

Cognitive capital in the British birth cohorts: an introduction

Marcus Richards¹ and Ian Deary²

¹MRC Unit for Lifelong Health and Ageing

²University of Edinburgh, Centre for Cognitive Ageing and Cognitive Epidemiology, Department of Psychology
m.richards@nshd.mrc.ac.uk

(Received May 2010 Revised June 2010)

In 1903 Alfred Binet published *L'Etude expérimentale de l'intelligence* (Experimental Study of Intelligence), following the aim of the French government to distinguish children who were not motivated to learn, from those whose capacity to do so was limited and who may require special education. Working with Théodore Simon, a physician, he developed tests of motor function, memory, and various aspects of verbal ability, such as naming, repetition, vocabulary and comprehension. With these graded measures, Binet and Simon instituted an approach that would become formalised into the concept of Intelligence Quotient (IQ), where a child's 'mental age' was estimated from performance in relation to that typical for a given chronological age. Thus began the practice of intelligence testing in children. Around the same time, a more theoretically-oriented approach to capturing cognitive ability as a general capacity was being developed by Charles Spearman in London (Deary 2000; Deary, Lawn and Bartholomew 2008).

This first special issue of Longitudinal and Life Course Studies is based on a series of seminars on the determinants and consequences of childhood cognitive ability, referred to as cognitive capital in a comprehensive series of British population-based cohorts. The seminar series was funded by the Nuffield Foundation, and took place at their headquarters in London during 2007.

<http://www.longviewuk.com/pages/children.shtml>

The studies in this special issue are mainly oriented around the four British birth cohorts, which all recruited as survey members, those children across the country who were born within

days of each other, so that any emerging developmental differences could not be attributable to differences in chronological age, or to changes over time in the environment. These cohorts were also designed to be as closely representative of the source national population as possible. The oldest cohort is that developed by the Medical Research Council National Survey of Health and Development (NSHD), also known by its year of birth as the British 1946 cohort (Wadsworth et al 2006, 2010). This was originally established to investigate the cost of childbirth and the quality of associated care in the immediate post-war years, when birth rates were continuing to fall, and at a time when serious health and social problems, as highlighted in the Beveridge report of 1942, precipitated the development of the modern welfare state. The NSHD was followed in time by the larger National Child Development Study and the British Cohort Study, respectively known as the British 1958 and 1970 birth cohorts. Finally, the youngest of the British birth cohorts is the eponymously named Millennium Cohort Study (for details of the three latter cohorts see the Centre for Longitudinal Studies website at

<http://www.cls.ioe.ac.uk>

Three other British cohorts drawn upon by the seminar participants should be mentioned here. One is the Avon Longitudinal Study of Parents and Children (ALSPAC) <http://www.bristol.ac.uk/alspac>. This originally consisted of mothers living in the old Avon (Bristol and Bath) area of south-west England, enrolled during pregnancy in 1991 and 1992, and of course their offspring. The other two cohorts are

the multi-purpose and multi-aged British Household Panel Survey (BHPS):- <http://www.iser.essex.ac.uk/survey/bhps> and the government-based Longitudinal Study of Young People in England (LSYPE):- <https://ilsype.gide.net/workspaces/public/wiki/LSYPE> also known as Next Steps.

So these are the resources; why the term cognitive 'capital'? This was defined during the seminar series as an "accumulating asset that can be drawn upon to create and to take advantage of opportunities and to sustain well-being, in response to environmental challenge and stress". Like its financial counterpart, cognitive capital can be endowed through inheritance; as O'Donovan and Owen (2009) note, "with its role in human adaptability and survival it would be remarkable if traits that result from variation in brain function were not influenced in part by genes". We should note, however, that the heritability of general cognitive ability is at its lowest in early life, at approximately 30% in very young childhood, increasing to as much as 70-80% in older adults (Deary et al 2009). This means, of course, that cognition is at its most malleable in infancy and childhood, being influenced by a vast range of factors, including nutrition, parental nurturing, material home conditions, the built environment, and schooling (Richards et al in press), though a portion of this influence can be attributed to parental genetic selection into the environment. Aspects of this malleability are the subject of the first of the empirical papers in this special edition (Schoon et al 2010). Like financial capital cognition is unequally distributed, particularly with respect to social position, a point to which we will return below. It can accrue over the life course (Richards and Deary 2005; Hatch et al 2007), with contributions via education, work, and healthy and stimulating lifestyle; and with returns by way of life chances, skills, wealth, health, and quality of life. It can also be drawn against in times of emergency, such as disease or trauma of the brain; this is the related if somewhat different concept of cognitive 'reserve' (Stern 2002; Richards and Deary 2005), another metaphor from economics. But, like a financial reserve, cognition can itself be depreciated, in the sense of impairment through a poor early start, chronic social disadvantage (Lynch et al 1997), self-harmful behaviours, and poor health (Richards and Deary 2005).

