Open access • Journal Article • DOI:10.1111/J.1540-5834.2010.00553.X

Vi. institutional deprivation, specific cognitive functions, and scholastic achievement: english and romanian adoptee (era) study findings — Source link

Celia Beckett, Jennifer Castle, Michael Rutter, Edmund J.S. Sonuga-Barke

Published on: 01 Apr 2010 - Monographs of The Society for Research in Child Development (Monogr Soc Res Child Dev)

VI. INSTITUTIONAL DEPRIVATION, SPECIFIC COGNITIVE FUNCTIONS AND SCHOLASTIC ACHIEVEMENT: ERA STUDY FINDINGS

by Celia Beckett*, Jenny Castle*, Michael Rutter* and Edmund J. Sonuga-Barke

*joint first authorship

<H1> Introduction

Whereas meta-analyses of cross-sectional adoption studies have indicated that there is an impact of early deprivation on adoptee's cognitive ability, these effects generally diminish markedly after upbringing in adoptive homes (van IJzendoorn, Juffer & Poelhis., 2005; van IJzendoorn & Juffer, 2006). Outcomes in terms of scholastic attainment were not quite so positive in a cross-sectional meta-analysis (van IJzendoorn et al., 2005), but the Swedish follow-up study of male conscripts did <u>not</u> find that scholastic attainment was impaired relative to IQ (Dalen et al., 2008; Lindblad, Dalen, Ramussen, Vinnerljung & Hjern, 2009). Longitudinal studies of adoptees experiencing extreme early deprivation have shown that the initial effects are especially marked, with cognitive deficit followed by substantial (but incomplete) cognitive recovery (Beckett et al., 2006; MacLean, 2003). Both initial impairment and catch-up vary as a function of the length and severity of deprivation experienced (Beckett et al., 2006; O'Connor et al., 2000; Rutter et al., 1998). Previous analyses of the ERA data patterns of educational attainment at age 11 indicated that these were largely predictable on the basis of cognitive ability (Beckett et al., 2007), although symptoms of inattention also played a minor role.

The published studies have been limited by the lack of longitudinal data. The current analysis extends the previous findings to include cognitive development at 15 together with independently adjudicated educational attainment in public examinations. The General Certificate of Secondary Education (GCSE) examinations are normally taken in the UK during the academic year when a young person reaches 16 years of age. IQ was still expected to be the major influence on performance in GCSE examinations; however, it was also considered that other factors, including child behavioral characteristics, might also have a bearing. For example, it might be expected that young people with postulated deprivation-specific patterns (DSPs - see chapter 3; Kumsta, Kreppner, Rutter et al.) might score lower in public examinations than predicted by their IQ alone.

In addition, scholastic attainment could be influenced by the degree of initial impairment and by subsequent catch-up in cognitive development. The children adopted from Romania with the most marked degree of cognitive impairment had displayed the most improvement over time at age 11 (Beckett et al, 2006). Nevertheless, it was not clear whether this improvement would continue and be translated into performance in public examinations at 16 years of age.

IQ scores are likely to be the primary factor influencing exam results, but there may also be underlying specific difficulties that could be expected to contribute to poor exam performance. Other studies of inter country adoptees have suggested that there may be a general recovery in IQ for the majority of the children studied, but within this group there may be specific deficits in social cognition, memory and executive functioning (Behen, Helder, Rothermel, Soloman & Chugani, 2008). Whether specific skills play a role in an individual's performance in public examinations is also examined here. Evidence of an association among executive functioning, memory and mathematical and reading skills has been shown in various studies (Andersson, 2008; Hughes & Ensor, 2008; Garon, Bryson &

Smith, 2008). However, it remains unclear how much specific impairments associated with early insult or experiences influence educational outcomes (e.g., in the profile of non-verbal impairment, or specific reading difficulties) (Hulme & Snowling, 2009).

<H2> Specific Cognitive Features

The literature (both conceptual and empirical) on specific cognitive functions has been concerned with several quite different issues. First, there have been the debates over the validity (or otherwise), and the meaning of, a general factor of overall intelligence 'g' (see Bock, Goode & Webb, 2000). On the one hand, Jensen (1998) and Lubinski (2000), among many others, have argued very strongly for the reality and importance of 'g'. On the other hand, others such as Gardner (1993) and Sternberg (1988) have argued for multiple separate cognitive functions. Gardner's seven 'intelligences' include functions such as linguistic, logical, mathematical and spatial skills. Sternberg proposed a triachic cognitive structure made up of analytic, creative, and practical intelligence. Both Baddeley (1990) and Tulving (1983) have presented good evidence for different memory functions. Many years ago, Hermelin and O'Connor (1970) showed the unusual pattern of cognitive functioning associated with autism, and within autism, and Howlin, Goode, Hutton and Rutter (2009) has shown the frequency of special cognitive talents in individuals with autism. Similarly, it is clear that various genetic conditions tend to show characteristic cognitive patterns, although variations in patterns within such conditions are rather greater than was first realized (Skuse & Seigel, 2008). Therefore, it may be concluded that the reality of 'g', and its biological importance, is not in doubt, but, equally, there can be no doubt about the reality and importance of specific cognitive functions.

