

NeuroTracker

Evidence based to improve brain function



What is NeuroTracker?



NeuroTracker is a multiple object tracking exercise that enhances and measures **awareness** and **focus**.

Important Principles

The NeuroTracker training exercise enhances and measures a persons' ability to manage attention and working memory in a dynamic context.



Multifocal attention: Information processing is done by switching back and forth from General (situational awareness) to specific (focusing on a particular thing).

Large Visual Field: NeuroTracker trains the user to spread its attentional resources throughout the entire field of view.

Speed thresholds: NeuroTracker speed increases or decreases based on individual tracking results.

Stereoscopy: Training in a 3-D environment enhances learning because we operate in a 3-dimensional world.

NeuroTracker Method



Research has shown that completing:

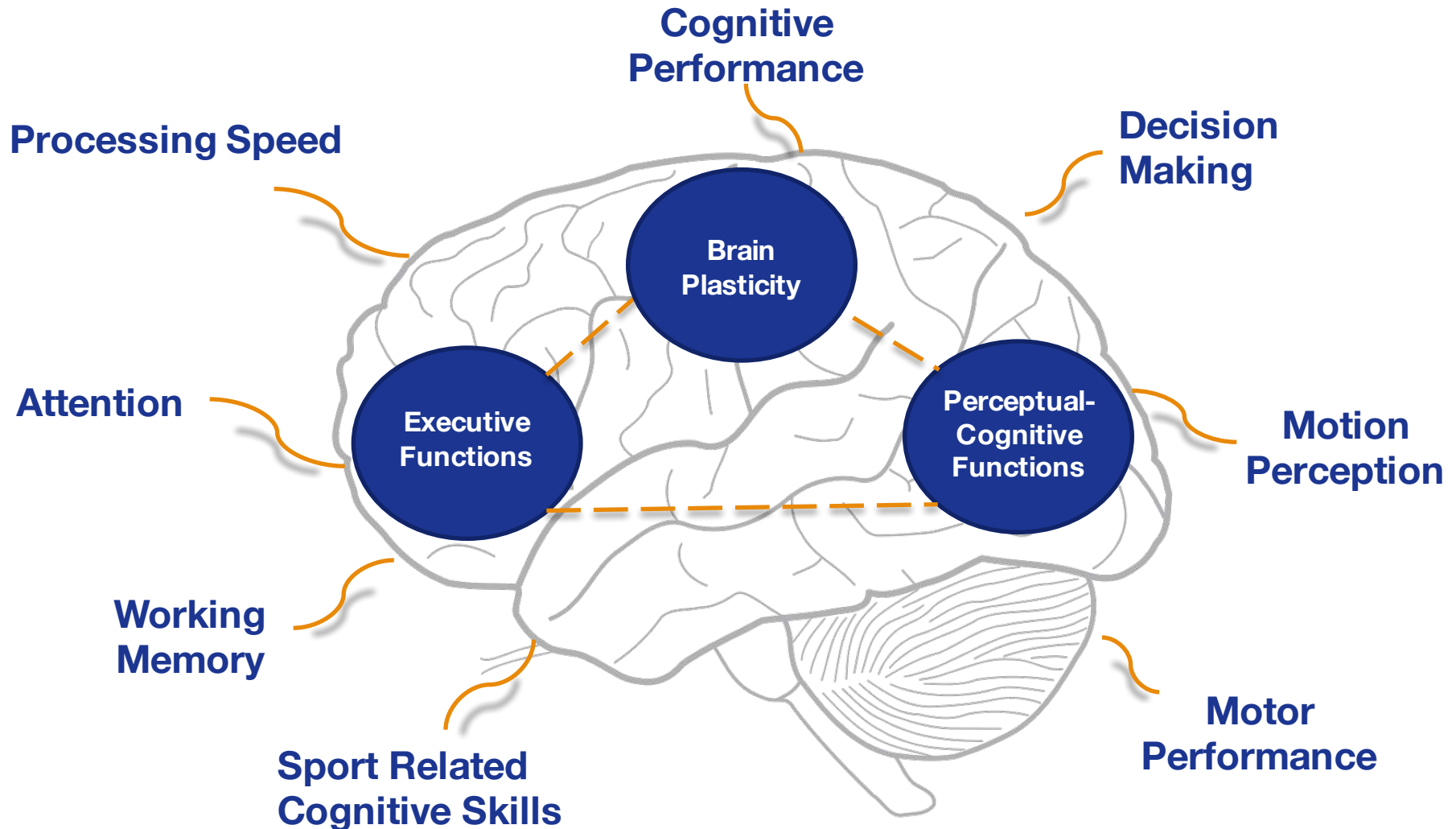
12-30 NeuroTracker sessions
each **5-6 minutes in length**

