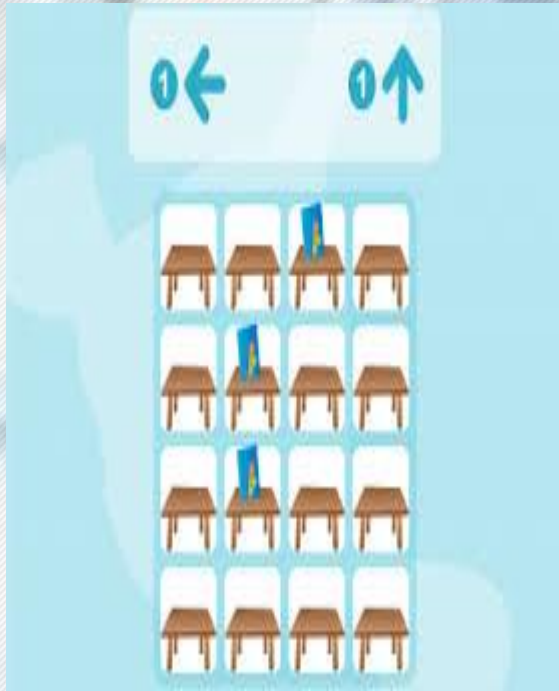
stable to stay on task



Rehabilitation of selective attention

- Video game affect
- inhibition of return (castle 2005)
- *Resolution of spatial attention (Green 2007)*
- Backward masking effect (Li 2010)
- *Detection spatial stimuli with up, down, left and right frequency*
- **Find stimuli between irrelevant stimuli and suppress irrelevant**
- *Working memory training*
- *Adaptive training” increasing difficulty level which help to working memory”*
- *14 one hours sessions*
- *Reading against auditory verbal distracting*
- ***People listen to spoken text in one ear against initially low volume competing text in other***
- *Gradually the competing text increase: down to quite low level of perceptual processing (inhibition of return and backward masking)*

J F I E S T A B Z
G P C O L A D O R
M P S T E R R A Z
L U F F V E D Z O
T I R I T A I X O
I R F I S B O I I



Khan Academy

Science > Health and medicine > Executive systems of the brain > Attention and language

Divided attention, selective attention, inattention blindness, & change blindness

Theories of selective attention

Theories of language and cognition

Theories of language development: Nativist, learning, interactionist

Language and the brain: Aphasia and split-brain patients

13

15

1:04 / 6:02

Divided attention, selective attention, inattention blindness, & change blindness

About Transcript

Learn about divided attention, selective attention, inattention blindness, & change blindness. By

<https://youtu.be/vycuLhs1GqM>

Q

Q	W	D	O	Q	N	J	Q	T	Q	Q	Q	J	M	Ñ
X	Ñ	Q	H	W	D	Q	Ñ	D	P	P	V	M	L	X
E	O	D	V	J	G	Q	B	M	N	U	C	Y	X	X
J	O	C	G	Y	Ñ	Q	N	J	L	R	Ñ	X	Q	M
Ñ	Q	F	O	Q	E	Q	Q	Y	Y	T	Ñ	E	D	F
B	S	S	G	U	X	L	J	U	Y	Ñ	A	X	G	Z
I	R	R	G	Q	E	M	M	M	Q	A	V	B	B	I
V	G	Q	Q	Q	Y	Q	Q	A	Ñ	B	Q	Q	U	W
O	N	L	R	Y	Q	V	Z	F	V	Q	H	Ñ	Y	T
N	N	Y	H	Q	S	F	X	J	N	V	U	D	J	G

Treatment Protocol of APT is hierarchical.

Training was provided for the participant for each task using **samples of questions** and **directions** to confirm **task comprehension**.

Tasks were **repeated** until an **accuracy level** of **85%** was achieved over **three consecutive presentations** and/or a minimum **35% decrease** in time was obtained over three consecutive presentations.

