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Abstract

The 1970 British Cohort Study (BCS70) data is rich in cognitive measures taken during childhood and adolescence, and also includes adult measures of literacy and numeracy. For the first time, the 2012 survey included a repeat measure in adulthood of a cognitive scale which had been used previously with the cohort in childhood – a vocabulary test first taken in 1986, when the cohort members were 16 years old. This paper asks how vocabulary scores changed between the ages of 16 and 42, taking account of early social background and childhood reading behaviour, but also examining the influence of educational and labour market attainment and reading for pleasure in mid-life. We find that both educational and occupational attainment, and reading habits in childhood and adulthood, are linked to vocabulary growth.

Non-technical summary: Vocabulary from adolescence to middle-age

Does reading increase people's vocabularies between the ages of 16 and 42? This paper addresses this question using a nationally representative cohort of people born in 1970 (the 1970 British Cohort Study). The sample has been surveyed repeatedly since they were born. Our analyses are based on 9,432 cohort members who completed a vocabulary test at age 42 in 2012.

We controlled for the survey members' socio-economic backgrounds, and for their vocabulary scores at the ages of 5, 10 and 16. We looked at the influence of both childhood and adult characteristics on vocabulary scores at age 42.

Key descriptive findings at 42 (without controls):

- Reading was a popular pastime at 42. 26% of people said they read books for pleasure every day, and a further 13% several times a week. However, 28% of respondents said that they read once a year or less.
- There were striking differences in what people said they like to read according to educational attainment, even among people with degrees from different universities. For example, 43% of those with degrees from Russell Group universities said they liked to read 'classic fiction' compared to 29% of those with degrees from other universities, and 11% of those with no qualifications.
- 56% of Russell Group graduates read only broadsheet newspapers, compared to 34% of those with degrees from other universities, and 7% of those with no qualifications. Conversely, 9% of Russell Group graduates read only tabloids, compared to 22% of other graduates and 55% of people with no qualifications.
- Cohort members took the same vocabulary test at age 16 and age 42. Overall, people's scores on the test improved substantially (by around 8 percentage points) on average, showing that they continued to learn new words after the age of 16.

Key findings from the linear regression analysis of vocabulary progress between 16 and 42 (with controls):

- Childhood reading habits exerted a long-term influence on adult vocabulary development, even controlling for adult reading habits.
- Both occupational social class at 42 and qualifications achieved by 42 were linked to vocabulary growth between 16 and 42. Holders of Russell Group degrees made the most progress.
- The frequency of reading for pleasure was positively linked to progress in vocabulary. Those who read every day had an advantage of 4 percentage points compared to non-readers.
- What people read mattered as much as how often they read, with the greatest gains for readers of high-brow fiction.
- Readers of broadsheets made more progress in vocabulary than people who didn't read newspapers, while tabloid readers actually made less progress than non-readers of newspapers.
- Finally, this paper builds on previous work which showed that reading for pleasure was linked to cognitive progress up to age 16, especially in vocabulary scores. We have now shown that reading for pleasure both in childhood and adulthood have a continued link to progress in vocabulary post-16.

Introduction

There is a substantial literature examining the longitudinal development of cognition in childhood and adolescence. The growth in cognitive inequalities according to socioeconomic status during childhood has been documented by analyses of the British cohort studies of 1946, 1958, and 1970 (Douglas 1964; Feinstein 2003; 2004; Fogelman 1983; Fogelman & Goldstein 1976; Sullivan & Brown 2013b; Sullivan et al. 2013). The BCS70 childhood cognitive scores have been shown to be important predictors of a range of adult outcomes, including employment (Breen & Goldthorpe 2001) and health (Batty et al. 2007). There is also a growing literature examining the decline in cognitive function from mid-life into old age (Richards & Hatch 2011; Richards & Sacker 2003; Richards et al. 2004; Singh-Manoux et al. 2012). The period between adolescence and early mid-life is relatively neglected however. Yet mental development surely continues post-16, and may be expected to be related to mental stimulation in adulthood, including further and higher education, occupational experience and leisure activities. For example, evidence from the 1946 birth cohort has demonstrated that both adult education and physical exercise are linked to cognitive attainment in mid-life (Hatch et al. 2007; Richards et al. 2003).

There is evidence that the complexity and level of intellectual stimulus provided by an individual's environment influences their cognitive performance. As such, increased cognitive demands and rewards to cognitive skills have been put forward as an explanation of massive IQ score gains in populations over time (Flynn 1987). The relationship between cognition and environmental stimulus is a reciprocal one, meaning that high cognitive functioning leads people into more stimulating environments and activities, which in turn promote cognitive function (Schooler & Mulatu 2001; Schooler et al. 2004). This reciprocal relationship provides a plausible model for the increased heritability of IQ as children get older (Dickens & Flynn 2001), and may help to account for the growth of cognitive inequalities during childhood that has been observed in the British birth cohorts.

The relationship between cognition and education is an example of this reciprosity, as cognitive high achievers tend to get more and higher quality education, thus further improving their cognitive attainment (Deary & Johnson 2010). But the extent of causality in one direction or the other is typically very difficult to unpack, and longitudinal data is clearly vital in tackling such questions.

Jobs which demand self-direction rather than obedience protect against cognitive decline in older workers (Schooler et al. 2004). Again, this is a reciprocal relationship. It is well established that high cognitive performance is linked to upward social mobility, and it is also plausible that jobs of higher social class status should be linked to cognitive development between adolescence and mid-life.