= **1.5-3 hours total training time**

produces improvements in **human cognitive function** among healthy subjects (18-75 years old) ¹⁻⁴ and athletes⁵⁻⁸



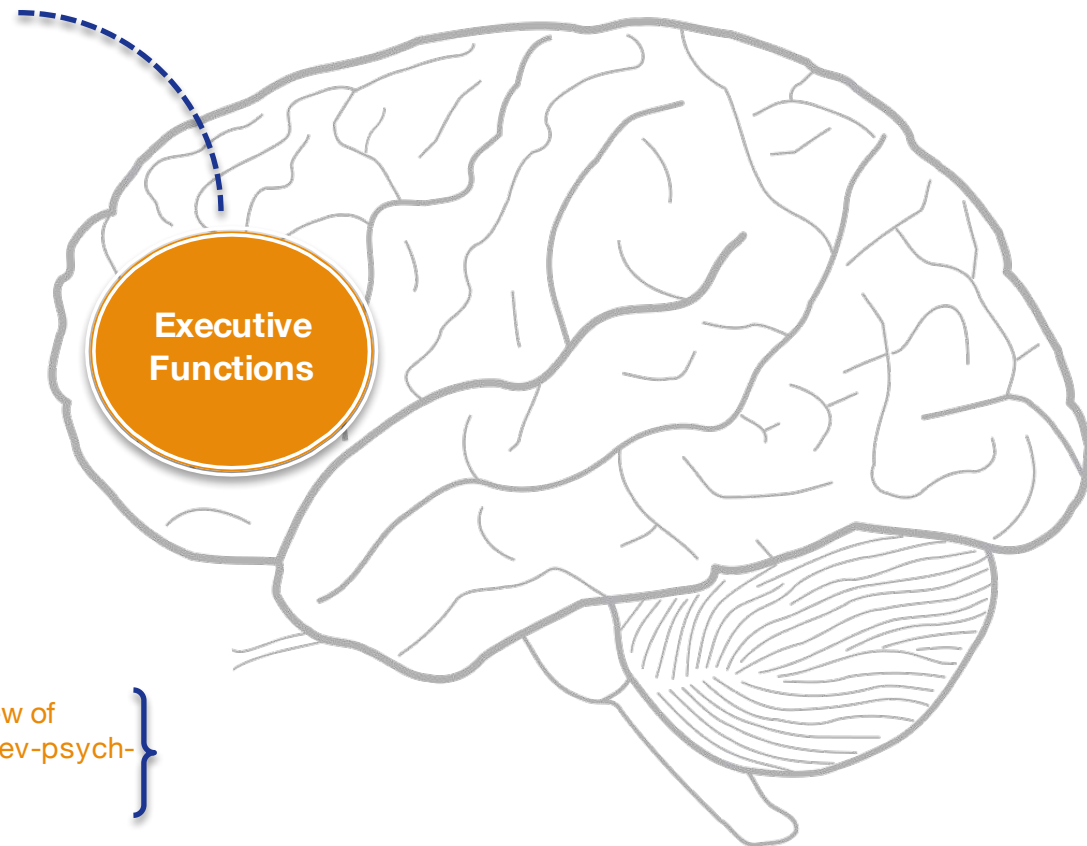
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Executive Functions



Executive functions refer to a family of top-down mental processes needed for **concentration and paying attention**, when relying on instinct or intuition would be ill-advised, insufficient, or impossible



{ Diamond, A. (2013). Executive Functions. Annual Review of Psychology, 64, 135–168. <http://doi.org/10.1146/annurev-psych-113011-143750> }

