

ISSF Seedcorn award: End of Award Report

Title: Visual attention control in individuals with neurodevelopmental disorders

Applicants:

Prof Susan Leekam, Director of Wales Autism Research, School of Psychology, Cardiff University
Dr Sam Wass, Research Scientist, MRC Cognition and Brain Sciences Unit, Cambridge University
Prof Jonathan Erichsen, Professor Optometry & Vision Sciences, Cardiff University
Professor Angus Clarke, Clinical Professor, Institute of Cancer & Genetics, Cardiff University
Mr Andrew Millington, Clinical Optometrist, Optometry & Vision Sciences, Cardiff University

Postdoctoral Research Associate: Dr Georgina Powell, Wales Autism Research Centre, School of Psychology, Cardiff University

Grant: £49,668. Start date: 1st Oct 2013 - 31st Dec 2014 (including no-cost extension)

Summary of application

This seedcorn project brought together research and clinical expertise in a new interdisciplinary collaboration between Psychology, Optometry and Clinical Genetics. Its main goal was to evaluate the feasibility of a novel training method designed to improve visual attention in children with neurodevelopmental disorders. Previous findings by Leekam and colleagues indicated that individuals with Autism Spectrum Disorder (ASD) show attentional learning, but no previous research had used training tasks designed to improve attention control in children with neurodevelopmental disorders. The study provided the first ever targeted training of this kind in low-IQ ASD and Rett syndrome. The research also provided a unique opportunity to apply advances in eye tracking technology and to apply attention training methods outside the lab and in a community setting. The seedcorn funding enabled the team to explore training methods that were based on those originally developed for typical infants and toddlers by Dr Wass and colleagues (Wass et al., 2011). Having developed the methodology, Dr Powell carried out a pilot study with children with ASD and children with Rett syndrome in special schools or in children's homes. All children had developmental delays (low functioning ASD and Rett syndrome) and detailed psychological assessments were taken to give insights into the effect of developmental level.

Outcome of research

The work was completed as planned. Time constraints prevented us taking additional assessments of clinical and visual information in order to tailor the intervention to each individual as we had originally proposed in the application. Instead, given the good uptake and response from children to the training programme, we decided that we would first carry out a study applying the same procedure to every child since individually tailoring the method at this stage would slow progress.

27 children with ASD and 3 children with Rett syndrome were initially recruited. Results below summarise the findings for the ASD sample. Nineteen completed the pre-assessment, and 17 were able to complete the entire training protocol. Evidence of transfer of training improvements to non-trained tasks was also identified – even given the limitations of the present study (primarily the small sample size). Specifically, we found significant transfer of training improvements to a non-trained assessment of visual sustained attention. Children selectively increased their attention to 'interesting' novel complex images, but not to 'boring' novel images, demonstrating transfer to stimuli that were not part of the training materials. Of note, we found strong relationships between this measure and mental age at pre-test ($r=.52$).

As expected, we also observed systematic ways in which training tasks needed to be adjusted for individual children. These observations identified the ways in which individually tailored tasks can be adapted to children with varying degrees of cognitive impairment, given the heterogeneity we encountered in our sample. We also found that, despite the advantages of providing high-intensity training at relatively low cost in a school setting, the quality of some of the eye tracking data was lower than that obtained in the lab. Future technological development should be aimed at increasing the accuracy of eye tracking in community settings, which will go some way toward alleviating these problems.

Our present findings are encouraging insofar as they represent, to our knowledge, the first demonstration of improvements on untrained assessments of attention control following targeted cognitive training in individuals with ASD. However, they need to be replicated with a larger sample size. Repeating the present study with a larger and more homogenous sample, will establish if training effects are stronger for some children (e.g. the more severely impaired), than for others. Further study will also examine the nature of transfer of training improvements across different types of stimuli.

In summary however, this pilot study has demonstrated the feasibility of attention training in children with neurodevelopmental disorders, an area where there is currently an absence of systematic cognitive assessment and intervention. Previous research proposes that it is desirable to attempt to apply cognitive training, in order to target 'hub' cognitive domains such as attention control. However, virtually no previous research has attempted this. The present results are limited, given the small sample size. However, they suggest that it may be feasible to train some of these cognitive abilities in children with ASD using gaze-contingent technology. These techniques have potential practical advantages to clinician-mediated interventions - insofar as they can potentially be applied to a wide range of children, to provide intensive training interventions at relatively low cost. However, further work is required to replicate the effects observed in the present study, and to apply more extensive assessment of transfer training effects. If this work is successful, these technologies have the long-term potential to be integrated as a component of more traditional, clinician-mediated interventions.

Publications and other outputs

To date, the findings have been submitted for publication, and are currently under review. They have also been disseminated at local events for parents with ASD and families without ASD and at international conferences and meetings. We will continue to disseminate the findings as our publication goes to press. A grant application was made to Action Medical Research before the end of the project, which was unsuccessful. We plan to make another grant application, but the timing has been postponed in light of changes of circumstances of the team members.

Papers submitted to scientific journals

Powell, G., Wass, S., Erichsen, J., & Leekam, S. (2015) First evidence of the feasibility of gaze-contingent attention training for school children with autism. Submitted 4th March 2015 to *Autism: International Journal of Research and Practice*. Under review.

Presentations at international conferences and workshops

La Trobe University, Melbourne Australia. 08/12/2014 Dr G.Powell. Training attention control in children with Neurodevelopmental Disorders. Workshop (120 people registered).

Poster submission presented at the inaugural International Convention of Psychological Science (**ICPS**), 12-14 March 2015 "Training attentional control in Autism Spectrum Disorders, Amsterdam

Presentations to families who took part in the research and to other families

Brain Games Dr Powell - March 2014 and March 2015

National Autistic Society Parent Event: Research Updates Prof Leekam - 11th July 2014.

Open Day Presentation: Demonstration of (80+ people) Dr Powell and Prof Leekam - 25th October 2014

New collaboration

The project opened up a new collaboration across Schools of Psychology, Medicine and Optometry and a completely new collaboration with the MRC Cognition and Brain Sciences Unit, Cambridge University.

Grant application

Action Medical Research 22nd Nov 2013 £167,507.60 (unsuccessful Jan 2014)