

ECONOMIC AND SOCIAL RESEARCH COUNCIL END OF AWARD REPORT

For awards ending on or after 1 November 2009

This End of Award Report should be completed and submitted using the **grant reference** as the email subject, to **reportsofficer@esrc.ac.uk** on or before the due date.

The final instalment of the grant will not be paid until an End of Award Report is completed in full and accepted by ESRC.

Grant holders whose End of Award Report is overdue or incomplete will not be eligible for further ESRC funding until the Report is accepted. ESRC reserves the right to recover a sum of the expenditure incurred on the grant if the End of Award Report is overdue. (Please see Section 5 of the ESRC Research Funding Guide for details.)

Please refer to the Guidance notes when completing this End of Award Report.

Grant Reference	RES-000-22-2771		
Grant Title	The development of repetitive behaviours in young children		
Grant Start Date	01-05-2008	Total Amount	£46,614.92
Grant End Date	31-01-2010	Expended:	
Grant holding Institution	Durham University		
Grant Holder	Professor S.R. Leekam		
Grant Holder's Contact Details	Address	Email	
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Co-Investigators (as per project application):	Institution		
Professor H. McConachie	Newcastle University		
Professor A. Le Couteur	Newcastle University		
Dr B. Arnott	Durham University		
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Dr C. Fernyhough	Durham University		

1. NON-TECHNICAL SUMMARY

Please provide below a project summary written in non-technical language. The summary may be used by ESRC to publicise your work and should explain the aims and findings of the project.

[Max 250 words]

Restricted and repetitive behaviours (RRBs) such as repetitive motor movements, routines, rituals, and intense sensory interests are an essential part of the diagnosis of autism. They are also common in all young children early in development. Little is known about how these behaviours change with age and such knowledge is important in order to detect atypical behaviour patterns in children with autism. Parents of 126 typically developing children completed the Repetitive Behaviour Questionnaire (RBQ-2) when their children were 15 months, 2 years old and 6 years old and the results were analysed in this study. Results showed that RRBs reduced with age. However at all three ages, two distinct subtypes of behaviour emerged, each showing different developmental pathways. One subtype included repetitive motor and sensory behaviours. The behaviours in this subtype were extremely common at 15 months, rapidly declined by 2 years and then remained low in frequency. In contrast, the other subtype of behaviours which included routines and insistence on sameness were low in frequency at 15 months, increased at 2 years and then decreased by 6 years. Results across time also revealed that repetitive behaviour subtypes at 15 months were strongly related to repetitive behaviour subtypes later in childhood at both 2 years and 6 years, even when language ability and socio-economic status were taken into account. Research findings on these changing patterns of behaviours will help future child health and education professionals to detect when repetitive behaviours are atypical for the child's age and level of development.

2. PROJECT OVERVIEW

a) Objectives

Please state the aims and objectives of your project as outlined in your proposal to the ESRC.

[Max 200 words]

Taken from original proposal

Restricted and repetitive behaviours (RRBs) are part of the diagnostic criteria for autism spectrum disorders (ASD) and are also found in the general population in the early years of childhood. The main purpose of the proposed research is to increase our understanding of children's development by investigating developmental changes in these behaviours. The specific objectives are to identify whether restricted and repetitive behaviours and subgroups of these behaviours (e.g., stereotypies, sensory interests and adherence to routines and rituals) change with age between the ages of 15, 24 and 75 months, and whether changes in RRBs are affected by gender, language ability and SES.

b) Project Changes

Please describe any changes made to the original aims and objectives, and confirm that these were agreed with the ESRC. Please also detail any changes to the grant holder's institutional affiliation, project staffing or funding. *[Max 200 words]*

The ESRC Small Grant Award commenced on 1/5/08. This was a 1-year grant employing Dr Bronia Arnott on a 0.5 post. There was a 9 month break in the grant due to Dr Arnott's maternity leave which meant that the grant period ended on 31/01/10. In April 2009 the PI, Prof Leekam moved from Dept of Psychology, Durham University to School of Psychology, Cardiff University. She continued as PI until the end of the grant.

