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Morphosyntax in Poor Comprehenders

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Abstract

Children described as *poor comprehenders* (PCs) have reading comprehension difficulties in spite of adequate word reading abilities. PCs are known to display weakness with semantics and higher-level aspects of oral language, but less is known about their grammatical skills, especially with regard to morphosyntax. The purpose of this study was to examine morphosyntax in fourth grade PCs and typically developing readers (TDs), using three experimental tasks involving finiteness marking. Participants also completed standardized, norm-referenced assessments of phonological memory, vocabulary, and broader language skills. PCs displayed weakness relative to TDs on all three morphosyntax tasks and on every other assessment of oral language except phonological memory, as indexed by nonword repetition. These findings help to clarify the linguistic profile of PCs, suggesting that their language weaknesses include grammatical weaknesses that cannot be fully explained by semantic factors. Because finiteness markers are usually mastered prior to formal schooling in typical development, we call for future studies to examine whether assessments of morphosyntax could be used for the early identification of children at risk for future reading comprehension difficulty.

Keywords

poor comprehenders; oral language; morphology; syntax; grammar

Children known as *poor comprehenders* (PCs), exhibit significant reading comprehension problems but good word reading skills (Catts, Adlof, & Ellis Weismer, 2006; Nation, Clarke, Marshall, & Durand, 2004). Some have estimated that 5-10% of young children show the PC profile (Nation & Snowling, 1997; Yuill & Oakhill, 1991), and there are indications that the percentage increases across school grades (Adlof & Catts, 2007; Landi, 2010). Studies testing the simple view of reading model (Gough & Tunmer, 1986; Hoover & Gough, 1990), have shown that two component skills, word reading and language comprehension, account for the majority of the variance in reading comprehension skill across the school grades (e.g., Adlof, Catts, & Little, 2006; Chen & Vellutino, 1997; Landi, 2010). Because PCs, by definition, have good word reading skills, the simple view predicts that weak language comprehension underlies their reading comprehension problems.

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A growing body of research into the language abilities of PCs has provided strong evidence that PCs have difficulties with certain aspects of oral language, including weaknesses in vocabulary and semantic processing (Catts et al., 2006; Henderson, Snowling, & Clarke, 2013; Nation & Snowling, 1998, 1999; Landi & Perfetti, 2007) and higher-level language skills, such as inferences (Oakhill, Yuill, & Parkin, 1986; Yuill & Joselyne, 1988), idioms (Cain & Towse, 2008), and narrative skills (Cain & Oakhill, 1996; Cain, 2003). In contrast, phonological skills are generally viewed as an area of strength, as PCs have performed as well as typical readers on tasks measuring broad phonological knowledge, fine-grain phonological awareness, and phonological memory (Cain, Oakhill, & Bryant, 2000; Catts et al., 2006; Nation, Adams, Bowyer-Crane, & Snowling, 1999; Nation et al., 2004; Nation & Snowling, 1998; Stothard & Hulme, 1995). It is hypothesized that PCs' relative phonological strengths provide a foundation for their good word reading skills.

Compared to phonological, semantic, and higher-level language skills, less is known about PCs' grammatical abilities, including inflectional morphology and syntax. Several studies have found that PCs score lower than skilled comprehenders on norm-referenced grammatical assessments that involve matching pictures to spoken sentences, repeating sentences, or following verbal directions that include grammatical variations (Catts et al., 2006; Cragg & Nation, 2006; Marshall & Nation, 2003; Nation et al., 2004; Stothard & Hulme, 1992; but see Cain & Oakhill, 2006; Yuill & Oakhill, 1991). However, because such assessments sample a wide variety of structures, they do not offer much insight into specific areas of difficulty. Additionally, because more difficult items are often longer or more semantically complex, the degree to which other factors, such as working memory or vocabulary and semantics, might influence performance also remains unclear. For example, two studies that used experimental tasks to examine specific syntactic structures—namely, regular and irregular past tense marking, and active, passive, and dative sentences—found that group differences were largest when the semantic complexity of the task was also high (Nation & Snowling, 2000; Nation, Snowling, & Clarke, 2005). Other studies testing morphological awareness in PCs have also found large group differences for items assessing derivational morphology (which involve changes to the meaning of the base word), but no significant differences for items assessing inflectional morphology (which involve changes in grammatical function, such as tense, number or case marking but do not change meaning; Tong, Deacon, Kirby, Cain, & Parrila, 2011; Tong, Deacon, & Cain, 2014).