Task difficulty **increased** once criterion level was achieved. If the participant did not reach criteria after **15 consecutive presentations**, the task was **abandoned**, and task difficulty continued to increase.

The participant completed each task according to the **instructions** received from the **clinician**.

Responses obtained from the participant were **collected** and **scored** during **each session** according to the **APT protocol manual** to determine if the participant could move on to the next task.

Attention deficits associated with frank brain injury require specific training administered in a hierarchical manner to demonstrate improvement, particularly when basic functions of attention are involved (Sturm, Willmes, Orgass, & Hartje, 1997).

Attention deficits are often misdiagnosed in patients and seem to appear solely as memory impairments. Sohlberg and Mateer (2005) hypothesized that by training attention these supposed memory impairments could be resolved.

It is based on cognitive processing models, neuroanatomical models, factor analytic models of attention, and clinical models of attention.

The APT program defines attention as a multidimensional cognitive domain consisting of four levels of attention: focused attention, sustained attention, selective attention, alternating attention, and divided attention.

Attention Process Training (APT) Generalizing activities

► Selective attention:

Tara Rezapour 2017 brain and cognition clinic

Residential	Vocational	Community settings
Cooking while children playing in the background	Filling out paperwork in busy office	Eating at busy, loud cafeteria
Household chores with TV or radio playing	Taking inventory of shelves in noisy, busy warehouse	Doing series of small errands at busy mall
Doing jigsaw puzzle while other conversation is going in room	Assembly line production with music playing in workroom	Following score and plays at baseball or football game
Woodworking task with ongoing machine noise	Work duties in office with lots of traffic going by window	Going to a fair, picnic, festival, etc. and participating in food or game activity

Sustained attention and alertness

- Top down enhancement selectivity to unchanged or unchallenging repetitive stimuli and response to extended time.
- Sustain attention even is necessary for motor learning
- With two months later assessing sustain attention can predict motor rehabilitation in TBI”Robertson 1997”
- Attention is a **capacity** allocated to a stimuli or category of stimuli this is a critical point in **experience dependent plasticity** .it is neglected for long time but recent research pointing to new avenues towards sustain attention enhancement
- It is controlled by **right lateralized cortical net work,ant singulate, right DLPFC, inferior parietal lobule regulate subcortical arousal(robertson 2004)**
- **LC arousal** hub through NA while suppressed induce **decreased Vigilance then increased errors of commission**

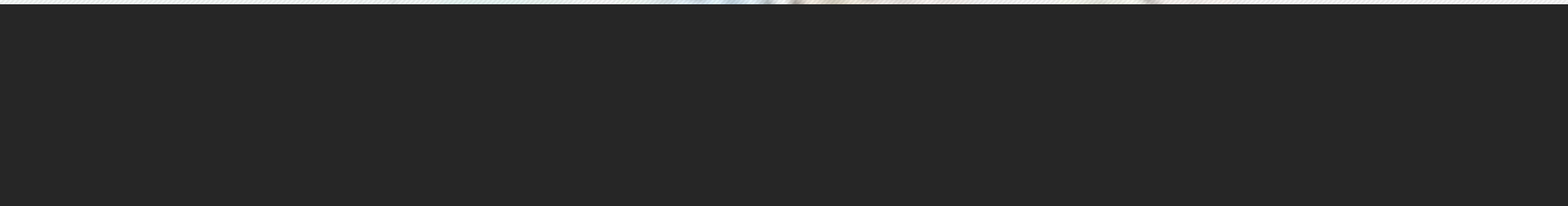
- 
- **YERKES-DODSON LAW**: optimal arousal make good performance for routine task arousal is high against challenging task.
 - Broadbent: stress can improve performance on routine non demanding task but impair performance on more complex and demanding task.
 - Clonidine decrease NA to diminish vigilant for familiar not unfamiliar task
 - Right frontoparietal attention “*alertness*” attentional system and spatial selective attention the former could modulate the later (posner 1993)
 - Time pressure make high arousal “neglects are better in time pressure”

