

TALI

Tali Train Research Compendium

A summary of the four foundational papers that establish the research of the Tali Train attention training software tool.

Attention,

may be the most important skill we have. Attention allows us to concentrate on a task and switch our focus, whilst stopping us from responding impulsively to distractions. Attention has been highlighted as a significant predictor of educational and vocational outcomes. Children with poor attention skills are shown to have fewer social relationships and increased vulnerability for mental health issues, whilst being at a greater risk for substance abuse and incarceration.

The core attention networks are selective attention, sustained attention and attentional control. Selective attention refers to the ability to attend to relevant information whilst simultaneously ignoring irrelevant information. This skill is particularly important in early childhood and helps children to direct attention appropriately at home and within the classroom. Sustained attention refers to the ability to maintain focus over a prolonged period of time. This skill is important to enable children to remain engaged with a task and to listen to instructions. Attentional control refers to the ability to shift attention and to prevent impulsive responding. This skill is more complex than the other attention processes and as such develops later in childhood.

Developmental disorders,

usually have a childhood onset but tend to persist into adulthood, sometimes causing impairment or delay in functions related to the central nervous system maturation. Some people with these disorders display a degree of intellectual disability and many do not. Some people with these disorders display difficulties in adaptive behaviour whilst others do not. Developmental disorders include down syndrome (DS), autism spectrum disorder (ASD), and attention deficit hyperactivity disorder (ADHD).

Down Syndrome (DS),

Trisomy 21, is a chromosomal abnormality, characterised by the presence of a third (partial or total) copy of chromosome 21, with clinical manifestations that may include; variable intellectual ability, muscular hypotonia and joint laxity, facial dysmorphism; variable malformations (essentially heart and digestive) and a risk of complications (epilepsy, leukaemia, auto-immune and endocrine pathologies, earlier aging and Alzheimer's disease).

World Health Organization's (WHO's) International Classification of Diseases – 11_LD40.0

Autism Spectrum Disorder (ASD),

is characterised by persistent difficulties in the ability to initiate and to sustain reciprocal social interaction and social communication, and, by a range of restricted, repetitive, and inflexible patterns of behaviour and interests.

The onset of the disorder occurs during the developmental period, typically in early childhood, but symptoms may not fully manifest until later, when social demands increase.

Deficits are sufficiently severe to cause impairment in personal, family, social, educational, occupational or other important areas of functioning and are usually a pervasive feature of the individual's functioning observable in all settings, although they may vary according to social, educational, or other contexts. Individuals along the spectrum exhibit a full range of intellectual functioning and language abilities.

World Health Organization's (WHO's) International Classification of Diseases – 11_6A02

Attention Deficit Hyperactivity Disorder (ADHD),

is characterised by a persistent pattern (at least 6 months) of inattention and/or hyperactivity-impulsivity. Onset typically occurs during the developmental period from early to mid-childhood. The degree of inattention and hyperactivity-impulsivity is outside the limits of normal variation expected for a child's age and intellectual functioning and additionally, the inattention-hyperactivity significantly interferes with academic, occupational or social functioning.

Inattention refers to: significant difficulty in sustaining attention to tasks that do not provide a high level of stimulation or frequent rewards; distractibility; and problems with organisation. Hyperactivity refers to excessive motor activity and difficulties with remaining still, most evident in structured situations that require behavioural self-control. Impulsivity is a tendency to act in response to immediate stimuli, without deliberation or consideration of the risks and consequences.

The relative balance and the specific manifestations of inattentive and hyperactive-impulsive characteristics varies across individuals, and may change over the course of development. In order for a diagnosis to be made, the behaviour pattern must be clearly observable in more than one setting.

World Health Organization's (WHO's) International Classification of Diseases – 11_6A06

Tali Train,

is an evidence-based training program, developed to improve attention and support learning in childhood. Designed by a team of neuroscientists at Monash University, the program is the result of over 20 years of research in developmental psychology and cognitive neuroscience.

See talihealth.com.

02

Cognitive training as a resolution for early executive function difficulties in children with intellectual disabilities

Kirk, H., Gray, K., Riby, D., and Cornish, K. (2015)
Research in Developmental Disabilities

Rationale

This study reviewed existing cognitive training programs that aim to improve cognitive and behavioural functions, and gauged any potential benefits they may offer children with intellectual disorders.