There is a substantial literature on 'cultural capital' and educational attainment (Bourdieu & Passeron [1977] 1990). While the concept of cultural capital can be somewhat opaque, empirical researchers have operationalised cultural capital in terms of leisure activities, and have found that reading has a distinctive link to educational attainment, whereas other 'cultured' pursuits such as going to art galleries or playing a musical instrument appear to be far less relevant to educational attainment once family background factors are taken into account (Crook 1997; De Graaf et al. 2000; Sullivan 2001). Drawing on Ganzeboom's distinction between status-seeking and information-processing versions of cultural reproduction theory (Ganzeboom 1982), we have argued that reading is distinctive because it introduces the reader to new vocabulary and new concepts (Sullivan 2002; 2007a). In previous work, we have demonstrated the role of reading for pleasure in the cognitive development of the BCS70 cohort members up to age 16 (Sullivan & Brown 2013b). We were able to demonstrate that it is not just that bright children read more, but reading is

linked to faster cognitive progress for children with the same levels of prior cognitive attainment. Reading was associated with progress both in mathematics and vocabulary, but the link was strongest for vocabulary. To our knowledge, the influence of reading on cognitive development up to mid-life has not previously been examined.

While our previous work established the importance of time spent reading, we were not able to examine the potential importance of the types of books that individuals read. Sociologists have seen cultural tastes as an important expression of class identity (Bourdieu 1984; Savage et al. 2013), and social differences in cultural tastes and participation have been documented extensively – see for example (Chan & Goldthorpe 2007b; Miles & Sullivan 2012). The question of whether exclusive high-brow tastes have been replaced by cultural omnivorousness as a marker of high social status has generated a long running debate (Peterson 1997). In this paper we are able to examine the genres that cohort members read, and whether this was linked to the development of their vocabularies. We might expect that reading 'high-brow' genres, which typically use more complex language and a wider range of vocabulary, will be more likely to lead to improvements in readers vocabularies over time.

Vocabulary is seen as a measure of crystallised cognitive ability, capturing an important aspect of literacy. Vocabulary is relatively robust, in that it is more resistant to decline during ageing than other cognitive measures, such as memory (Rabbitt 1993). Adult vocabulary has been found to be protective against general cognitive decline (Richards et al. 2004). While vocabulary is just one component of cognition, its distinctive importance comes from the fact that knowledge of words is both an adjunct to knowledge of concepts and assists further learning (Hirsch 1983).

Research questions

In previous work, we have examined the predictors of vocabulary and maths scores at age 16, and found that reading for pleasure in childhood was a powerful predictor of progress in both vocabulary and maths, but especially of vocabulary. Inequalities in educational attainment continued to expand between the ages of ten and 16. In this paper we examine the role of both childhood and adult circumstances and childhood and adult reading behaviour on vocabulary change between the ages of 16 and 42.

1. How do adult reading habits vary according to educational status?
2. Do vocabulary scores continue to diverge according to childhood socio-economic circumstances between 16 and 42?
3. Do post-16 educational and occupational experiences have an influence on vocabulary change between 16 and 42?
4. Does reading for pleasure in childhood and adulthood have a continuing role in vocabulary development post-16? If so, does it matter what people read, or simply how much they read?
5. Does reading have a distinctive role in vocabulary development? We will test whether playing a musical instrument is linked to vocabulary development in a similar way to reading.

Data

The 1970 British Cohort Study (BCS70) follows the lives of more than 17,000 people born in England, Scotland and Wales in a single week of 1970 (Elliott & Shepherd 2006). Over the course of cohort members' lives, the BCS70 has collected information on health, physical,

educational and social development, and economic circumstances among other factors. Since the birth survey in 1970, there have been eight surveys (or 'waves') at ages 5, 10, 16, 26, 30, 34, 38 and 42.

The 1970 cohort study is rich in cognitive test scores throughout the early years, and the early test scores (up to age ten) have been analysed extensively, including influential work by Feinstein (2003; 2004). A comprehensive guide to the cognitive scores used in childhood is available (Parsons 2014 in press). The age 16 scores have been used less frequently (Duncan et al. 2012; Sullivan & Brown 2013a). Influential work has also been carried out on the adult literacy and numeracy data collected at age 34 (Bynner & Parsons 2006).

Tests of vocabulary were included in the surveys at age 5, 10, 16 and 42. At age 5, vocabulary was assessed using the English Picture Vocabulary Test (EPVT) (Brimer and Dunn 1962), a test of verbal vocabulary in which the child selected the picture from four options which corresponded to a given word. At age 10, study members completed a 100 item Pictorial Language Comprehension Test which was based on the EPVT. Of the 100 items, 71 were used to assess vocabulary. At age 16, vocabulary was assessed using a 75 item test where each item was a word followed by a list of five other words and the respondent was required to pick the one with the same meaning as the first word. The measure included at age 42 is a shortened 20 item version of the test used at 16.

It is important to acknowledge that people's levels of motivation and compliance, as well as potential stereotype-threat (anxiety due to the potential to confirm a negative stereotype about a group one belongs to) (Croizet & Claire 1998; Spencer et al. 1999) will affect their scores in cognitive tests. We also acknowledge that multiple-choice tests do not capture the full range of academic skills, and females tend to fare worse in multiple-choice tests than in other forms of assessment (Gipps & Murphy 1994). We do not interpret the tests used here as providing an estimation of innate intelligence. They are simply tests of attainment based on the capability and motivation to complete a particular task under given conditions.

