Cogmed Working Memory Training and the dual-component model of working memory

Dual-component model and ADHD

Unsworth and Engle's (2007) dual-component model of working memory (WM) holds that WM has two primary roles that are; "… (a) active maintenance of a limited amount of novel information in primary memory (PM), particularly in the presence of internal and external distraction; and (b) the retrieval of goal-relevant information from secondary memory (SM), after that information has been lost from PM (due to failures of active maintenance and/or storage limitations)" (Gibson et al., 2010, p. 61). In a 2010 study, Gibson et al. investigated the utility of Unsworth and Engle's model as a theoretical basis for the WM capacity differences in individuals with and without ADHD. Results from Gibson et al. (2010) suggested that maintenance of information in PM was largely intact in ADHD individuals and that SM was the deficient WM structure in ADHD.

Rationale: Testing verbal vs. visuo-spatial Cogmed

Stemming from this 2010 study, Gibson et al. (2011) questioned whether Cogmed Working Memory Training was effectively training PM or SM or both in ADHD individuals. These researchers proposed that the Cogmed RM program, consisting of simple span tasks, was training only the PM component of working memory. Instead, complex tasks would be necessary to train the SM structure because these exercises force all but the last item of span to be shifted from PM to SM and thus, the participant would be attempting to extract information from SM during training. Gibson et al. (2011) further reasoned that spatial simple span tasks may function like complex span tasks and may be more appropriate for training the SM component than verbal simple span tasks. Thus, one group of ADHD individuals trained with a spatial task-only version of Cogmed RM and another group of ADHD individuals with a verbal task-only version of Cogmed RM.

Impact of Cogmed on PM and SM

Gibson et al. (2011) found that when tested with immediate-free-recall tasks after training that there was no significant difference between the verbal and visuospatial Cogmed training groups. Participants in both groups recalled a greater number of items from PM post-intervention but, there was no improvement post-intervention in number of items recalled from SM. Based on these findings, Gibson et al., (2011) concluded that the spatial and verbal exercises in Cogmed are equally effective and that these simple span exercises primarily train the PM component of WM rather than the SM component. These researchers suggested that Cogmed should incorporate complex span tasks so to increase the likeliness that items to-be-remembered are lost from PM and thus, the user must try and extract these items from SM during training.

Despite these conclusions, Gibson et al. (2011) did find a significant improvement in parent and teacher ratings of ADHD symptoms in both training groups. Thus, although the WM structure believed to be deficient (ie., SM) in this ADHD population was not trained, Gibson et al. (2011) maintained that the training of PM had decreased the likeliness that information was lost from PM and consequently had removed some of the information load from the SM structure.

Cogmed response to Gibson et al., 2011 findings

As a forerunner in the field of evidence based cognitive training, Cogmed maintains committed to collaborating with independent researchers and to allowing them freedom to publish any findings that may results from their studies with the Cogmed program. Thus, it is to be expected that the Cogmed program will be evaluated in light of various theoretical viewpoints of attention and attention problems. Cogmed not only welcomes these alternative interpretations of experimental results but also, strives to support independent research endeavors so that changes can be made to the Cogmed program if supported by ample evidence.

Currently, there is scant evidence in the scientific literature to suggest that WM should be dissociated into SM and PM elements nor that the deficit structure in ADHD is the SM component. Differently, there are over fifty peer reviewed articles evaluating WM as a deficit structure in ADHD including those providing evidence at the neural level. These studies are based on a framework supported by the scientific community that is; Baddeley's model of WM (1974, 2000). This framework holds that the WM consists of a central executive that controls and directs information to verbal (phonological) and visual (visuo-spatial) stores and that an episodic buffer links WM to long term memory (Baddeley, 2000).

Nevertheless, Cogmed has extended our development resources to Bradley Gibson and colleagues to further investigate the implications of the Gibson et al. (2011) findings. It is encouraging that despite the dissimilar theoretical approaches of past Cogmed research teams and that of Gibson et al. (2011), decreased report of ADHD symptoms were also found in Gibson et al. (2011). In summation, we at Cogmed believe that as Cogmed Working Memory Training continues to gain acceptance in the scientific community as a reliable intervention for improving working memory capacity, the Cogmed program, the knowledge base surrounding working memory plasticity and the proven impacts on behavioral outcomes will continue to be challenged and to evolve.