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A longitudinal investigation of early reading and language skills in children with poor reading comprehension

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Background: Poor comprehenders have difficulty comprehending connected text, despite having age-appropriate levels of reading accuracy and fluency. We used a longitudinal design to examine earlier reading and language skills in children identified as poor comprehenders in mid-childhood. **Method:** Two hundred and forty-two children began the study at age 5. Further assessments of language and reading skill were made at 5.5, 6, 7 and 8 years. At age 8, fifteen children met criteria for being a poor comprehender and were compared to 15 control children both concurrently and prospectively. **Results:** Poor comprehenders showed normal reading accuracy and fluency at all ages. Reading comprehension was poor at each time point and, notably, showed minimal increases in raw score between 6 and 8 years. Phonological skills were generally normal throughout, but mild impairments in expressive and receptive language, listening comprehension and grammatical understanding were seen at all ages. **Conclusions:** Children identified as poor comprehenders at 8 years showed the same reading profile throughout earlier development. Their difficulties with the non-phonological aspects of oral language were present at school entry and persisted through childhood, showing that the oral language weaknesses seen in poor comprehenders in mid-childhood are not a simple consequence of their reading comprehension impairment. **Keywords:** Poor comprehenders, reading comprehension, reading development, language impairment.

According to the Simple View of reading (e.g., Hoover & Gough, 1990; Catts, Adlof, & Weismer, 2006), children need to become proficient at two sets of skills if they are to become skilled readers. They need to learn how to recognise or decipher words from print, and they also need to learn how to comprehend the message that words convey. Although correlated, these skills are separable and depend on different cognitive and linguistic skills (e.g., Oakhill, Cain, & Bryant, 2003). This is illustrated most clearly in cases where the two sets of skills develop out of step. Children with *developmental dyslexia* struggle with word-level aspects of reading, yet manage to comprehend what they read reasonably well (Bishop & Snowling, 2004; Snowling, 2000). Our focus is on the contrasting group, *poor comprehenders*, who have difficulty understanding what they have read, despite being able to read text accurately, fluently and at age-appropriate levels (Cain & Oakhill, 2007; Nation, 2005). Reading comprehension takes time to develop: it is impossible to demonstrate reading comprehension impairments in children before they are able to read with sufficient accuracy and fluency. Accordingly, most experimental reports of poor comprehenders include children who are aged 8 years and upwards (Cain & Oakhill, 2007; Nation, 2005). By this age, however, children have already begun to fail, complicating both the clinical and theoretical picture. Our study adopts a novel approach, looking at the early reading and language skills of a group of children identified as poor comprehenders later in development.

By definition, poor comprehenders read words and sentences at age-appropriate levels but have serious difficulty understanding text. Experiments by Oakhill, Cain, and colleagues have shown that poor comprehenders are poor at making inferences when reading (Oakhill, 1984; Cain, Oakhill, Barnes, & Bryant, 2001). They tend to read superficially, engaging less than their peers in active processes such comprehension monitoring (Oakhill & Yuill, 1996). These text-level weaknesses are exacerbated when the working memory demands of the task are increased. An important question is whether poor comprehenders' difficulties are specific to the domain of reading, or whether they reflect difficulties with oral language more generally. Although these children are typically not identified as having any special educational needs, there is now considerable evidence pointing to a variety of oral language weaknesses. For example, poor comprehenders are poor at making inferences when listening to language (Cain et al., 2001), and more generally, they show impaired listening comprehension (Nation & Snowling, 1997).