Executive Functions: Target Training Domains

Working Memory Training

The majority of cognitive training programs available to children target working memory (WM). Within these programs, improvements in working memory tasks have been found for both typically developing children and those with Attention Deficit Hyperactivity Disorder (ADHD). Mostly, these improvements were found to occur in the WM tasks that were directly targeted through the training tool (referred to as 'near transfer' effects). For example, improving performance on verbal WM tasks after undergoing training on visuospatial WM tasks. However, some caution should be taken when interpreting near transfer effects, as the assessments used to measure improvements after training often closely resemble the tasks used in the training programs themselves. Hence, the improvement might simply be the result of practice effects rather than changes in broader cognitive skills. In contrast to near transfer effects, improvements in untrained domains such as ADHD symptoms, attention or IQ (referred to as 'far transfer' effects) were, in many cases, not observed outside of the training tool. This lack of far transfer effects suggests that working memory training may only be reliable in producing changes in targeted domains and highlights the potential limits of this intervention in producing more widespread improvements, such as behaviour or academic achievement.

Attention Training

Cognitive training targeting attention has revealed improvements in attention in children with ADHD as well as improvements in non-trained skills such as mathematical competence and parent reported inattentive behaviour.

Training targeting attention has been more promising for both typically developing children and those with ADHD, though a lack of improvement in inhibitory control is thought to be due to the non-adaptive nature of the tasks. There is promising support for the potential of attention training programs to produce both near and far transfer effects, however as some studies show that far-transfer effects occur and some do not, it appears universal far-transfer effects for attention training are still elusive.

Gaps in the Efficacy of Cognitive Training for Children with Intellectual Disabilities

Difficulties in cognitive abilities are prevalent in children with intellectual disorders. Despite this, there are currently very few training programs that target children with reduced cognitive capacity. Therefore, the extent to which training-induced improvements may occur in children with severe Executive Function difficulties is yet to be confirmed. However, the emergence of touch screen tablets offers the potential to engage these children with early intervention.

Conclusion

Cognitive training programs focussing on working memory and attention have shown some promising results in both typically developing children and those with ADHD. However, this review found there was not sufficient evidence to fully evaluate the effectiveness of these interventions.

Between cognitive training paradigms targeting working memory and the ones targeting attention, the latter strategy is preferable in children with intellectual disability due to an already severely reduced working memory capacity. Therefore, developing computer-based cognitive training interventions that target attention is critical for these children.

03

Visual attention and academic performance in children with developmental disabilities and behavioural attention difficulties (part 1)

Kirk, H., Gray, K., Riby, D., Taffe, J. and Cornish, K. (2016)
Developmental Science

Rationale

This study aimed to provide a comprehensive assessment and comparison of the types of attention difficulties experienced by children diagnosed with Down Syndrome (DS), Autism Spectrum Disorder (ASD) and other Non-Specific Intellectual Disability (NSID), who were rated as having similar behavioural attention difficulties.

Methods

Participants:

77 children with developmental disorders (Autism Spectrum Disorder (n=23), Down Syndrome (n=22), Non-Specific Intellectual Disability (n=32)), 4–11 years of age.

Measures:

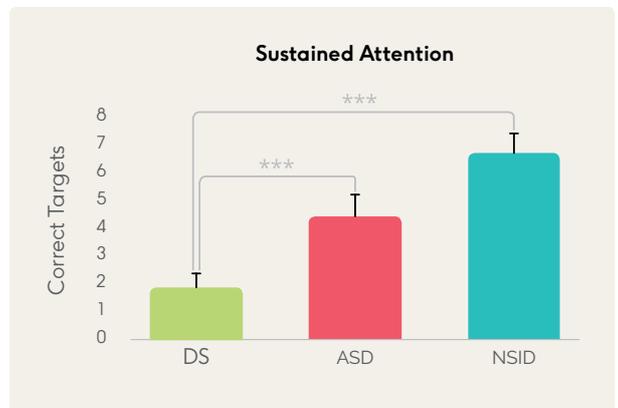
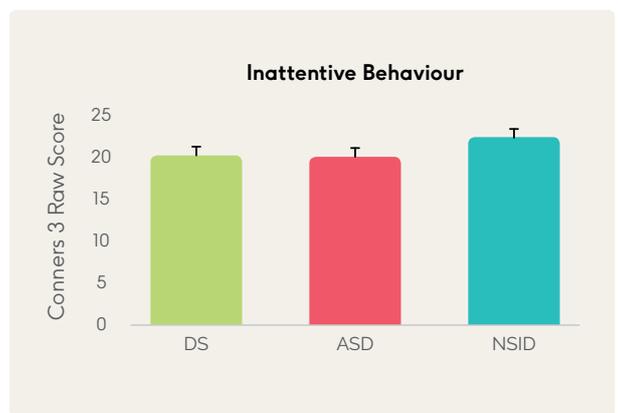
- Computerised cognitive attention battery:
 - Selective attention (Visual Search)
 - Sustained attention (Vigilance)
- Behavioural rating scale of inattention

Key Finding

Despite comparable levels of inattentive behaviour, children with Down Syndrome had poorer visual search (selective attention) and vigilance abilities (sustained attention) than children with Autism Spectrum Disorder or those with Non Specific Intellectual Difficulties.