c) Methodology

Please describe the methodology that you employed in the project. Please also note any ethical issues that arose during the course of the work, the effects of this and any action taken. *[Max. 500 words]*

This longitudinal study provided comparative data across three time-points. Published data from parents of 192 children were already available. These data were collected in 2003 when the children were 2 years old, as part of an ESRC-funded study (R000239456). We also held unpublished data for 139 of the same children at age 15 months (collected in 2001/2002). Therefore with the addition of new data collected in the current ESRC project, when children were 6 years old, we were able to investigate age changes in restricted and repetitive behaviour (RRB) across three age phases.

Participants

The original sample from our published study of 192 2-year-olds (94 female, 98 male) comprised a mixed SES group. We had anticipated a return to the sample by 132 of these participants when children were 6 years. 126 of the original sample returned to the study. Of these, 88 had data for all 3 phases.

Measures

The Repetitive Behaviour Questionnaire-2 (RBQ-2; Leekam et al. 2007) is a 20-item parent questionnaire that collects information on a range of repetitive behaviours. Data that had already been collected for 15 month and 2 year phases were combined with the new RBQ-2 data collected at age 6 years.

The Childhood Communication Checklist (CCC-2; Bishop, 2003) provides an overall language measure and has subscale measures for pragmatic and syntactic skills. The CCC-2 is applicable only to children aged 4-16 years. A different language measure was therefore used for earlier phases (MacArthur Communication Index : Fenson, Dale, Resnick & Bates, 1993).

The Strengths and Difficulties Questionnaire. (SDQ; Goodman, 1997) provides a measure of the child's general behavioural difficulties as reported by the parent. This was used at 6 year phase only (suitable above age 3 years),

Background information questionnaire: At the 6 year phase, parents answered a brief questionnaire asking whether their child had any medical diagnoses and/or statement of special educational needs.

Ethical approval was obtained from the Psychology Department's Ethics Sub-Committee. There were no specific ethical issues.

Statistical methods

The following methods were used to answer questions taken from original proposal.

1. What is the developmental trajectory for RRBs?

Comparison of RBQ-2 scores (mean repetitiveness score) across the three testing phases used a nonparametric test, nptrend in STATA (skews and kurtosis in the data prevented to the use of repeated measures ANOVA).

2. Does the structure of RRBs change with age?

Exploratory and confirmatory factor analyses were used to establish whether the repetitive behaviour subtypes seen at 24 months were also found at other ages.

3. Is the frequency of RRBs associated with gender, SES and parents' reports of their children's

d) Project Findings

Please summarise the findings of the project, referring where appropriate to outputs recorded on *ESRC Society Today*. Any future research plans should also be identified. [Max 500 words]

Findings based on questions in the original proposal.

1. What is the developmental trajectory for RRBs?

We found that RRBs reduced steadily with age from a mean of 1.69 (0.34) at 15 months to 1.58 (0.35) at 2 years and 1.37 (0.30) at 6 years. Higher RRBs at 15 months had a faster decline at the next 2 time points ($z=7.60$, $p<.001$), meaning that 15 months was the most important age for indicating rate of change in scores across time. Two subtypes of RRBs emerged ('repetitive motor-sensory' versus 'routines-sameness') each with different trajectories. Motor and sensory behaviours were extremely common at 15 months and rapidly declined at 2 years and beyond, while routines and sameness were low in frequency at 15 months, increased at 2 years and then decreased by 6 years. Path analysis showed that repetitive behaviour subtypes at 15 months significantly predicted repetitive behaviour subtypes later in childhood at both 2 years and 6 years, even when other contributing factors were controlled for.

2. Does the structure of RRBs change with age?

The two repetitive behaviour subtypes described above, that were seen at 2 years were also found at 6 years. Confirmatory factor analysis resulted in a well-fitting 2-factor solution at both ages. This 2-factor solution was also found at 15 months, although at 15 months there was more cross-loading of items.