Executive Functions^{3,9}

Specific Cognitive Function	Measure			Pre-Post Training Improvement	Significance Level		
	Discipline	Population	Test			Sub-test	
Selective Attention <i>The ability to attend to/focus on/cognitively process a given thing</i>	Neuropsychology	Healthy young adults	IVA+Plus CPT	Consistency	-	Strong (p<0.01)	
				Focus	-	Moderate (p<0.05)	
			WAIS	Symbol Search	11.5%	Strong (p<0.01)	
			d2	-	13.8%	Very strong (p<0.001)	
Sustained Attention <i>The ability to maintain selective attention over time</i>			IVA+Plus CPT	Stamina	-	Moderate (p<0.05)	
				Consistency	-	Strong (p<0.01)	
				Focus	-	Moderate (p<0.05)	
				Sustained Quotient	-	-	
Divided Attention <i>The ability to selectively attend to multiple loci at once (multifocal)</i>			D-KEFS	Inhibition / Switching	-	13.8%	Very strong (p<0.001)
						13.5%	Strong (p<0.01)
Inhibition <i>The ability to not attend/focus on/cognitively process a given thing</i>	D-KEFS	Inhibition / Switching	-	13.8%	Very strong (p<0.001)		
				12.3%	Strong (p<0.01)		
Attention <i>Includes all of the above components</i>	Neuroimaging	Healthy young adults	qEEG Frequency bands analysis	↓Theta band (slow waves, 2-11Hz)	-	Moderate (p<0.05) to Strong (p<0.01)	
				↑Beta band (faster waves, 12-20Hz)			
Response Control and Attention <i>Includes impulsivity, attentional 'drifting off', inattention and 'tuning out'</i>	Neuropsychology	Children with deficient attention	IVA+Plus CPT	Prudence	20%	Strong (p<0.01)	
				Consistency	15%	Strong (p<0.01)	
				Vigilance	25%	Strong (p<0.01)	
				Focus	15%	Strong (p<0.01)	

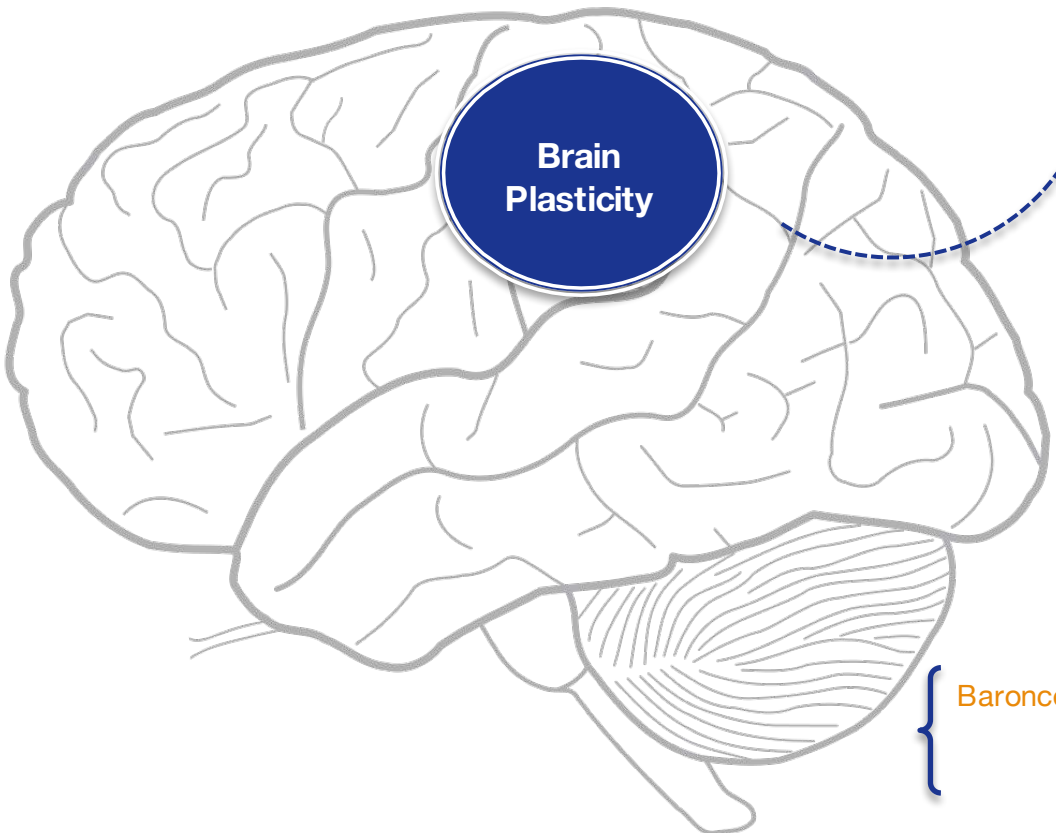
IVA+Plus CPT: Integrated Visual and Auditory Continuous Performance Test (www.braintrain.com); WAIS: Wechsler Adult Intelligence Scale III (<http://www.pearsonclinical.com>); d2: d2 Test of Attention (<http://www.hogrefe.com/>); D-KEFS: Delis-Kaplan Executive Function System (<http://www.pearsonclinical.com>); qEEG: quantitative electroencephalography (www.mitsar-medical.com)