Analytical strategy

Our analysis investigates the influence of childhood, adolescent and adult characteristics on vocabulary at age 42. We use linear regression, with percentage scores in vocabulary as the outcome variable. In order to examine influences on longitudinal change in vocabulary between 16 and 42, we condition on vocabulary percentage scores at 5, 10 and 16 from model two onwards.

Because we exploit data from all of the childhood waves of the study, including the age 16 wave, the problem of missing data must be addressed. The age 16 survey employed sixteen separate survey instruments, and unfortunately coincided with a teachers' strike which affected the completion of those instruments, including cognitive tests, that were administered via schools (Dodgeon 2008). This led to substantial instrument non-response, though the overall response and representativeness of the sample at this wave was good (Mostafa & Wiggins draft). Levels of missing data for the variables used in our analysis are provided in table 1. As list-wise deletion was not a practical option, we use multiple imputation to 'fill-in' values of any missing items in the variables selected for our analysis, adopting Schafer's algorithm under the assumption of 'missing at random' (MAR). In order to strengthen the MAR assumption and to protect against departures from multivariate normality we included a set of auxiliary variables in our imputation model (Schafer 1997). All reported analyses are averaged across twenty replicates based upon Rubin's Rule for the

efficiency of estimation under a reported degree of missingness across the whole data of just under 20 per cent (Little & Rubin 1987). The analytical sample consists of the 9,432 cohort members who completed the age 42 vocabulary test.

Model 1: Social origins

Model 1 focuses solely on social background which is captured by parental social class and education. Social class is based on the National Statistics Socio-Economic Classification (NS-SEC) categorisation, which groups occupations according to their employment relations and conditions (Goldthorpe 1997). NS-SEC at age 10 has been derived recently for BCS70 (Gregg, et al. 2012). Parental education is based on the highest qualification obtained by the mother or father (whichever is the highest). The child's sex is also included in Model 1.

Model 2: Childhood reading and cognitive and educational attainment

Model 2 adds information regarding childhood reading and childhood cognitive and educational attainment. Frequency of reading was recorded at age 10 and 16. Information provided by parents at 16 has been used to summarise the availability of newspapers in the home (classified as tabloids, broadsheets, both or no national papers). Newspaper readership is a strong cultural identifier (Chan & Goldthorpe 2007a). The prose style of tabloids was simpler and geared towards a lower reading age and smaller vocabulary than the broadsheets.

We also include measures of whether the cohort member played a musical instrument at the ages of 10 and 16 in this model. Playing an instrument is seen as a classic 'beaux arts' measure, and children who play musical instruments are part of the stereotype of a 'cultured' middle class family. Playing an instrument may share some characteristics in common with reading, for example it demands a degree of self-directed effort. Playing a musical instrument therefore acts as a useful control variable. To the extent that reading matters specifically because it introduces individuals to new words and concepts, we would hypothesise that reading should be more powerfully linked than playing an instrument to progress in vocabulary.

Educational attainment is based on examination results at age 16 (1986). We derive a total points score from all O-level and CSE examinations. An O-level grade A is awarded 7-points, grade B 6-points, continuing to a grade E, being awarded 3-points. A CSE grade 1 is equivalent to an O-level grade C and is awarded 5-points, a grade 2 4-points, etc. The lowest CSE grade is grade 6, which is awarded 1-point.

Cognitive attainment is based on the vocabulary assessments completed at 5, 10 and 16, which is described above.

Model 3: Educational and occupational attainment at 42

Model 3 adds information relating to post-16 educational attainment and adult occupation. Educational attainment is based on the highest qualification obtained by the age of 42. At the top end of the scale we use new data from the 2012 wave of the study to distinguish between 'elite degrees' from highly selective university degrees (operationalised as Russell

Group[1]) and other degrees. Occupational social class is based on the National Statistics Socio-Economic Classification (NS-SEC).

Model 4: Reading at 42

Finally, Model 4 adds information on the frequency of reading at age 42 along with summary measures of the types of books and newspapers which are read. We also include information on whether the cohort member played a musical instrument at 42.

Analysis

Who reads what?

In order to derive a classification of reading genres for our analysis, we first examined patterns of reading according to the educational status of respondents. The paper self-completion questionnaire at age 42 asked respondents 'How often do you read books in your spare time, not for work or study (including in electronic format)?'. This was followed up by two questions on preferred genres: 'Which of the following types of fiction books do you usually read?' and 'Which of the following types of factual books do you usually read?'. This was followed by a list of genres taken from standard bookshop section classifications which we expected would be familiar and meaningful to cohort members.

[1] We also include University of Bath and University of St Andrews in our elite category, as they have been consistently as highly selective as Russell Group institutions.