3. Is the frequency of RRBs associated with gender, SES and parents' reports of their children's strengths and difficulties? 4. Is the frequency of RRBs associated with language ability?

Gender was a significant predictor of RRBs. Males had higher scores than females at all ages, especially for the sensory and motor subtype, with faster declines of scores ($z=-3.25$, $p<.001$ for males; $z=5.18$, $p<.001$ for females). Language was also a significant predictor of RRBs. By 6 years, higher RRB scores were associated with lower language scores ($r = -.52$). Higher RRBs were also associated with parents' reports of their children's strengths and difficulties (SDQ). However, when gender and language were controlled for in the analysis, this effect no longer held because boys, particularly with poor language abilities, had both high RBQ scores and high SDQ difficulties scores.

Outputs – ESRC Society Today

The results for 15month (and 2 year) phases are reported in Arnott et al. (2010) *Development and Behavioral Pediatrics* (see *Society Today*). The results for changes across all 3 phases have been reported in an international conference paper (SRCD, 2009) and recorded in *Society Today*. The full report of the confirmatory factor analyses and path analyses for all three phases are to be reported.

Future plans

Future research plans include (a) the use of the RBQ-2 to identify measurement characteristics of RRBs in children with ASD and typical development (collaboration with colleagues at Autism Research Centre, Cambridge University), (b) the use of the RBQ-2 as a baseline and outcome measure in a new intervention study.

e) Contributions to wider ESRC initiatives (eg Research Programmes or Networks)

If your project was part of a wider ESRC initiative, please describe your contributions to the initiative's objectives and activities and note any effect on your project resulting from participation. *[Max. 200 words]*

Not part of a wider ESRC initiative

3. EARLY AND ANTICIPATED IMPACTS

a) Summary of Impacts to date

Please summarise any impacts of the project to date, referring where appropriate to associated outputs recorded on *ESRC Society Today*. This should include both scientific impacts (relevant to the academic community) and economic and societal impacts (relevant to broader society). The impact can be relevant to any organisation, community or individual. *[Max. 400 words]*

Impacts on scientists and practitioners have been achieved through research publications, workshop dissemination and through grant awards.

The research outputs listed below and marked * have been recorded on *ESRC Society Today*.

Scientific Publications and presentations

*Arnott, B., McConachie, H., Meins, E., Fernyhough, C., Le Couteur, A., Turner, M., Parkinson, K., Vittorini, L., Leekam, S. (2010) The frequency of restricted and repetitive behaviour in 15 month-old typically developing infants. *Journal of Development and Behavioral Pediatrics*. vol 31, issue 3 (online April 1st) impact factor (2.49)

*Arnott, B. (2008). *Restricted and repetitive behaviours at 15 and 24 months*. British Psychological Society Developmental Section Conference, Sept 2008.

*Leekam, S. (2009). *Continuity and change in children's restricted repetitive behaviour* Poster Biennial Meeting for the Society for Research in Child Development, Denver, USA 2-4th April 2009.

Leekam, S. (2009). *Restricted and repetitive behaviour in typical development and autism*.

Seminar to UC Davis M.I.N.D. Institute, Sacramento, USA, 8th April 2009.

Arnott, B. & Leekam, S. (2009). *Developmental Changes in Restricted and repetitive behaviour in typical development*. Paper presented to North East Autism Research Group. Nov 27th

Meetings with international collaborators Professor David Evans (USA) and Professor Margot Prior (Australia) at International Meeting for Research in Autism (IMFAR), May 2008; Nov 2009.

Paper to be presented (scientific audience)

Arnott, B. & Leekam, S. (2010). Early predictors of restricted and repetitive behaviours. Paper to be presented to North East Autism Research Group. May 21st 2010

Other Impacts

Leekam, S. (2009). *Restricted and repetitive behaviours*. Presentation to Learning Disability and Autism Network, Annual Event held at Wales National Museum, March 2nd, 2009. This network reaches all practitioners and researchers working in Autism throughout Wales and includes parent representation.