In sum, the status of PCs' basic grammatical abilities is unclear. Past studies have usually revealed group differences on omnibus tasks assessing a variety of structures, but they provide little information about which specific structures are problematic, or whether grammatical difficulties persist when semantic factors are controlled. Therefore, we examined grammatical knowledge in fourth grade PCs and typically developing controls using three experimental tasks with short, simple sentences and familiar vocabulary words. The three tasks specifically assessed an aspect of morphosyntax known as finiteness marking, the marking of tense and agreement between the subject and verb. Finiteness marking is obligatory in all main clauses, but in English it is only overtly marked in four forms: third person singular present tense (*He walks to school*), regular and irregular past tense[1] (*She walked to school*; *He ate an apple*), auxiliary and copula forms of the verb *BE* (*The baby is crying*; *The baby is sad*), and auxiliary *DO* (*He does not have any*).

Although one previous study had examined past tense verb marking (Nation et al., 2005), no previous studies have specifically examined other forms of overt finiteness marking in PCs. In addition to filling a gap in the literature, we saw at least two other advantages to examining PCs' finiteness marking skills. First, there is evidence that finiteness-marking difficulties are good early indicators of broader language weaknesses. For example, whereas typically-developing children master finiteness marking in spontaneous speech in the preschool years, children with specific language impairment (SLI) exhibit finiteness-marking difficulties in spontaneous speech through at least age 8 (Rice, Wexler, & Hershberger, 1998) and in grammatical judgment tasks through adolescence (Betz, 2005; Miller, Leonard, & Finneran, 2008; Rice, Hoffman, & Wexler, 2009; Wulfeck, Bates, Krupa-Kwiatkowski, & Saltzman, 2004). To date, there has been little research aimed at the early identification of PCs, but prediction accuracy based on vocabulary measures alone is low (Elwer, Keenan, Olson, Byrne, & Samuelsson, 2013). If PCs present with finiteness marking difficulties concurrently with their classification as PCs, future longitudinal studies could examine whether the addition of similar measures would improve the precision of early estimates of risk for future reading comprehension problems.

Additionally, an examination of finiteness marking in PCs will provide useful descriptive information for comparing and contrasting PCs to children with SLI. These two labels have traditionally been applied to children of differing ages (preschool and kindergarten for SLI; third grade and older for PCs), but they involve broadly similar profiles of significant language weakness in the presence of typical nonverbal cognitive skills (Catts et al., 2006; Nation et al., 2004). One reason that the two profiles have remained distinct in the literature is that it is thus far unclear whether PCs show the same kinds of difficulties with morphosyntax that are considered a hallmark of children with SLI (Leonard, 1998; Nation et al., 2005). A finding that PCs show difficulties with finiteness marking would support future prospective longitudinal studies to determine whether PCs and children with SLI show distinct developmental profiles.

In this study, fourth grade PCs and typically developing peers (TDs) completed three experimental morphosyntax tasks assessing finiteness marking, as well as a large battery of norm-referenced language and nonverbal cognitive assessments. We hypothesized that PCs would perform as well as TDs on norm-referenced measures of phonological memory but more poorly on measures of vocabulary, semantics, and syntax; such a finding would suggest that our participants were similar to those of past studies. In addition, although past studies yielded mixed evidence, we hypothesized that PCs would show poorer performance on the morphosyntax tasks.

Method

Participants

Two groups of fourth grade students (age 9;1 – 10;10): 16 poor comprehenders (PCs) and 24 typically-developing good comprehenders (TDs) participated. They were selected from 188

[1]Not all irregular past tense verbs are overtly marked for finiteness. Some irregular past tense verbs (e.g., *hit, cut*) are phonologically and orthographically identical to their present tense forms.

children from fourth grade classrooms in 12 public elementary schools in two school districts in a Midwestern state who were screened for participation. To identify children who were most likely to meet criteria for the study, teachers were asked to distribute study information, informed consents, and parent questionnaires to parents of students in their classrooms who had performed between the 5th and 30th percentile (potential PCs) or between the 40th and 85th percentile (potential TDs) on the school's most recent progress monitoring assessment.[2] Participants whose parent reports indicated that they were monolingual English speakers without significant hearing, cognitive, or neurological deficits were then tested for possible PC or TD group membership. To ensure that all participants had relatively normal nonverbal cognitive abilities, all participants in both groups were required to score above the 10th percentile on the *Test of Nonverbal Intelligence-3* (TONI-3; Brown, Sherbenou, & Johnsen, 1997).