Table 1: Genres of books 'usually read' by highest qualification

	None	Other	AS/A-levels/Diploma	Degree	Elite degree	All
FICTION						
Action / Adventure / War Fiction	17.5%	18.4%	22.0%	21.8%	25.1%	19.8%
Comics / Graphic Novels	4.7%	5.1%	6.2%	6.1%	5.9%	5.4%
Crime / Thrillers / Mystery	36.2%	39.8%	47.3%	48.9%	54.6%	19.8%
Classic Fiction	10.5%	13.0%	20.5%	29.0%	43.3%	18.7%
Contemporary Literary Fiction	5.2%	5.4%	15.8%	29.8%	47.5%	14.6%
Historical Fiction	9.0%	11.1%	17.3%	22.2%	29.8%	15%
Humour	17.8%	23.3%	30.5%	32.5%	33.7%	25.5%
Horror	11.6%	11.6%	12.8%	8.4%	7.7%	10.9%
Poetry	1.9%	2.1%	3.4%	4.6%	7.0%	3.1%
Romance	22.5%	27.7%	28.6%	21.8%	18.5%	24.7%
Science Fiction / Fantasy	17.6%	16.5%	23.5%	25.1%	27.2%	20.3%
Other Fiction	7.5%	9.0%	8.3%	9.6%	7.2%	8.5%
Do Not Read Fiction Books	33.0%	28.1%	14.6%	14.5%	8.7%	23.3%
Base	**2159**	**2889**	**1257**	**1742**	**573**	**8620**
FACTUAL						
Art / Photography	5.0%	5.9%	12.3%	13.5%	14.7%	8.7%
Autobiography	35.1%	40.0%	41.4%	40.7%	39.0%	39.1%
Biography	24.0%	27.8%	32.1%	35.5%	39.5%	29.8%
Career-specific / Professional	11.0%	12.9%	26.5%	42.8%	44.2%	22.5%
Computing / Technology	7.0%	7.7%	11.6%	13.0%	13.5%	9.5%
Cookery / Food and Drink	31.9%	36.9%	45.1%	46.2%	44.8%	39.2%
Family and Parenting	6.2%	8.1%	12.3%	14.0%	16.8%	10%
Health, Wellbeing, Self-help	12.7%	15.2%	23.2%	25.6%	23.3%	18.4%
DIY / Interiors / Gardening	17.9%	20.4%	26.7%	22.9%	22.9%	21.4%
Music	7.5%	8.5%	9.0%	9.9%	8.6%	8.6%
Religion / Philosophy	4.2%	4.5%	7.5%	11.3%	13.8%	6.9%
Science	5.7%	6.1%	8.2%	15.2%	24.3%	9.4%
Sport	14.8%	16.8%	14.5%	18.0%	16.3%	16.2%
Politics / Economics / Current	3.0%	2.7%	4.5%	11.9%	18.5%	5.9%
Travel	14.1%	18.7%	24.7%	28.8%	33.2%	21.4%
History	14.6%	17.6%	20.4%	27.0%	36.4%	20.4%
Other factual	8.5%	8.4%	8.8%	9.9%	10.1%	8.9%
Do Not Read Factual Books	25.8%	19.1%	8.4%	6.8%	4.7%	15.8%
Base	**2158**	**2894**	**1257**	**1746**	**572**	**8627**

The descriptive tables are based on raw rather than imputed data. Table 1 shows that the pattern of readership of different genres of fiction and factual books according to educational status varies widely. In terms of fiction, there is a general tendency for respondents with higher levels of education to be more likely to read each genre, with some exceptions: horror

was less popular with graduates than with non-graduates, and romance was most popular with respondents with intermediate qualifications (O-levels and A-levels) and less popular with graduates and those with no qualifications. Genres which would typically be classified as 'high culture' had the strongest educational gradients. This was most marked in the case of 'contemporary literary fiction' which was read by nearly half (48%) of respondents with elite degrees, 30 per cent of those with other degrees, and only 5 per cent of those with no qualifications. The difference between those with elite and other university degrees is particularly striking, and is also evident in the case of classic fiction, which was read by 43 per cent of elite graduates and 29 per cent of other graduates. The most popular genre across all educational categories is 'crime, thrillers and mystery', which can be seen as middle-brow, and has a less sharp educational gradient than the high-brow genres.

In terms of factual books the readerships of genres such as sport and autobiography are fairly undifferentiated by educational status, while more intellectual topics such as science and politics, economics and current affairs show a marked educational gradient in readership, including a divide between elite graduates and other graduates.

We derived summary variables for fiction and non-fiction genres, classing genres as high-brow if the ratio of readers between the highest and lowest education categories was 2.5 or more, low-brow if the ratio was 1.5 or less, and middle-brow for those in between. We made an exception for the 'family and parenting' genre, which would have been categorised as high-brow on this basis, but which we chose to classify as middle-brow. We considered that the relationship between educational attainment and reading parenting books at age 42 is likely to be partly due to the relationship between educational attainment and the age at which people typically become parents.

We classed readers as high-brow if they read any high-brow books, middle-brow if they read middle-brow books and no high-brow books, and low-brow if their reading was exclusively low-brow. We considered dividing high-brow univores, with exclusively high-brow tastes, from high-brow omnivores, but there were too few high-brow univores in the fiction category (4% of the sample) to justify this approach. We acknowledge the drawback that the categories that our derived variable is based on are likely to contain a wide range of books of different registers, e.g. some crime fiction is also literary fiction. Nevertheless, the analysis we have presented here shows that these categories are quite well differentiated in terms of the educational gradients of their readerships (Table 2). Study members were also asked about which newspapers they had read in the last month (including online newspapers), and this information was used to classify them as reading broadsheets only, tabloids only, broadsheets and tabloids or neither. Overall three quarters had read at least one newspaper in the last month and Table 2 makes clear the strong relationship between education and the types of newspaper read. The difference between those with 'elite degrees' and other degrees is again striking with over three quarters (76%) of those with an elite degree reading a broadsheet (including 21% who also read a tabloid) compared with 57% of other graduates. Broadsheets readership is fairly rare among non-graduates.

