

Brain Cross Training

Computerized Cognitive Training for Working Memory

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2015

CONTENTS

Foreword	3
Increasing Cognitive Ability with Working Memory Training	4
What is Working Memory?	4
Known Benefits of Working Memory Training	6
Working Memory Training Optimization	7
Computerized Cognitive Training Summary	7

Foreword

My training is in cognitive neuroscience. I earned my doctorate from Carnegie Mellon and the University of Pittsburgh's flagship [Center for the Neural Basis of Cognition](#) program. I have since worked as a Lecturer/Assistant Professor at the University of Cambridge's [Experimental Psychology Department](#) – the top ranking Psychology Department in the top ranking University in the UK - where the basis of IQ Mindware's training program was devised.

In this series of eBooks I present you with the most effective, evidence-based cognitive interventions within a brain 'cross training' paradigm that combines computerized brain training with other strategies to improve brain health, resilience, performance and creativity.

Enjoy your training!

Mark



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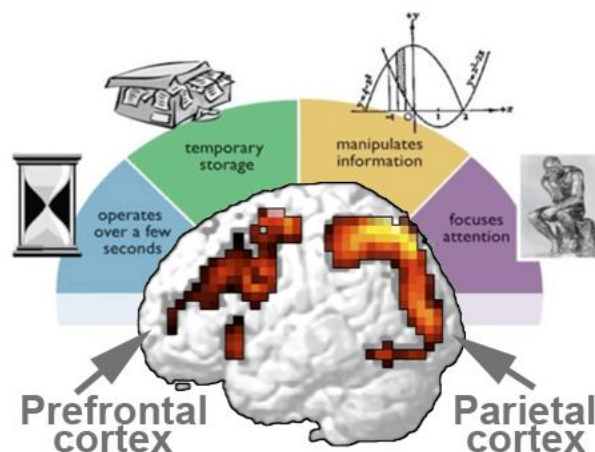
Generally what we understand by ‘brain training is **computerized cognitive training (CCT)** – apps usually designed to improve your attention, processing speed, memory, reasoning and so on. In this chapter I shall be reviewing what is known about the effectiveness of this kind of training for working memory.

Increasing General Cognitive Ability with Computerized Cognitive Training: Working Memory Training

Over the past 10 years there has been a growing body of scientific evidence that a specific type of computerized cognitive training (CCT) has the potential to raise IQ significantly - namely **working memory training**. Commercial CCT comes in many forms. Many brain training companies divide training between different types of cognitive processing such as speed, memory, attention, and so on. In the light of all the studies done on these different types of training, it is only working memory training that has demonstrated real potential for increasing intelligence and executive functioning.

What Is Working Memory?

Working memory is a short-term memory and attention focus system – your ‘mental workspace’. It can be defined as a brain system that keeps information in mind temporarily while using it to think something through, make a decision, pursue a goal or comprehend something. It involves a pre-frontal – parietal brain circuit called the cognitive control network.



Working memory is necessary for staying focused on a task, blocking out distractions, keeping you updated and aware of what is going on in this process, and applying relevant thinking strategies to process the information.

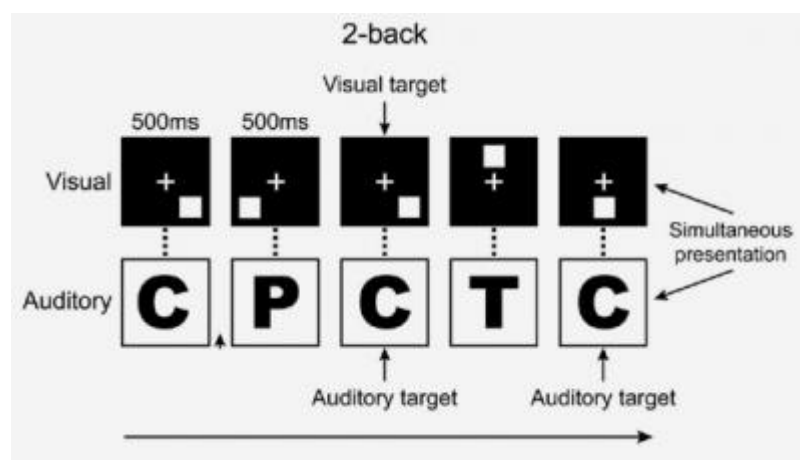
Working memory deficits result in loss of attentional focus such as difficulty keeping track while reading a text, or memory problems such as forgetting what to do in the few seconds of walking from one room to the another. A deficit may also result in being easily distracted while trying to focus on a task and not being able to finish an activity according to plan.

In general the larger your working memory capacity (mental workspace) the better your focus and the greater your capacity for focus, self-control, problem solving and comprehension. There is a strong correlation between working memory and IQ as well as emotion regulation.

What is Working Memory Brain Training?