Executive Functions^{3,9}

Specific Cognitive Function	Measure			Pre-Post Training Improvement	Significance Level	
	Discipline	Population	Test			Sub-test
Working Memory <i>The ability to retain and transform information over a short time span</i>	Neuropsychology	Healthy young adults	WAIS	Spatial Span	14.4%	Moderate (p<0.05)
				Letter-Number Sequence	12.9%	Strong (p<0.01)
IVA+Plus CPT			Speed	-	Trend toward significance (p=0,068)	
WAIS			Symbol Search	11.5%	Strong (p<0.01)	
			Code	10.6%	Very strong (p<0.001)	
			Block Design	15.6%	Very strong (p<0.001)	
d2			-	13.8%	Very strong (p<0.001)	
D-KEFS			Color Naming	13.6%	Strong (p<0.01)	
	Word Reading	9.5%	Not significant (p>0,05)			
Processing Speed <i>The time needed to consciously integrate perceptual stimuli</i>						

IVA+Plus CPT: Integrated Visual and Auditory Continuous Performance Test (www.braintrain.com); WAIS: Wechsler Adult Intelligence Scale III (<http://www.pearsonclinical.com>); d2: d2 Test of Attention (<http://www.hogrefe.com/>); D-KEFS: Delis-Kaplan Executive Function System (<http://www.pearsonclinical.com>)

Brain Plasticity



The term “plasticity” refers to the ability of the nervous system to **reorganize its connections functionally and structurally** in response to changes in environmental experience, underlying the adaptive development of neuronal circuitry

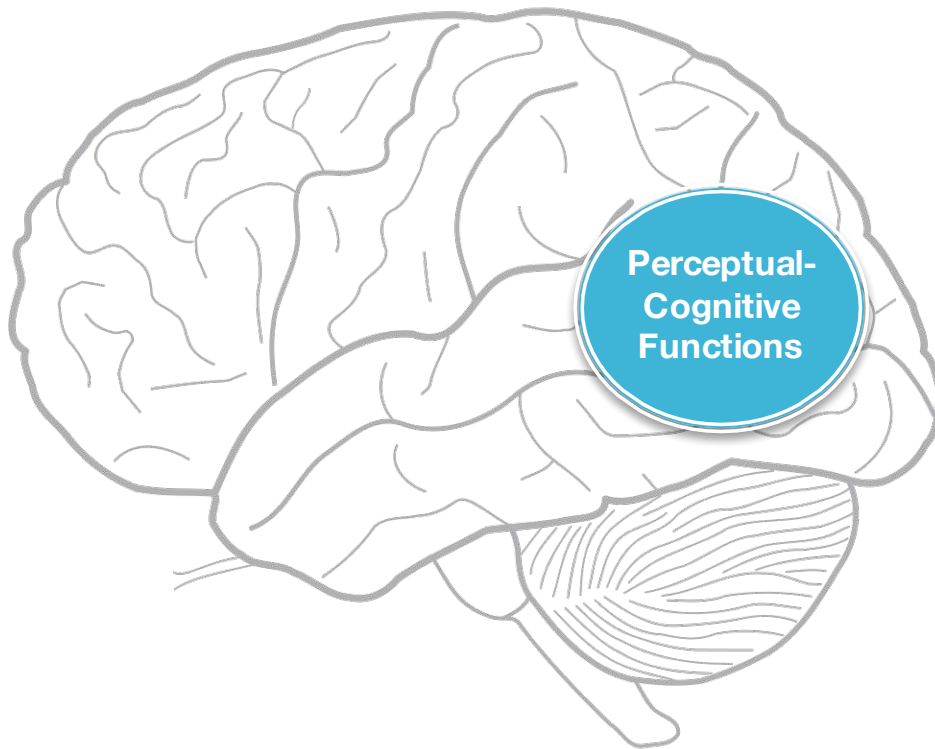
{ Baroncelli, L, et al. (2011). Brain Plasticity and Disease: A Matter of Inhibition. *Neural Plasticity*, 2011, 286073. <http://doi.org/10.1155/2011/286073> }