Reading test criteria were modeled after those of Catts et al. (2006). All PCs and TDs were required to score above the 40th percentile but below the 86th percentile based on fourth grade norms for the Sight Words subtest of the subtest of the *Test of Word Reading Efficiency* (TOWRE; Torgesen, Wagner, & Rashotte, 1999); these cutoffs ensured average performance but avoided having an extremely high-skilled control group. The Passage Comprehension subtest of *Group Reading Assessment and Diagnostic Evaluation* (GRADE; Williams, Cassidy, & Samuels, 2001) was used to place children in the PC, TD, or neither group. Whereas this measure provides a valid and reliable estimate of reading comprehension (cf. Malone et al., 2010), its normative information is in the form of stanine scores, with each stanine score representing a large range of percentile ranks within the normal distribution. This made the selection of a specific cut-off score that would match previous work (i.e., below the 25th percentile) more challenging. The fourth stanine corresponds to a percentile rank between 23 and 40. To include children who would have met previous criteria and optimize the number of poor comprehenders available, we selected the middle raw score of the fourth stanine as the maximum score for children in the PC group. The middle raw score of the fifth stanine, which corresponds to a percentile rank between 40 and 60, was selected as the minimum score for the TD group. Although our cut score for the PC group was slightly more liberal than that of Catts et al. (2006), the mean raw score of the PC group would place them in the third stanine, commensurate with the previous study (see Table 1). Students whose scores fell in between these cutoffs were not included in either group. Sixteen children met the test score criteria for the PC group; 26 met the test score criteria for the TD group. Two participants who met the eligibility criteria for the TD group were later excluded from the study upon further data collection. One failed the training for the computerized morphosyntax assessments (see Procedures section). The other exhibited features of African American English dialect (AAE). Because this study examined knowledge of standard American English morphosyntax, it was not appropriate to include speakers of dialects that follow different grammatical rules, such as AAE. No PCs displayed these features.[3]

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[2]Although teachers used progress-monitoring scores to distribute consent forms, the scores were not provided to the examiners for analysis in this study.

[3]Because this study examined knowledge of standard American English morphosyntax, it was not appropriate to include speakers of dialects that follow different grammatical rules, such as African American English (AAE). Therefore, audio recordings of the Recalling Sentences and Formulated Sentences subtests of the CELF-4 were checked by a trained research assistant for the presence of

Thus, the final analysis sample included 16 PCs and 24 TDs. Table 1 displays descriptive statistics for the tests used to identify and subgroup the participants. Both groups showed average word reading fluency and were well matched on nonverbal intelligence; following group selection criteria, the TD group's reading comprehension scores were significantly higher than the PC group (GRADE raw scores $d = 5.18$; GRADE stanine scores $d = 3.42$). Table 2 summarizes the demographic and educational characteristics of each group. Slightly less than half of the parents of PCs reported that their children had ever received any type of tutoring or special education services, and as in previous studies (e.g., Catts et al., 2006; Nation et al., 2004), few parents in either group reported any concerns about their child's language or reading abilities or a family history of language or reading difficulties. Although two parents of children in the TD group reported language/reading concerns, one was about vocal quality, whereas the other was about a child's lack of reading interest.

Procedures

Norm-Referenced Language Assessments—Participants completed the Core Language subtests from the *Clinical Evaluation of Language Fundamentals-4th Edition* (CELF-4; Semel, Wiig, & Secord, 2006), which included: 1) Concepts and Following Directions, in which participants followed oral directions involving spatial concepts and chronological order; 2) Recalling Sentences, in which participants repeated sentences read by the examiner; 3) Formulated Sentences, in which participants generated sentences about a picture using a word provided by the examiner; and 4) Word Classes, in which participants identified related words and explained their relationships.

Participants also completed norm-referenced assessments of vocabulary and phonological memory. The *Peabody Picture Vocabulary Test-4th Edition* (PPVT-4; Dunn & Dunn, 2007) required participants to select one picture out of four that best represented a word spoken by the examiner. Phonological memory was assessed using the Nonword Repetition subtest from the *Comprehensive Test of Phonological Processing* (CTOPP; Wagner, Torgesen, & Rashotte, 1999), which required participants to repeat recorded nonsense words ranging from one to seven syllables in length.