Nation, Clarke, Marshall, and Durand (2004) reported a thorough assessment of poor comprehenders' spoken language skills. They administered a battery of tests that are routinely used to assess children's speech and language to a group of

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8–9-year-old poor comprehenders and control children. Poor comprehenders were less skilled than control children on tasks tapping semantics (e.g., vocabulary and word knowledge), morphosyntax (e.g., past tense inflection, sentence comprehension) and aspects of language use (e.g., understanding figurative language). In line with previous experimental findings, however (e.g., Cain, Oakhill, & Bryant, 2000; Nation & Snowling, 1998; Stothard & Hulme, 1995), poor comprehenders performed well on tasks tapping phonological processing and phonological awareness. Reflecting on the relationship between oral language skills and the development of reading, Nation et al. (2004) speculated that strengths in the phonological domain enable poor comprehenders to develop strong decoding and word reading skills, while relative weaknesses in dealing with the non-phonological aspects of language constrain and limit their reading comprehension. However, although it is tempting to consider poor comprehenders' difficulties with reading comprehension as a consequence of their language weaknesses, another explanation is equally plausible: the mild-to-moderate weaknesses in spoken language seen in poor comprehenders in mid-childhood might be a consequence of their reading comprehension impairments. On this view, poor comprehenders may read less, and also benefit less from their reading experiences than control children. This may lead to relative weaknesses in spoken language, in vocabulary for example, emerging over time as a downstream consequence of their reading impairment.

One way to explore the early reading and language skills of poor comprehenders is via a longitudinal study. Only one study has used this design to address the nature of specific comprehension impairments earlier in time. Catts et al. (2006) identified 57 poor comprehenders in 8th Grade (14 years). At this time, they showed weaknesses in vocabulary and grammatical understanding, consistent with Nation et al.'s (2004) findings with younger children. As the children had been part of the Iowa Epidemiological Study of Language Impairment (Tomblin et al., 1997), retrospective data were available from Kindergarten, 2nd Grade and 4th Grade. Generally, the longitudinal data were in line with those obtained concurrently – at each testing point, poor comprehenders scored below skilled comprehenders on a language composite measure. The pattern of performance on the phonological composite was more difficult to interpret. Although there was no group difference in phonological processing in 2nd and 4th Grade, children who went on to become poor comprehenders in 8th Grade showed deficits in phonological awareness in kindergarten. This raises the intriguing possibility that children who go on to become poor comprehenders make a slow start in phonological awareness and word reading. Although this may resolve quite quickly (in Catts et al.'s study, there were no differences in phonological awareness or word-level reading by 2nd Grade), it may be indicative of a subtle processing bottleneck that contributes to reading comprehension impairments (e.g., Shankweiler et al., 1995).

Our longitudinal study used a similar methodological approach to that used by Catts et al. but we focused in greater detail on early reading and language development between 5 and 8 years of age. In addition, we used the *Neale Analysis of Reading Ability-II* (NARA-II; Neale, 1997) to define the poor comprehender group and a case-matched control group. This makes our sample comparable to the extant literature on poor comprehenders, most of which has used performance on the NARA-II to define samples. This is important as different reading comprehension tasks tap different aspects of the comprehension process; they also vary enormously according to the processes they tap at different developmental levels (Keenan, Betjemann, & Olson, 2008; Nation & Snowling, 1997). Potentially therefore, the poor comprehenders recruited by Catts and colleagues may differ from those described in the UK literature, especially given the changing nature of reading comprehension and its relation to oral language and decoding skills over time (e.g., Vellutino, Tunmer, Jaccard, & Chen, 2007).

We recruited a large unselected sample of children on school entry shortly before their 5th birthday and re-assessed their early reading and language skills on four further occasions over a four-year period. Having identified poor comprehenders at 8 years of age using the NARA-II, we then looked back at their performance earlier in development. First, we investigated the children's reading development from 5 years through to 8 years of age, focusing on both word-level reading accuracy and text comprehension. This included a thorough examination of early reading, assessing the hypothesis that poor comprehenders show initial deficits in learning to read that nevertheless resolve quickly. Related to this question, we also examined whether the phonological strengths reported in empirical studies of older poor comprehenders (e.g., Cain et al., 2000; Stothard & Hulme, 1995) extended to early development. Finally, we examined the children's non-phonological language skills longitudinally. We anticipated that children who went on to become poor comprehenders would show early difficulties with vocabulary, comprehension, production of grammar and listening comprehension.