Table 2: Derived summary reading variables by highest qualification

	None	Other	AS/A-levels/Diploma	Degree	Elite degree	All
Fiction						
None	32.1%	27.3%	14.5%	14.0%	8.2%	22.6%
Low brow	12.1%	11.8%	9.5%	5.6%	2.8%	9.7%
Middle brow	36.9%	38.3%	39.4%	31.2%	22.8%	35.6%
High brow	18.9%	22.5%	36.5%	49.2%	66.3%	32.0%
Base	**2092**	**2834**	**1238**	**1704**	**575**	**8443**
Factual						
None	24.7%	18.6%	8.2%	6.6%	4.2%	15.2%
Low brow	21.6%	20.4%	14.0%	7.8%	5.1%	16.2%
Middle brow	20.9%	23.6%	23.4%	15.4%	10.5%	20.4%
High brow	32.8%	37.4%	54.3%	70.2%	80.3%	48.3%
Base	**2093**	**2839**	**1239**	**1708**	**574**	**8453**
Newspapers						
Broadsheets and tabloids	10.7%	13.2%	21.0%	22.4%	20.9%	16.1%
Broadsheet only	6.8%	7.5%	14.5%	34.4%	55.7%	17.0%
Tabloid only	54.6%	53.7%	39.8%	21.5%	8.9%	42.4%
No newspaper	27.9%	25.7%	24.7%	21.7%	14.5%	24.6%
Base	**2119**	**2859**	**1245**	**1705**	**573**	**8501**

Descriptive analysis of variables in the models

Table 3 shows the percentage response for the categorical variables to be used in our regression analyses, and means for continuous variables. A comparison of mean percentage scores for vocabulary at age 16 and 42 is provided for each categorical variable, and correlations for the continuous variables.

Table 3: Descriptive summary of variables in models

		Imputed %	Original N	% missing	Age 16 - Mean vocab score (%)	Age 42 - Mean vocab score (%)
All			9,432		54.7	63.0
Sex	Male	48.0	4523	-	54.0	64.0
	Female	52.0	4909	-	55.3	62.1
	Missing	-	0	0		
Parental social class	Managerial/professional	32.2	2431	-	59.5	69.1
	Intermediate	28.2	2100	-	54.4	63.1
	Routine/Semi-routine	35.5	3107	-	60.0	58.4
	Long-term unemp/never worked	4.1	359	-	49.9	54.6
	Missing	-	1435	15.2		
Highest parental qual	No qualifications	44.2	3942	-	49.2	56.7
	Lower than A-levels etc	34.9	3172	-	56.3	65.4
	A-levels etc	6.0	518	-	60.6	69.4
	Degree	14.9	1398	-	64.4	73.6
	Missing	-	402	4.3		
Newspapers in home at 16	Broadsheets and tabloids	5.2	317	-	58.9	68.5
	Tabloids only	57.2	3270	-	52.3	60.5
	Broadsheets only	9.3	616	-	65.0	74.1
	No papers in home	28.3	1682	-	55.1	63.5
	Missing	-	3547	37.6		
Book reading at 16	More than once a week	26.7	1176	-	61.2	70.2
	Once a week	23.1	516	-	54.9	63.4
	Less than once a week	25.4	843	-	52.6	60.9
	Rarely/Never	24.8	1290	-	49.5	57.0
	Missing	-	5607	59.4		
Child reading at 10	Often	61.4	4792	-	58.4	66.9
	Sometimes	33.9	2942	-	49.5	57.8
	Never/hardly ever	4.7	437	-	43.4	50.8
	Missing	-	1261	13.4		
Plays a musical instrument at 10	Yes	50.3	4072	-	57.3	65.7
	No	49.7	4068	-	52.0	60.3
	Missing	-	1292	13.7		
Plays a musical instrument at 16	Yes	22.0	925	-	57.2	66.4
	No	78.0	2875	-	53.9	62.1
	Missing	-	5632	59.7		
Highest qualification by 42	No qualifications	26.2	2467	-	47.0	53.5
	Lower than A-levels etc	33.2	3128	-	51.6	59.7
	A-levels etc	14.5	1369	-	57.5	66.6
	Degree	19.9	1874	-	62.9	72.9
	Elite degree	6.3	594	-	70.3	80.7
	Missing	-	0	0		