We do not attempt to summarise the history of the measurement of cognitive abilities in this Introduction. For this, the interested reader is referred to summaries provided elsewhere (Cooper 2010; Deary 2001a, b). Studies in this special edition do not address the detailed structure of intelligence, as variously represented by Spearman (1927), Thorndike (1927), Guilford (1967), Cattell (1971), Sternberg (1985) and Carroll (1993). Nor do they address the stage-based developmental 'genetic epistemology' of Piaget (Piaget and Inhelder 1973), or other models of cognitive skills that are qualitatively different to the psychometric tradition. This is appropriate in the context of the British birth cohorts, where cognitive ability was first measured in 1954 when children of the 1946 cohort were aged eight years, by four simple graded tests of vocabulary, pronunciation, comprehension, and analysis of non-verbal material devised by the National Foundation for Educational Research (NFER). James Douglas, who founded the 1946 cohort, was interested in educational returns to cognitive capital thus measured, and was influenced by the Scottish Mental Surveys (Deary, Whalley and Starr 2009). He found that those with test scores in anything but the highest range, were far less likely to enter selective secondary education if they were from manual occupational class households, than if they were from more professional households (Douglas 1964). This was referred to as the 'wastage of ability', as had already been highlighted in the Crowther Report (1959), and is returned to in detail by Schoon in this special issue of LLCS. This turned out to be the first of many policy-relevant and policy-influencing findings based on the measurement of cognitive capital in these cohorts.

The lives of British cohort members span almost the entire sweep of the post-war years, from 1946 through to the millennium; and at the time of writing a new national cohort is being commissioned for 2012. This span encompasses the formation of the post-Beveridge welfare state, as noted, including the National Health Service; the expansion of educational opportunity; the expansion then contraction of occupational mobility and the growth of income inequality; and changes in family structure, social participation, and gender roles (Ferri, Bynner, and Wadsworth 2003). To begin the special issue, this context is set by the historian Gillian Sutherland, who reviews these important structural changes, with a particular

emphasis on educational policy. This is then followed by five research papers, proceeding along the life course, on the determinants and consequences of cognitive capital.

First, Schoon, Hope, Ross and Duckworth examine the effects of parental socio-economic conditions on the development of cognitive capital in infants, represented as everyday learning (for example, knowledge of colours, letters, numbers and objects). Drawing on the Millennium Cohort Study, they show that the negative effects of material hardship on cognitive development are partially mediated by maternal distress, and the impact this has on the quality of parenting; although mediating effects of the latter are stronger in regard to behavioural outcomes. Then, moving into primary education, Duckworth and Schoon examine continuity and change in Key Stage assessments of literacy and numeracy in ALSPAC. They find a high degree of continuity in attainment, but also some evidence of 'escaping' and 'dropping down' from expected trajectories, with measures of attention problems as a particularly important predictor in this respect. The narrative then shifts to the consequences of cognitive capital beginning with Schoon, who examines educational attainment in the 1946, 1958 and 1970 cohorts. She finds a fairly consistent level of association over these cohorts between parental socio-economic status and the highest level of educational qualification achieved, but a diminishing predictive power of cognitive capital - suggesting that it is the less able children of socially advantaged backgrounds who have benefitted the most from the expansion of educational opportunity. Linking the first and last of these papers, Gregg and Macmillan present evidence that such inequalities may be levelling off in those born in the 1980s and 1990s (using ALSPAC, BHPS and LSYPE), at least in regard to cognitive capital and to educational attainment by the minimum school leaving age. However, these authors caution that the picture may be different for higher education, and that the impact of changes at both these levels of educational attainment on future occupational mobility and earnings are difficult to anticipate.

Where most of these papers have implications for wealth, the final empirical paper, by Richards, Stephen and Mishra, investigates returns to childhood cognitive capital in an area of equal concern - health. Using the 1946 cohort they test associations between childhood cognition and adult cardiovascular disease risk, adding several missing pieces of the British adult birth cohort jigsaw in this respect. The question of health in relation to prior cognitive ability is a complex one; its antecedents are in the medical sociology of health in relation to education, but where education may best represent social pathways to health, cognition may provide a more sensitive marker of underlying biological processes, including those programmed in early life. Consistent with most other studies in the birth cohorts, these authors find that links between childhood cognitive capital and risk of cardiovascular disease are largely mediated by education; that is, cognitive development may be a necessary link in the life course chain to health, but it is not a sufficient one. There are interesting qualifications to this, of course, in this study and elsewhere.

In conclusion, the series of papers in this special edition highlights one of the most fascinating aspects of the British birth cohort studies: that these are in effect natural experiments, where changes in social structures, whether resulting from the implementation of policy or from shifts in cultural norms, alter the weight and relative balance of components that we think of as building blocks of the life course - early circumstances, cognitive development, schooling, progress or otherwise in the labour market, social roles, lifestyle, health and function, and quality of life. Such changes strongly apply in Britain, but other changes can also be tracked around the world. Cognitive ability conceptualised as capital helps to bring this alive, since factors that influence the accumulation of this particular form of wealth, and the purchasing power of the wealth itself, are, to borrow an image from Gillian Sutherland, a shifting kaleidoscope. If this special edition helps to maintain the impetus of this kind of research, then that in itself is an achievement.