Method

Participants

Seventeen primary schools serving a range of neighbourhoods in Oxfordshire took part in this study. All children beginning these schools in 2004 were invited to participate. Informed consent from parents was received for 242 children (141 girls and 108 boys;

M = 4.83 years, *SD* = .34). National Office of Statistics data confirmed the range of socio-economic circumstances (SES) (Index of Multiple Deprivation percentile rank *M* = 59.03, *SD* = 30.55, range = 15.29–95.38) that characterised the sample. The majority of the sample (95.18%) were native speakers of British English.

The 242 children were first assessed within 3 months of starting school and again approximately 6 months later (*M* age = 5.27, *SD* = .31; *N* = 234). They were then assessed annually in Year 1 (*M* = 6.26, *SD* = .34; *N* = 215), Year 2 (*M* = 7.23, *SD* = .35; *N* = 202) and Year 3 (*M* = 8.32, *SD* = .30; *N* = 172). These five testing points are referred to as 5 years, 5.5 years, 6 years, 7 years and 8 years. At each testing point, children were assessed individually in a quiet area adjacent to their classrooms. The large drop in sample size at 8 years was largely due to our biggest school (*N* = 28) being unable to participate due to internal factors, unrelated to this study. In all schools, children were receiving the reading curriculum specified by the UK National Literacy Strategy, employing a variety of reading strategies with an emphasis on phonics.

Procedure and materials

Children were assessed individually in a quiet room adjacent to their classroom. At each time point, tests were administered by trained research assistants in 2–3 sessions each lasting approximately 30 minutes. Most of our measures were standardized assessments that have good psychometric properties according to test manuals. Estimates of the reliability of our own measures are noted in the relevant tables.

Assessing reading skills. Letter knowledge was assessed at 5 years and 5.5 years by asking children to give the name or sound for each of the 26 lowercase letters of the alphabet. To assess early word reading skills at 5.5 and 6 years of age, we selected 50 words from the lists of age-appropriate sight words published by the National Literacy Strategy. The words were ordered according to written frequency (Masterson et al., 2002) and presented on individual cards. Testing was discontinued if the child made 10 consecutive errors. To assess fluency and accuracy, children completed both the word and nonword component of the *Test for Word Reading Efficiency* (TOWRE; Torgesen, Wagner, & Rashotte, 1999) at 6, 7 and 8 years of age. The NARA-II provided an assessment of text reading at 6, 7 and 8 years. In this test, children read aloud short passages of text (accuracy) and are then asked questions to assess literal and inferential understanding (comprehension). At 8 years, children also completed four passages (two level 3 and two level 4) from a prepublication version of *The York Assessment of Reading Comprehension* (YARC; Snowling et al., 2009). The children read the stories aloud, generating an accuracy score; their answers to a series of comprehension questions generated a reading comprehension score.

Assessing phonological skills. Two subtests from the *Comprehensive Test of Phonological Processing* (Wagner et al., 1999) were used to provide a measure of phonological processing (*Nonword Repetition*, in which children repeat nonsense words) and phonological awareness (*Phoneme Elision*, in which children delete an initial or final phoneme from orally presented words) at 5, 6, 7 and 8 years. Two additional tests were administered at 5 years: *Sound Matching*, also from the CTOPP, and *Rime Judgement*, a task developed by Bird, Bishop, and Freeman (1995) to measure phonological awareness in young children. In *Sound Matching*, children hear three words and are asked to select which one starts (or ends) with the same sound as a target item. In *Rime Judgement*, children selected from an array of four pictures the one that rhymed with a target item. For all phonological measures, materials were recorded digitally and presented from a computer via headphones.

Assessing language skills. Expressive vocabulary was assessed using the vocabulary subtest from the *Wechsler Preschool and Primary Scale of Intelligence* (WPPSI; Wechsler, 2002) at 5 years of age and the vocabulary subtest from the *Wechsler Abbreviated Intelligence Scales* (WASI; Wechsler, 1999) at 6, 7 and 8 years. The WASI requires children to provide definitions for words supplied by the experimenter; the later items on the WPPSI follow the same format, but the earlier items require children to name pictures. To further assess expressive vocabulary at 5 years, we designed a bespoke vocabulary task, modelled on the WASI. Children were asked to define 20 high-frequency words (Masterson et al., 2002); responses were scored on a scale of 0–3.