Morphosyntax Assessments—Three experimental tasks were presented with Direct RT experimental software (Jarvis, 2008) over high quality headphones (Creative Fatal1ty) plugged into a laptop computer. Audio responses were recorded on a separate digital audio recorder (Olympus DS-50).

Irregular Past Tense Grammaticality Judgment: This task assessed participants' knowledge of rules for marking irregular past tense by eliciting grammaticality judgments of three types of sentences: (a) correct sentences (e.g., *The girl swam a lap.*), (b) sentences with omitted finiteness errors (e.g., *The girl swim a lap.*), and (c) sentences with regularization errors, (e.g., *The girl swimmed a lap.*).

features of AAE. No PCs displayed these features, but one member of the TD group did and was subsequently excluded from further analyses.

Twenty sentences were constructed for the correct condition and modified for the omitted finiteness error and regularization error conditions. All sentences were five words long, containing a two-word subject, a verb, and a two-word noun or prepositional phrase (e.g., *The boy hid a toy. The girl stood in line.*) All irregular verbs were monosyllabic, overtly marked for past tense (i.e., verbs such as *hit* and *cut* were excluded), and selected to be familiar to fourth-graders based on frequency data from spoken and written corpora for children (Moe, Hopkins, & Rush, 1982; Zeno, Ivens, Millard, & Duvvuri, 1995). Stimulus sentences were recorded in a soundproof booth by a female native speaker of English and digitized for computer presentation.

The procedures were modeled after previous studies eliciting grammaticality judgments from children with SLI (e.g., Betz, 2005; Redmond & Rice, 2001; Wulfeck et al., 2004). Participants were trained to make grammaticality judgments of sentences containing the progressive –ing affix, an earlier-acquired morpheme that does not mark finiteness and was not a structure of interest for this study. Participants used a button press to indicate sentences that "sound good" (correct sentences, e.g., *The girl is washing her hands.*) or "do not sound so good" (error sentences, e.g., *The boy is play outside.*). Participants received feedback about response accuracy during training, and all participants included in this study achieved a minimum of 90% accuracy on the training items. As mentioned previously, one child originally selected for the TD group was released from the study when she could not achieve the minimum accuracy level after two training attempts. Following training, participants were instructed that they would hear more sentences without feedback. The remaining stimulus sentences were presented in random order. Internal consistency for items in this task was high, Cronbach's alpha = .87.

BE-DO Question Grammaticality Judgment: This task assessed participants' knowledge of morphosyntax rules governing the use of the auxiliary verbs *BE* and *DO* in wh-questions. Participants were asked to judge three types of questions using each of the verbs: correct questions, questions containing omitted finiteness errors, and questions with overt agreement errors. The stimulus items were adapted from Atchley, Rice, Betz, Kwasny, Sereno, & Jongman, (2006) and Betz (2005). Grammatical *BE* questions were of the form, *Where is a [subject] [verb]-ing?* Grammatical *DO* questions were of the form: *Where does a [subject] like to [verb]?* In questions with omitted finiteness errors, the *BE* or *DO* auxiliary was deleted (e.g., *Where _ a bear growling? Where _ a boy like to play?*); whereas in questions with overt agreement errors, a plural verb form was used with the singular subject (e.g., *Where <u>are</u> a bear growling? Where <u>do</u> a boy like to play?*[4]). Stimulus preparation and task procedures were identical to those in the Irregular Verb Grammaticality Judgment Task. For this task, Cronbach's alpha = .86.

Finiteness Elicitation: This cloze sentence task elicited productions of: (a) third person-singular present tense, (b) regular past tense, (c) irregular past tense, and (d) regular plurals.

[4]We note that under a different analysis, "Where do a boy like to play" could be considered an error of omission because the bare-stem form of DO is phonologically identical to the third-person singular form. *DO* also differs from *BE* because it is inserted to mark tense and agreement for the formation of questions, rather than being generated in the matrix clause and moved. The following example demonstrates this difference.