		Imputed %	Original N	% missing	Age 16 - Mean vocab score (%)	Age 42 - Mean vocab score (%)
Social class at 42	Managerial/professional	41.6	3899	-	60.3	70.4
	Intermediate	22.3	2075	-	53.3	61.9
	Routine/Semi-routine	24.6	2309	-	48.9	55.5
	Long-term unemp/never worked	11.5	1081	-	49.2	54.6
	Missing	-	68	.7	-	-
Frequency of reading at 42	Read books every day	25.7	2265	-	60.4	70.9
	Several times a week	12.5	1052	-	58.5	67.7
	Once or twice per week	10.5	831	-	55.6	64.1
	At least once a month	9.6	737	-	53.8	61.8
	Every few months	13.8	1148	-	53.4	61.7
	At least once a year	10.6	894	-	50.6	58.5
	Never/less often	17.3	1530	-	46.8	51.8
	Missing	-	975	10.3	-	-
Reading fiction at 42	No fiction	23.9	1912	-	47.9	53.2
	Low brow	12.3	817	-	49.7	55.5
	Mid brow	34.3	3009	-	54.6	63.6
	High brow	29.5	2705	-	62.3	73.4
	Missing	-	989	10.5	-	-
Reading factual at 42	No fiction	16.0	1283	-	47.4	51.5
	Low brow	18.0	1367	-	50.2	57.0
	Mid brow	21.2	1721	-	53.7	62.1
	High brow	44.7	4082	-	59.5	70.0
	Missing	-	979	10.4	-	-
Reading newspapers at 42	Broadsheets and tabloids	15.5	1366	-	58.8	69.1
	Broadsheets only	16.2	1445	-	64.5	76.0
	Tabloids only	41.6	3603	-	50.7	57.2
	No newspaper	26.7	2087	-	52.4	60.7
	Missing	-	931	9.9	-	-
Plays a musical instrument at 42	Yes	12.1	1026	-	60.9	71.4
	No	87.9	7392	-	53.8	61.9
	Missing	-	1014	10.8		

		Imputed Mean	Original N	% missing	Corr. Age 16 vocab score (%)	Corr. Age 42 vocab score (%)
Age 16 exam score	Score (max score 59)	13.6	3985	-	0.53	0.58
	Missing		5447	57.8	-	-
Prior vocabulary scores	Age 5 (%)	66.5	7257	-	0.34	0.39
	Missing	-	2175	23.1	-	-
	Age 10 (%)	58.3	7590	-	0.34	0.46
	Missing	-	1842	19.5	-	-
	Age 16 (%)	54.7	7349	-	-	0.61

Missing	-	2083	22.1	-	-

First of all, we can see that respondents made substantial progress in vocabulary scores between age 16 (mean score 55%) and 42 (mean score 63%). Men scored slightly lower than women at 16, but achieved higher scores at 42 (64% compared to 62%).

In terms of childhood characteristics, we see strong gradients in the vocabulary scores at both 16 and 42, as expected, with a general upward shift in scores from 16 to 42 across the board. This pattern is repeated for adult characteristics. For example, people with no qualifications scored 47 per cent on the vocabulary test at age 16, rising to 54 per cent at 42, while those with elite degrees scored 70 per cent at 16, rising to 81 per cent at 42.

Over a quarter (26%) said they read books in their spare time every day, and nearly half (49%) read for pleasure at least weekly, while 28 per cent read books once a year or less. We can see a clear association between reading frequency and vocabulary scores at 16 and 42, showing that those with strong vocabularies at 16 were more likely to be frequent readers at 42. Both fiction and factual book genres were clearly associated with vocabulary scores, with respondents who read high-brow genres gaining higher scores. 16 per cent of the sample read broadsheet newspapers only, a further 16 per cent read both broadsheets and tabloids, 42 per cent read tabloids only, and the remaining 27 per cent had not read any newspapers in the last month. Those who read tabloids exclusively gained the lowest vocabulary scores at 16 and 42, lower even than those who did not read newspapers. Those who read a mixture of broadsheets and tabloids scored lower than those who read broadsheets exclusively. At age 42, tabloid readers attained vocabulary scores of 57 per cent compared to 76 per cent for broadsheet readers.

Playing a musical instrument, both in childhood and particularly in adulthood was also found to be associated with higher scores – the 12 per cent who played an instrument at 42 achieved average scores of 71 per cent, compared to 62 per cent amongst those who did not.

The correlation matrix of cognitive scores shows that age 5 and age 10 vocabulary are both correlated 0.34 with age 16 vocabulary. Correlations between age 5, age 10 and age 16 vocabulary and age 42 vocabulary were 0.39, 0.46 and 0.61 respectively. The examination score at age 16 is correlated 0.53 with vocabulary at 16 and 0.58 with vocabulary at 42.

Regression analysis of vocabulary at 42

Table 4 shows a series of linear regressions Ordinary least squares (OLS) predicting vocabulary scores at age 42. Our dependent variable is treated as a percentage score, as using standardised scores can mask increases in social differences due to increased variance in absolute skills over time (Magnuson et al. 2012).

Model 1 includes the child's sex and childhood social origins, captured via parental social class and educational qualifications. Men scored nearly 2 percentage points higher than women in this model. Social class differences were apparent, with a 5 percentage point advantage for the children of managers and professionals, and a 3 percentage point disadvantage for the children of the long term unemployed compared with those whose parents had routine or semi-routine occupations. Parental education was substantially more powerful than social class in this model, with a 14 per cent advantage for respondents whose parents had a university degree.

