PERFORMANCE with ZING

Performance withZing was founded in order to enhance human performance through utilising the best research in neuroscience.

The company's team of scientists, educators and business leaders worked for many years to develop and test a programme that enhances brain function, based on cutting-edge research from some of the world's top universities. Performance withZing is the result and the company has developed several programmes for children, athletes, women and men.

Performance withZing is engaged in ongoing research and development, and users will benefit from our dedication to the continual improvement of the withZing programmes.

Brain Performance Drives Development

The withZing programmes not only help develop your ability to learn new skills quicker but when the cerebellum is fully functional a person's executive functions will increase. Executive functions include attention, working memory and cognitive flexibility. Improving this area will have a knock-on effect to other aspects of a person's life including social skills, productivity and depression.

Many studies have been done on the impact of executive functions but below is a table from **Diamond (2013)** which summarises it effects:

Aspects of life	**The ways in which Executive Functions (EFs) are important to that aspect of life**	**References:**
Mental health	EFs are impaired in many mental disorders, including:	
	- Addictions	Baler and Volkow (2006)
	- Attention deficit hyperactivity (ADHD)	Diamond (2005), Lui and Tannock (2007)
	- Conduct disorder	Fairchild et al. (2009)
	- Depression	Taylor-Tavares et al. (2007)
	- Obsessive compulsive disorder (OCD)	Penadès et al. (2007)
	- Schizophrenia	Barch (2005)
Physical Health	Poorer EFs are associated with obesity, overeating, substance abuse, and poor treatment adherence	Cresioni et al. (2011), Miller et al. (2011), Riggs et al. (2010)

Quality of life	People with better EFs enjoy a better quality of life	Brown and Landgraf (2010), Davis et al. (2010)
School readiness	EFs are more important for school readiness than are IQ or entry-level reading or math	Blair and Razza (2007), Morrison et al. (2010)
School success	EFs predict both math and reading competence throughout the school years	Borella et al. (2010), Duncan et al. (2007), Gathercole et al. (2004)
Job success	Poor EFs lead to poor productivity and difficulty finding and keeping a job	Bailey (2007)
Marital harmony	A partner with poor EFs can be more difficult to get along with, less dependable, and/or more likely to act on impulse	Eakin et al.(2004)
Public safety	Poor EFs lead to social problems (including crime, reckless behaviour, violence, and emotional outbursts)	Broidy et al. (2003), Denson et al. (2011)

Source: Diamond (2013).

Brain - Body Connection: The Key to Lasting Improvements

The withZing programmes create enhanced human performance by engaging the brain-body connection. Using a personalised programme of coordinative exercises which you access through an app, we develop the connections in your brain required to perform at your best. Neurological assessments are used to monitor your progress and update you on your changes.

These exercises require difficult and careful movements, but no great physical strength or endurance, for example standing on one leg and moving your head from side to side.

By performing coordinative exercises daily, it stimulates part of the brain responsible for attention, memory and coordination making it more efficient and automatic. When these skills are more automatic there is less stress on the brain increasing the 'mental resources' available for a range of tasks.

The coordinative exercises stimulate three areas of the balance system and the repetitive stimulation of these systems leads to development in a region of the brain called the cerebellum. The cerebellum is a small yet major brain region, at only 10% of the brain's volume it holds 50% of the total neurons.

'The Brain's Brain' - An Overview of the Cerebellum

The power of withZing lies in recent discoveries about a part of the brain called the *cerebellum*. Sometimes known as "the brain's brain", the cerebellum is responsible for the automation of fundamental skills. These skills include spatial awareness, language skills and social interaction.

When the automation of basic skills is not fully developed, simple tasks have to be undertaken by the working memory — a part of the brain that is critical for processing information and making executive decisions.

The cerebellum has grown in importance with research into the area increasing significantly in the last 5 years as neuroscientists have realised that it plays a larger role and particularly in cognition – a selection of research papers in support of this are referenced below:

- **Cerebellar brain volume accounts for variance in cognitive performance in older adults.** Michael J. Hogan, et al., (2010)
- **Mechanisms of cerebellar contributions to cognition in humans.** Christian Bellebaum, et al., (2012)
- **Seeking a unified framework for cerebellar function and dysfunction: from circuit operations to cognition.** Egidio D'Angelo and Stefano Casali. (2013)
- **The Cerebellum's Role in Movement and Cognition.** Leonard F. Koziol, et al., (2014)
- **Rapid Evolution of the Cerebellum in Humans and Other Great Apes.** Robert A. Barton, and Chris Venditti. (2014)
- **The Cerebellum, Sensitive Periods, and Autism.** Samuel S-H Wang, et al., (2014)

How does withZing stimulate the brain?

At Performance withZing we have built upon research which demonstrates that the cerebellum can be developed through coordinative exercise and particularly through exercises that stimulate the three areas which form the balance system; 1) the vestibular system, which is located in the inner ear, 2) the visual system, which uses information received through the eyes and 3) the somatosensory system, which uses information received from the muscles and joints.

- **Acute coordinative exercise improves attentional performance in adolescents.** Henning Buddea., et al., (2008)
- **Brain changes associated with postural training in patients with cerebellar degeneration: A voxel-based morphometry study.** Roxana G. Burciu, et al., (2013)
- **Increased Cerebellar Volume and BDNF level following Quadrato Motor Training.** Tal D. Ben-Soussan, et al., (2015)

By stimulating the balance system and providing a challenge to the cerebellum, sensory feedback from the body whilst performing the exercises will indicate a failure to maintain balance, and this will lead to extensive cerebellar activation in 'error mode'. This activation facilitates brain changes, 'shaking' up existing networks, and allowing the connection of brain regions that were previously not connected. Success in this type of exercise will specifically improve the body's coordination under abnormal conditions but can also prime the brain for change and breaking out of old habits.