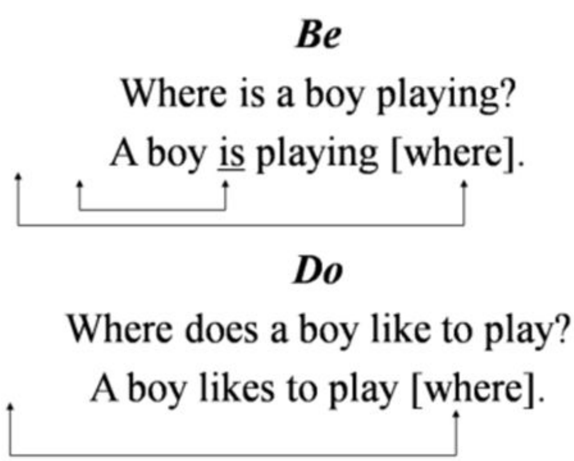
The first three stimulus types involve finiteness marking, and the plural condition was included as an easy comparison condition.

Target words were selected to be monosyllabic, familiar to young children, and easily illustrated using simple black and white line drawings that were scanned for computer presentation. Cloze sentences were recorded in a soundproof booth and digitized for presentation on the computer. For each item, a picture appeared on the computer screen accompanied by an auditory prompt spoken in a female voice (e.g., *Here is a singer. Tell me what she does.*) Next, a pronoun spoken in a male voice signaled the onset of the response sentence (i.e., *She* ____.). Participants were instructed to complete the sentence with the correct target form (i.e., *sings*).

Training for this task involved first administering one item of each type (i.e., plural, third person singular present, regular past, irregular past) live-voice by the examiner who provided feedback, and then presenting the same items via the computer without feedback. Following training, participants completed the test sentences. The entire task was transcribed online and audio recorded. A trained research assistant verified the accuracy of the online transcripts by comparing them to the audio recordings. Internal consistency of items in this task was lower than for the grammaticality judgment tasks (Cronbach's alpha = .63).

Results

Although all participants scored at or above the 40th percentile on the word reading fluency measure, there was a marginally significant difference between the TOWRE means of PC and the TD groups [$F(1, 39) = 3.41$, $p = .07$, $d = .61$]. Because group differences in word reading ability could potentially influence results relating to differences in comprehension skills, all analyses were carried out with the TOWRE standard score entered as a covariate. Note that the TOWRE covariate was not statistically significant in any model, and group effects from analyses with the covariate were essentially the same as analyses without the covariate.



Norm-referenced assessments

Table 3 provides descriptive statistics for all norm-referenced language assessments, including the individual subtests of the CELF-4, the PPVT-4, and the CTOPP Nonword Repetition task. Consistent with our hypotheses and with previous studies, after controlling for potential differences in TOWRE standard scores, large between-group differences were observed for all standardized language assessments except the CTOPP Nonword Repetition subtest, where the groups achieved essentially equivalent scores [CTOPP: $F = .035$, $p = .852$, $d = .03$; all other tests and subtests: $F > 4.85$, $p < .039$, $d > .82$].

Grammaticality judgment tasks

The dependent variable for grammaticality judgment accuracy was A', a measure of sensitivity from signal detection theory. Studies eliciting grammaticality judgments from children typically use A' to adjust for potential response bias (Rice, Wexler, & Redmond, 1999; Wulfeck et al., 2004). A' is calculated by comparing the proportion of *hits* (correctly accepting grammatical sentences) to the proportion of *false alarms* (incorrectly accepting ungrammatical sentences). A' is calculated as follows: A' = .5 + {[(y-x) (1+y-x)] / [(4y (1-x)]}, where y equals the proportion of hits, and × equals the proportion of false alarms.

Inspection of A' values revealed negatively skewed distributions of scores for the participants in the TD group in both grammaticality judgment tasks. Also, a few participants in both the PC and TD groups occasionally displayed outlying scores more than three inter-quartile ranges below the 25^{th} percentile for the group and condition. This included four children for the Irregular Past Tense task: One child in the TD group was an outlier for the omitted finiteness condition, and one child in the PC group and two children in the TD group were outliers for the regularization error condition. For the Be-Do Questions task, one child in the PC group and one child in the TD group showed extreme outlying scores in the omitted finiteness condition. Since there was no a-priori reason to exclude these children from the analysis, these extreme outlying scores were adjusted by bringing them to 1.5 inter-quartile ranges beyond the 25^{th} percentile.