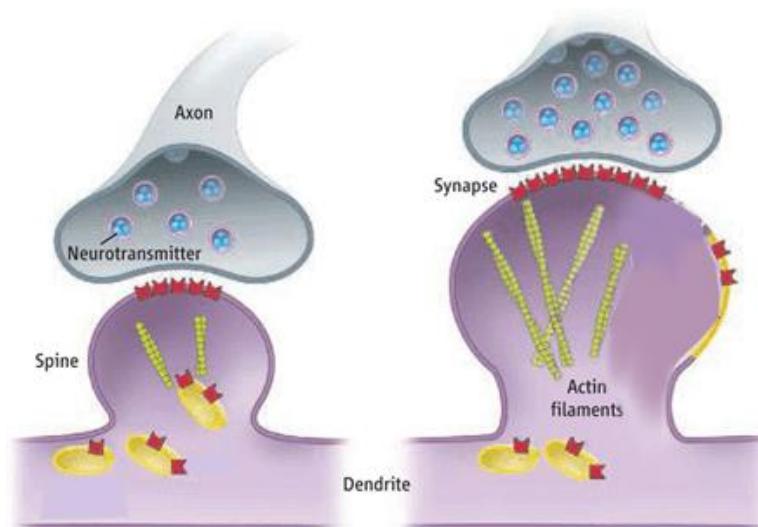
Working memory brain training is currently the most scientifically credible, effective brain training that is available. The aim of all working memory (WM) training programs is to expand working memory capacity.

The most widely studied brain training exercise targeting WM capacity is the **dual n-back**. This game involves viewing a continuous stream of both visual and audio items and deciding whether each item matches the stimulus presented n stimuli back. In the example shown here, the 2-back matches (targets) are shown.



Known Benefits of Working Memory Training

Working memory training has clear long-term **neuroplasticity effects** in brain regions involved in attention, executive function and intelligence, such as changes in the density of cortical dopamine D1 receptors ([1](#), [2](#), [3](#))



There are many scientific studies demonstrating that WM training results in improvements in a range of important cognitive skills as well as improved cognitive function in clinical populations with known WM deficiencies. ([1](#))

“The results of individual studies encourage optimism regarding the value of WM training as a tool for general cognitive enhancement. ...Studies of core training show improvements in a variety of areas of cognition... Core WM training thus represents a favourable approach to achieve broad cognitive enhancement.” ([Morrison & Chein, 2011, p. 34](#)).

Working memory training has been shown in replicated studies and meta-reviews to result in the following brain benefits. Such benefits are often found for both younger and older benefits, indicating that neuroplasticity effects from training are not restricted to younger brains.

- Fluid intelligence (IQ) – i.e. abstract reasoning and problem-solving abilities ([1](#)). We looked at this in our first eBook.
- Improvements in both verbal and visuospatial working memory ([1](#))
- Improvements in executive attention control such as multi-tasking in both younger and older adults ([1](#), [2](#)).
- Memory for personal experiences ([1,2](#))

- Reduced symptoms of ADHD and learning disabilities, for children and adults ([1](#), [2](#))

Working Memory Training Optimization

Jacky Au and colleagues argue in their meta-review of working memory training for IQ conclude that effect sizes can be increased by **optimizing** certain parameters including:

- Program completion
- Increasing intrinsic motivation for program completion

For these reasons the authors argue:

“the results reported [are] a low-end estimate of the true extent of improvement that n-back training can have”.

IQ Mindware specializes in determining the parameters that optimize the benefits to general cognitive performance.

We do this in part by building in **gamification** principles to boost intrinsic motivation – and consequently the likelihood of program **completion**.

In addition we make use of a powerful training method called **interference control**. This is based on building in ‘near target’ distracting information in traditional working memory training. There is known to be a strong role of interference control in linking IQ with working memory capacity ([reference](#)). Building interference control into the dual n-back game is something new, and for this reason we call it ‘second generation’ (2G) dual n-back training.

IQ Mindware apps are also designed to selectively train different aspects of ‘executive control’ such as focus, flexibility and multi-tasking.

Computerized Cognitive Training Summary

Based on meta-review evidence we can conclude that working memory training is worth investing your time and effort into if you want to achieve gains in general cognitive performance. No equivalent cognitive gains result from other types of computerized cognitive training.

We can consider an analogy with sports performance. Substantial gains in sports performance are now possible – and achieving those gains relies on

scientifically guided training programs. Likewise it is becoming apparent that cognitive performance gains are possible and these too rely on scientifically guided training programs. Evolved versions of the dual n-back and other forms of working memory training will be central over the next decade in achieving and maintaining the highest levels of cognitive health, resilience and performance.

IQ Mindware Apps

If you are interested in finding out more about the IQ Mindware working memory training app **i3** for brain performance, resilience and health you can do so at [this website](#).