Model 2 includes both childhood reading behaviour, educational attainment at age 16, and prior vocabulary scores at the ages of five, ten and 16. In this and subsequent models we

are essentially examining the predictors of change in vocabulary between the ages of 16 and 42. Vocabulary scores at 5, 10 and 16 and educational attainment at 16 are powerfully predictive of vocabulary at 42. Broadsheets and tabloids in the home are not significant, but reading books for pleasure at the ages of ten and 16 strongly predicts vocabulary at age 42, with a 4 percentage point advantage for those that read 'more than once a week' at 16, and a 5 percentage point advantage for those that read 'often' at age ten. We interpret this as showing that the advantage of childhood reading is not fully captured by attainment up to age 16, as childhood reading has a continued link with subsequent progress. As an indicator of 'beaux arts' cultural participation, Model 2 also includes whether musical instruments were played at 10 and 16. Playing a musical instrument at age 10 was a significant predictor of vocabulary at 42 but the coefficient is much smaller than those associated with regularly reading books, and playing an instrument at 16 is negative and non-significant. The gender difference increases in this model, confirming that men made more progress in vocabulary between the ages of 16 and 42 than women did. The influence of social origins is greatly attenuated in this model. Parental social class becomes largely insignificant, with the exception of a 2 percentage point disadvantage for cohort members who grew up with a long-term unemployed parent. The advantage due to a graduate parent declines from just under 14% to just over 1%, showing that this advantage is largely captured by factors which are already apparent by age 16. The model fit is substantially improved, increasing from R2 = 0.13 in model 1 to 0.52 in model 2.

Model 3 includes adult educational and occupational attainment, measured at age 42. Post-16 educational attainment is clearly linked to progress between the ages of 16 and 42. Compared to those with no qualifications, respondents with higher qualifications achieved higher vocabulary scores, with an advantage in vocabulary gains amounting to around three percentage points for those with ordinary degrees, and four percentage points for those with elite degrees. Managerial and professional social class status was associated with an advantage of three percentage points, and intermediate social class was associated with a 2 percentage point advantage. But the influence of childhood reading is barely attenuated in this model, and childhood reading remains an important predictor of progress in vocabulary scores. Model fit is barely improved compared to the previous model.

Model 4 includes reading for pleasure at age 42. The frequency of reading for pleasure is clearly linked to vocabulary, with the greatest gains for those who read every day (4 percentage points). Reading less often than once a week lead to no advantage in the vocabulary test. Reading high brow fiction is linked to an advantage in vocabulary gains of 5 percentage points, with a smaller advantage (3 percentage points) for middle-brow fiction, and no advantage for reading low-brow fiction compared to not reading at all. Reading high-brow factual books was linked to an advantage of around 3 percentage points, while middle brow factual reading made a smaller difference, and low brow reading presented no advantage compared to not reading factual books at all. Reading broadsheet newspapers was linked to an advantage in progress in vocabulary of 1 percentage point, while reading tabloids was linked to a small but significant disadvantage (1 percentage point). Reading both tabloids and broadsheets was not significantly different from reading no newspapers. Playing a musical instrument at 42 was associated with a small but significant advantage of 1 percentage point. Model fit was only slightly improved compared to the previous model.

Interestingly, the effect of the highest qualification achieved by age 42 is partially mediated by reading behaviour (the elite degree coefficient declines from 4.2 to 2.2). The social class coefficients on the other hand, are only marginally reduced in this model. The male advantage rises to 4 percentage points in this model. This presents a puzzle, as men clearly make more progress in vocabulary between 16 and 42 despite reading less for pleasure than women. It may be that other forms of reading (e.g. reading at work) fill the gap for men. The influence of childhood social origins has been almost entirely attenuated in this model, with the exception of a small persistent disadvantage due to long-term parental

unemployment, and a small advantage for respondents whose parents had intermediate qualifications. The advantage due to childhood reading is persistent, especially reading 'often' at age ten, which is linked to a 4 percentage point advantage in progress in vocabulary.

Conclusions

First, we asked how reading habits in mid-life varied according to educational status. We found a strong educational gradient in reading habits, with the most highly-educated respondents more likely to read high-brow genres such as contemporary literary fiction. The divide between elite graduates and other graduates in this regard is interesting, and suggests that, just as broad social class categories can mask distinctive 'class fractions' (Savage 1992), broad educational categories can also mask important differences. The patterns of reading behaviour shown here are consistent with both the 'status seeking' hypothesis regarding cultural participation as a way of asserting social superiority (Bourdieu 1984), and the 'information processing' hypothesis, according to which intellectually able and/or highly educated individuals prefer intellectually stimulating material (Ganzeboom 1982; Sullivan 2001; 2002; 2007b). It may well be that both of these processes are at work, but the strong link between reading habits and both adolescent and mid-life vocabulary points towards the reciprocal relationship between intellectual performance and intellectual stimulus noted elsewhere in the literature. We found that the link between reading and vocabulary growth was far greater than the link between playing a musical instrument and vocabulary growth. This adds weight to the view that reading is distinctive, and is important to learning in a way that other forms of cultural participation are not.

Second, we asked whether social origins had a persistent influence on vocabulary, extending into mid-life. For the most part, the influence of social origins was fully mediated by factors apparent by age 16, including measured vocabulary at five, ten and 16, examination results at 16, and childhood reading behaviour. The small differences that remained according to parents' social class and education were in turn largely mediated by adult status attainment and reading patterns. However, unlike childhood social origins and playing an instrument in childhood, childhood reading habits appeared to exert a long-term influence, even when adult characteristics were included in the model. The greater progress in vocabulary made by frequent childhood readers was only partially mediated by mid-life reading habits. This long-term influence may be because frequent childhood readers continued to read throughout their twenties and thirties, but unfortunately we do not have measures of reading for these waves of the study.