This helped to preserve their status as the lowest scoring member of the group while reducing some of the negative skew.

Irregular Past Tense

A' values (see Figure 1) were analyzed using a 2 Group × 2 Error Type repeated measures analysis, with TOWRE standard scores entered as a covariate. These analyses revealed a significant effect of Group, with the TD group outperforming the PC group [$F(1, 37) = 8.23$, $p = .007$, $\eta_p^2 = .182$]. The main effect of Error Type was non-significant [$F(1, 37) = .22$, $p = .64$, $\eta_p^2 = .006$], while the Group by Error Type interaction was marginal [$F(1, 37) = 3.83$, $p = .06$, $\eta_p^2 = .09$]. The TOWRE covariate was nonsignificant and did not interact with any other factors (all *F*s < .8, all *p*'s > .39). Planned follow-up *t*-tests revealed significant between-group effects for each error type, with a slightly larger effect for regularization errors ($t = 2.88$, $p = .007$, $d = .95$) than for omission errors ($t = 2.03$, $p = .05$, $d = .67$).

BE-DO Questions

A' values (see Figure 2) were analyzed using a 2 Group × 2 Verb × 2 Error Type repeated measures analysis, with TOWRE standard scores entered as a covariate. The main effect of Group was large and significant [$F(1, 37) = 21.22$, $p<.001$, $\eta_p^2 = .36$], whereas the main effects of Error Type [$F(1, 37) = 0.00$, $p=.99$, $\eta_p^2 = .00$], and Verb [$F(1, 37) = .59$, $p=.49$, $\eta_p^2 = .02$] were non-significant. There were two significant two-way interactions: Group by Error Type [$F(1, 37) = 5..42$, $p=.026$, $\eta_p^2 = .13$] and Group by Verb [$F(1, 37) = 7.81$, $p=.008$, $\eta_p^2 = .17$]. The TOWRE covariate was non-significant and did not interact with any other factors (all *F*'s < .75, all *p*'s > .39)

To investigate the Group by Error Type interaction, group differences within each error type were examined separately. The Group effect was large for both error types. The TD group outperformed the PC group in detecting errors of omission [$F(1, 38) = 6.83$, $p=.013$, $\eta_p^2 = .15$] and errors of agreement [$F(1, 38) = 19.55$, $p<.001$, $\eta_p^2 = .34$]. Although both effect sizes were large, the interaction appeared to be driven by larger group differences for agreement errors than omission errors.

Group differences within each verb type were examined separately for the Group by Verb interaction. The TD group showed better performance than the PC group for both verb types, and again, the interaction was driven by different effect sizes between the two verb types. A medium-sized effect of Group was found for *BE* items [$F(1, 38) = 5.18$, $p=.03$, $\eta_p^2 = .12$], whereas a large effect of Group was found for *DO* items [$F(1, 38) = 23.28$, $p<.001$, $\eta_p^2 = .38$].

Elicited finiteness task

Analyses involved responses where participants used some form of the target word to complete the cloze sentence, henceforth *scorable* responses. Responses where children used another word (e.g., “screamed” for “yelled”), changed the sentence structure (e.g., “stopped running” for “ran”), said “I don't know” or gave no response were deemed nonscorable and excluded. The majority of responses from all participants were scorable (93.1% from PCs and 93.2% from TDs). Two error types were coded for plurals, third person singular present, and regular past: 1) omission of the target inflection or 2) use of an incorrect inflection. For the irregular past tense items, regularization errors constituted a third error type.

Both PCs and TDs were highly accurate overall (see Figure 3). Although the PC group means were lower than the TD group means, parametric analyses were not appropriate for plurals, third person singular present tense or regular past tense because no more than three participants in the TD group achieved less than a perfect score. More variance was observed in both groups for the irregular past tense items, for which the PC group achieved lower scores than the TD group, $t(1,38) = 2.10$, $p = .042$, $d = .71$. Further examination of the error types revealed that that groups did not differ in their rate of finiteness marking for irregular past tense items $t(1,38) = .13$, $p = .90$, $d = .19$. Thus, the participants in the PC group were just as likely as participants in the TD group to mark finiteness in irregular past tense verbs, but they marked it incorrectly, using the regularized form.