Shallice 1991: six simple tasks

- Instruction: they don't have to complete all tasks, In 15 minutes they should switch spontaneously *Hotel-test*===6 -Element tests"sorting conference labels into alphabetic orders, looking up Telephone numbers"
- When *required to think* about that to response to each six tones presented at random intervals their performance increased relative to healthy controls.
- Making phone call at certain times that needed executed during normal life about two weeks. during training a particular cue phrase "STOP:stop think organize plan" associated with reviewing one intention. manage their own goals by sending message during working days.

Sustained attention training

- It is fundamental for other training
- White noise can mitigate the effect of an arousal depleting drug
- Left spatial neglect could learn to self alert then could improve both sustain attention and left neglect
- The arousal was first increased by loud noise or hand claps
- Using a graded self instruction strategy patients learn to replace the external stimuli with a simple internally generated self alert instruction- a phrase or word to them signified alertness
- Repeat periodically trained temporary effect of arousal change



SUSTAINED ATTENTION ACTIVITIES

Paragraph **Listening** training
Alphabetized **Sentence** training
Reverse Sentence training Progressive Sentence
training
Number **Sequencing Ascending** training
Number **Sequencing Descending** training
Number **Sequence Reverse** training
Number Sequence Every Other training
Mental **Math** Activity

ADHD

- O'Connell, 2008, similar to what happened above
- Participant to learn increase self generated increases in alertness
- First to response to a periodic auditory cue and later internally generated cue.
- To strengthen training effect participants were provided with visual feedback conveying the magnitude of each self alert event via online changes in electrodermal activity (EDA) during the performance of untrained sustained attention task and made significantly fewer errors
- Non strategic adaptive training: in selective attention, working memory, computerized adaptive training for sustain attention and alertness without evidence generalization to real life

Switching /attention control

Divided Attention

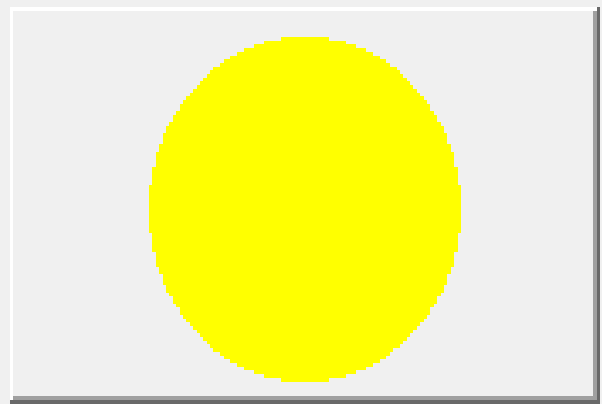
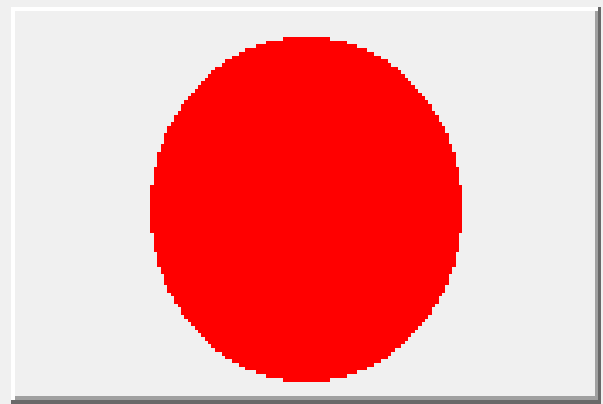
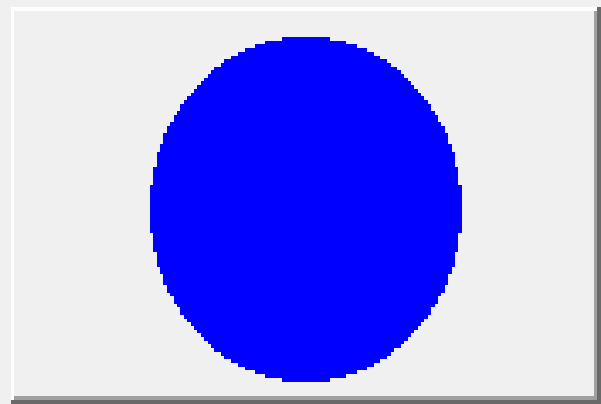
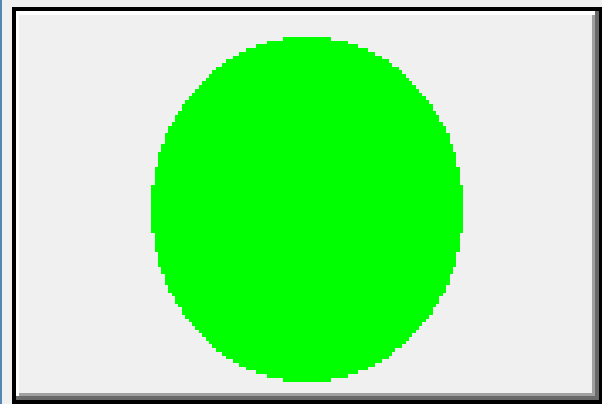
Struggle to **multi-task**