The second key issue is whether these specific cognitive functions are regularly associated with different types of scholastic performance (see Hulme & Snowling, 2009; Snowling & Hulme, 2008). Although comparative studies are largely lacking, a degree of specificity is evident. Thus, reading difficulties are particularly associated with phonological (speech) processing deficits. However, both visual (Stein & Talcott, 1999) and auditory (Mody, 2003; Tallal, 1980) deficits have been claimed by some to be additionally relevant, although the evidence in support is more equivocal than with phonological processing. Less is known about the cognitive functions associated with arithmetic difficulties, but they appear to involve a complex interplay between nonverbal and verbal cognitive systems, including working memory, speed of information processing, executive skills, spatial skills and number sense (Rutter, 2000).

The evidence on the reality and importance of specific cognitive functions might lead to an expectation that they could prove crucial in the ERA study, but there are two other issues that lead to an opposite expectation. Over the years, there have been many attempts to test the hypothesis that brain lesions would lead to specific cognitive patterns that could be of diagnostic value. The results have been uniformly disappointing, whether considered in relation to known brain damage (Rutter, 1981) or more diffuse concepts such as ‘ minimal brain dysfunction’ (Rutter, 1981; Reitan & Boll, 1974). Claims were made in the 1970s that quantitative computer analysis of EEG and sensory potentials (termed ‘neurometrics’) would serve to identify specific cognitive functions (John et al., 1977) but this has not been confirmed. Modest group differences have been reported in some studies, but they are too minor to be of much use for individual diagnosis. There is no characteristic pattern of scores on the Wechsler scales (Conners, 1968), and no increase in verbal-performance discrepancies (Paine, Werry & Quay, 1968). Moreover, batteries of special cognitive tests do not do much better (Chadwick, Rutter, Shaffer & Shrout, 1981; Knights & Tymchcuk, 1968). Neurological lesions are associated with considerable cognitive pattern heterogeneity, however it is assessed (Bortner, 1979).

The other issue is that brain trauma in infancy and early childhood has effects that differ markedly from acquired lesions in later childhood or adult life (see Rutter, 1982; 1993). Thus, the effects of left hemisphere damage on language functioning are quite different in early life from those in later childhood and adult life (Alajounaine & L'hermitte, 1965; Bates & Roe, 2001; Vargha-Khadem & Mishkin, 1997; Woods & Carey, 1979). It is not that brain lesions in early life have lesser effects (the so-called Kennard [1942] principle); indeed the reverse is the case, but rather that the effects are less cognitive function-specific. The question we sought to examine here was whether this applied to the effects of profound early deprivation as experienced by the children adopted from Romanian institutions.

<H2> Genetic and Environmental Influences

Twin studies of genetic and environmental influences suggest that the strong genetic influence on intelligence is principally associated with stability in IQ, whereas change over time may be more likely to reflect environmental influences (Kovas, Haworth, Dale & Plomin, 2007). Where children have moved from an extremely disadvantaged environment to another more beneficial one, such as happens in adoption, then any change in development might be a consequence of the new environmental influences. However, up until now, these issues have not been examined in the case of individuals suffering profound institutional deprivation. Change may also be associated with differing school environments, for example, the type of school or the particular individual help provided for a given child (Coon, Carey, Fulker & De Fries, 1993; Rutter, 1983).

Other factors that might influence outcome are factors associated with the degree of deprivation. For example, earlier studies from the ERA team had indicated that for the minority of children who had some language when they left the institutions this acted as a protective factor for later language performance and for IQ (Croft et al., 2007). Thus, the presence of early language appeared to act as a protective factor for cognitive ability, but without an association with social or behavioral outcomes, suggesting that there might be different pathways for IQ and psycho-social outcomes following deprivation.

<H2> Aims of this Chapter:-

1. To determine whether the different cognitive and scholastic measures showed similar patterns of association with institutional deprivation.
2. To determine whether scholastic achievement in those experiencing institutional deprivation for over 6 months was associated with either over or under-achievement as considered in relation to predictors based on IQ at age 6, and as compared with that in the pooled comparison group.
3. To determine whether cognitive gains between 11 and 15 years were associated with deprivation specific patterns (DSPs) and, whether gains were greater in those with cognitive impairment at age 11.
4. To determine whether the findings at age 11 years (that even minimal language at the time of leaving institutional care) predicting cognitive, but not psychosocial, outcomes, still held at age 15.
5. To assess the possible role of school factors in scholastic outcome.

<H1> Methodology

The measures used in this chapter are as outlined in chapter 2, with the results being examined according to whether the adopted young people were in the pooled comparison group or the two groups who had spent 6 months or more in depriving institutions, and within the latter whether findings differed between the deprivation-specific (DSP) and non deprivation-specific (non-DSP) subgroups. The contribution of the individual components of family risk and protective factors to educational outcomes are examined in chapter 8 (Castle, Beckett, Rutter & Sonuga-Barke).

<H1> Results

The measures used in this study of IQ at age 15 and achievement and 15 and 16 were all highly inter-correlated in the total group, with *rho*'s ranging from .45 to .85, see table 6.1.

TABLE 6.1 about here

<H2> IQ, Attainment and GCSE Results

At age 15, the findings on IQ followed broadly the same pattern that had been found at age 11, with significant differences in IQ between the pooled comparison group and the two over 6 months groups (DSP *vs*. non-DSP, table 6.2.) There were also differences between DSP and non-DSP in full scale IQ, verbal IQ and in the GCSE results, but not in the levels of performance IQ or mathematical reasoning.