Significance

Importantly, this study highlights that commonly used behavioural rating scales are not sensitive enough to detect differences in underlying attention skills. It is important to accurately assess attention difficulties in children with developmental disorders to facilitate the design of tailored interventions that meet the unique needs of each child.



04

Visual attention and academic performance in children with developmental disabilities and behavioural attention deficits (part 2)

Kirk, H., Gray, K., Riby, D., Taffe, J. and Cornish, K. (2016)
Developmental Science

Rationale

This study aimed to assess the relationship between attention difficulties and academic skills such as literacy and numeracy.

Methods

Participants

77 children with developmental disorders (Autism Spectrum Disorder (n=23), Down Syndrome (n=22), Non-Specific Intellectual Disability (n=32)), 4–11 years of age.

Measures

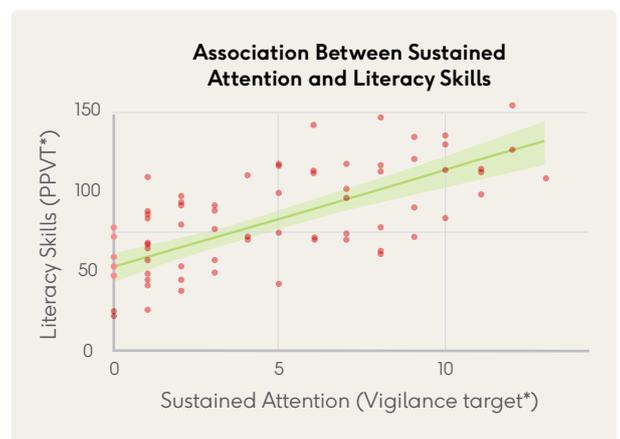
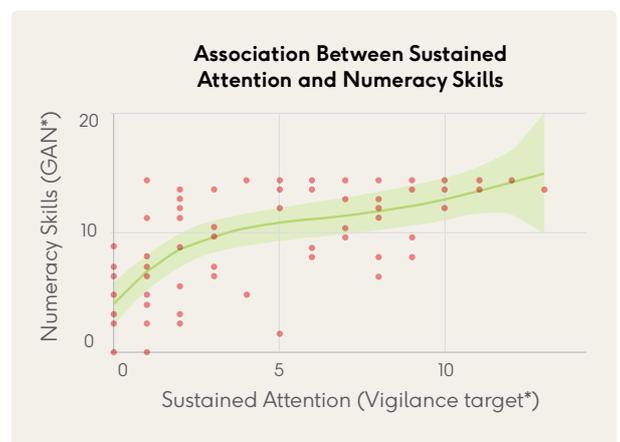
- Sustained attention (Vigilance)
- Early literacy skills: Receptive vocabulary (PPVT)
- Early numeracy skills: Cardinality (GAN)

Key Finding

Visual attention is significantly associated with literacy and numeracy skills, regardless of a child's developmental disorder.

Significance

The association between visual attention and academic skills is a highly useful early indicator of learning impairments and a potential target for early intervention for children with and without intellectual and developmental disorders.



*GAN: "give-a-number" protocol; a measure of cardinality.

*Vigilance target: A measure of sustained attention in Wilding Attention battery (WATT).

*PPVT: The Peabody Picture Vocabulary Test 4; a measure of receptive vocabulary.

05 Computerised attention training for children with intellectual and developmental disabilities: A randomised controlled trial

Hannah Kirk, Kylie Gray, Kirsten Ellis, John Taffe, and Kim Cornish (2016)
Journal of Child Psychology and Psychiatry

Rationale

This study aimed to assess the immediate and long-term efficacy of a computerised attention training program (Tali Train) on attentional difficulties, in children with developmental disorders including Down Syndrome (DS), Autism Spectrum Disorder (ASD), and Non-Specific Intellectual Disability (NSID).

Methods

Participants:

75 children with developmental disorders (ASD, DS, NSID), 4–11 years of age

Randomised into:

1. Tali Train (n=38)
2. Control program (n=37) used to control for time spent using a touchscreen program, increased parent involvement and adhering to scheduled training.

Location: home-based

Training duration: 5 weeks

Follow-up: 3 months

Key Finding

Children in the Tali Train group showed a significantly greater reduction in the number of errors made on the Selective Attention task from baseline to post-training and baseline to 3-month follow-up than children in the control condition.



Significance

The current findings provide evidence that training can positively influence aspects of attention (selective attention) in children with developmental disorders. These findings are important as they highlight that impairments of attention are not necessarily permanent in children with developmental disorders and that by using intensive computerised attention training, they can be improved.

06 Impact of attention training on academic achievement, executive functioning, and behaviour: A randomised controlled trial

Hannah Kirk, Kylie Gray, Kirsten Ellis, John Taffe, and Kim Cornish (2017)
American Journal on Intellectual and Developmental Disabilities

Rationale

The aim of this study was to investigate the efficacy of computerised attention training (Tali Train) on untrained outcomes such as executive functions, literacy and numeracy skills, and behavioural/emotional problems in children with developmental disorders.

Methods

Participants:

75 children with developmental disorders (Down Syndrome (DS), Autism Spectrum Disorder (ASD), and Non-Specific Intellectual Disability (NSID)) from 4–11 years of age.

Randomised into:

1. Tali Train (n=38)
2. Control program (n=37)

Location: home-based

Training duration: 5 weeks

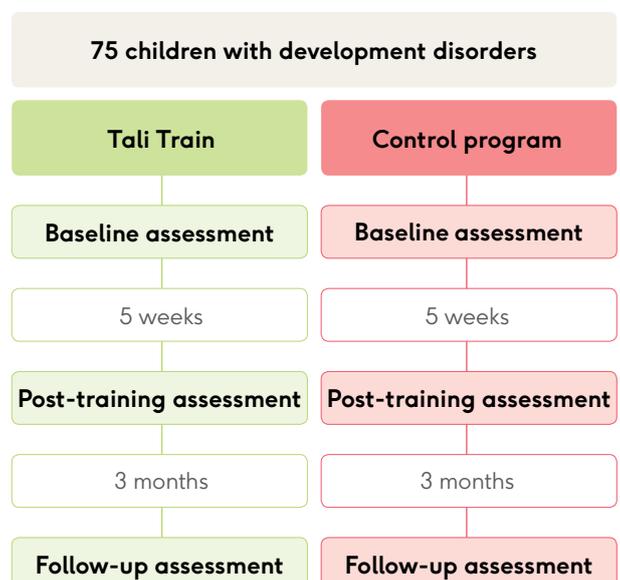
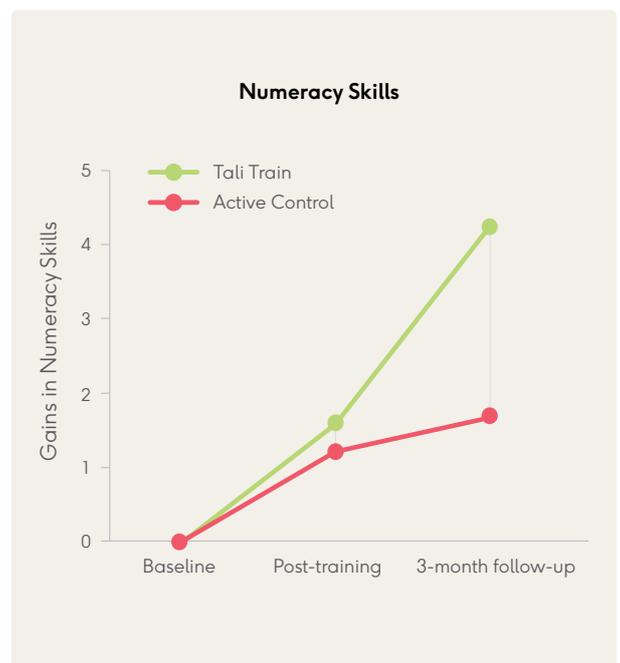
Follow-up: 3 months

Key Finding

Children in the training group showed significantly greater improvements in numeracy skills at the 3-month follow-up, compared with children in the control program.

Significance

Improvements in untrained skills are very rare. These findings provide evidence that certain untrained skills in children with developmental disorders, such as numeracy, can be modestly improved, using intensive computerised attention training. Tali Train is one of the very few programs to show an untrained improvement in learning. This is important as attention training may have the potential to overcome some of the academic difficulties faced by individuals with developmental disorders and support children's educational development.





TALI

Our Mission

To help the littlest humans* find their happy.

*We know all children thrive with better attention. We want to support them early to give them a better chance at improving their attention, and finding that happy.

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