Very **deliberate** in completing one task before moving to the next

Can get easily **overwhelmed**



Large Green Circle



Click the correct button.

Number

Timer

1

00:02

Attention Process Training (APT)

Generalizing activities

► **Divided attention:**

Tara Rezapour 2017 brain and cognition clinic

Residential	Vocational	Community settings
Cooking task with two items requiring simultaneous monitoring	Taking written minutes during a work meeting (listening and writing)	Driving on a freeway or busy highway
Talking on the phone while doing the dishes	Operating machinery with requiring monitoring multiple dishes or systems at the same time	Playing video games at arcade which require divided attention

Direct Training of Cognitive Processes of attention

- Therapy tasks should be organized according to a **theoretical models**
- Example: - a theoretical model that is supported in the literature for attention includes: *sustained attention, selective attention, alternating attention, working memory, suppression of response*
- Working from a model ensures a **scientific basis** for treatment hierarchies
- Working from a model supports **systematic implementation** of therapy as it informs assessment and treatment tasks
- Attention
 - •Attention Process Training
 - •APT Generalizing Activities
 - •Time Pressure Management
 - •Self-Talk
 - •N-back
 - •Hemi-Spatial Neglect

Sustained Attention

- ❑ Write start and stop times on assignments
- ❑ Use incentive systems
- ❑ Break down tasks into steps
- ❑ Make tasks interesting for students
- ❑ Give child something fun to do when task is completed
- ❑ Provide attention and praise when student is remaining on task
- ❑ *To teach the skill:*
 - Discuss attention time with the student
 - Teach them to break down tasks on their own
 - Help them make work plans for completing tasks
 - Reinforce them when they use the plan



Organize the Bookcase



Corregir

Attention Process Training (APT) Generalizing activities

► Sustained attention:

Residential	Vocational	Community settings
Cooking	Typing	Driving
Paying bills	Answering Phone call	Grocery shopping
Child care	Adding figures	Banking
Cleaning/house keeping	Stocking shelves	Library
Car maintenance	Documentation	Completing list of errands
Writing letters	Building	Recreational activities
Handicraft	Data entry tasks	Fitness activity

Strategies to Improve Attention

- ❖ Minimize distractors
- ❖ Talk yourself through the task
- ❖ Discover the best time of day to work
- ❖ Plan a schedule of activities
- ❖ Set deadlines do one thing at a time
- ❖ Structure the task within a set time frame
- ❖ Take frequent breaks
- ❖ Use incentives
- ❖ Don't rush things
- ❖ Check work for errors