TABLE 6.2 about here

<H2> Specific Cognitive Abilities

The pattern was similar for the specific tests conducted at age 11: the 'Theory of Mind'; Stroop test; Digit span; Tower of London; FAS; and DANVA as shown in table 6.3.

With the 'Theory of Mind' test, the Stroop, and the DANVA test of facial expression, there were differences between the pooled comparison, DSP and non-DSP groups. For the Tower of London, a test of executive function, and the FAS, a test of verbal fluency, there were differences between the pooled comparison group and the 2 groups who were over 6 months of age upon arrival to the UK, but not between the DSP and non-DSP groups.

TABLE 6.3 about here

<H2> Are the exam results the same as would be predicted by cognitive scores?

A calculation was made of the adoptees' predicted GCSE results from the regression equation for the whole sample using the adoptees' IQ at age 6 (Yule, Lansdown & Urbanowicz, 1982). The IQ at age 6 was used to predict the GCSE results because this was the first time that IQ was assessed across the entire sample, because this was the age at which the DSP was designated and because we needed a broad measure of IQ. The age at which the GCSE examinations were sat was also examined, but it was not found that there was any positive association between the age at sitting examinations and outcomes, with children who were older on sitting examinations tending to fare slightly worse than those who were younger. Consequently, age at sitting the examination was not included in the regression. A discrepancy score was then calculated by subtracting their actual score from the predicted score. There were no significant differences between the predicted and the actual score in English in any of the subgroups suggesting that a DSP did not moderate the relationship between IQ at age 6 and educational attainment at age 16 (table 6.4).

TABLE 6.4 about here

There was greater variation in actual compared to predicted scores both in Math and English in all the three groups, apart from the English scores in the non-DSP subgroup:

pooled comparison group ([results of Levene's tests] English: F (216) = 4.95, p<.05; Math: F (216) = 11.92, p=.001); non-DSP group (English: F (84) = 2.30, n.s.; Math: F (84) = 6.05, p<.05); DSP group (English: F (77) = 21.63, p<.001; Math: F (77) = 14.26, p<.001). This was more marked in the DSP group relative to the other groups (DSP *vs*. pooled comparison group: English: F (143) = 24.90, p<.001; Math: F (143) = 5.73, p<.05; DSP *vs*. non-DSP: English F (76) = 13.20, p<.01; Math; F (76) = 4.85, p<.05).

<H2> Catch-Up in Cognitive Scores

Between the ages of 11 and 15, there had been a further catch-up in the IQ scores of the DSP group (t (35) = -3.60, p<.01,η^2 = .27), but no similar increase for either the pooled comparison group (t (94) =1.60, η^2 = .03) or the > 6 month group who were not in the DSP subgroup (t (36) = -1.55, η^2 = .03).

A score was created to measure the difference between IQ at age 11 and 15. This was significantly correlated with IQ at age 11, (r (166) = -.36 p<.001). The IQ scores in the cognitively impaired group, whose IQ was <80 (n= 39), had increased by on average 5 points since they were assessed at age 11 (from 70.14 (7.79) to 75.39 (11.42), t (35) = -3.78, p< .01) and this increase had been principally in the performance scores, which had increased by 7 points (from 66.39 (9.03) to 72.61(12.36), t (35) =-3.82, p<.01, η^2 = .29), whereas the verbal scores had only risen by 3 points (from 79.47 (12.80) to 82.42 (15.05), t (35) = -1.64, n.s., η^2 = .07).

Whereas there was an overall increase in cognitive scores for the cognitively impaired, there was also some movement in both directions in scores between the ages of 11 and 15, with some young people scoring less than they had at age 11 which resulted in their score at age 15 being less than 80 (n= 5). However, generally, the change in scores for the most impaired group was upwards, and 14 children who were in the cognitively impaired group at age 11 were no longer in that group at age 15 (see Figure 6.1). Also, within the cognitively impaired group there were some examples of individual young people who had made substantial progress by the age of 15 although remaining overall impaired relative to the rest of the sample (see chapter 4; Kreppner, Kumsta, Rutter, Beckett et al.).

FIGURE 6.1. here

<H2> Was the pattern for cognitive impairment in the deprivation specific groups the same as in the group who were not part of the deprivation specific syndrome?

Just over one half of the children who had cognitive impairment at age 11 were also in the deprivation-specific group 20/38 (53% [one had not been assessed at both ages]), and there were another 18 young people who were not in the DSP group (11 in the >6 month, non-DSP group; 9 in the pooled comparison group). Did the young people who were not in the DSP group make more or less progress than those who were in the DSP group, and was there any variation according to whether they were over or under 6 months at time of UK entry? A univariate analysis indicated that the catch-up in IQ scores was strongest in the DSP group relative to the pooled comparison group with an increase of 8.37 (*SD* 6.73) points on the full scale IQ score (F (2, 33) = 4.04, p<.05, η^2 =.20). For the non-DSP group, the increase was 4.13 points (*SD*, 8.31); for the cognitively impaired in the pooled comparison group there was no increase; the mean scores fell by -.33 points (*SD* 6.73), see table 6.5. There was a marked significant increase in performance scores in the DSP group of 9 points (from 66.63 (*SD* 8.71) to 76.47 (*SD* 8.51), and a modest increase in the verbal scores of 6 points (from 73.42 (*SD* 10.95) to 78.68 (*SD* 18.06), but no significant increase for the non-DSP group or the pooled comparison group as shown in table 6.5

<H2> Did the improvement in scores have an effect on the examination results?

Within the group who were cognitively impaired, there was a correlation between the change in IQ at 11 and 15 and the examination results in Math, with those who improved having significantly higher marks at GCSE (r = .41; p<.05) than those who had not improved, but the result was not significant for English (r= .28, n.s).

<H2> Effects of Early Minimal Language

The influence of early language ability could only be assessed in children who were over 18 months who would be anticipated to have some verbal ability on arrival. It was found that in this sub sample of 54 children, the 17 who had some language on arrival, were significantly more likely to have GCSE English or Math scores that were higher than those who had no language on arrival. Mean scores for English: in those with minimal language = 6.95 (*SD* 1.96) *vs*. no language = 4.08 (*SD* 3.15), (t (52) = 3.79, p<.001, η^2 = .22); mean scores for Math: in those with minimal language = 6.19 (*SD* 2.06) *vs*. 3.14 (*SD* 2.97), (t (52) = -4.34, p<.001 η^2 = .27); total number of grades A*-C, (t (52) = -3.61, p=.001); total exams taken (t (52) = -2.82, p<.01). These effects remained significant when IQ was controlled for at age 6 (for Math F = 4.07, p<.05, η^2 = .08), and number of grades A*-C, (F = 4.43, p<.05 η^2 = .05,), but not for English (F =2.57, n.s. η^2 = .02) or for the number of exams taken (F= 1.00, n.s., η^2 = .06).

By contrast, there were no effects of minimal language on the psychosocial outcomes, with those with minimal language having similar levels of DSP problems as those without language. Of the 19 young people who had disinhibited attachment at age

15, 8/19 (42%) had minimal language on arrival and 11/19 (58%) did not (Fisher's exact test =.78).

<H3> Did School Factors Affect Scholastic Achievement? There were no differences between the three groups in the proportion of children who were in private education (excluding the children with marked special needs who are considered below) (χ^2 = 2.95, n.s.). The effects of private or state education were examined according to the three groups: pooled comparison, >6 months non-DSP and DSP. Within the pooled comparison group, the children in private schools gained higher English scores (t (102) = -2.52, p<.05, η^2 = .06) and also more A*-C grades (t (102) = -3.24, p<.01, η^2 = .09). This result was still significant when it was controlled for their IQ at age 11(English scores; F (1,96) = 6.86, p<.05); total number of GCSEs; F (1,96) = 8.51, p<.01). There was no association between private education and the Math score (t (102 = -1.69, n.s., η^2 = .01) nor for the number of GCSEs taken (t (102) = -1.62, n.s., η^2 = .03). For the non-DSP children who were more than 6 months old on arrival to the UK, there was no significant association between type of school the children attended and GCSE results in English (t (38) = -.99, n.s., η^2 = .03) or Math, t (38) =1.40 n.s. η^2 = .05,), numbers of A*-C grades attained (t (39) = -1.40, n.s., η^2 = .05), or in the total number of GCSE's taken (t (39) = -1.33, n.s. η^2 = .04,). For the DSP group, there was no significant association with the type of school and results in English (t (32) = -.41, n.s., η^2 = .01) or Math (t (32) = -1.00, n.s. η^2 = .03), but there was a significant association with the numbers of A*-C grades attained (t (32) = -2.02, p=.05, η^2 = .11) but this was no longer significant once IQ at age 11 had been controlled for (F (1, 30) = 2.34, n.s., η^2 = .07). Finally, there was no association between

the number of GCSEs taken and type of school attended in the DSP group (*t* (32) = .54, n.s.).

A number of children were in ‘special’ schools (*n*= 8), and of these 5 (63%) were in the DSP group (χ^2 = 9.81, *p*<.01). Also, of the children who were over 6 months on arrival to the UK, 15 had been kept back a year at school, this delay being generally in the first year that they had attended school. Being kept back a year was significantly more likely in the DSP group, with 11/15 (73%) children kept back in that group (χ^2 = 32.36, *p*<.001) compared with only 2/50 (4%) in the non-DSP group, and 2/100 (2%) in the pooled comparison group. These children gained significantly lower scores in both English (*t* (80) = 2.30, p<.05, η^2 = .06) and Math GCSEs (*t* (80) = 3.57, *p*<.01, η^2 = .16) than those who were not kept back a year. However, when IQ was controlled for, this difference became non-significant for English (*F* (1, 75) = 1.56, n.s., η^2 = .03) but remained significant for Math (*F* (1, 75) =4.59, *p*<.05, η^2 = .08).

<H1> Discussion and Conclusions

There were strong correlations among the various cognitive and scholastic measures, and remarkably similar patterns in relation to institutional deprivation. In all cases, scores were substantially lower in the above 6 month DSP group than in the pooled comparison group, and, in the former, tended to be lower in those with a DSP than those without. The clear implication is that institutional deprivation tends to have a lasting deleterious effect on all aspects of cognition and not just on a few highly specific functions. Because the ERA study needed to encompass a broad range of functioning (see chapter 2), necessarily we had to rely on single tests of specific cognitive functions, and it is possible that greater specificity would be evident if we had multiple measures of each function.

However, neither our own findings, nor those in the literature, suggest that great specificity is likely.

With respect to the second aim, our findings were clear cut in showing that scholastic attainment as predicted on the basis of IQ at age 6 and achievement as actually obtained at age 16 years, showed the same pattern in the over 6 months institutional group and the pooled comparison group. Moreover, the pattern was similar within the over 6 month group in those with and without DSP. That is, the scholastic achievements were substantially lower in the over 6 month group, and within that group, lower in those with a DSP than those without. The key point, however, is that this was a function of the IQ level at 6 years. This finding is different from that reported in the meta-analysis of cross-sectional data (van IJzendoorn & Juffer, 2006), but in keeping with the Swedish conscript study (Dalen et al., 2008; Lindblad et al., 2009), and it is necessary to consider why there was this difference. The ERA study has 4 major strengths: the use of longitudinal analyses to study within-individual change; the focus on scholastic achievement at a standard age; the use of a standard independent measure of scholastic achievement; and the availability of an appropriate comparison group. We conclude that the claim that scholastic achievement lags behind cognitive level cannot be sustained. The four major strengths of the ERA study design mean that our findings are likely to be valid. Even within a single examination system, there is great variation in the subjects taken for exams and, inevitably, this provided a limitation in the evaluation of success in public examinations. Our response was to use several different examination indices and they all gave rise to the same pattern of findings. Accordingly, it is most unlikely that the limitations affect the conclusions.

With respect to our third aim, the findings showed that the cognitive gains between 11 and 15 years followed the same pattern as that found at 11 years, but with new information provided by the focus on DSPs. Within the DSP group, there was a significant gain in IQ for those with cognitive impairment at 11, with a mean gain of 8 points in WISC full scale IQ, a mean gain of 6 points in verbal IQ, and a mean gain of 9 points in performance IQ. It is notable that these gains were not found in the young people without cognitive impairment at age 11, and were not found in either the pooled comparison group or those in the above 6 month group without a DSP. We acknowledge that small numbers in the cells necessarily limits the strength of the negative findings. Nevertheless, our findings carry the clear implication that, even some dozen years after leaving institutional care, modest continuing cognitive gains are possible. Why these should apply more strongly to performance skills than verbal skills remains uncertain. It could be tentatively suggested that this might mean that institutional deprivation could have a more specific cognitive impact than appears to be the case.

With respect to the fourth aim, we found that minimal language skills at the time of leaving institutional care were associated with superior cognitive performance at the age of 15 but not with better psychosocial outcomes - exactly as found at age 11 (Croft et al., 2007). This finding is important because it implies that the minimal language skills did not constitute an index of the severity of institutional deprivation. That is because, if they did index such severity, the association should apply to both cognitive and psychosocial outcomes and that was not the case. Rather, the minimal language skills needed to be viewed as some kind of index of cognitive capacity. Neither the underlying mechanisms nor the meaning of capacity in this context are at all clear.

The fifth aim was to assess the possible role of school factors on scholastic achievement. Our ability to meet this aim was severely constrained by our lack of measures of school quality, as well as by the marked heterogeneity in school arrangements. Nevertheless, the main finding was that the presence of a DSP was associated with variations in how schooling decisions were made, in particular, with a much greater likelihood of being held back a year (an unusual occurrence in the UK school system, unlike in the US). Because the influence of DSPs was so strong, it was difficult to determine the role of school variation on scholastic achievement. As was to be expected because of the role of DSPs, those held back for a year in schooling reached lower levels of scholastic attainment. Nevertheless, the detailed clinical assessments (see chapter 4; Kreppner et al.) showed important, meaningful individual accomplishments. Causal inferences are not possible, but the impression gained was that when good use had been made of the extra year of schooling in order to build skills, it had brought benefits.

<H2> Overall conclusion

The three key messages may be succinctly summarized as follows:-

1. Longitudinal data with good measures, appropriate comparisons and standardized independent assessment at the same age were crucial in showing that scholastic achievements did <u>not</u> lag behind cognitive skills, despite claims to the contrary from much more heterogeneous cross-sectional data.
2. Perhaps surprisingly, cognitive gains in those with impairment at 11, continued up to age 15 years. These gains, however, were not found in the comparison group, thereby suggesting that they were part of the pattern following institutional deprivation, and not a general phenomenon.

3. Although it would be absurd to suppose that all cognitive skills are the same, the effects of institutional deprivation seem rather pervasive across different aspects of cognition. On the other hand, for reasons that remain unclear, the cognitive gains in the young people were more evident in the case of performance than verbal skills.

<H1> References

Alajouaine, T., & L'hermitte, F. (1965). Acquired aphasia in children. *Brain*, 88, 653-662.

Andersson, U. (2008) Working memory as a predictor of written arithmetical skills in children: The importance of central executive function. *British Journal of Educational Psychology,* 78*,* 181-203.

Baddeley, A (1990) *Human memory: Theory and practice.* Hove, Sussex: Lawrence Erlbaum Associates.

Bates, E., & Roe, K. (2001). Language development in children with unilateral brain injury. In: C.A. Nelson & M. Luciana (Eds.) *Handbook of developmental cognitive neuroscience.* Cambridge, MA: MIT Press. 281-307.

Beckett, C., Maughan, B., Rutter, M., Castle, J., Colvert, E., Groothues, C., et al. (2006). Do the effects of early severe deprivation on cognition persist into early adolescence? Findings from the English and Romanian Adoptees study. *Child Development*, 77, 696–711.

Beckett, C., Maughan, B., Rutter, M., Castle, J., Colvert, E., Groothues, C., Hawkins, A., Kreppner, J., O' Connor, T. G., Stevens, S., & Sonuga-Barke, E. J. S. (2007). Scholastic attainment following severe early institutional deprivation: A study of adoptees adopted from Romania. *Journal of Abnormal Child Psychology*, 35, 1063-1073.

Behen, M.E., Helder, E., Rothermel, R., Solomanm K., Chugani, H.T. (2008). Incidence of specific absolute neurocognitive impairment in globally intact children with histories of early severe deprivation. *Child Neurology*, 14, 453-469.

Bock, G.R., Goode, J.A., & Webb, K. (Eds.) (2000). *The Nature of Intelligence.* London: Wiley & Sons.

Bortner, M. (1979). Heterogenity in children with neurological impairment. In: M. Bortner (Ed.), *Cognitive growth and development.* New York, NY: Brunner & Mazel. 187-221.

Chadwick, O., Rutter, M., Shaffer, D., & Shrout, P.E. (1981). A prospective study of children with head injuries: IV Specific cognitive deficits. *Journal of Clinical Neuropsychology,* 3, 101-120.

Conners, C.K. (1968). The syndrome of minimal brain dysfunction: Psychological aspects. *Pediatric Clinics of North America,* 14, 749-766.

Coon, H., Carey, G., Fulker, D.W., & De Fries, J.C. (1993). Influences of school environment on the academic achievement scores of adopted and non adopted children, *Intelligence,* 17, 79-104.

Croft, C., Beckett, C., Rutter, M., Castle, J., Colvert, E., Groothues, C., Hawkins, A., Kreppner, J., Stevens, S.E. & Sonuga-Barke, E.J.S. (2007). Early adolescent outcomes of institutionally-deprived and non-deprived adoptees. II: Language as a protective factor and a vulnerable outcome. *Journal of Child Psychology and Psychiatry*. 48, 31-44.

Dalen, M., Hjern, A., Lindblad, F., Odenstad, A., Rasussen, F., & Vinnerljung, B. (2008). Educational attainment and cognitive competence in adopted men – A study of international and national adoptees, siblings and a general Swedish population. *Children and Youth Services Review*, 30, 1211-1219.

Gardner, H. (1993) *Frames of mind (*2nd ed.). New York, NY: Basic Books.

Hermelin, B., & O'Connor, N. (1970). Psychological experiments with autistic children. London: Pergamon.

Howlin, P., Goode, S., Hutton, J., & Rutter, M. (2009). Savant skills in autism: Psychometric approaches and parental reports. *Philosophical Transactions of the Royal Society B*, 364, 1359-1367.

Hughes, C., Ensor, R. (2008). Does executive function matter for preschoolers' problem behavior? *Journal of Abnormal Child Psychology,* 36, 1-14.

Hulme, C., & Snowling, M.J. (2009) *Developmental disorders of* l*anguage, learning and cognition.* Chichester, UK: Wiley Blackwell.

Jensen, A.R. (1998). *The g factor: The science of mental ability*. Westport, CT: Praeger.

Garon, N., Bryson, S.E., & Smith, I.M. (2008). Executive functioning in preschoolers: A review using an integrative framework. *Psychological Bulletin,* 134*,* 31-60.

John, E.R., Karmel, B.Z., Corning, W.C., Easton, P., Brown, D., Ahn, H., John, M., Harmony, T., Prichep, L., Toro, A., Gerson, I., Bartlett, F., Thatcher, F., Kaye, H., Valdes, P., & Schwartz, E. (1977). Neurometrics. *Science,* 196, 1393-1410.

Kennard, M.A. (1942). Cortical reorganization of motor function. *Archives of Neurology and Psychiatry,* 48, 227-240.

Kovas, Y. Haworth, C.M. A., Dale, P.S, Plomin, R. (2007). The genetic and environmental origins of learning abilities and disabilities in the early school years. *Monographs of the Society for research in Child Development,* 72, 1-144.

Knights, R.M., Tymchuck, A.J. (1968). An analysis of the Halstead-Retan category tests for children. *Cortex,* 4, 403-414.

Lindblad, F., Dalen, M., Rasmussen, F., Vinnerljung, B., & Kjern, A. (2009). School performance of international adoptees better than expected from cognitive test results. *European Child and Adolescent Psychiatry*, 18, 301-308.

Lubinski, D (2000). Intelligence: success and fitness. In: G.R. Bock, J.A. Goode, & K. Webb (Eds.), *The nature of intelligence*. London: Wiley & Sons. 6-36.

MacLean, K. (2003). The impact of institutionalization on child development. *Development and Psychopathology,* 15, 853-884.

Mody, M. (2003). Rapid auditory processing deficits in dyslexia: A commentary on two differing views. *Journal of Phonetics*, 31, 529-539.

O'Connor, T.G., Rutter, M., Beckett, C., Keaveney, L., Kreppner, J., & the ERA study team. (2000). The effects of global severe privation on cognitive competence: Extension and longitudinal follow-up. *Child Development,* 71, 376-390.

Paine, R.S., Werry, J.S., & Quay, H.C. (1968). A study of minimal cerebral brain dysfunction. *Developmental Medicine and Child Neurology,* 10, 505-520.

Reitan, R.M., & Boll, T.J. (1973). Neuropsychological correlates of minimal brain dysfunction. *Annals of New York Academy of Science,* 205, 65-88.

Rutter, M. (1981). Psychological sequelae of brain damage in childhood. *American Journal of Psychiatry*, 138, 1533-1544.