What Evidence is there?

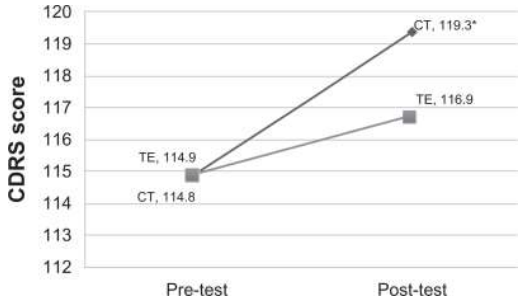
There are numerous research papers published on coordinative exercise developing brain function, however we have selected two easy to understand studies and provided the summaries below. The first study uses elderly participants, being able to show an increase in cognitive function in this declining generation indicates that an improvement could be made in the general population.

1) **Effectiveness of coordination exercise in improving cognitive function in older adults: a prospective study -** Timothy CY. Kwok, KC Lam, PS Wong, WW Chau, Kenneth SL. Yuen, KT Ting, Elite WK. Chung, Jessie CY. Li, Florence KY. Ho. (September 2011)

40 participants (3 males, 37 females) mean age of 79yrs.

Methods:
Participants from two centres for the elderly were allocated to practice either an 8-week coordination training (CT) program or an 8-week towel exercise (TE) program. The Chinese Dementia Rating Scale (CDRS) was used to measure cognitive functioning of participants among other physical measurements. These assessments were administered before and after the program.

Results:
The dementia rating scale scores (CDRS) of the coordination training (CT) group improved significantly from 114.8 at pre-test to 119.3 after training. The scores of the towel exercise (TE) group also improved from 114.9 at pre-test to 116.9 after training.



Conclusion:

Findings from this study demonstrated that low-intensity level mind-body exercise could be beneficial to the cognitive functioning of older adults, particularly coordinative exercises.

2) **Acute coordinative exercise improves attentional performance in adolescents.** Henning Buddea, Claudia Voelcker-Rehageb, Sascha Pietraßyk-Kendziorraa, Pedro Ribeiroc, Gunter Tidowa (June 2008)

Healthy adolescents aged 13-16yrs old from an elite performance school; 99 (80 male and 19 female) mean age of 14.98yrs.

Methods:

The group was split into 2 sub-groups. A group of 52 (44 male, 8 female – referenced as the 'NSL' group in the results) who performed normal physical education classes of medium intensity exercise without any specific coordinative requests, and a group of 47 (36 male, 11 female – referenced as the 'CE' group in the results) who performed coordinative exercises which were selected from special coordinative training forms for soccer.

The Neuropsychological performance of students were assessed in areas of attention and concentration through an assessment called the d2-test.

Results:

(a) GZ – total number of responses
(b) SKL – standardized value of the number of correct responses minus errors of confusion
(c) F% - number of errors related to the total number of responses

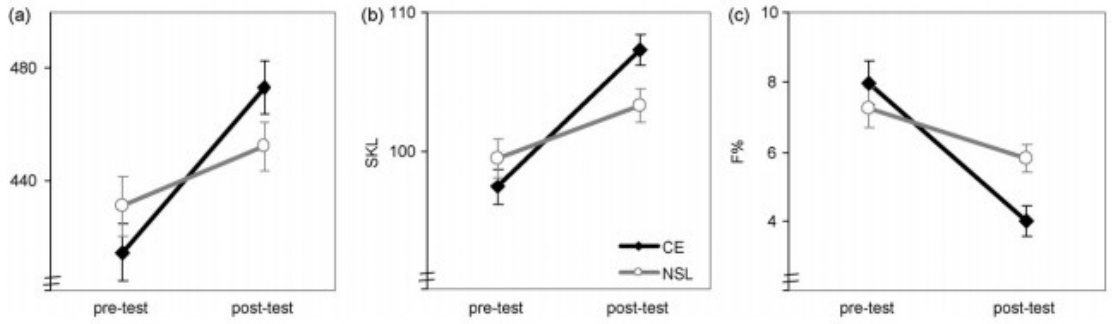


Fig. 1. (a) Results of the GZ for the experimental group (CE) and the control group (NSL). (b) Results of SKL for the experimental group (CE) and the control group (NSL). (c) Results of F% for the experimental group (CE) and the control group (NSL).

Conclusions:

The results indicate that the group which undertook the coordinative exercises (CE) displayed greater improvements in the controlled attention and concentration tests over the group which undertook regular physical exercise.

in terms of memory, attention and coordination. The Insight assessments used to evaluate user progression are therefore the most accurate in testing performance on these dimensions:

- Memory: long and short term memory recall, working memory (Schoenauer, et al., 2014; Albouy et al., 2015; Moreau & Conway, 2013).
- Attention: task switching and response inhibition (Diamond, 2013; Oei and Pattersen, 2014; Lustig et al., 2007).
- Coordination: motor coordination and timing (Riecker, et al., 2003; and Guenther et al., 1998)

In addition, as a result of these benefits caused by the programme's stimulation, it is reasonable to expect to see beneficial changes in other areas of life and in particular those areas that involve input from the above three dimensions. These can include cognitive aspects, such as enhanced attention and working memory, physical aspects such as game playing and agility, and social aspects, such as better inter-personal skills and confidence. It is therefore clear that Performance withZing can impact not only on learning but also on personal wellbeing.

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