Two subtests from the *Clinical Evaluation of Language Fundamentals* (CELF-3^{UK}; Semel, Wiig, & Secord, 2000) provided an estimate of expressive and receptive language skills at 6, 7, and 8 years. *Recalling Sentences* required children to repeat sentences of increasing length and grammatical complexity; *Sentence Structure* assesses acquisition of structural rules at the sentence level by asking children to select a picture that matches the target sentence. *Listening Comprehension* was assessed at 6 and 7 years using three stories taken from Form 2 of the NARA-II (stories 1–3). These were recorded digitally and played to the children; after each story, the children were asked the comprehension questions. At 5 years of age, they also completed the *Test for Reception of Grammar-2* (TROG-2; Bishop, 2003) and the comprehension subtest from the *Wechsler Intelligence Scale for Children* (WISC; Wechsler, 2003). TROG-2 measures children's comprehension of sentences with grammatical complexity increasing over the test. It is presented in a multiple-choice format and children select the picture that matches the sentence spoken by the experimenter. WISC Comprehension requires children to answer orally presented, socially relevant comprehension questions.

Results

Group selection at 8 years

Fifteen poor comprehenders and 15 control children were selected from the 172 children seen at age 8 years. All children were native speakers of British English, and children with known sensory impair-

Table 1 Performance of poor comprehenders and control readers on selection and background measures taken at 8 years

	Poor comprehenders		Control readers		
	M	*SD*	*M*	*SD*	*F*(1,29)
Age (years)	8.38	.35	8.34	.29	< 1.0
NARA Accuracy	102.87	8.44	102.80	6.30	< 1.0
NARA Comprehension	83.67	4.05	105.13	7.21	101.11**
Matrices	92.63	13.26	106.58	14.91	7.32*
SES (IMD score)[1]	26.24	16.33	17.98	14.15	2.10

**p < .01, *p < .02. [1]Index of Multiple Deprivation: higher scores represent greater deprivation. When child's home postcode was not available, school postcode was used to calculate IMD score.

ments were excluded. All poor comprehenders had at least average-for-age reading accuracy, operationalised as a NARA-II Reading Accuracy standard score above 90, and a NARA-II Comprehension score of below 90, with the additional constraint of a minimum discrepancy of more than 10 standard score points between their accuracy and comprehension scores (M = 19.20, SD = 9.65, range = 11–43). Control children were individually matched to poor comprehenders for accuracy; all achieved a comprehension score in excess of 100. Neither nonverbal ability nor SES was part of the selection criteria. Although within normal range, poor comprehenders achieved lower nonverbal ability scores than the control children (replicating Catts et al., 2006). The groups did not differ in socio-economic circumstances or age. Relevant data are shown in Table 1.

Having selected the two groups of children at 8 years, we next examined their reading and language skills retrospectively. The case-matched control group provided a direct comparison between poor and skilled comprehenders, allowing our results to be compared with the extant literature. In addition, we calculated *z*-scores from raw scores based on the M and SD of the entire sample assessed at each time point; for ease of reference, *z*-scores were transformed to standard scores (M = 100, SD = 15). These data reveal each group's level of performance, relative to the entire sample, as well as allowing for direct comparison across different tests.

Reading over time

Table 2 summarises the performance of the two groups at each time point. There were no group differences in letter knowledge, early word reading, and reading fluency as assessed by the TOWRE at any time point, with both groups performing at an average age level relative to the population norm.