Rutter, M. (1982). Developmental neuropsychiatry: Concepts, issues and problems. *Journal of Clinical Neuropsychology*, 4, 91-115.

Rutter, M. (1983). School effects on pupil's progress; Research findings and policy implications *Child Development,* 54, 1-29.

Rutter, M. (1993). An overview of developmental neuropsychiatry. In: F.M.C. Besag & R.T. Williams (Eds.). *The brain and behavior: Organic influences on the behavior of children. Educational and Child Psychology*, 10, 4-11.

Rutter, M., & the ERA Study Team. (1998). Developmental catch-up, and deficit following adoption after severe early privation. *Journal of Child Psychology and Psychiatry,* 39, 465-476.

Rutter, M., (2000). Closing remarks. In: G.R. Bock, J.A.Good, & K. Webb (Eds.). *The nature of intelligence*. Chichester, UK: Wiley & Sons. 281-288.

Skuse, D.H., & Seigal, A. (2008). Behavioral phenotypes and chromosomal disorders. In: M. Rutter, D. Bishop, D. Pine, S. Scott, J. Stevenson, E. Taylor, A. Thapar (Eds.) *Rutter's child and adolescent psychiatry (5th ed.)*. Oxford: Blackwell Publishing. 359-376.

Snowling, M.J., & Hulme, C. (2008). Reading and other specific learning difficulties. In: M. Rutter, D. Bishop, D. Pine, S. Scott, J. Stevenson, E. Taylor, A. Thapar (Eds.) *Rutter's child and adolescent psychiatry (5th ed.)*. Oxford: Blackwell Publishing. 802-819.

Stein, T., & Talcott, T. (1999). Impaired neuronal timing in developmental dyslexia: The magnocellular hypothesis. *Dyslexia*, 5, 59-77.

Sternberg, R. (1988). *The triachic mind: A new theory of intelligence.* New York, NY: Viking.

Tallal, P. (1980). Auditory temporal perception, phonics, and reading disabilities in children. *Brain and Language*, 9, 182-198.

Tulving, E. (1983). *Elements of episodic memory.* London & Oxford: Oxford University Press.

van IJzendoorn, M.H., Juffer, F., & Poelhis, C.W.K. (2005). Adoption and cognitive development: A meta-analytic comparison of adopted and non-adopted adoptees' IQ and school performance. *Psychological Bulletin,* 131, 301-316.

van IJzendoorn, M.H., & Juffer, F. (2006). Emanuel Miller Lecture, 2006: Adoption as intervention: Meta-analytic evidence for massive catch-up and plasticity in physical, socio-emotional and cognitive development. *Journal of Child Psychology and Psychiatry,* 47. 1228-1245.

Vargha-Khadem, F., & Mishkin, M. (1997). Speech and language outcome after hemispherectomy in childhood. In: I. Tuxhorn, H. Holthausen, & H.E. Boenigk (Eds.), *Pediatric epilepsy syndromes and their surgical treatment*. Sydney, Australia: Libbey. 774-784.

Yule, W., Lansdown, R., Urbanowicz, M.A (1982). Predicting educational attainment from WISC-R in a primary school sample. *British Journal of Clinical Psychology,* 51, 237-240.

Woods, C.T., & Carey, S. (1979). Language deficits after apparent clinical recovery from childhood aphasia. *Annals of Neurology,* 6, 405-409.

TABLE 6.1: Bivariate correlations between measures of IQ at age 15 and attainment at 15/16 in pooled comparison and DSP groups

	WISC full scale Age 15	WISC verbal scales	WISC performance scales	Mathematical reasoning	English language	Math	Total number of GCSE's A*-C
WISC verbal scales	.83*** (170)						
WISC performance scales	.84*** (170)	.42*** (170)					
Mathematical reasoning at 15	.72*** (169)	.72*** (169)	.51*** (169)				
English language GCSE	.57*** (160)	.61*** (160)	.37*** (160)	.65*** (159)			
Math GCSE	.66*** (160)	.66*** (160)	.45*** (160)	.75*** (159)	.85*** (185)		
Total number of GCSE's A*-C	.64*** (161)	.63*** (161)	.44*** (161)	.72*** (160)	.74*** (184)	.77*** (184)	
Total number of GCSE's taken	.50*** (160)	.53*** (160)	.32*** (160)	.56*** (159)	.79*** (183)	.77*** (183)	.77*** (185)

*** $p<0.001$

TABLE 6.2: Cognitive tests, social cognitive tests, attainment scores according to DSP non-DSP and pooled comparison group