Models of Attention

- **Broadbent Model**
- **Triesman Model**
- **Capacity Model**
- **Cognitive Effort Model**

Broadbent Model

- **Basic Idea: Person switches back and forth between different sources of stimulation**
- **Attention Deficit = Breakdown of the switching process**
- **Rehabilitation: Retrain switching skill – e.g., dichotic listening.**

Triesman Model

- **Basic Idea: Attention is a filtering process**
- **Attention Deficit = breakdown of the filtering mechanism**
- **Retraining: Teach person to focus on dominant filter – Eliminate distractions – Eliminate thought intrusions**

Capacity Models

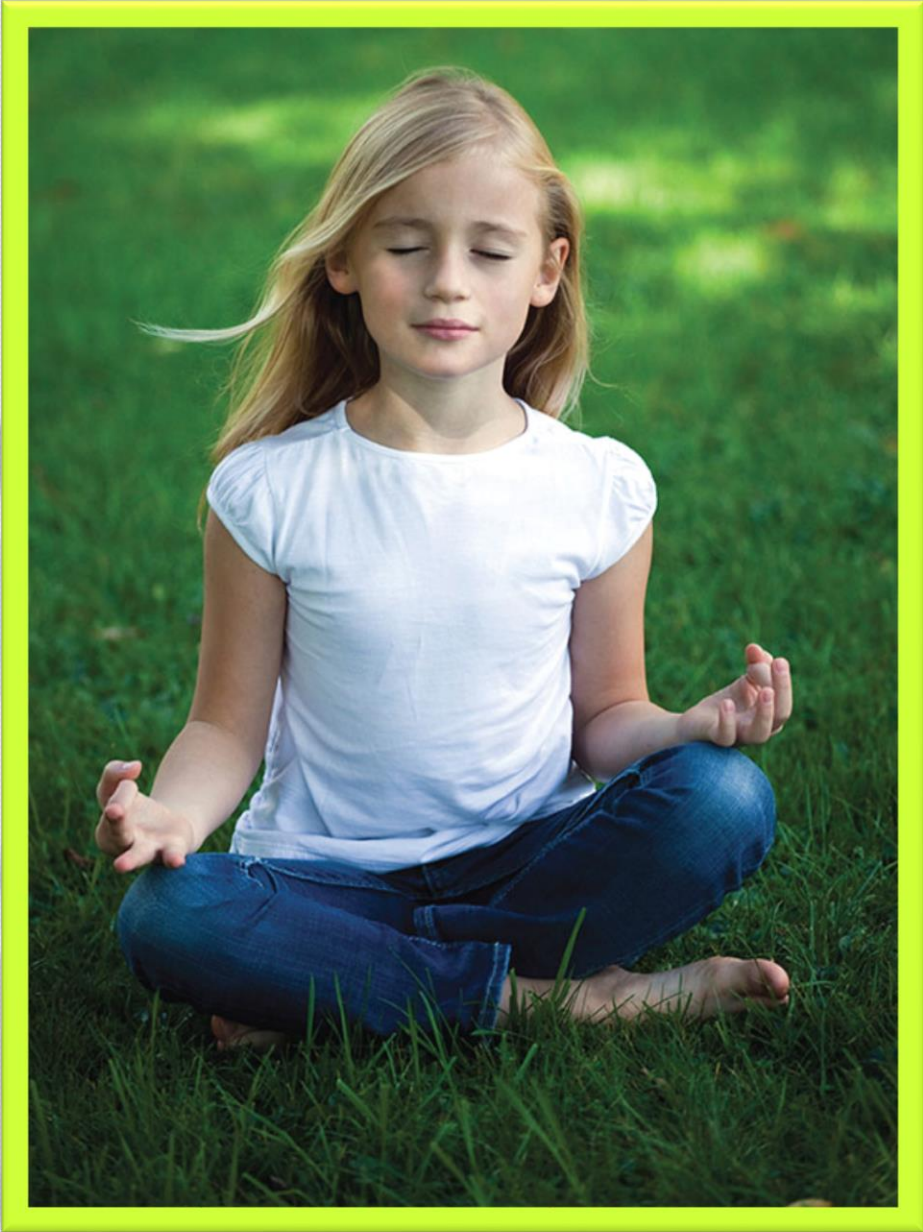
Basic Idea: allocation of resources

**Attention Deficit = Breakdown of the
allocation process**