Third, we asked whether post-16 educational attainment and achieved social class in mid-life were linked to the development of vocabulary between 16 and 42. We found that both social class at 42 and qualifications attained by 42 were linked to vocabulary growth. The analysis further supported the distinction between elite degrees and other degrees, as elite degree holders made the most progress.

Fourth, we asked whether adult reading habits were linked to progress in vocabulary between 16 and 42. We found that the frequency of reading for pleasure was positively linked to progress in vocabulary. What people read mattered as much as how often they read. Those who read high-brow fiction made greater vocabulary gains than those who read middle-brow fiction; and low-brow fiction readers made no more progress than non-readers. The gains linked to reading factual books were smaller than those for fiction, and similarly, low-brow factual reading was not linked to any vocabulary gain. Readers of broadsheets made more progress in vocabulary than people who didn't read newspapers; while tabloid readers actually made less progress than non-readers of newspapers. This negative tabloid

effect is in line with our previous work showing the presence of tabloid newspapers in the home during childhood was linked to poor cognitive attainment at age 16 (Sullivan and Brown 2013).

Finally, our previous work showed that reading for pleasure was linked to cognitive progress up to age 16, especially in vocabulary scores; and this paper suggests that reading for pleasure both in childhood and adulthood have a continued link to progress in vocabulary post-16. On an optimistic note, learning certainly doesn't stop at 16, and average scores increased substantially from 16 to 42. In addition, while childhood scores were powerful predictors of vocabulary at 42, post-16 educational and occupational attainment and leisure reading at 42 were all relevant, showing that learning continues to be influenced by adult activities.

Table 4: Regression models (N = 9,432)

		Model 1		Model 2		Model 3		Model 4	
		B	Sig	B	Sig	B	Sig	B	Sig
	(Constant)	54.5	0.00	14.0	0.00	12.8	0.00	12.8	0.00
Sex(Ref = F)	Male	1.9	0.00	3.2	0.00	2.9	0.00	3.9	0.00
Parental social class	Managerial/professional	5.3	0.00	0.4	0.31	0.2	0.56	0.1	0.77
(Ref = Routine/Semi-routine)	Intermediate	2.4	0.00	0.2	0.62	0.0	0.92	0.1	0.76
	Long-term unemployed	-3.3	0.00	-1.8	0.02	-1.7	0.03	-1.5	0.05
Highest parental qual	Lower than A-levels etc	7.5	0.00	1.6	0.00	1.3	0.00	1.2	0.00
(Ref=No quals)	A-levels etc	10.7	0.00	1.0	0.14	0.7	0.30	0.7	0.30
	Degree	13.9	0.00	1.3	0.02	0.8	0.17	0.5	0.38
Newspapers in home 16	Broadsheets and tabloids			1.2	0.13	1.1	0.14	0.7	0.33
(Ref =No papers in home)	Tabloids only			0.1	0.88	0.3	0.59	0.4	0.35
	Broadsheets only			0.1	0.83	0.0	0.96	-0.7	0.28
Book reading 16	More than once a week			3.9	0.00	3.9	0.00	1.8	0.00
(Ref=Rarely/Never)	Once a week			2.2	0.00	2.2	0.00	0.9	0.09
	Less than once a week			1.1	0.06	1.0	0.07	0.3	0.55
Child reading (10)	Often			4.9	0.00	4.8	0.00	3.5	0.00
(Ref=Never/Hardly ever)	Sometimes			2.8	0.00	2.7	0.00	2.0	0.00
Musical instrument	Age 10			0.8	0.03	0.7	0.06	0.6	0.08
	Age 16			-0.3	0.66	-0.4	0.52	-0.6	0.37
Age 16 exam score	Score			4.9	0.00	4.1	0.00	3.5	0.00
Prior vocab scores	Age 5			0.1	0.00	0.1	0.00	0.1	0.00
	Age 10			0.3	0.00	0.3	0.00	0.2	0.00
	Age 16			0.4	0.00	0.3	0.00	0.3	0.00
Highest qual by 42	Lower than A-levels etc					1.8	0.00	1.7	0.00
(Ref=No quals)	A-levels etc					2.7	0.00	1.8	0.00
	Degree					3.3	0.00	1.9	0.00
	Elite degree					4.2	0.00	2.2	0.01
Social class at 42	Managerial/professional					2.9	0.00	2.4	0.00
(Ref = Routine/Semi-routine)	Intermediate					1.8	0.00	1.7	0.00
	Long-term unemployed					-0.7	0.15	-1.0	0.05
Frequency of reading 42	Read books every day							3.5	0.00
(Ref=Never/less often)	Several times a week							2.3	0.00
	Once or twice per week							1.5	0.04
	At least once a month							1.0	0.14
	Every few months							1.1	0.12
	At least once a year							0.4	0.59
Fiction at 42	Low-brow							0.8	0.23
(Ref = None)	Middle-brow							3.4	0.00
	High-brow							5.3	0.00
Factual books at 42	Low-brow							1.1	0.05
(Ref = None)	Middle-brow							2.3	0.00
	High-brow							3.0	0.00
Reading newspapers 42	Broadsheets and tabloids							0.2	0.64
(Ref=No newspapers)	Broadsheets only							1.2	0.03
	Tabloids only							-1.3	0.00
Musical instrument	Age 42							1.2	0.02
R-squared		0.13		0.52		0.53		0.56	

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