	Pooled comparison group Mean (*SD*)	Non-DSP> 6 months Mean (*SD*)	DSP > 6 months Mean (*SD*)	*F* value partial η^2	Significant contrasts
Verbal score at age 15	106.43 (14.90)	98.24 (13.01)	86.83 (18.65)	2 (167) =21.79*** .21	PCG< (NDSP & DSP > 6 months) NDSP < DSP > 6 months
Performance score at age 15	96.84 (20.01)	89.35 (20.84)	85.75 (19.34)	2 (167) = 4.74* .05	PCG < DSP> 6 months
WISC full scale score age 15	102. 22 (16.36)	92.43 (13.93)	84.97 (17.10)	2 (167) = 16.67*** .17	PCP< (NDSP & DSP > 6 months) NDSP < DSP > 6 months
Mathematical reasoning at age 15	103.89 (15.63)	88.27 (11.29)	84.67 (15.91)	2 (167) = 28.96*** .26	PCG < (DSP> 6 months & NDSP > 6 months)
Total number of GCSEs	8.98 (2.81)	7.59 (3.12)	5.39 (3.72)	2 (182) = 19.30*** .18	PCG< (NDSP & DSP > 6 months) NDSP < DSP > 6 months
Total number of grades A-C	6.93 (3.99)	4.44 (3.60)	2.53 (3.23)	2 (183) = 21.09*** .19	PCG< (NDSP & DSP > 6 months) NDSP < DSP > 6 months
English language†	7.22 (1.90)	6.30 (2.05)	4.71 (3.12)	2 (182) = 17.91*** .16	PCG< (NDSP & DSP > 6 months) NDSP < DSP > 6 months
Math†	6.60 (2.86)	5.33 (2.16)	4.00 (2.71)	2 (182) = 18.29*** .17	PCG< (NDSP & DSP > 6 months) NDSP < DSP > 6 months

†Based on 10 grades (from 'not entered', 'ungraded' and G – A*)

*** p<0.001, ** p<0.01, * p<0.05

<u>TABLE 6.3:</u> Specific cognitive tests of executive function, theory of mind, memory, verbal fluency at age 11in pooled comparison and DSP groups

	Pooled comparison group Mean (*SD*)	Non-DSP >6 months Mean (*SD*)	DSP >6 months Mean (*SD*)	*F* value partial η^2	Significant contrasts
Theory of Mind	1.31 (.30)	1.16 (.22)	.83 (.37)	2 (187) = 35.72*** .28	PCG< (NDSP & DSP > 6 months) NDSP < (DSP > 6 months)
Stroop test difference in errors	6.18 (6.88)	8.54 (7.74)	15.08 (9.70)	2 (184) = 18.47*** .17	PCG< (NDSP & DSP > 6 months) NDSP < (DSP > 6 months)
Digit Span backwards	5.07 (1.95)	4.39 (1.64)	4.46 (1.89)	2 (187) = 2.80 *p*=.06 .06	PCG< (DSP > 6 months)
Tower of London total correct solutions	11.07 (1.06)	10.70 (1.21)	10.31 (1.28)	2 (183) = 6.55** ..07	PCG< (DSP > 6 months)
FAS total correct words	22.18 (6.01)	20.50 (5.76)	19.90 (5.07)	2 (183) = 2.81 *p*=.06 .03	PCG< (DSP > 6 months)
FAS total incorrect words	.46 (.78)	.70 (1.07)	1.00 (1.28)	2 (183) =4.59* .05	PCG< (DSP > 6 months)
DANVA total correct across 48 child and adult faces	38.57 (4.12)	36.47 (5.42)	34.21 (7.97	2 (188) = 9.86 *** .10	PCG< (NDSP & DSP > 6 months) NDSP < (DSP > 6 months)

*** p<0.001, ** p<0.01, * p<0.05

TABLE 6.4: Difference between mean predicted and actual GCSE results according to age on arrival and whether in institutional care: Predicted on age 6 cognitive ability.

	Pooled comparison group Mean (*SD*)	Non-DSP >6 month group Mean (*SD*)	DSP >6 month group Mean (*SD*)
Predicted Grade English	7.49 (1.32)	6.52 (1.26)	5.14 (1.61)
Actual grade English	7.19 (1.91)	6.19 (2.09)	4.71 (3.12)
t-test	(*df* 103) = -1.82 , =.03	(*df* 36) = -1.03 =.03	(*df* 37) = -.98 =.02
Predicted grade Math	6.42 (1.32)	5.37 (1.26)	3.99 (1.61)
Actual grade Math	6.58 (2.27)	5.16 (2.15)	4.00 (2.71)
t-test	(*df* 103) = 1.17 =.01	(*df* 36)= -.66 =.01	(*df* 37) = .02 =.00

TABLE 6.5: Cognitively impaired at age 11: IQ scores at age 15 according to DSP

	Cognitive impaired Pooled comparison *n*= 9, Mean (*SD*)	Cognitively impaired at age 11 non-DSP *n*=11, Mean (*SD*)	Cognitively impaired at age 11 DSP *n*=20, Mean (*SD*)
Wisc score at age 11	73.00 (5.12)	73.23 (6.82)	67.47 (8.51)
Wisc score at age 15	72.67 (9.53)	77.38 (9.38)	75.84 (13.18)
t-test	(*df* 8)=.15 =.00	(*df* 10)= -1.41 =.17	(*df*19)=-4.64*** =.53
Wisc verbal score at age 11	90.89 (8.43)	81.00 (12.68)	73.42 (10.94)
Wisc verbal scores at age 15	86.78 (9.92)	86.38 (10.08)	78.68 (18.06)
t test	(*df* 8)1.31 =.18	(*df* 10)=-1.59 =.20	(*df* 19)=-2.12* =.19
Wisc performance score at age 11	62.11 (6.90)	70.63 (10.68)	66.63 (8.71)
Wisc performance score at age 15	63.77 (11.66)	73.50 (13.24)	76.47 (8.51)
t-test	(*df* 8)-.58 =.04	(*df* 10)=-.65 =.04	(*df* 19)=-5.28*** =.59

***p<0.001, **p<0.01, *p<0.05

FIGURE 6.1: Changes in IQ between ages 11 and 15 for cognitively impaired at age 11 according to DSP grouping