The NARA-II provided an assessment of reading accuracy and comprehension at 6 and 7 years. Poor comprehenders achieved equivalent reading accuracy scores to controls earlier in time. Consistent with their later comprehension impairments at age 8 years, however, they were relatively poor at reading comprehension at both 6 and 7 years of age. Strikingly, the poor comprehenders made very small gains in reading comprehension raw score over time. Raw scores were analysed using a 3 (time: 6 vs. 7 vs. 8 years) × 2 (group) analysis of variance with repeated measures on the first factor. Note that eight children (5 poor comprehenders, 3 controls) are not included in this analysis as they were unable to read a passage accurately enough to administer comprehension questions at 6 years. Along with main effects of time, $F(2, 19) = 42.82$, $p < .001$, $\eta^2 = .68$, and group, $F(2,19) = 14.74$, $p < .001$, $\eta^2 = .43$, there was a significant interaction between time and group, $F(2, 19) = 14.26$, $p < .001$, $\eta^2 = .42$. As shown in Figure 1, control readers showed substantial increases in raw score with increasing age whereas the poor comprehenders showed a much flatter rate of development with no change in mean raw score between 7 and 8 years of age.

Confirming the profile of reading skills at 8 years, the poor comprehenders scored an average of one standard deviation below the controls on the comprehension component of the YARC (a very large effect size, d = 2.18) despite achieving equivalent levels of reading accuracy on the same instrument.

Language and phonological skills over time

Table 3 shows that the poor comprehenders scored towards the lower end of average range and at a lower level than the controls on all non-phonological language measures and at each time point. Effect sizes were medium to large and group differences were statistically significant, confirming good consistency and stability across time and across different measures.[1] There was, however, one exception to this general pattern. At 5 years, poor comprehenders did not differ significantly from the control children in expressive vocabulary, as assessed by both the WPPSI and the bespoke vocabulary task. On both measures, poor comprehenders showed average-for-age skills, relative to the entire sample (standard scores of 98 and 97).

Turning to the phonological measures, Table 4 shows that, generally, the two groups of children did not differ from each other on any measure at any time point. Although effect sizes are moderate, both groups scored close to the population mean. Once

[1] One control was excluded from the analysis of vocabulary scores at 7 years. He achieved a very low score (raw score = 8, standard score = 67) and the tester had noted on the record form that he was distracted and reluctant to engage in this test. At other time points, he achieved standard scores greater than 90, suggesting that their data point at age 7 years was spurious.

Table 2 Performance of poor comprehenders and control readers on measures of reading over time. Scores are standard scores are relative to age-matched sample (M = 100, SD = 15)

	Poor comprehenders		Control readers			
	M	*SD*	*M*	*SD*	*F*(1,29)	Cohen's *d*
Letter Knowledge						
5 years	105.25	12.63	106.86	9.19	< 1.0	.15
5.5 years	105.64	9.52	107.72	10.15	< 1.0	.21
Early Word Reading						
5.5 years[1]	104.71	18.68	102.82	15.01	< 1.0	.11
6 years[2]	101.64	13.47	107.50	7.64	2.11	.55
TOWRE Words						
6 years	100.37	15.19	102.73	7.27	< 1.0	.21
7 years	100.76	12.15	104.28	7.81	< 1.0	.35
8 years	108.34	6.89	105.73	7.11	< 1.0	.37
TOWRE Nonwords						
6 years	100.09	14.60	97.32	7.28	< 1.0	.25
7 years	96.69	10.13	99.94	9.05	< 1.0	.34
8 years	104.69	10.39	101.52	7.21	< 1.0	.36
NARA Accuracy						
6 years	99.07	13.73	100.29	9.91	< 1.0	.10
7 years	98.37	12.91	102.49	8.12	< 1.0	.39
§§8 years	102.87	8.44	102.80	6.30	< 1.0	< .01
8 years (YARC)	98.40	16.09	103.87	8.97	1.23	.44
NARA Comprehension						
6 years	94.17	8.96	103.00	13.26	3.32∼	.80
7 years	93.38	9.42	103.36	11.51	6.36**	.95
§§8 years	83.67	4.05	105.13	7.21	101.11**	3.81
8 years (YARC)	83.89	12.25	106.32	8.79	32.41**	2.10

§§Tests used to define the groups. ∼p < .08, **p < .01.
[1]Reliability assessed by correlating with letter knowledge at 5 years, r = .521, p < .01.
[2]Reliability assessed by correlating with TOWRE words at 6 years, r = .833, p < .01.

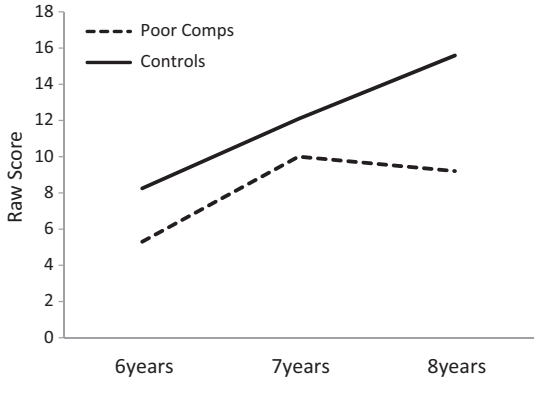

Figure 1 Mean reading comprehension raw score over time in poor comprehenders and controls

again, there was one exception: poor comprehenders performed significantly less well than controls on the sound-matching task at 5 years, achieving a mean standard score towards the lower end of average range (91 vs. 104).

Discussion

The aim of this study was to document the early reading and language skills that characterise children who go on to develop specific reading comprehension impairments in mid-childhood. Using a longitudinal design, a large sample of children was followed from school entry close to their 5th birthday through to 8 years of age. At age 8, 15 children (8.7% of the sample) were identified as showing the poor comprehender profile, a rate that is broadly consistent with previous work and a recent larger-scale screen (N = 1120; Clarke, Snowling, Truelove, & Hulme, in press). We compared their reading and language skills with a group of case-matched controls using both concurrent and retrospective measures. In addition, standard scores calculated from the whole sample seen at each time point provided an estimate of the children's performance, relative to the entire population tested.

Poor comprehenders' profile of strengths and weaknesses measured concurrently mirrored that reported in the literature. At 8 years, their phonological skills were entirely normal and indistinguishable from those of the control children (Cain et al., 2000; Nation & Snowling, 1998; Stothard & Hulme, 1995). In contrast, their non-phonological language skills were relatively weak: they achieved significantly lower standard scores than control children and overall their performance fell towards the lower end of normal range according to our local norms, derived from the entire sample of 172 children who were tested at 8 years of age. These findings are consistent with previous studies documenting mild-to-moderate language weaknesses in poor comprehenders in mid-to-late childhood (e.g., Nation et al., 2004). Although the poor

Table 3 Performance of poor comprehenders and control readers on measures of language skill over time. Scores are standard scores are relative to age-matched sample (M = 100, SD = 15)

	Poor comprehenders		Control readers			
	M	*SD*	*M*	*SD*	*F*(1,29)	Cohen's *d*
Vocabulary						
5 years (WPPSI)	98.44	9.57	106.41	15.48	2.73	.64
5 years (bespoke) [1]	97.02	16.77	100.62	15.39	< 1.0	.22
6 years	93.84	11.52	104.03	13.79	4.62*	.83
7 years[2]	96.33	13.40	105.98	12.08	3.76∼	.76
8 years	92.34	11.53	103.05	15.16	4.75*	.82
Listen Comprehension						
6 years	92.50	9.56	104.72	14.06	7.23*	1.05
7 years	91.36	13.99	101.38	9.23	4.84*	.88
Recalling Sentences						
6 years	89.30	9.26	102.67	12.27	10.82**	1.27
7 years	90.68	18.87	103.00	12.96	8.82**	.79
8 years	91.60	10.76	104.47	11.39	10.13**	1.2
Sentence Structure						
6 years	88.33	9.30	105.61	9.62	23.17**	1.84
7 years	93.80	12.76	103.84	13.25	4.16*	.8
8 years	92.96	10.76	103.26	10.88	3.63∼	.99
TROG-2						
5 years	91.30	11.54	104.86	15.08	7.13**	1.05
WISC Comprehension						
5 years	93.76	14.26	108.73	12.89	8.81**	1.14

∼p = .06, *p < .05, **p < .01.
[1]Reliability assessed by correlating with WPPSI at 5 years, r = .60, p < .01.
[2]One control child excluded, see text for details.

Table 4 Performance of poor comprehenders and control readers on measures of phonological skill over time. Scores are standard scores are relative to age-matched sample (M = 100, SD = 15)

	Poor comprehenders		Control readers			
	M	*SD*	*M*	*SD*	*F*(1,29)	Cohen's *d*
Nonword Repetition						
5 years	98.95	7.38	100.31	15.50	< 1.0	.12
6 years	99.39	10.60	100.66	16.66	< 1.0	.05
7 years	97.34	9.78	100.05	14.53	< 1.0	.22
8 years	99.11	9.17	103.46	13.57	1.06	.38
Phoneme Elision						
5 years	97.61	13.47	104.61	10.47	2.36	.59
6 years	97.21	9.66	102.26	13.27	1.36	.44
7 years	101.04	14.87	99.13	11.02	< 1.0	.15
8 years	97.30	12.75	104.95	13.56	2.25	.59
Sound Matching						
5 years	91.37	11.66	104.82	17.72	5.74*	.92
Rime Judgement						
5 years	97.44	14.76	104.49	14.50	1.68	.49

*p < .05.

comprehenders had lower nonverbal ability, replicating Catts et al. (2006), the specific pattern of phonological strengths and non-phonological language weaknesses argues against group differences being attributable to nonverbal ability (see Nation, Clarke, & Snowling, 2002, for full discussion of poor comprehenders' cognitive profile).

Looking back over time at the children's reading development, our findings demonstrate very clearly that children who went on to show a poor comprehender profile at 8 years of age showed normal word-level reading skills from the outset. They started school with normal levels of letter knowledge and they established word reading skills at the same rate as control children. Reading fluency for words and nonwords was also normal throughout, as was text reading accuracy. Thus, our longitudinal data provide no support for the hypothesis that poor comprehenders make a slow start with reading accuracy or fluency early in development. Turning to reading comprehension, this is difficult to measure before 6 years of age. Notably, however, even at this early age the poor comprehenders scored less well than the control children, an effect that was also observed at 7

years of age. Strikingly, while control children showed improvements in raw scores over time, poor comprehenders showed little change in raw scores and scored well below the population mean at each time point. Thus, the children identified here at 8 years of age as poor comprehenders showed a consistent pattern of reading comprehension impairments from the outset.

Given the well-replicated experimental finding that poor comprehenders show relative strengths in phonological processing, we expected that children who emerged as poor comprehenders would show normal phonological skills earlier in development. This expectation was generally confirmed. Throughout, the poor comprehenders were statistically indistinguishable from the control children in terms of nonword repetition and phoneme elision. The two groups were also indistinguishable at 5 years on a measure of rime judgement, and the poor comprehenders performed at average levels according to the population norms provided by the entire sample on all of these measures. In some cases, however, effect sizes were moderate, suggesting that with greater power significant group differences might emerge. One group difference was significant, with poor comprehenders scoring towards the lower end of average range on the sound-matching task at 5 years of age. While it is inappropriate to over-interpret this one statistically significant finding, it is perhaps not surprising to see a trend towards poor comprehenders showing lower phonological awareness in the early years, given the substantial demands these tasks place on general language and cognitive resources.

We turn now to discuss performance over time on the non-phonological language tasks. Although there is some evidence that poor comprehenders have oral language difficulties in mid-childhood and adolescence (e.g., Catts et al., 2006; Nation et al., 2004), it is not clear whether these impairments are a consequence of the reading comprehension problem, or whether they precede it. Our design allowed us to examine the children's spoken language skills before they learned to read, thus ruling out the possibility that any weaknesses were a consequence poor reading comprehension itself. With one exception, poor comprehenders were worse than controls on all of the language tasks, regardless of whether they were measured concurrently or longitudinally, and effect sizes were medium to large. Thus, our data show for the first time that weaknesses in aspects of oral language were apparent before the poor comprehenders were benefiting (or failing to benefit) from their reading experiences, although of course reciprocal influences are to be expected. Although our study differs from the one reported by Catts et al. (2006) in important ways (for example, age of the participants, diagnostic methods), our findings are strikingly similar. More generally, our data are also consistent with the finding that within non-selected samples, variation in oral language in the pre-school years is a good predictor of reading comprehension in 2nd Grade (e.g., Kendeou, van den Broek, White, & Lynch, 2009).

A complicating issue for our interpretation is that we did not find a group difference in vocabulary at 5 years. One explanation might be that both tests administered at 5 years lacked the sensitivity to reveal subtle group deficits, given they both contained only high-frequency and concrete items. Nevertheless, the clear demonstration of normal levels of expressive vocabulary rules out the simple hypothesis that reading comprehension impairments in mid-childhood are always a straightforward consequence of lack of vocabulary knowledge. Rather, it may be useful to make a distinction between non-phonological tasks that measure language processing and those that assess crystallised knowledge such as vocabulary. Poor comprehenders were less skilled at processing sentences, both in comprehension tasks (as measured by TROG and Sentence Structure) and in expressive tasks (as measured by Recalling Sentences), and they showed early deficits in listening comprehension. Since performance on these language measures reflects many of the processes important for reading comprehension, we suggest that reading comprehension impairments are caused by the same factors that lead to difficulties in the spoken domain. Relative weaknesses in these domains would not only place children at risk of reading comprehension difficulties, but may also lead to decrements in crystallised knowledge, including vocabulary, accumulating over time (Cain et al., 2003; Nation, 2009).

Consistent with this suggestion are findings from a randomised controlled trial. Clarke et al. (in press) found that an intervention programme focusing on 8-year-old poor comprehenders' oral language skills led to significant improvements in both reading comprehension and expressive vocabulary. In addition, gains were greater and more sustained for children who received this intervention compared to one focusing on text comprehension strategies, or combining both oral language and text comprehension. Clarke et al. concluded that basic weaknesses in understanding and using spoken language play a causal role in the reading comprehension impairments shown by poor comprehenders. Our observation that oral language weakness are present at school entry and before the onset of reading development support Clarke et al.'s conclusion. We should note that while most of the non-phonological language tests discriminated between the two groups with moderate effect size, no specific test was uniquely or strongly associated with the poor comprehender profile. Instead, different poor comprehenders scored relatively well or relatively poorly on each assessment, with the exception of vocabulary at 5 years where only two poor comprehenders scored below 90.

Our methodology – comparing tightly matched groups of poor vs. skilled comprehenders – allows direct comparison with the experimental literature documenting reading and language processes in the two groups. However, a clear limitation concerns the small sample size: it is far too small to examine profiles and developmental trajectories in detail. This is unfortunate given the likelihood that a number of different factors play a role in causing poor reading comprehension, probably in an interactive and reciprocal way (Nation, 2005). Future larger-scale longitudinal studies are needed to chart and understand this variability.

In conclusion, children who go on to become poor comprehenders in mid-childhood show a genesis of the same profile earlier in time. Despite making good gains in word reading, underpinned by adequate levels of phonological skill, weaknesses in aspects of oral language skill are apparent at school entry. These findings highlight the interaction between oral language skills and the development of written language and suggest that early oral language weaknesses place children at risk of later reading comprehension impairments.

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Key points

- Poor comprehenders struggle to comprehend connected text despite having age-appropriate levels of reading fluency and accuracy.
- Poor comprehenders often have mild-to-moderate oral language weaknesses but to date it has been unclear whether these impairments are a consequence of, or a precursor to, reading comprehension difficulties.
- This longitudinal study shows that oral language difficulties are apparent *before* children learn to read, ruling out the possibility that oral language weaknesses are a simple consequence of poor reading comprehension.
- These results instead suggest that weaknesses in non-phonological language skills may place children at risk for later reading comprehension problems.

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