**Rehabilitation: Teach skills to an
automatic level – Teach encoding
strategies**

Retraining Attention

- **Self questioning**
- **Assigning time**
- **Ear plugs – untimed tests**
- **Distributed practice**
- **Forced rehearsal**
- **Creating incentives**
- **Personal Relevance**
- **Changing diet**
- **Avoiding stimulants**



Meditation

❖ Computer interaction Methods

Neurofeedback
Virtual reality
Computational games



Virtual reality



Elements



Hardware components

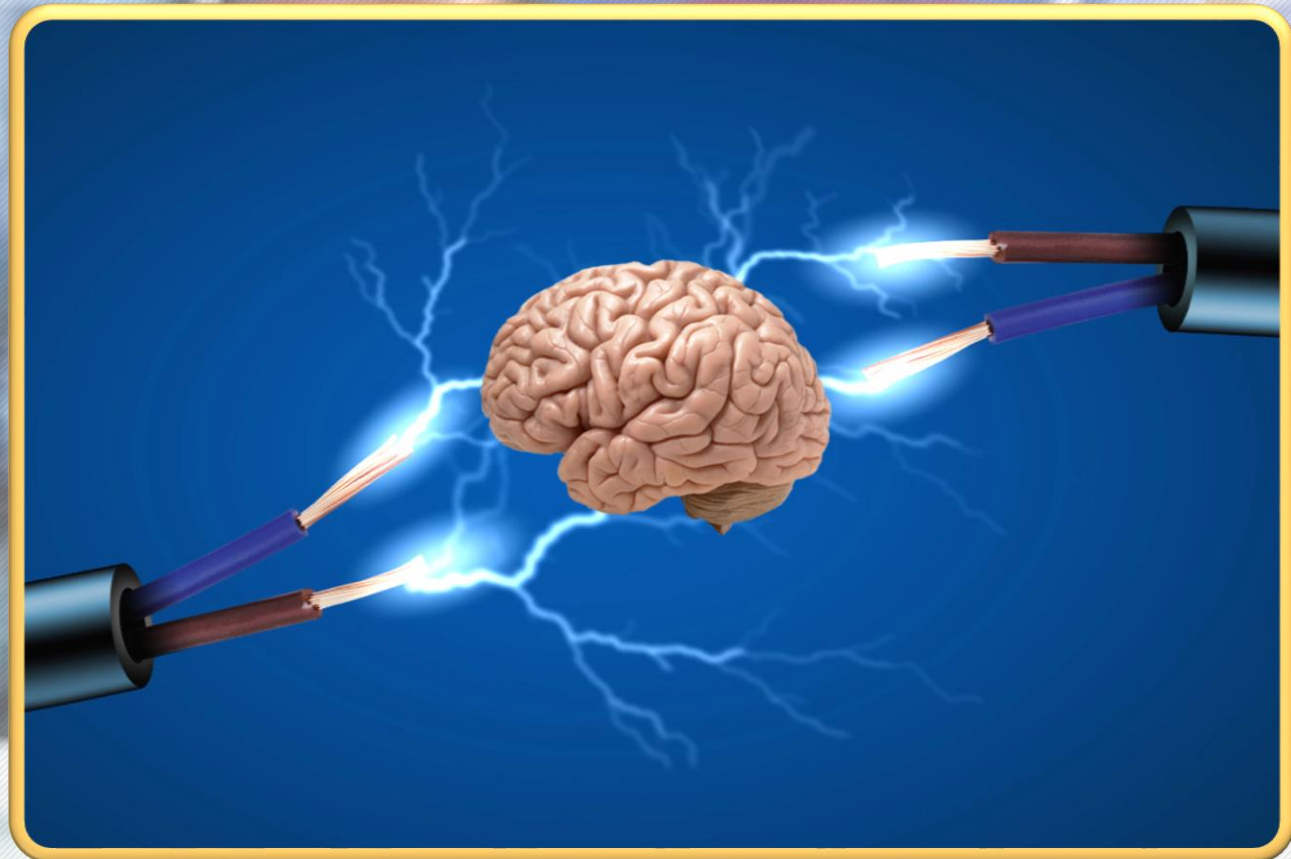
- Primary user input (Keyboard, Mouse, Joystick/3D Pointing Devices/Whole-hand and body input)
- Tracking interface (Measure head, body, hand or eye motion)
- Visual, auditory, haptic interface