Acknowledgements

Marcus Richards is funded by the UK Medical Research Council (MRC). Ian Deary receives funding from the cross-Council Lifelong Health and Wellbeing Initiative (Biotechnology and Biological Sciences Research Council, Engineering and Physical Sciences Research Council, Economic and Social Research Council and MRC).

References

- Carroll JB. (1993) *Human cognitive abilities: a survey of factor analytic studies*. Cambridge University Press, Cambridge, UK.
- Cattell RB. (1971) *Abilities: their structure, growth and action*. Houghton Mifflin, Boston.
- Cooper C. (2010) *Individual differences and personality*. 3rd edition. Hodder, London.
- Crowther Report. (1959) *A report of the Central Advisory Council for Education*. Her Majesty's Stationery Office, London.
- Deary IJ. (2000) *Looking down on human intelligence. From psychometrics to the brain*. Oxford University Press, Oxford.
- Deary IJ. (2001a) *Intelligence: a very short introduction*. Oxford University Press, Oxford.
- Deary IJ (2001b) Human intelligence differences: a recent history. *Trends in Cognitive Sciences*, 5, 127-130.
- Deary IJ, Lawn M and Bartholomew DJ. (2008) A conversation between Charles Spearman, Godfrey Thompson, and Edward L. Thorndike: the International Examinations Enquiry. *History of Psychology*, 11, 122-142.
- Deary IJ, Johnson W and Houlihan LM. (2009) Genetic foundations of human intelligence. *Human Genetics*, 126, 215-232.
- Deary IJ, Whalley LJ and Starr JM. (2009) *A Lifetime of Intelligence: follow-up studies of the Scottish Mental Surveys of 1932 and 1947*. American Psychological Association, Washington, DC.
- Douglas JWB. (1964) *The home and the school*. Macgibbon and Kee, London.
- Duckworth K and Schoon I. (2010) Progress and attainment during primary school: the roles of literacy, numeracy and self-regulation. *Longitudinal and Life Course Studies*, 1, 223-240
- Ferri E, Bynner J and Wadsworth MEJ. (2003) *Changing Britain, changing lives: three generations at the turn of the century*. Institute of Education, London.
- Hatch SL, Feinstein L, Link B, Wadsworth MEJ and Richards M. (2007) The continuing benefits of education: adult education and midlife cognitive ability in the British 1946 birth cohort. *Journal of Gerontology Series B*, 62, S404-S414.
- Gregg P and Macmillan L. (2010) Family income, education and cognitive ability in the next generation: exploring income gradients in education and test scores for current cohorts of youth. *Longitudinal and Life Course Studies*, 1, 261-282.
- Guilford JP. (1967) *The nature of human intelligence*. McGraw-Hill, New York.
- Lynch JW, Kaplan GA and Shema SJ. (1997) Cumulative impact of sustained economic hardship on physical cognitive, psychological and social functioning. *New England Journal of Medicine*, 337, 1889-1895.
- O'Donovan MC and Owen MJ. (2009) Genetics and the brain: many pathways to enlightenment. *Human Genetics*, 126, 1-2 (editorial).
- Piaget J and Inhelder B. (1973) *Memory and intelligence*. Basic Books, New York.
- Richards M and Deary IJ. (2005) A life course approach to cognitive reserve: a model for cognitive aging and development? *Annals of Neurology*, 58, 617-622.
- Richards M, Stephen A and Mishra G. (2010) Health returns to cognitive capital in the British 1946 birth cohort. *Longitudinal and Life Course Studies*, 1, 283-298.
- Richards M, Hatch SL and Kuh D. (in press). Early life, mental development, and mental aging. *Journal of Gerontology Series B*.
- Schoon I. (2010) Childhood cognitive ability and adult educational attainment: evidence from three British birth cohorts. *Longitudinal and Life Course Studies*, 1, 241-260.
- Schoon I, Hope S, Ross, A and Duckworth K. (2010) Family hardship and children's development: the early years. *Longitudinal and Life Course Studies*, 1, 209-222.
- Spearman C. (1927) *The abilities of man*. Macmillan, London.
- Stern Y. (2002) What is cognitive reserve? Theory and research application of the reserve concept. *International Journal of the Neuropsychology Society*, 8, 448-460.
- Sternberg RJ. (1985) *Beyond IQ: A Triarchic Theory of Intelligence*. Cambridge University Press, Cambridge.
- Sutherland G. (2010) Setting the scene. *Longitudinal and Life Course Studies*, 1, 201-208.
- Thorndike EL. (1927) *Measurement of intelligence*. Bureau of Publications, Teacher's College, Columbia University, New York.
- Wadsworth MEJ, Kuh D, Richards M and Hardy R. (2006) Cohort profile: the 1946 National Birth Cohort (MRC National Survey of Health and Development). *International Journal of Epidemiology*, 35, 49-54.
- Wadsworth, MEJ. (2010) The origins and innovatory nature of the 1946 British national birth cohort study. *Longitudinal and Life Course Studies*, 1, 121-136.