Brain Plasticity^{3,6}

Specific Cognitive Function	Measure			Pre-Post Training Improvement	Significance Level
	Discipline	Population	Test		
Visual Attention <i>The ability to mediate the selection of relevant visual information from a visual scene</i>	Neuroimaging	Healthy young adults	qEEG, Frequency bands analysis: ↑Gamma band (30-50Hz) in occipital cortex (the 'visual cortex')	-	Moderate (p<0.05) to Strong (p<0.01)
Visual Working Memory <i>The ability to retain and transform visual information over a short time span</i>					
Visual Information Processing Speed <i>The time needed to consciously integrate visual information</i>					
Learning Capacity <i>The ability to recognise, absorb and use knowledge</i>	Psychophysic	Professionnal athletes Semi-professionnal athletes Non-athletes	VTS	-	Strong (p<0.01)

qEEG: quantitative electroencephalography (www.mitsar-medical.com); VTS: Visual Tracking Speed

Perceptual-Cognitive Functions



Perceptual-cognitive functions represent the human brain's ability to **extract meaningful contextual information from the visual scene**. The term illustrates the role played by both perceptual and cognitive processes. Those functions are tightly linked with **anticipation** and **decision making skills**

Perceptual-Cognitive Functions^{1,4,7,8}

Specific Cognitive Function	Measure			Pre-Post Training Improvement	Significance Level
	Discipline	Population	Test		
Decision-Making <i>The ability to make a choice and achieve a specific task goal from a set of possibilities</i>	Sport Psychology	Semi-professional athletes (soccer)	Standardized decision-making coding instrument to evaluate performance in real-world situation; e.g. on-field passing decision-making in soccer players	15%	Moderate (p<0.05)
			VAS to evaluate subjective decision-making (self-assessment) in soccer players	15%	Strong (p=0.01)
Motion Perception <i>The ability of inferring the speed and direction of objects/humans that move in a visual scene</i>	Psychology & Aging	Healthy older adults	BMP allows to evaluate human motion perception. Significant improvements were seen at critical distances for collision avoidance in elderly	-	Moderate (p<0.05)
Sport-related Cognitive Skills <i>Brain systems that are necessary and linked to on-field performance</i>	Sport Performance	Professional athletes (basketball)	VTS	-	Most likely correlated (assist [78%], steal [77%], assist/turnover [78%])
			Measures of performance (assist, steal, assist/turnover ratio) in basketball	-	
Cognitive and Motor performance <i>A performance that relies on both cognitive and motor skills</i>	Surgery Education	Surgeon	VTS correlated to surgical performance in surgeon	-	VTS explains 20-25% of the precision of a surgical task
			Surgical simulation (LapMentor simulator)		

VAS: Visual Analog Scale (http://vision.opto.umontreal.ca/english/technologies/apps_en.html); BMP: Biological Motion Perception; VTS: Visual Tracking Speed

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NeuroTracker 

THANK YOU!

www.NeuroTracker.net