30th Nov 2009. Workshop for Professionals on Repetitive Behaviour. Attended by representatives from local Social Care and Health Departments, local Child and Adolescent Psychiatry Services, local Educational Psychology Services and members of a Children's Challenging Behaviour Team

*Leekam, S.R & Prior, M. (2010). Restricted and repetitive behaviours. Lecture in Volkmar, F (Ed). *Autism and Autism Spectrum Disorders: History, Diagnosis, Neurobiology, Treatment and Outcome*. The Biomedical & Life Sciences Collections, Henry Stewart Talks Ltd. London. Online at <http://hstalks.com/?t=BL1042580-Leekam>

This lecture reviews the field and refers to the results of this study. It is part of an international series of lectures that is available for training of professionals

working in medicine and bio-medical fields.

b) Anticipated/Potential Future Impacts

Please outline any anticipated or potential impacts (scientific or economic and societal) that you believe your project might have in future. [Max. 200 words]

Potential local, national and international societal impact is anticipated through the reporting of summaries of the research findings to lay-audiences that will be presented on the following local, regional and national websites; <http://research.ncl.ac.uk/daslne>; <http://research.ncl.ac.uk/cargo-ne>; <http://www.awares.org>; <http://www.nas.org.uk>

Further potential international research impact is anticipated through the reporting of the results at workshop on Restricted and Repetitive Behaviours on 24 Sept 2010, Cardiff University that will bring together the co-applicants and collaborators.

A scientific review paper on restricted and repetitive behaviours by PI and collaborators is currently under review with the journal *Psychological Bulletin*. If accepted for publication, this article will reach a wide ranging audience beyond the subject area and is likely to lead broaden the impact of the work that we have carried out in this project.

Further impact on practitioners is expected through the award of a new grant (Baily Thomas Charitable Fund starts July) investigating the effects of intervention on repetitive behaviours. Consultant speech and language therapists are working with us on this project.

You will be asked to complete an ESRC Impact Report 12 months after the end date of your award. The Impact Report will ask for details of any impacts that have arisen since the completion of the End of Award Report.

4. DECLARATIONS

Please ensure that sections A, B and C below are completed and signed by the appropriate individuals. The End of Award Report will not be accepted unless all sections are signed.

Please note hard copies are NOT required; electronic signatures are accepted and should be used.

A: To be completed by Grant Holder

Please read the following statements. Tick ONE statement under ii) and iii), then sign with an electronic signature at the end of the section.

i) The Project

This Report is an accurate overview of the project, its findings and impacts. All co-investigators named in the proposal to ESRC or appointed subsequently have seen and approved the Report.

X

ii) Submissions to *ESRC Society Today*

<p>Output and impact information has been submitted to <i>ESRC Society Today</i>. Details of any future outputs and impacts will be submitted as soon as they become available.</p> <p>OR</p> <p>This grant has not yet produced any outputs or impacts. Details of any future outputs and impacts will be submitted to <i>ESRC Society Today</i> as soon as they become available.</p> <p>OR</p> <p>This grant is not listed on <i>ESRC Society Today</i>.</p>	X
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iii) Submission of Datasets

<p>Datasets arising from this grant have been offered for deposit with the Economic and Social Data Service.</p> <p>OR</p> <p>Datasets that were anticipated in the grant proposal have not been produced and the Economic and Social Data Service has been notified.</p> <p>OR</p> <p>No datasets were proposed or produced from this grant.</p>	X
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SIGNATURE:	
NAME:	DATE:

B: To be completed by Head of Department, School or Faculty

Please read the statement below then sign with an electronic signature to confirm your agreement.

This Report is an accurate overview of the project, its findings and impacts.	
SIGNATURE:	
NAME:	
POSITION:	DATE:

C: To be completed by Finance Officer of Grant-Holding Institution

Please read the statement below then sign with an electronic signature to confirm your agreement.

This Report is an accurate overview of the project, its findings and impacts. All co-investigators named in the proposal to ESRC or appointed subsequently have seen and approved the Report.

SIGNATURE:

NAME:

POSITION:

DATE: