Bilingualism: Language and Cognition 19 (5), 2016, 1057–1078 © Cambridge University Press 2015. This is an Open Access article, distributed under the terms of the Creative Commons Attribution licence (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted re-use,distribution, and reproduction in any medium, provided the original work is properly cited. doi:10.1017/S1366728915000504

Socioeconomic level and bilinguals' performance on language and cognitive measures*

VIRGINIA C. MUELLER GATHERCOLE
Florida International University
IVAN KENNEDY
Bangor University
ENLLI MÔN THOMAS
Bangor University

(Received: November 10, 2014; final revision received: July 9, 2015; accepted: July 9, 2015; first published online 6 August 2015)

The performance of bilingual children and adults in Wales on Welsh and English vocabulary and grammar and on cognitive measures is re-analysed in relation to SES indicators of parental education and parental professions. Results are reported for 732 participants ranging across seven age groups from age 3 to over 60 and from four home language types, monolingual English, and bilinguals with only English at home, Welsh and English at home, or only Welsh at home. Results reveal extensive evidence of SES influence on performance, and of a complex relation of exposure in the home and SES level on performance, modulated by the age of the participant and whether one is considering the majority or minority language.

Keywords: bilingual language performance, SES, socioeconomic level, vocabulary, grammar, cognitive performance, McCarthy, Raven's

It is well known that multiple factors influence the timing and rate of language acquisition in bilingual children (e.g., Gathercole, in press). One factor that is little understood, however, is the influence of socioeconomic (SES) factors. Their influence appears to be complex and not necessarily straightforward, and how they interact with other factors that affect progress in bilinguals, such as exposure to each language, is an open question. We know that monolingual children growing up in poverty can lag behind their peers in language performance (Hart & Risley, 1995) and, at the same time, it is commonly reported that bilingual children can also lag behind their monolingual peers linguistically (Bialystok, Luk, Peets & Yang, 2010; Gathercole, 2007; Gathercole & Thomas, 2009; Harley, Allen, Cummins & Swain, 1991; Hoff, Core, Place, Rumiche, Senor & Parra, 2012; Lapkin, Swain & Shapson, 1990; Letts, 2013; Oller & Eilers, 2002; Paradis, 2010; Thordardottir, 2011). Because bilingual children often come from cultural and geographic backgrounds distinct from their monolingual peers, it is not always clear to what extent SES factors versus input factors are responsible for observed differences in performance. The purpose of this paper is to provide further insights into the growing literature on the relative contributions of exposure and SES levels to bilinguals' performance on linguistic measures. A secondary question is whether similar patterns of influence of these two factors affect bilinguals' performance on cognitive measures as well.

The effects of socioeconomic status on the development and performance of children, from the earliest years through the school years and beyond, are well documented. An early, clear demonstration of its effects on language development came from the influential study by Hart and Risley (1995), which documented the profound differences in the linguistic knowledge of children growing up in poverty versus middle class children. Differences in performance by SES correlated with dramatic differences in the input from their parents (with welfare parents using fewer than one third as many words per day in speech to their children as professional parents). Not only can SES factors have profound and long-lasting effects on children's linguistic performance, but they can also influence cognitive performance, socioemotional wellbeing, and health (Bradley & Corwyn, 2002).

The specific SES factors that have shown direct correlations with children's performance include household income, parental education, and home environment (including level of stimulation provided), the nature of the interaction between the mother and child (including joint attention), the quantity of speech to which the child is exposed, and the nature of that speech (Ginsborg,

* The data re-analyzed here were collected in relation to a study supported by ESRC grant RES-062-23–0175 on Cognitive Effects of Bilingualism Across the Lifespan and by ESRC/HEFCW grant RES-535-30–0061 for the ESRC Centre for Research on Bilingualism in Theory and Practice. We are grateful to Cynog Prys, Nestor Viñas Guasch, Nia Young, Leah Jones, Emma K. Hughes, Emily J. Roberts, and Catrin Hughes for their work in relation to the larger study (reported elsewhere), and to the parents, teachers, and participants who took part in the studies. The first author wishes to also thank FIU's Statistical Consulting program, especially Tyler Stout, for assistance in the analyses.

Address for correspondence:
V. C. Mueller Gathercole, Linguistics Program, English Department, Florida International University, Miami, FL 33199
vmueller@fiu.edu

2006). Additional factors seem to be a low level of access to nutritional and health care resources, poor or deficient housing, lack of access to cognitively stimulating materials and experiences, parental expectations and styles, teacher attitudes and expectations, and levels of stress and reaction to stress (Bradley & Corwyn, 2002).

For example, evidence shows that household socioeconomic level is associated with the level of cognitive function (Bradley & Caldwell, 1984; Bradley, Caldwell, Rock, Ramey, Barnard, Gray, Hammond, Mitchell, Gottfried, Siegel & Johnson, 1989), with math skills (Case, Griffin & Kelly, 1999), and with language skills (Ginsborg, 2006; Hart & Risley, 1995; Hoff, 2003; Raviv, Kessenich & Morrison, 2004). Among the influential factors, parental education has been linked specifically with linguistic and cognitive abilities in children. In one recent study, Ardila, Rosselli, Matute & Guajardo (2005) examined the performance of 5- to 14-year-old (monolingual) children in Colombia and Mexico. They studied these children's abilities on cognitive tasks of visual pattern matching, tests of graphic fluency, a dimensional change card sorting task, and linguistic tasks of semantic verbal fluency, of phonemic verbal fluency, and of similarities between words. They found that the parents' educational levels as well as the type of school the child attended (public or private) predicted performance on almost all measures, but parental education was a better predictor of performance than school type on the semantic verbal fluency, the graphic fluency measures, and the word similarities tests.

In another study, Sarsour, Sheridan, Jutte, Nuru-Jeter, Hinshaw & Boyce (2011) examined the influence of familial SES and quality of the home environment on the performance of 8- to 12-year-old children in the San Francisco Bay area on measures of working memory, cognitive flexibility, executive control, and expressive language. SES and the home environment were both associated with all of these, and expressive language was also associated with the cognitive measures of inhibitory control and working memory.

The effects of these factors related to SES are not easily remedied through intervention (Chittleborough, Mittinty, Lawlor & Lynch, 2014) and can be long-lasting. In one study, Kaplan, Turrell, Lynch, Everson, Helkala & Salonen (2001) examined the performance of Finnish adult males aged 58 and 64 on a number of cognitive tasks. These included tests of perceptual motor speed, visual searching and sequencing, visual memory and reproduction, attention, orientation, and three tasks that involved language – verbal fluency; a selective reminding task (of words); and the Mini Mental State Exam (Folstein, Folstein & McHugh, 1975), which includes nine items on language. The authors measured performance on these relative to the participants' parents' education and professions ("childhood socioeconomic position", or SEP). Even when controlling for the participants' own educational and professional status, childhood SEP, especially the mother's education (did not complete primary school vs primary school or more[1]), correlated with poorer cognitive performance. These authors conclude that there is "a long-lasting imprint of childhood socio-economic conditions on adult cognitive performance" (p. 259).

Wilson, Scherr and Bienias (2005) similarly examined the association of SES with cognitive performance and decline in persons over age 65 in the Chicago area. They examined participants' performance on a range of tests that included tests of episodic memory, perceptual speed, and the Mini Mental State Exam, and measured these against the socioeconomic characteristics of the county in which the person had grown up, the household socioeconomic level of their childhood home, and the participant's own educational and professional level. They found that a higher SES level in the county correlated with higher levels of performance at baseline on the cognitive measures (but not cognitive decline), as did the SES level of the childhood home and the participant's educational and occupational achievements. The effect of childhood county SES still held when the results were controlled for these additional factors.

One difficulty in interpreting these studies is that many of them conflate language and cognitive factors such as processing speed, attention, and visual perception under the overall rubric of 'cognition'. This means that it is sometimes difficult to separate the effects of SES factors on (nonlinguistic) cognitive performance per se versus their effects on linguistic knowledge (which is commonly used as a medium for accessing cognitive knowledge – e.g., Gathercole, 2010). Several studies have attempted to define more specifically what the relative influence might be of the various SES factors on particular cognitive or linguistic skills.

In one study, for example, Raviv et al. (2004) argued that SES, as mediated specifically via maternal sensitivity and cognitive stimulation, significantly correlated with 3-year-olds' productive and receptive vocabularies, as measured by Reynell (1991), as well as their basic concepts of quantity, comparisons, shapes, colors, and letters. In another study, Hoff (2003) looked specifically at the extent to which the effects of SES, as mediated through mothers' speech to their children at different SES levels, affected vocabulary growth in 2-year-olds. She examined mid-SES and working class mothers' speech to their 2-year-old children at time 1 and its relation to those children's vocabulary growth as sampled 10 weeks later. While the vocabularies of the two sets of children at time

[1] Given the age of the participants, their parents had been educated at the turn of the 20th century, when levels of achievement in school were normally lower.

https://doi.org/10.1017/S1366728915000504 Published online by Cambridge University Press

1 were comparable, the mid-SES children's vocabularies grew significantly more by time 2 than the working class children's. The particular aspect of the mothers' speech that mediated this difference was their MLU, as well as the correlated difference in the word types used by the mothers. Once the effect of this factor was removed, there was no remaining difference in the vocabulary growth in the two sets of children – that is, mothers' MLU was the major factor affecting differences in vocabulary growth.

While many of the above studies involved monolingual children, it is clear that SES factors play a significant role in relation to bilingual children's development as well. In Oller & Eiler's (2002) study of bilinguals in the Miami context, SES was directly controlled for, so that half the children in each group came from high SES families, and half from low SES families. In that study, a consistent finding across linguistic measures was that for English, high SES children had the early advantage, but for Spanish, low SES children in two-way schools or from homes in which only Spanish was spoken had the early advantage. These results are likely related to input factors (e.g., the low SES parents from homes in which only Spanish was spoken rated their own command of English as low) and, for English, the range of opportunities available to higher SES children.

Similarly, Gatt & O'Toole (2013) used parent-report measures of vocabulary performance of bilingual infants from 7 language pairs and found a significant correlation between the fathers' educational levels and total vocabulary scores (in which the scores in the two languages are added together). In another study, Chiat, Armon-Lotem, Marinis, Polišenská, Roy & Seeff-Gabriel (2013) tested L2 bilingual children speaking several language pairs on a sentence-repetition task. Their study included Russian–German bilinguals from two SES levels (according to parental education) and Turkish–English bilinguals (and English monolinguals) from a uniformly low SES background. Their findings showed that in the case of Russian–German bilinguals' performance on German, 17% of high SES bilinguals performed less than one standard deviation below the mean, but fully 41% of low SES bilinguals fell into that category; for the low SES English monolinguals and Turkish–English bilinguals' performance on English, 13% of the monolinguals and 18% of the bilinguals fell between 1 to 2 standard deviations below the mean; however, yet another 70% of these low SES bilinguals fell more than 2 standard deviations below the mean.

Another recent study (Fuller, Bein, Kim & Rabe-Hesketh, 2015) compared the growth trajectories of Californian Mexican American children with White American children from 9 months of age to 24 months of age. The Mexican American children showed much flatter growth trajectories than their White American counterparts on a range of cognitive and verbal tasks, including infants' use and comprehension of words and purposeful activities with objects at 9 months and children's expressive and receptive vocabularies, memories, concept attainment, and rudimentary problem-solving skills at 24 months. On close examination of the social class, maternal attributes, and home practices that correlated with performance, these researchers found that while immigrant status of the parents (foreign-born vs US-born) played a significant role, the factors of poverty, amount of praise and encouragement among mothers, and work outside the home were significant. The authors conclude "The mother's social-class position, consistent with developmental risk theory, largely explains flatter growth trajectories. Indicators of class position include maternal education, employment status, and certain home practices" (p. 162). In fact, "The educational background of the mother and parenting practices displayed the most consistent positive associations with growth over the 9- to 24-month period. Children showed more robust cognitive development when their mothers had completed some college and when they engaged their child in daily reading and storytelling" (p. 163).

Even in fully fluent adult bilinguals, there may be long-standing effects of SES on performance. A recent study in Miami examined educated, end-state adult bilinguals' performance on English and Spanish receptive vocabularies (Stadthagen-González, Gathercole, Pérez-Tattam & Yavas, 2013). That study found that, while mean scores in those languages were at or above the norms in both languages, SES of the family in which the adult had been raised had an effect. English and Spanish scores correlated with parental education, especially for those who had grown up in homes in which parents spoke to them in both English and Spanish.

It is sometimes difficult to separate effects of SES from effects of bilingualism. In many studies of bilinguals, the bilingual and monolingual populations under study are from distinct cultural backgrounds, and the bilinguals might include either immigrants or non-immigrants, or both. So it is not always clear whether observed effects when bilinguals are compared with monolinguals or across types of bilinguals stem from SES differences or from the nature of bilingualism and the effects of language exposure. However, some studies have begun seeking evidence on this distinction.

In one study, for example, Kohnert and colleagues (Kohnert & Windsor, 2004; Windsor & Kohnert, 2004) studied differential effects of bilingualism on strictly linguistic versus strictly cognitive tasks. They compared typically developing (TD) 8- to 13-year-old monolingual English-speaking children, TD bilingual children, and language impaired (LI) monolingual children. With regard to language, similar to what has been reported in other studies (Bialystok et al., 2010; Gathercole, 2007; Gathercole & Thomas, 2009; Harley et al., 1991; Hoff, Core, Place, Rumiche, Senor & Parra, 2012; Lapkin et al., 1990; Letts, 2013; Oller & Eilers, 2002; Paradis, 2010; Thordardottir, 2011), the bilinguals (and the LI children) performed below the TD monolingual children in both accuracy and RTs in vocabulary, especially later-acquired vocabulary items (Windsor & Kohnert, 2004). The bilinguals performed in general also below the LI children in vocabulary, but, again, mostly in the later acquired vocabulary items. However, on non-linguistic tasks of auditory and visual detection, the bilinguals patterned like the TD monolinguals on at least one task, a choice visual detection task, responding more quickly than the LI children (Kohnert & Windsor, 2004). (On other tasks, the TD monolinguals outperformed the LI children, but the bilinguals did not show a significant difference with either group, possibly because of low numbers of bilingual participants (Kohnert & Windsor, 2004: 900).)

In another recent study, Calvo and Bialystok (2014) examined the separate effects of SES level and bilingualism on the performance of middle class and working class 6- to 7-year-old children in Toronto on a range of cognitive, linguistic (including English receptive vocabulary, Dunn & Dunn, 1997), and executive function tasks. They found that both SES and bilingualism served to influence performance on the language and executive function tasks. While lower SES served to delay progress in both language and executive function development, bilingualism served to delay progress only in language, and, in contrast, to boost progress in executive function. These authors note that, because the working class children were not growing up in poverty, "the effect sizes for comparisons of SES were small, but they were significant and demonstrate the effect of even subtle SES differences on children's language and cognitive development, irrespective of language background" (p. 286).

Such results on normally developing bilinguals are striking, and could have important ramifications for bilinguals growing up under less favorable socioeconomic conditions. In order to examine the effects of SES more closely, data on Welsh–English bilinguals' performance on receptive vocabulary and receptive grammar in their two languages (Gathercole, Pérez-Tattam, Stadthagen-González & Thomas, 2014a; Gathercole & Thomas, 2007; Gathercole, Thomas & Hughes, 2008; Gathercole, Thomas, Roberts, Hughes & Hughes, 2013), as well as performance on independent cognitive measures, are re-examined here in relation to socioeconomic status. The following questions were addressed:

1. To what extent do SES differences, as judged by parents' education and professions, correlate with performance on linguistic and cognitive tasks in a population of bilingual speakers (and their monolingual counterparts) from a range of SES levels but from homogeneous cultural and educational backgrounds?
2. Does SES influence both linguistic and cognitive performance in equivalent fashion?
3. If SES correlates positively with performance on either linguistic or cognitive tasks, how influential is SES relative to level of exposure to the languages, as judged by home language?

Method

Participants

The participants engaged for a larger project on executive function in bilinguals across the lifespan (Gathercole, Thomas, Jones, Viñas Guasch, Young & Hughes, 2010; Gathercole, Thomas, Kennedy, Prys, Young, Viñas Guasch, Roberts, Hughes & Jones, 2014b) were administered a variety of tests that included receptive vocabulary and receptive grammar tasks in English and Welsh, as well as general cognitive measures in addition to executive function measures. All participants were typical or typically developing. The participants fell into 4 home language groups, according to the language spoken to them by their parents as children. Monolingual English ("Mon E") participants came from families in which only English was spoken. Bilinguals came from homes in which only or mostly English was spoken ("OEH"), both Welsh and English were spoken ("WEH"), or only or mostly Welsh was spoken ("OWH"). Performance on the vocabulary and grammar tasks at each age and for each home language group are reported elsewhere (Gathercole et al., 2013; Gathercole et al., 2014a; Thomas, Gathercole & Hughes, 2013).

For many of those participants, we had information on parental education and parental professions, which had been collected via a background measure seeking detailed information about the participants' linguistic and familial backgrounds. (The adult participants completed the questionnaire themselves; for the children, parents provided the responses.) For the present analyses, those participants for whom we had such information were entered into new analyses to examine the contribution of SES to performance on the language and cognitive measures. Parents' educational levels were classified into 5 categories: 1 = Primary education, 2 = GCSE level [General Certificate of Secondary Education, the qualifying level obtained in the UK through examinations at age 15 or 16], 3 = A level [General Certificate of Education Advanced Level, or GCE Advanced Level, the more advanced qualifying level obtained in the UK through examination after the GCSE, prior to university education], 4 = undergraduate education, and 5 = post-graduate education. Parents' professions were

Table 1. *Participants for whom SES information is available, by age group and home language (Mean age is shown in italics.)*

Age	Mon E	OEH	WEH	OWH	TOT
3	12	21	21	25	79
	3;2	*2;11*	*2;11*	*3;0*	*3;0*
4	30	18	19	20	87
	4;1	*4;3*	*4;1*	*4;2*	*4;2*
5	18	19	20	20	77
	5;5	*5;6*	*5;3*	*5;5*	*5;5*
Primary School	5*	36	39	37	117
	*7;6**	*8;1*	*8;0*	*8;0*	*8;0*
Teenagers	16	40	33	37	126
	14;8	*14;2*	*14;2*	*14;9*	*14;6*
Younger Adults	29	32	34	41	136
	23;5	*27;1*	*23;6*	*25;7*	*25;0*
Older Adults	28	25	21	36	110
	67;1	*65;9*	*69;6*	*67;10*	*67;6*

Key: Mon E = monolingual English (only tested in English); OEH = bilingual with only English at home; WEH = bilingual with Welsh and English at home; OWH = bilingual with only Welsh at home

* Sufficient SES information regarding parental education and professions was not available for enough of the Mon E participants in the primary school age group, so they are only included for some of the initial ANOVA analyses and excluded from correlational analyses reported.

classified into 4 major categories, following the ONS Standard Occupational Classification (2010). These were as follows: 1 = elementary trades and services, etc., 2 = secretarial, skilled trades, sales, etc., 3 = non-corporate managers, health and science-associated professionals, etc. and 4 = corporate directors, health and science professionals, etc. For each participant, the Mother's education, Father's education, Mother's profession, and Father's profession were entered, and a "composite SES" score that combined these was computed. For those participants for whom all parental information was available, the composite score was computed by simply adding the 4 scores, for a maximum composite score of 18. For those participants for whom one or more of the sub-scores was missing (8.9% of the participants here), composite scores were transformed proportionally to equate levels with those of the participants having all 4 sub-scores (e.g., if a child had only one parent, and that parent's education was at level 4 and profession was at level 3, the sum of 7 was doubled to transform it to a composite score of 14).

The data from seven age groups of participants were re-examined in these analyses. There were 732 participants, 138 Mon E participants and 594 bilinguals. They are shown in Table 1 by age and home language, with mean ages for each group and home language sub-group shown in italics. Most participants participated in all of the tests, except that only the bilinguals were given the Welsh tests. Occasionally, a few participants were missing for some of the tests, so the exact totals will be given for each test below. (For Mon E children at Primary School age, there were very few participants for whom SES information was available, so that group was left out of correlational analyses, but included, for the purposes of comparison where possible, in the initial ANOVAs and in the regression analyses.)

Measures

Language Measures

English vocabulary was measured using the BPVS (British Picture Vocabulary Scales, Dunn, Dunn, Whetton & Burley, 1997) (N = 705), and Welsh vocabulary was measured with the original 240 words gathered for the development of the *Prawf Geirfa Cymraeg* ("PGC", Gathercole & Thomas, 2007; Gathercole, Thomas & Hughes, 2008) (N = 545). The PGC is a receptive vocabulary test in which a participant hears a word and is shown four pictures and must choose one that depicts the meaning of the word. It was developed using 30 words from each of 8 word frequency levels; words that have been borrowed into Welsh from English were excluded. For the purposes of this study, words were ordered by frequency level, and most participants heard all 240 words. However, in the case of the youngest participants, if the child missed 10 words in a row, testing was discontinued.

For receptive grammatical abilities, English and Welsh tests devised by our group (Gathercole, Thomas, Roberts, Hughes & Hughes, 2013) were administered. These covered 13 sets of structures ranging from simpler structures (e.g., active sentences) to more complex (e.g., relative clauses), with 3 trials per item, for a total possible score of 39 in each language (E grammar N = 568, W grammar N = 443). The structures covered are comparable in function across the two languages; however, the participant received distinct stimuli (verbal and pictorial) in the two languages. (There are two versions for each language, so that half the participants received version A in English and B in Welsh, and half were given B in English and A in Welsh.) As in the case of the PGC, the participant heard a sentence, was shown four pictures, and had to choose one picture out of the four as best depicting the meaning of the sentence. The administration of the two languages and of the two versions for each language was balanced across participants within each Age X Home Language sub-group).

Cognitive Measures

For purposes of comparison, two cognitive measures are included here. For children through age 8, 8 sub-sections of the *McCarthy Scales of Children's Abilities* (McCarthy,

https://doi.org/10.1017/S1366728915000504 Published online by Cambridge University Press

1972) were administered (N = 294), and for participants from age 7 through adults, Raven's Progressive Matrices (Raven, Raven & Court, 2004) was administered (N = 411). The sections of the McCarthy Scales that were administered were chosen because they were the least contingent on language skills. They were block building, puzzle making, pictorial memory, number questions, a tapping task, a numerical memory task, a numerical memory reversal task, and a counting and sorting task. The "totals" on the McCarthy entered here were the totals derived from these 8 sub-scores only, not the whole McCarthy test. The general instructions for both tests, and any general explanatory information, were usually given in English, unless the participant preferred Welsh. The tasks themselves were given in English.

Procedure

The tests were administered in conjunction with a battery of other tests exploring cognitive abilities and performance on executive function tasks, not reported here (see Gathercole, Thomas, Jones, Viñas Guasch, Young & Hughes, 2010; Gathercole et al., 2013, Gathercole et al., 2014a, 2014b). Tests were administered on 2 or 3 different days, the English and Welsh language tests always on distinct days. The order of testing for English and Welsh language tests was counter-balanced across participants.

Results

General performance by age and home language

First, ANOVAs were conducted on performance for each measure to confirm consistency of the results from this sub-group of participants with those reported elsewhere for the whole group of participants. (All statistical analyses, where relevant, were conducted using Bonferroni corrections for multiple comparisons.) These results are shown in Tables 2 and 3. Table 2 shows the overall main and interaction effects, Table 3 the results by age group and home language.

The general performance on the language measures is totally in line with what has been reported previously (Gathercole et al., 2013; Gathercole et al., 2014a; Thomas et al., 2013). First, on every measure, performance improves significantly with age. Second, performance on each measure by home language is parallel to the exposure to the given language at home: for English (BPVS, English grammar), those with greater English exposure perform at a higher level than those with less exposure; for Welsh (PGC, Welsh grammar), those with greater Welsh exposure perform at a higher level than those with less. This is especially true at the younger ages. For vocabulary (BPVS, PGC), differences across home language groups persist until the later ages, when those with the least exposure (OWH for English, OEH for Welsh) are set apart from the others; for grammar, differences across groups become non-significant for English by age 4, and for Welsh by the teen years.

For the cognitive measures, there are effects of home language on the McCarthy at ages 3 and 4, and on the Raven's for the older adults. The effects, unlike those for the language measures, do not show straightforward relations with exposure to either language, however. Thus, for the McCarthy, Mon E and OWH appear to outperform WEH and OEH children at age 3, but OEH and OWH children outperform WEH and Mon E children at age 4; for the Raven's, OEH adults outperform WEH and OWH participants, and Mon E outperform OWH adults. There is no ready explanation for these home language effects in relation to these cognitive measures (but see further discussions below).

Correlations with SES variables

In order to determine whether performance on any of these linguistic and cognitive measures correlated with SES at all, we first analyzed participants' performance through correlational patterns. Significant correlations between the composite SES and performance on the BPVS, PGC, English grammar, Welsh grammar, the McCarthy scores, and the Raven's scores are shown in Table 4 . For each age, the correlations are shown for all participants (including Mon E) together, for all bilinguals together, and for each home language sub-group. The tables show the Pearson r value on the first line, the p value on the second line, and the n on which the correlation was calculated on the third line. Only significant correlations are shown, except in a few cases in which correlations were near-significant, usually $p = .06$ or .07.

For the language tasks, a quick perusal of these Tables reveals the striking pervasiveness of the significant correlations between performance on the language tasks, especially on the vocabulary tasks and English grammar, as follows.

BPVS

Performance on the BPVS correlates with composite SES for one or more groups at every age except perhaps the primary school age. For illustrative purposes, the scatter plots of performance by age and home language in relation to the composite SES scores are shown in Figure 1. Fit lines are included to show the direction of the correlation for each home language group; these are shown in bold in those cases in which the composite SES scores correlate significantly with the BPVS raw scores. In most cases, the correlations are positive and robust, indicating that the higher the SES, the better the performance on that measure

https://doi.org/10.1017/S1366728915000504 Published online by Cambridge University Press

Table 2. *General Results on Each Measure*

Measure	Effects	Significant Effects *df*	*F*	*p*	Pairwise comparisons*
BPVS	Age Group	6, 687	2305.63	.000	All ages significantly different, *ps* < .001
	Home Language	3, 687	35.18	.000	Mon E, OEH > WEH > OWH, *ps* < .001
	Age Group X Home Language	18, 687	1.14	.311	n.s.
PGC	Age Group	6, 524	279.30	.000	All ages significantly different, at *ps* ≤ .001, except Younger Adults > Primary, *p* = .082, Teens and Older Adults n.s.
	Home Language	2, 524	29.19	.000	All HLs significantly different, *ps* = .000
	Age Group X Home Language	12, 524	3.25	.000	(see Table 3.)
English Grammar	Age Group	6, 541	525.43	.000	All ages significantly different, at *p* < .001, except Teens, Younger Adults, and Older adults, n.s.
	Home Language	3, 541	6.53	.000	Mon E, OEH > OWH, *ps* = .003, .028 Mon E > WEH, *p* = .076
	Age Group X Home Language	17, 541	1.49	.094	(see Table 3.)
Welsh Grammar	Age Group	6, 422	390.96	.000	All ages significantly different, at *p* < .001, except Younger Adults > Teens, Older Adults, *ps* = .081, .068 Teens and Older Adults, n.s.
	Home Language	2, 422	15.39	.000	OWH > WEH, OEH, *ps* < .001
	Age Group X Home Language	12, 422	30.27	.096	(see Table 3.)
McCarthy	Age Group	3, 279	318.52	.000	All ages significantly different, *ps* < .001
	Home Language	3, 279	2.94	.033	OWH, OEH > WEH > OEH, *ps* ≤ .012
	Age Group X Home Language	8, 279	1.79	.079	(see Table 3.)
Ravens	Age Group	3, 395	36.09	.000	All ages significantly different, *ps* ≤ .017, except Older Adults > Teens, *p* = .061
	Home Language	3, 395	5.42	.001	Mon E, OEH > WEH, OWH, *ps* ≤ .012
	Age Group X Home Language	9, 395	0.98	.456	n.s.

*All pairwise comparisons conducted with Bonferroni correction.

is. This is true for 3-year-old bilinguals (especially OEH and WEH), 4-year-old OEH bilinguals, 5-year-old monolinguals and bilinguals (both in general, and the OEH and OWH groups separately), the monolingual and bilingual teenagers (including the separate OEH and WEH bilingual sub-groups), and the younger and older monolingual and bilingual adults (including some of the separate sub-groups of bilinguals as well). The one exception to the direction of the correlation is that in the case of the monolingual 3-year-olds, the correlations are negative, indicating that lower SES children outperformed higher SES children. Visual inspection of the scatter plot suggests that at this age, even some of the lower SES Mon E children had relatively high BPVS scores.

PGC

Performance on the PGC also correlates with composite SES for one or more group at every age except at the very youngest (age 3) and very oldest (older adults) ages. The correlations are positive, indicating that the higher the SES, the better the performance. This holds at ages 4, 5, the teens and the younger adults for all bilinguals

https://doi.org/10.1017/S1366728915000504 Published online by Cambridge University Press

Table 3. *Performance by Age Group X Home Language on each Measure*

		Home Language Mean Score				Significant Effects of HL (and pairwise comparisons*)		
Measure	Age Group	Mon E	OEH	WEH	OWH	*df*	*F*	*p*
BPVS (max 168)	3	27.7	20.4	15.1	9.4	3, 74	16.50	.000
						All HL s.d., $ps \leq .031$		
	4	36.9	36.3	32.9	26.5	3, 81	5.13	.003
						Mon E, OEH, WEH > OWH, $ps \leq .046$		
	5	49.8	46.8	40.7	35.9	3, 73	5.20	.003
						Mon E > WEH, OWH, $ps = .022, .001$; OEH > OWH, $p = .006$		
	Primary	75.8	75.2	67.3	62.9	3, 102	5.38	.002
						OEH > WEH, OWH, $ps = .016, .000$; Mon E > OWH, $p = .065$		
	Teens	119.8	118.3	114.0	106.8	3, 119	5.80	.001
						Mon E, OEH, WEH > OWH, $ps \leq .028$		
	Younger Ads	140.4	139.8	137.5	134.4	3, 132	4.00	.009
						Mon E, OEH > OWH, $ps = .003, .006$		
	Older Ads	145.6	145.8	142.2	141.4	3, 106	3.43	.020
						OEH > OWH, $p = .089$		
PGC (max 240)	3		5.52	11.95	21.16	2, 64	6.15	.004
						OWH > WEH, OEH, $ps = .045, .001$		
	4		20.53	48.69	100.77	2, 47	17.26	.000
						OWH > WEH, OEH, $ps = .001, .000$; WEH > OEH, $p = .051$		
	5		66.88	84.75	126.74	2, 53	10.06	.000
						OWH > WEH, OEH, $ps = .003, .000$		
	Primary		158.14	183.75	190.87	2, 79	14.05	.000
						OWH, WEH > OEH, $ps = .000$		
	Teens		201.41	209.94	217.63	2, 103	8.35	.000
						OWH, WEH > OEH, $ps = .000, .039$; OWH > WEH, $p = .068$		
	Younger Ads		169.63	205.03	189.33	2, 101	2.65	.076
						WEH > OEH, $p = .024$		
	Older Ads		206.09	205.48	213.22	2, 77	0.21	.813, n.s.
English Grammar (max 39)	3	10.91	7.11	3.81	3.88	3, 49	4.38	.008
						Mon E > WEH, OWH, $ps = .003$		
	4	17.59	16.67	16.79	16.20			n.s.
	5	22.75	21.14	21.67	19.68			n.s.
	Primary		31.37	30.17	29.13			n.s.
	Teens	36.75	36.36	36.83	36.59			n.s.
	Younger Ads	37.08	36.69	37.33	35.92			n.s.
	Older Ads	36.33	36.17	34.95	36.13			n.s.

https://doi.org/10.1017/S1366728915000504 Published online by Cambridge University Press

Table 3. *Continued*

Measure	Age Group	Home Language Mean Score: Mon E	OEH	WEH	OWH	Significant Effects of HL (and pairwise comparisons*): *df*	*F*	*p*
Welsh Grammar (max 39)	3		4.25	3.19	6.00			n.s.
	4		11.22	13.85	17.50	2, 35	5.28	.010
						OWH > WEH, OEH, *ps* = .049, .003		
	5		15.79	18.20	21.78	2, 44	5.83	.006
						OWH > WEH, OEH, *ps* = .047, .002		
	Primary		26.30	26.61	29.67	2, 66	2.71	.074
						OWH > OEH, *p* = .034; OWH > WEH, *p* = .081		
	Teens		34.71	34.86	35.62			n.s.
	Younger Ads		35.63	36.55	36.53			n.s.
	Older Ads		34.73	34.72	35.43			n.s.
McCarthy	3	27.91	21.45	16.88	24.98	3, 73	4.14	.009
						Mon E, OWH > WEH, *ps* = .003, .006; Mon E > OEH, *p* = .079		
	4	39.36	45.89	38.42	45.24	3, 77	2.88	.041
						OEH > Mon E, WEH, *ps* = .041, .028; OWH > WEH, *p* = .042; OWH > Mon E, *p* = .061		
	5	52.28	52.38	50.79	53.47			n.s.
	Primary		77.82	75.00	73.34			n.s.
Raven's	Primary	38.00	27.55	25.90	26.74			n.s.
	Teens	43.13	43.19	41.96	41.33			n.s.
	Younger Ads	48.24	48.16	45.65	45.73			n.s.
	Older Ads	45.78	48.44	42.52	41.23	3, 104	3.61	.016
						OEH > WEH, OWH, *ps* = .029, .003; Mon E > OWH, *p* = .052		

*All pairwise comparisons conducted with Bonferroni correction.

together and for OEH children at age 4, WEH children at the teen years, and OWH participants at primary age and younger adults.

English grammar

Again, performance correlates positively with composite SES at several ages: at age 3 for all bilinguals and the OWH children, at age 4 for the OEH participants, at age 5 for the Mon E participants, at primary school age for all bilinguals, at the teen ages for all participants and the OWH participants, and for the younger adult OWH participants. At age 3, the significant correlations are negative for the bilinguals, in particular OWH bilinguals. One speculation is that higher SES Welsh speakers are especially keen to transmit Welsh to their children, so the youngest children in that group may not be experiencing much English at that age.

Welsh grammar

The data again suggest some correlation in performance with composite SES level, but this relationship is less pervasive. There are some positive correlations with SES at age 5, for all bilinguals, and at the teen ages, for WEH bilinguals.

Table 4. *Significant Correlations with Composite SES*

BPVS

Age		ALL	ALL Bils	Mon	OEH	WEH	OWH
3	*r*			−.642	.626	.517	
	p			.045	.003	.023	
	n			10	20	20	
4	*r*				.810		
	p				.000		
	n				16		
5	*r*	.302	.322	.598	.455		.474
	p	.009	.016	.011	.066		.035
	n	73	56	17	17		20
Primary School*	*r*						
	p						
	n						
Teens	*r*	.370	.372		.454	.655	
	p	.000	.000		.010	.000	
	n	103	88		31	27	
Younger Adults	*r*	.191	.235				.372
	p	.035	.019				.023
	n	122	99				37
Older Adults	*r*	.309	.323		.436	.418	
	p	.003	.005		.043	.067	
	n	93	73		22	20	

E Grammar

Age		ALL	ALL Bils	Mon	OEH	WEH	OWH
3	*r*		−.305				−.477
	p		.059				.062
	n		39				16
4	*r*				.859		
	p				.013		
	n				7		
5	*r*			.496			
	p			.060			
	n			15			
Primary School	*r*		.312				
	p		.012				
	n		64				
Teens	*r*	.217					.555
	p	.048					.002
	n	83					29
Younger Adults	*r*						.511
	p						.002
	n						34
Older Adults	*r*						
	p						
	n						

PGC

Age		ALL	ALL Bils	Mon	OEH	WEH	OWH
3	*r*						
	p						
	n						
4	*r*		.350		.717		
	p		.021		.003		
	n		43		15		

W Grammar

Age		ALL	ALL Bils	Mon	OEH	WEH	OWH
3	*r*						
	p						
	n						
4	*r*						
	p						
	n						

Table 4. *Continued*

PGC							
Age		ALL	ALL Bils	Mon	OEH	WEH	OWH
5	*r*		.300				
	p		.029				
	n		53				
Primary School	*r*						.416
	p						.025
	n						29
Teens	*r*		.225			.399	
	p		.036			.039	
	n		87			27	
Younger Adults	*r*		.217				.375
	p		.034				.024
	n		96				36
Older Adults	*r*						
	p						
	n						

W Grammar							
Age		ALL	ALL Bils	Mon	OEH	WEH	OWH
5	*r*		.334				
	p		.025				
	n		45				
Primary School	*r*						
	p						
	n						
Teens	*r*					.426	
	p					.069	
	n					19	
Younger Adults	*r*						
	p						
	n						
Older Adults	*r*						
	p						
	n						

McCarthy							
Age		ALL	ALL Bils	Mon	OEH	WEH	OWH
3	*r*	.387	.474		.605	.656	
	p	.001	.000		.006	.002	
	n	71	61		19	19	
4	*r*						
	p						
	n						
5	*r*						
	p						
	n						
Primary School	*r*						
	p						
	n						

Ravens							
Age		ALL	ALL Bils	Mon	OEH	WEH	OWH
Primary School	*r*						
	p						
	n						
Teens	*r*						
	p						
	n						
Younger Adults	*r*						
	p						
	n						
Older Adults	*r*	.210					
	p	.045					
	n	91					

*Because of insufficient SES information on the Mon E group, they are excluded from these correlational analyses.

McCarthy

The correlation of composite SES with performance on the McCarthy is apparent at the youngest age, age 3, for all children, for the monolinguals, and for all bilinguals, as well as the OEH and WEH bilinguals. This suggests that any effects of SES associated with language performance are not unique to language, especially at the very youngest age.

Raven's

Performance on the Raven's, a test that only applies from age 7 upward, appears more immune to SES effects, although even there a correlation appears with composite SES among all the older adults, indicating a higher level of performance on the Raven's at those ages among those of higher SES backgrounds.

Regression Analyses

Given these significant correlations, the question of the influence of SES relative to that of the home language profile is important to examine. In order to explore the relative effects of the two, hierarchical step-wise multiple regression analyses were conducted, in which the relative contributions of home language and SES level on performance were examined.

For each measure, analyses were first conducted on all the data combined, with age in months entered as

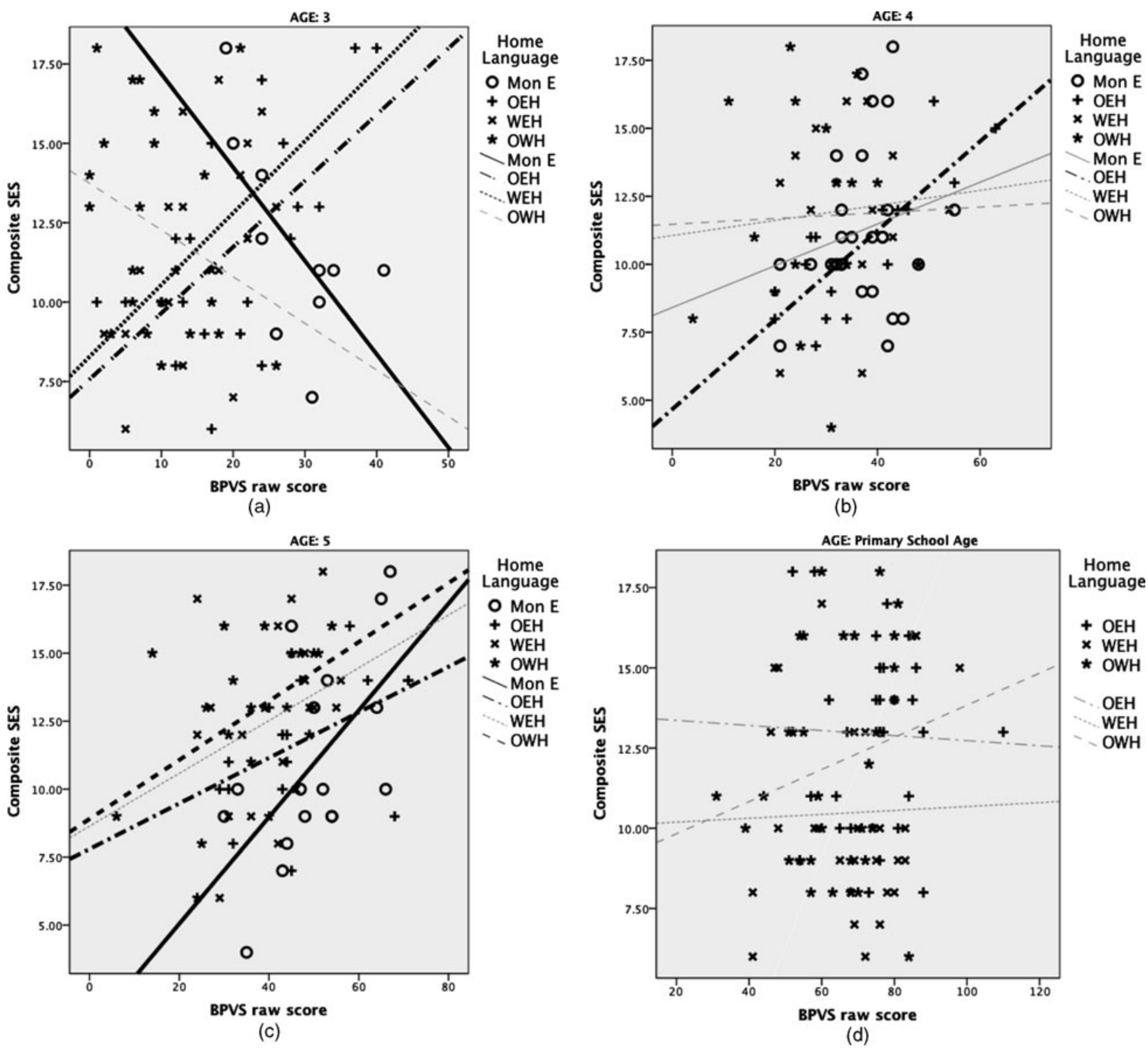

Figure 1. Scatter Plots BPVS X Composite SES, 1a. 3-year-olds, 1b. 4-year-olds, 1c. 5-year-olds, 1d. Primary School Age, 1e. Teenagers, 1f. Younger Adults, 1g. Older Adults

https://doi.org/10.1017/S1366728915000504 Published online by Cambridge University Press

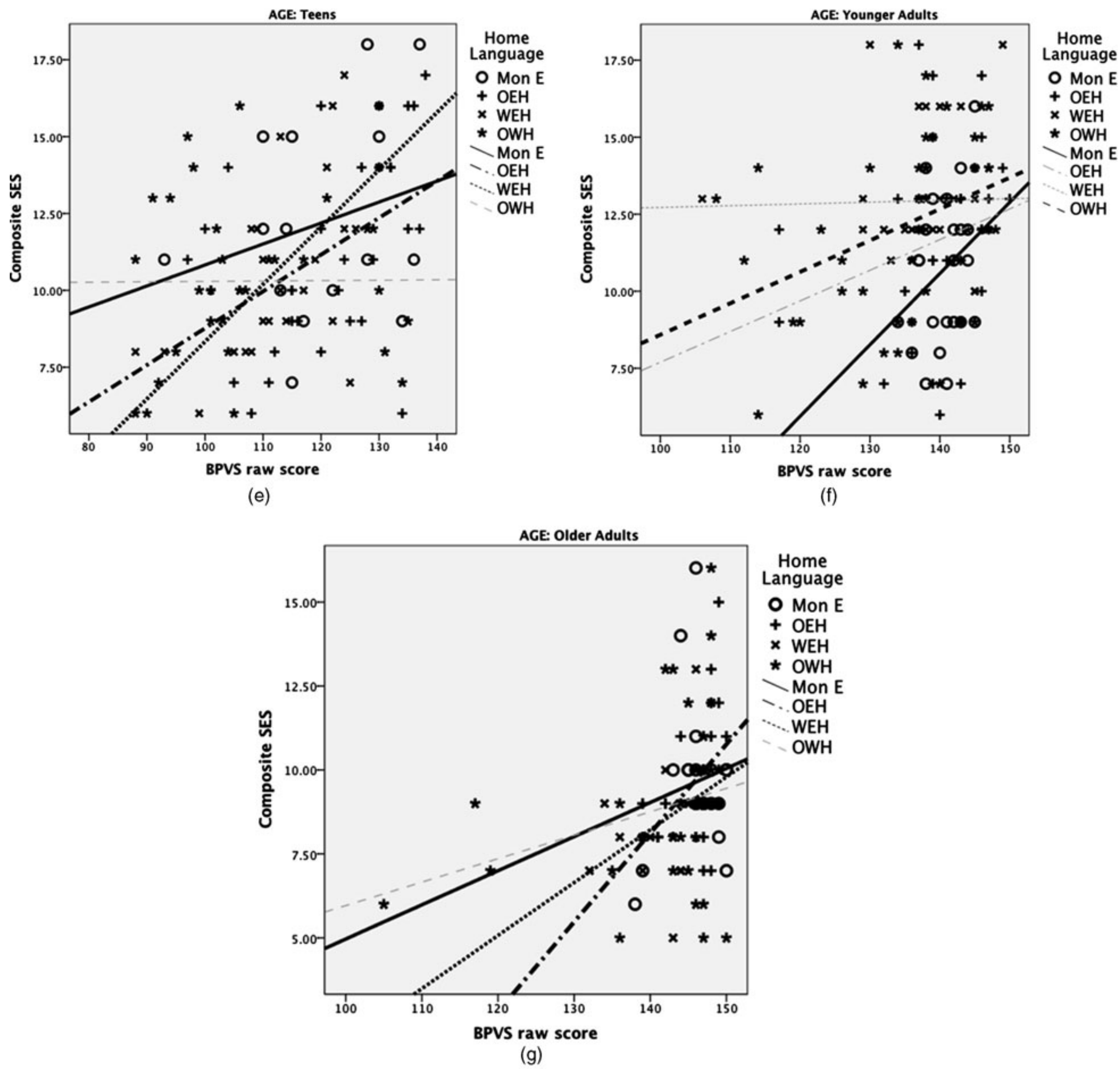

Figure 1. Continued

a control variable at the first step of the regression, and home language and composite SES, the two test variables, at the second step. The results of these first analyses are shown in Table 5, with R^2, R^2 change, β coefficients, and significance levels shown. All significant β values are shown in bold. The results on the overall data reveal the following. First, for every measure, age in months contributed the most to performance. This is as expected, especially given the wide spread of ages across the seven age groups of participants. For the two vocabulary measures, the BPVS and the PGC, further, both home language and SES contribute significantly to performance. For BPVS, SES made a greater contribution than home language; for PGC, home language made the greater contribution. For the two grammar tasks, when all participants are considered together, neither home language nor SES showed significant contributions to performance. For the two cognitive measures, we see that SES contributed to performance in both cases, and home language significantly contributed to performance on the Raven's. For the Raven's, home language contributed more than SES.

https://doi.org/10.1017/S1366728915000504 Published online by Cambridge University Press

Table 5. *Results of Regression Analyses (All Participants)*

Measure	Model	R^2	*Adjusted* R^2		R^2 *Change*	Standardized Coefficients β Age Months	HL*	SES
BPVS	1	.533	.532	$F(1{,}698) = 796.56, p < .001$	.533	**.730**		
					$p < .001$	**$p < .001$**		
	2	.545	.543	$F(3{,}696) = 277.62, p < .001$	.012	**.755**	**.055**	**.097**
					$p < .001$	**$p < .001$**	**$p = .033$**	**$p < .001$**
PGC	1	.225	.223	$F(1{,}538) = 155.99, p < .001$	.225	**.474**		
					$p < .001$	**$p < .001$**		
	2	.247	.243	$F(3{,}536) = 58.56, p < .001$	.022	**.492**	**.117**	**.098**
					$p < .001$	**$p < .001$**	**$p = .002$**	**$p = .012$**
English Grammar	1	.268	.267	$F(1{,}553) = 202.59, p < .001$	.268	**.518**		
					$p < .001$	**$p < .001$**		
	2	.271	.267	$F(3{,}551) = 68.13, p < .001$	.002	**.530**	.003	.051
					n.s.	**$p < .001$**	n.s.	n.s.
					($p = .399$)		($p = .925$)	($p = .176$)
Welsh Grammar	1	.274	.272	$F(1{,}437) = 164.83, p < .001$	.274	**.523**		
					$p < .001$	**$p < .001$**		
	2	.277	.272	$F(3{,}435) = 55.68, p < .001$	.004	**.534,**	.042	.044
					n.s.	**$p < .001$**	n.s.	n.s.
					($p = .343$)		($p = .299$)	($p = .295$)
McCarthy	1	.789	.788	$F(1, 290) = 1084.91, p < .001$	.789	**.888**		
					$p < .001$	**$p < .001$**		
	2	.800	.798	$F(3{,}288) = 383.82, p < .001$	.011	**.895**	.031	**.101**
					$p < .001$	**$p < .001$**	n.s.	**$p < .001$**
							($p = .242$)	
Ravens	1	.080	.077	$F(1{,}395) = 34.23, p < .001$	.080	**.282**		
					$p < .001$	**$p < .001$**		
	2	.120	.113	$F(3{,}393) = 17.82, p < .001$	.040	**.305**	**.156**	**.116**
					$p < .001$	**$p < .001$**	**$p = .001$**	**$p = .020$**

*Home Language is coded for all measures, except the PGC and Welsh Grammar, in terms of amount of English input; for the PGC and Welsh Grammar, HL is coded for amount of Welsh input.

These overall results were broken down further to examine the predictive value of these same variables within each particular age group. The results for each measure by age group are shown in Tables 6 to 11. These results reveal the following:

BPVS

For the BPVS, actual age in months significantly contributed to performance in the case of the youngest two age groups and the younger adults. In all three cases, the effect was positive, indicating that the older the participants within the group, the better they performed. (No first-stage model is shown for those cases in which there was no significant effect when age was entered as the only predictor, e.g., for the 5-year-olds, primary schoolers, and teens.)

For all age groups, home language also contributed significantly to performance. In all cases, the more English input in the home, the better the performance. And for all age groups except the youngest children and the primary school children, SES also contributed to performance, with an increase in SES predictive of better performance on the BPVS.

The relative predictive value of the distinct variables differed across the age groups, however. For the 3-, 4-, and 5-year-olds and the primary schoolers, home language had the greatest predictive power of all three variables. For the 3- and 4-year-olds, age in months was next most predictive. For the 4- and 5-year-olds, SES also had predictive power. For the younger adults, age had the most predictive power, then home language, and then SES. For both the teens and the older adults, SES carried greater predictive weight than did home language. Thus, at

https://doi.org/10.1017/S1366728915000504 Published online by Cambridge University Press

Table 6. *Results of Regression Analyses by Age Group, BPVS*

							Standardized Coefficients β		
Measure	Age Group	Model	R^2	*Adjusted* R^2		R^2 *Change*	Age Months	HL*	SES
BPVS	3	1	.193	.182	$F(1,76) = 18.16, p < .001$	.533	**.439**		
						$p < .001$	$\mathbf{p < .001}$		
		2	.547	.528	$F(3,74) = 29.73, p < .001$	.012	**.363**	**.593**	.098
						$p < .001$	$\mathbf{p < .001}$	$\mathbf{p < .001}$	n.s.
									($p = .216$)
	4	1	.068	.056	$F(1, 81) = 5.91, p = .017$	.068	**.261**		
						$p = .017$	$\mathbf{p = .017}$		
		2	.306	.280	$F(3,79) = 11.62, p < .001$	.238	**.320**	**.407**	**.289**
						$p < .001$	$\mathbf{p = .001}$	$\mathbf{p < .001}$	$\mathbf{p = .003}$
	5		.360	.343	$F(2,74) = 20.82, p < .001$	.360	.159	**.522**	**.445**
						$p < .001$	n.s.	$\mathbf{p < .001}$	$\mathbf{p < .001}$
							($p = .089$)		
	Primary		.138	.121	$F(2,103) = 8.24, p < .001$	.138	.154	**.344**	.093
						$p < .001$	n.s.	$\mathbf{p < .001}$	n.s.
							($p = .094$)		($p = .318$)
	Teens		.293	.282	$F(2,120) = 24.90, p < .001$	.293	.086	**.264**	**.426**
						$p < .001$	n.s.	$\mathbf{p = .001}$	$\mathbf{p < .001}$
							($p = .269$)		
	Younger Adults	1	.201	.195	$F(1,123) = 30.97, p < .001$	.201	**.449**		
						$p < .001$	$\mathbf{p < .001}$		
		2	.333	.316	$F(3,121) = 20.10, p < .001$	.131	**.459**	**.342**	**.148**
						$p < .001$	$\mathbf{p < .001}$	$\mathbf{p < .001}$	$\mathbf{p = .050}$
	Older Adults		.151	.134	$F(2,105) = 9.30, p < .001$	.151	−.025	**.239**	**.280**
						$p < .001$	n.s.	$\mathbf{p = .009}$	$\mathbf{p = .003}$
							($p = .781$)		

*Home Language is coded here in terms of amount of English input.

younger ages, home language carries the greatest weight, and both home language and age carry greater weight than SES, but at older ages, SES seems to carry the greatest weight.

PGC

For the PGC, actual age within the group did not contribute significantly to performance for any age group. (Thus, no models are shown for the first-step models in which age was entered as the only predictor.) In the case of all the child age groups, through the teen years, home language had the most predictive power. For the 4-year-olds, 5-year-olds, and teenagers, SES also contributed significantly to performance, but at a lower level. For the adults, none of the variables contributed significantly to performance. Thus, for Welsh vocabulary, home language carried the greatest predictive power, and SES contributed power at the lower ages.

English grammar

For English grammar, age in months was the most significant predictor of performance for the youngest group (the 3-year-olds) and for the older adults. In the case of the 3-year-olds, the relation was positive, indicating that older children performed better; in the case of the older adults, the relation was negative, indicating that older adults performed more poorly. (For other age groups, age in months contributed to performance for the primary age children, but for everyone else was not predictive, so models in which age in months was entered as the only predictor are not shown.)

Home language was predictive of performance only for the youngest children and for the younger adults, in both cases in the direction of greater exposure to English in the home predicting better performance. For the 3-year-olds, SES was a greater predictor than home language on performance, and the relationship was negative, indicating

Table 7. *Results of Regression Analyses by Age Group, PGC*

							Standardized Coefficients β		
Measure	Age Group	Model	R^2	*Adjusted* R^2		R^2 *Change*	Age Months	HL*	SES
PGC	3		.163	.137	$F(2,64) = 6.22, p = .003$	.163 $p = .003$	.092 n.s. ($p = .433$)	**.396** **$p = .001$**	.056 n.s. ($p = .630$)
	4		.476	.452	$F(2,45) = 20.41, p < .001$	.476 $p < .001$	.203 n.s. ($p = .062$)	**.605** **$p < .001$**	**.276** **$p = .015$**
	5		.326	.300	$F(2,53) = 12.81, p < .001$	.326 $p < .001$	.161 n.s. ($p = .161$)	**.472** **$p < .001$**	**.259** **$p = .027$**
	Primary		.240	.220	$F(2,79) = 12.45, p < .001$	.240 $p < .001$	−.003 n.s. ($p = .976$)	**.489** **$p < .001$**	−.005 n.s. ($p = .963$)
	Teens		.263	.248	$F(2,103) = 18.35, p < .001$	.263 $p < .001$	.112 n.s. ($p = .197$)	**.424** **$p = .001$**	**.355** **$p < .001$**
	Younger Adults		.042	.023	$F(2,98) = 2.15$, n.s. ($p = .122$)	.042 n.s. ($p = .122$)	−.014 n.s. ($p = .890$)	.119 n.s. ($p = .232$)	.169 n.s. ($p = .090$)
	Older Adults		.004	−.022	$F(2,77) = 0.16$, n.s. ($p = .851$)	.004 n.s. ($p = .851$)	−.116 n.s. ($p = .317$)	.065 n.s. ($p = .572$)	.011 n.s. ($p = .922$)

*Home Language is coded here in terms of amount of Welsh input.

that lower SES children performed better than higher SES. It is possible that this effect is mediated by home language, in that higher SES Welsh parents may choose to provide Welsh input to the exclusion of English at this age. Such a possibility should be explored in future research. For the primary age children and the teens, SES was the only variable that was a significant contributor to performance. Thus, as with English vocabulary, at the youngest ages, age and home language had predictive value, but, unlike for English vocabulary, at the primary and teenage years, home language carried less predictive power, and SES was the greatest predictor of performance.

Welsh grammar

For Welsh grammar, age in months was predictive for the youngest age group, for the younger adults, and for the older adults, and it was the only predictor of performance for all of these. The relation was positive in the first two cases, indicating that the older the participant, the better the performance; but in the case of the older adults, it was negative, indicating that the older the person, the lower the performance.

For the youngest children, neither of the other variables served as significant predictors. For the 4-year-olds, 5-year-olds, and primary age children, home language was the highest (or only) significant predictor of performance. For the 5-year-olds, SES also contributed, and for the teens, SES was the only significant predictor.

McCarthy

For the McCarthy tasks, age in months acted as a significant predictor of performance for all age groups. The relation was positive in all cases, indicating that the older the person, the better the performance.

Home language was not a predictor for any age group. This is as might be expected, since the McCarthy, especially in relation to the components of the test selected for inclusion here, is a test of cognition, not language. The absence of any home language effects here provides an important contrast with the home language effects observed for the language measures.

Table 8. *Results of Regression Analyses by Age Group, English Grammar*

							Standardized Coefficients β		
Measure	Age Group	Model	R^2	*Adjusted* R^2		R^2 *Change*	Age Months	HL*	SES
English Grammar	3	1	.181	.165	$F(1,51) = 11.28, p = .001$	.181 $p = .001$	**.426** ***p* = .001**		
		2	.416	.381	$F(3,49) = 11.65, p < .001$	.235 $p < .001$	**.476** ***p* < .001**	**.295** ***p* = .012**	**−.369** ***p* = .003**
	4		.040	.010	$F(2,64) = 1.34$, n.s. ($p = .268$)	.040 n.s. ($p = .268$)	.183 n.s. ($p = .141$)	.108 n.s. ($p = .379$)	.171 n.s. ($p = .168$)
	5		.066	.036	$F(2,61) = 2.17$, n.s. ($p = .123$)	.066 n.s. ($p = .123$)	.004 n.s. ($p = .976$)	.227 n.s. ($p = .080$)	.189 n.s. ($p = .144$)
	Primary		.149	.123	$F(2,66) = 5.76, p = .005$	.149 $p < .005$	**.255** ***p* = .024**	.181 n.s. ($p = .120$)	**.436** ***p* = .008**
	Teens		.056	.036	$F(2,95) = 2.80, p = .066$	.056 $p = .066$	.126 n.s. ($p = .209$)	−.048 n.s. ($p = .635$)	**.240** ***p* = .020**
	Younger Adults		.064	.047	$F(2,109) = 3.75, p = .027$	.064 $p = .027$	.181 n.s. ($p = .051$)	**.222** ***p* = .018**	.136 n.s. ($p = .145$)
	Older Adults	1	.093	.083	$F(1,90) = 9.24, p = .003$	.093 $p = .003$	**−.305** ***p* = .003**		
		2	.127	.097	$F(3,88) = 4.26, p = .007$	.034 n.s. ($p = .190$)	**−.301** ***p* = .003**	.005 n.s. ($p = .963$)	.183 n.s. ($p = .071$)

*Home Language is coded here in terms of amount of English input.

SES, in contrast, was a significant predictor of performance for the 3-year-olds and the 5-year-olds. In both cases, the predictive power of SES was at a lower level than that of age in months.

Raven's

For the Raven's, age in months was, as was the case for the McCarthy's, the most significant (or only) predictor of performance for all groups except the primary schoolers.

For the two adult groups, home language was also a predictor, with those whose home language background showed greater English input performing better. This result coincides with that reported above indicating superior performance on the Raven's among the Mon E and OEH adults in this group. For the older adults, SES was also a significant predictor of performance.

Discussion

The results of these analyses reveal the following:

1. One of the most influential factors on performance on both the language and cognitive measures was age in months. It was most influential in the case of English vocabulary performance, McCarthy scores, and Raven's scores. It was not significant at all within age groups in performance on the Welsh vocabulary scores.
2. As already documented, for the language measures, relative exposure to the language in question (as measured by home language) is, in general, highly predictive of performance on vocabulary and grammar tasks in that language. Home language can also play a role, albeit only for the older adults, in performance on the Raven's.
3. In addition, the results indicate that SES also plays, in general, a significant role in performance, for both the language measures and the cognitive measures. But it is especially influential in the performance on the language measures and shows much weaker influence on the cognitive performance.

https://doi.org/10.1017/S1366728915000504 Published online by Cambridge University Press

Table 9. *Results of Regression Analyses by Age Group, Welsh Grammar*

							Standardized Coefficients β		
Measure	Age Group	Model	R^2	*Adjusted* R^2		R^2 *Change*	Age Months	HL*	SES
Welsh	3		.078	.031	$F(2,39) = 1.65$, n.s. ($p = .204$)	.078 n.s. ($p = .204$)	**.434** $\boldsymbol{p = .008}$	.203 n.s. ($p = .203$)	−.235 n.s. ($p = .141$)
Grammar	4		.230	.186	$F(2,35) = 5.22$, $p = .010$	.230 $p = .010$	.146 n.s. ($p = .337$)	**.481** $\boldsymbol{p = .003}$	−.010 n.s. ($p = .948$)
	5		.296	.264	$F(2,44) = 9.23$, $p < .001$	.296 $p < .001$	.117 n.s. ($p = .368$)	**.420** $\boldsymbol{p = .002}$	**.300** $\boldsymbol{p = .023}$
	Primary		.095	.068	$F(2,66) = 3.48$, $p = .037$	.095 $p = .037$	.178 n.s. ($p = .131$)	**.279** $\boldsymbol{p = .021}$	.178 n.s. ($p = .137$)
	Teens		.057	.033	$F(2,77) = 2.35$, n.s. ($p = .103$)	.057 n.s. ($p = .103$)	−.021 n.s. ($p = .855$)	.117 n.s. ($p = .295$)	**.219** $\boldsymbol{p = .052}$
	Younger Adults	1	.089	.079	$F(1, 91) = 8.90$, $p = .004$	.089 $p = .004$	**.299** $\boldsymbol{p = .004}$		
		2	.093	.062	$F(3,89) = 3.04$, $p = .033$	.004 n.s. ($p = .827$)	**.305** $\boldsymbol{p = .003}$	.062 n.s. ($p = .541$)	.008 n.s. ($p = .938$)
	Older Adults		.020	−.009	$F(2,67) = 0.70$, n.s. ($p = .500$)	.020 n.s. ($p = .500$)	**−.244** $\boldsymbol{p = .048}$	.117 n.s. ($p = .341$)	.098 n.s. ($p = .425$)

*Home Language is coded here in terms of amount of Welsh input.

4. The relative contributions of language exposure and SES can vary by type of measure, however, as follows.

a. Language measures

1) For the vocabulary measures (the BPVS and the PGC), home language exposure appears to be the greatest predictor of performance for most of the age groups, at least through the primary school ages (i.e., for ages 3, 4, 5, and primary schoolers). SES is also significant at many ages (ages 4, 5, teens, and both sets of adults), and appears to play a more predictive role at the higher ages: for the BPVS, SES has the greatest contribution of the three variables at both the teen years and among the older adults; for the PGC, SES never contributes as much as home language to performance, but it does play a role at ages 4, 5, and the teens, where it shows the greatest contribution.

2) For the grammar measures, both English grammar and Welsh grammar, age in months appears predictive primarily at the youngest age (age 3) and for the adults. At the youngest age, the relation is a positive one: many of the structures tested are only beginning to be mastered, so slightly older children in the same age group perform better than younger children. At the oldest age group, however, for both English and Welsh grammar, the relation is negative: the older the participant, the lower the performance, suggesting some decline in performance with age.
At the intermediate ages, either home language or SES or both appear significant. For English grammar, home language is predictive at age 3 and the teen years; for Welsh grammar, home language is predictive of performance at ages 4, 5, and the primary school age. SES is predictive of performance, for English grammar, at age 3 and among the primary school and teen years. For Welsh grammar, SES is predictive of performance at age 5 and the teen years.

These results on the language measures are suggestive of a general pattern in which, while both home language

https://doi.org/10.1017/S1366728915000504 Published online by Cambridge University Press

Table 10. *Results of Regression Analyses by Age Group, McCarthy*

Measure	Age Group	Model	R^2	Adjusted R^2		R^2 Change	Standardized Coefficients β Age Months	HL*	SES
McCarthy	3	1	.203	.192	$F(1,75) = 19.11, p < .001$	.203 $p < .001$	**.451** **$p < .001$**		
		2	.317	.289	$F(3,73) = 11.30, p < .001$	.114 $p = .004$	**.406** **$p < .001$**	.023 n.s. ($p = .810$)	**.340** **$p < .001$**
	4	1	.372	.364	$F(1,77) = 45.67, p < .001$	.372 $p < .001$	**.610** **$p < .001$**		
		2	.383	.358	$F(3,75) = 15.52, p < .001$	.011 n.s. ($p = .526$)	**.616** **$p < .001$**	−.044 n.s. ($p = .632$	.092 n.s. ($p = .319$)
	5	1	.066	.053	$F(1, 70) = 4.94, p = .030$	.066 $p = .030$	**.257** **$p = .030$**		
		2	.149	.111	$F(3,68) = 3.97, p = .011$	.083 $p = .042$	**.299** **$p = .011$**	.001 n.s. ($p = .996$)	**.291** **$p = .014$**
	Primary	1	.142	.128	$F(1,62) = 10.28, p = .002$	.142 $p = .002$	**.377** **$p = .002$**		
		2	.195	.155	$F(3,60) = 4.85, p = .004$	.053 n.s. ($p = .148$)	**.387** **$p = .001$**	.148 n.s. ($p = .219$)	.144 n.s. ($p = .233$)

*Home Language is coded here in terms of amount of English input.

and SES can influence performance at any age, home language may be more influential at younger ages, when perhaps more fundamental aspects of the language are being learned, while SES may be more influential at later ages, when more subtle fine-tuning of the language may be taking place. The predictive power of home language appears to be more persistent for Welsh, in that home language is the best predictor of performance on the PGC through the teen years and on the Welsh grammar through the primary school years. In contrast, for the BPVS, SES becomes a more powerful predictor of performance at the older years, especially the teen years and the older adult years and is the most powerful predictor of performance on the English grammar task at the primary school and teen years. It is possible that as the differences across home language groups become leveled, the effects of SES become more visible and are perhaps more long-lasting; at younger ages, the predictive value of SES may be partially masked by the strength of home language as a predictor.

b. Cognitive measures

For both the McCarthy and the Raven's, unlike the language measures, age in months was the greatest predictor of performance. For most age groups, the older the participant, the better the performance. For the oldest age group, i.e., the older adults, however, performance on the Raven's declined with age (similar to the effects observed for the English and Welsh grammar).

For the McCarthy tasks, home language played no role, but SES significantly contributed to performance at ages 3 and 5; for the Raven's, home language (greater English) contributed to performance only for the adults.

The results here are striking because they provide evidence for the pervasive influence of SES factors, primarily on acquisition of language. The participants of the study re-examined here for SES influence were all typically developing children or typical adults. None of them were growing up in poverty, and none of them were from immigrant groups more typical in today's shifting geographical boundaries. The impact of SES in these latter groups of bilinguals is worthy of further in-depth study in the light of the results here. If the results here are representative of the pervasiveness of SES influence on performance, we might expect the role of SES to play an even more significant role in the performance of children growing up under less advantageous conditions. The fact that home language had some influence on cognitive

https://doi.org/10.1017/S1366728915000504 Published online by Cambridge University Press

Table 11. *Results of Regression Analyses by Age Group, Raven's*

							Standardized Coefficients β		
Measure	Age Group	Model	R^2	Adjusted R^2		R^2 *Change*	Age Months	HL*	SES
Raven's	Primary		.019	−.011	$F(2,64) = 0.63$, n.s. ($p = .534$)	.019 n.s. ($p = .534$)	.214 n.s. ($p = .087$)	.090 n.s. ($p = .491$)	.083 n.s. ($p = .523$)
	Teens	1	.116	.107	$F(1,99) = 12.98$, $p < .001$	.116 $p < .001$	**.340** **$p < .001$**		
		2	.133	.106	$F(3,97) = 4.95$, $p = .003$	.017 n.s. ($p = .392$)	**.339** **$p < .001$**	.093 n.s. ($p = .336$)	.076 n.s. ($p = .431$)
	Younger Adults	1	.076	.068	$F(1,121) = 9.92$, $p = .002$	.076 $p = .002$	**.275** **$p = .002$**		
		2	.113	.091	$F(3,119) = 5.06$, $p = .002$	.037 $p = .085$	**.280** **$p = .002$**	**.179** **$p = .041$**	.084 n.s. ($p = .333$)
	Older Adults	1	.066	.057	$F(1,104) = 7.31$, $p = .008$	.066 $p = .009$	**−.256** **$p = .008$**		
		2	.148	.123	$F(3,102) = 5.93$, $p = .001$	.083 $p = .009$	**−.233** **$p = .013$**	**.192** **$p = .041$**	**.198** **$p = .033$**

*Home Language is coded here in terms of amount of English input.

performance at the later years on the Raven's and that SES had some influence on cognitive performance at the youngest year on the McCarthy are also worthy of further examination.

In relation to the larger perspective on language development and proficiency in bilingual populations, these results make the following clear: First, language development in bilinguals is contingent on both SES level and exposure to the language, as well as other contributing factors. These two are often conflated, or are not differentiated, in bilingual populations being considered, especially when comparisons are being made with monolinguals. The clearly separate, but equally profound, influences on language performance in bilinguals make it imperative that future work cannot ignore either factor when conducting research focusing on any aspect of bilinguals' speech. We did not examine the adults' own educations and professions here and how those may have contributed to performance. In the light of others' work (e.g., Kaplan et al., 2001), this would be a valuable component to include in further studies.

Secondly, we can no longer conflate linguistic and cognitive aspects of performance under a single rubric of 'cognitive abilities' if we wish to gain an accurate account of the influence of SES on development. The above results show, first, that SES level is especially influential in the case of language development, and treating language and cognitive performance together under a single measure muddies the picture of what is influencing what. As some research has begun to do (e.g., Calvo & Bialystok, 2014; Kohnert & Windsor, 2004; Windsor & Kohnert, 2004), it is essential to diligently separate both linguistic from cognitive performance (and specific linguistic measures and specific cognitive measures) in examining dependent measures and to separate a range of SES factors from input factors as independent measures. Only then will we have any real hope of fully understanding how the various factors lead to the various outcomes.

It is hoped that the new information that has been provided here on the relative role that SES level may play in bilinguals' language acquisition, and its contribution relative to language exposure, will help to encourage further research into this critical area.

References

Ardila, A., Rosselli, M., Matute, E., & Guajardo, S. (2005). The influence of the parents' educational level on the development of executive functions. *Developmental Neuropsychology, 28(1)*, 539–560.

Bialystok, E., Luk, G., Peets, K.F., & Yang, S. (2010) Receptive vocabulary differences in monolingual and bilingual children. *Bilingualism: Language and Cognition, 13(4)*, 525–531.

Bradley, R. H., & Caldwell, B. M. (1984). The relation of infants' home environment to achievement test performance in first grade: A follow-up study. *Child Development, 55,* 803–809.

Bradley, R. H., Caldwell, B., Rock, S. L., Ramey, C., Barnard, K., Gray, C., Hammond, M., Mitchell, S., Gottfried, A., Siegel, L., & Johnson, D. (1989). Home environment and cognitive development in the first 3 years of life: A collaborative study involving six sites and three ethnic groups in North America. *Developmental Psychology, 25,* 217–235.

Bradley, R. H., & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual Review of Psychology, 53,* 371–99.

Calvo, A., & Bialystok, E. (2014). Independent effects of bilingualism and socioeconomic status on language ability and executive functioning. *Cognition, 130(3)*, 278–288.

Case, R., Griffin, S., & Kelly, W.M. (1999). Socioeconomic gradients in mathematical ability and their responsiveness to intervention during early childhood. In D.P. Keating, & C. Hertzman (eds.), *Developmental health and the wealth of nations: Social, biological and educational dynamics* (pp. 125–149). New York: The Guilford Press.

Chiat, S., Armon-Lotem, S., Marinis, T., Polišenská, K., Roy, P., & Seeff-Gabriel, B. (2013). Assessment of language abilities in sequential bilingual children: The potential of sentence imitation tasks. In V. C. M. Gathercole (ed.), *Issues in the assessment of bilinguals* (pp. 56–89). Bristol: Multilingual Matters.

Chittleborough, C. R., Mittinty, M. N., Lawlor, D. A., & Lynch, J. W. (2014). Effects of simulated interventions to improve school entry academic skills on socioeconomic inequalities in educational achievement. *Child Development, 85,* 2247–2262.

Dunn, L. M., & Dunn, L. M. (1997). *Peabody Picture Vocabulary Test-III*. Circle Pines, MN: American Guidance Service.

Dunn, L. M., Dunn, L. M., Whetton, C., & Burley, J. (1997). *The British Picture Vocabulary Scale: Second Edition*. NFER-NELSON.

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). Mini-Mental State: A practical method for grading the mental state of patients for the clinician. *Journal of Psychiatry Research, 12,* 189–198.

Fuller, B., Bein, E., Kim, Y., & Rabe-Hesketh, S. (2015). Differing cognitive trajectories of Mexican American toddlers: The role of class, nativity, and maternal practices. *Hispanic Journal of Behavioral Sciences, 37(2)*, 139–169.

Gathercole, V. C. M. (2007) Miami and North Wales, so far and yet so near: Constructivist account of morpho-syntactic development in bilingual children. *International Journal of Bilingual Education and Bilingualism, 10(3)*, 224–247.

Gathercole, V. C. M.. (2010). Bilingual children: Language and assessment issues for educators. In K. Littleton, C. Wood, & J. Kleine Staarman (eds.), *Handbook of psychology in education* (pp. 713–748), Bingley: Emerald Group.

Gathercole, V. C. M. (in press). Factors moderating proficiency in bilinguals. In E. Nicoladis & S. Montanari (eds.), *Lifespan perspectives on bilingualism*.

Gathercole, V. C. M., Pérez-Tattam, R., Stadthagen-González, H., & Thomas, E. M. (2014a). Bilingual construction of two systems: To interact or not to interact? In E. M. Thomas & I. Mennen (eds.), *Advances in the study of bilingualism* (pp. 63–89). Bristol: Multilingual Matters.

Gathercole, V. C. M., & Thomas, E. M. (2007). *Prawf Geirfa Cymraeg, Fersiwn 7–11*. (Welsh Vocabulary Test, Version 7–11). www.pgc.bangor.ac.uk.

Gathercole, V. C. M., & Thomas, E. M. (2009) Bilingual first-language development: Dominant language takeover, threatened minority language take-up. *Bilingualism: Language and Cognition, 12(2)*, 213–237.

Gathercole, V. C. M., Thomas, E. M., & Hughes, E. K. (2008). Designing a normed receptive vocabulary test for bilingual populations: A model from Welsh. *International Journal of Bilingual Education and Bilingualism, 11*(6), 678–720.

Gathercole, V. C. M., Thomas, E. M., Jones, L., Viñas Guasch, N., Young, N., & Hughes, E. K. (2010). Cognitive effects of bilingualism: Digging deeper for the contributions of language dominance, linguistic knowledge, socioeconomic status, and cognitive abilities. *International Journal of Bilingual Education and Bilingualism, 13(5)*, 617–664.

Gathercole, V. C. M., Thomas, E. M., Kennedy, I., Prys, C., Young, N., Viñas Guasch, N., Roberts, E. J., Hughes, E. K., & Jones, L. (2014b). Does language dominance affect cognitive performance in Bilinguals? Lifespan evidence from preschoolers through older adults on Card Sorting, Simon, and Metalinguistic Tasks. Special issue on the Development of Executive Function in Children, *Frontiers in Psychology: Developmental Psychology, 5,* article 11.

Gathercole, V. C. M., Thomas, E. M., Roberts, E., Hughes, C., & Hughes, E. K. (2013). Why assessment needs to take exposure into account: Vocabulary and grammatical abilities in bilingual children. In V. C. M. Gathercole (ed.), *Issues in the Assessment of Bilinguals* (pp. 20–55). Bristol: Multilingual Matters.

Gatt, D., & O'Toole, C. (2013). Parent report of early lexical production in bilingual children across varied contexts. Paper presented at Child Language Impairment in Multilingual Contexts, Krakow, May 27–29, 2013.

Ginsborg, J. (2006). The effects of socio-economic status on children's language acquisition and use. In J. Clegg & J. Ginsborg (eds.), *Language and social disadvantage: Theory into practice* (pp. 9–27). Chichester, West Sussex: John Wiley & Sons.

Harley, B., Allen, P., Cummins, J., & Swain, M. (1991). The development of second language proficiency. Cambridge: Cambridge University Press.

Hart, B., & Risley, T. (1995). *Meaningful differences in the everyday experiences of young American children*. Baltimore: Paul Brookes.

Hoff, E. (2003). The specificity of environmental influence: Socioeconomic status affects early vocabulary development via maternal speech. *Child Development, 74(5)*, 1368–1378.

Hoff, E., Core, C., Place, S., Rumiche, R., Senor, M., & Parra, M. (2012) Dual language exposure and early bilingual development. *Journal of Child Language, 39,* 1–27.

Kaplan, G.A., Turrell, G., Lynch, J.W., Everson, S. A., Helkala, E-L., & Salonen, J. T. (2001). Childhood socioeconomic position and cognitive function in adulthood. *International Journal of Epidemiology, 30,* 256–263.

Kohnert, K., & Windsor, J. (2004). In search of common ground-Part II: Non-linguistic performance by linguistically diverse learners. *Journal of Speech, Language, and Hearing Research, 47,* 891–903.

Lapkin, S., Swain, M., & Shapson, S. (1990) French immersion research agenda for the 90s. *Canadian Modern Language Review, 46,* 638–674.

Letts, C. (2013). What are the building blocks for language acquisition? Underlying principles of assessment for language impairment in the bilingual context. In V. M. Gathercole (ed.), *Solutions for the assessment of bilinguals* (pp. 36–56). Bristol: Multilingual Matters.

McCarthy, D. (1972). *McCarthy Scales of Children's Abilities*. San Antonio: Harcourt Assessment.

Oller, D. K., & Eilers, R. E. (eds.). (2002). *Language and literacy in bilingual children*. Clevedon: Multilingual Matters.

ONS Standard Occupational Classification. (2010). *Office for National Statistics, www.ons.gov.uk*. Basingstoke: Palgrave Macmillan.

Paradis, J. (2010). Bilingual children's acquisition of English verb morphology: Effects of language exposure, structure complexity, and task type. *Language Learning, 60*(3), 651–680.

Raven, J., Raven, J. C., & Court, J. H. (2004). *Manual for Raven's progressive matrices and vocabulary scales*. San Antonio, TX: Pearson Assessment.

Raviv, T., Kessenich, M., & Morrison, F.J. (2004). A meditational model of the association between socioeconomic status and three-year-old language abilities: The role of parenting factors. *Early Childhood Research Quarterly, 19(4)*, 528–547.

Reynell, J. (1991). *Reynell Developmental Language scales* (U.S. Edition). Los Angeles: Western Psychological Service.

Sarsour, K., Sheridan, M., Jutte, D., Nuru-Jeter, A., Hinshaw, S., & Boyce, W. T. (2011) Family socioeconomic status and child executive functions: The roles of language, home environment, and single parenthood. *Journal of the International Neuropsychological Society, 17,* 120–132.

Stadthagen-González, H., Gathercole, V. C. M., Pérez-Tattam, R., & Yavas, F. (2013). Vocabulary assessment of bilingual adults: To cognate or not to cognate. In V. C. M. Gathercole (ed.), *Solutions for the assessment of bilinguals* (pp. 125–145). Bristol: Multilingual Matters.

Thomas, E. M., Gathercole, V. C. M., & Hughes, E. K. (2013). Sociolinguistic influences on the linguistic achievement of bilinguals: Issues for the assessment of minority language competence. In V. C. M. Gathercole (ed.), *Solutions for the assessment of bilinguals* (pp. 175–193). Bristol: Multilingual Matters.

Thordardottir, E. (2011). The relationship between bilingual exposure and vocabulary development. *International Journal of Bilingualism, 15(4)*, 426–445.

Wilson, R. S., Scherr, P. A., & Bienias, J. L. (2005). Socioeconomic characteristics of the community in childhood and cognition in old age. *Experimental Aging Research, 31*: 393–407.

Windsor, J., & Kohnert, K. (2004). The search for common ground: Part I. Lexical performance by linguistically diverse learners. *Journal of Speech, Language, and Hearing Research, 47,* 877–890.