Software components

- Input process
- Simulation process
- Rendering process
- World database

❖ Brain stimulation Methods

Transcranial Magnetic Stimulus (tDCS)



Cognitive Rehabilitation in Community Mental Health

Vancouver Coastal Health



mental health
occupational therapy

Standardizing Cog Rehab

- **Cognitive Rehabilitation Curriculum** (teaching modules/ powerpoints for groups) developed in 2012 – 2013 by group of mental health occupational therapists and spearheaded by Kristen La Grand, VCH Clinical Resource Therapist Mental Health and Addictions.
- Manual and educational materials introduced to VCH mental health teams/tertiary facilities, mental health sites in BC and other provinces at CAOT conference in June 2013 and OT Cognitive Expo October 2013
- Goal: To standardize provision of cognitive rehab and to ensure equitable access for all mental health consumers

Current OT Cognitive Rehab Groups

- **Brain Fitness** and **SmartBrains** (2 separate groups)
 - Clients identify areas of cognitive concern and occupational priorities
 - Education given on the brain and brain function
 - Education on cognitive compensatory strategies
 - Weekly SMART goals + homework
 - Introduction to cognitive software
 - Clients engage in brain healthy activities
 - **Mindfulness**, brain healthy snacks, yoga stretches

An Occupational Based Cognitive Rehabilitation Curriculum for Mental Health

Vancouver Coastal Health

How to Be Your Own Brain Fitness Coach

I. Debunk Myths

II. Address Basics

III. Cross-train your Brain

IV. Coach Yourself

1

Understand how the brain works, how it impacts work and life.



2

Healthy Nutrition



Aerobic Exercise

3



4

Stress Management



5

Mental Stimulation



6

With Meditation



7

With Reframing



8

With Biofeedback



9

With Cognitive Training



To Self-Monitor

10



To Prioritize Options

11



12

To Develop, Implement and Iterate your Own Plan



4 Pillars For Brain Health

(Sharpbrains, 2009)

- **Balanced nutrition**
- **Stress Management**
- **Physical Exercise**
- **Mental Stimulation**



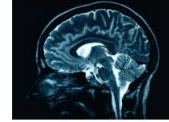
Mindfulness

- Start with a mindfulness exercise: settle our minds; make it easier for our brains to learn and work.



The Right Questions To Ask

- Does the treatment have demonstrated efficacy?
- Is there any evidence of effectiveness i.e., carryover to the real world
- Can you provide an incentive ?
- Does the person see relevance to the treatment?
- Is it possible to measure improvement?
- Is there a clear therapeutic goal?
- Can the client or family continue the treatment without you?



Computerized cognitive rehabilitation:
BRAIN REHAB BASICS

 LOMA LINDA UNIVERSITY