Table 4 displays the number of participants within each group who ever exhibited each type of error within each inflection type. Both groups were highly accurate on plural and third person singular present tense items. However, half of the PCs (50%) omitted regular past tense at least once, whereas only one member of the TD group (4%) ever did. Likewise, 80% of PCs over-regularized irregular past tense at least once, compared to only 20% of the TD group. Fisher's exact test confirmed a significant between group-difference in the proportion of participants making any errors for both regular verbs ($p = .001$) and irregular verbs ($p < .001$).

Discussion

We examined broad oral language and specific morphosyntax skills in fourth grade PCs and typical readers with similar word reading and nonverbal IQ skills. Commensurate with past studies, we found that PCs showed equivalent phonological memory, but significantly lower levels of vocabulary, semantic, and syntactic performance than TD readers on norm-referenced oral language assessments. We examined morphosyntactic knowledge at a more detailed level using two grammaticality judgment tasks and one cloze sentence task.

This study was the first to examine PCs' knowledge of all four of the overt finiteness markers in English. We found that PCs exhibited weakness with finiteness marking across all experimental tasks and with all of the overt finiteness markers except third person singular present tense, which was only measured in the production task. The sentences in the various conditions of our grammaticality judgment tasks were semantically equivalent, and errors in both the grammaticality judgment and cloze production tasks did not affect semantics. Thus, this study is the first to report specific grammatical weaknesses that cannot be attributed to other factors, such as the semantic reversibility of sentence arguments (e.g., Nation & Snowling, 2000), or knowledge that a verb is irregular (e.g., Nation et al., 2005).

These findings also extend those of a small number of previous studies where the evidence for differences in grammatical morphology has been less strong (e.g., Nation et al., 2005; Tong et al., 2011; Tong et al., 2014). For example, a previous study by Nation et al. (2005) used an elicited production task and found that PCs frequently over-regularized irregular past tense verbs but rarely made errors involving regular past tense verbs. This finding was interpreted as evidence of semantic, rather than grammatical deficits. The findings of results of the first grammaticality judgment task indicated that regularization errors were the most difficult for all children to detect, but PCs were less sensitive than TDs to both regularization errors and omitted tense errors. These findings converge with Nation et al.'s (2005) finding that over-regularization errors are the most common, but they also suggest that some PCs do experience grammatical weakness that is not fully explained by semantic factors. The findings of the *BE-DO* grammaticality judgment task—which also produced the largest between-group effect sizes of all three of the experimental tasks—provide even stronger evidence of grammatical weakness that is not explained by semantic factors, as the same two verbs were manipulated throughout the task.

We note that both groups were highly accurate across all conditions of the production task—the elicited finiteness task. It is possible that production errors would have been more common if we had used more complex sentence structures to elicit finiteness markers. However, in spite of the simplicity of our task, errors of any type were more likely to come from children in the PC group than children in the TD group. In sum, while the rate of errors in production was very low overall, and though some PCs did not make any production errors on the task, the PCs as a group exhibited weaker performance than the TD group.

Although these data provide reliable evidence of grammatical weakness in PCs, the degree of weakness in grammar was somewhat smaller than the degree of weakness observed in vocabulary knowledge and semantics (e.g. as measured by the PPVT-4 and CELF Word Classes subtest), except in the case of the *BE-DO* questions task. Our experimental tasks focused on very basic sentence structures, and it is possible that more complex structures may have revealed greater differences. Another possibility is that some of the differences in effect sizes are related to differences in the developmental trajectories of morphosyntax versus vocabulary and semantic knowledge. Typically developing children usually master finiteness marking in spontaneous sentences well before formal reading instruction begins (Rice, Wexler, & Cleave, 1995). In contrast, vocabulary is never "mastered"; it develops throughout the lifespan and appears to be reciprocally related to reading comprehension (cf. Adlof & Perfetti, 2013). Thus, it might be expected that differences in vocabulary and semantic knowledge between PCs and TDs would grow over time (e.g., Cain & Oakhill, 2011), whereas differences in grammatical knowledge would not. Longitudinal studies by Catts et al. (2006) and Nation, Cocksey, Taylor, & Bishop (2010), which looked retrospectively at oral language skills of children who were later identified as PCs, provide supporting evidence (cf. Elwer et al., 2013). In both studies, oral language deficits were observable prior to formal reading instruction, and group differences in vocabulary knowledge increased over time, whereas group differences in syntactic skills remained more stable. In fact, Nation et al. (2010) found that group differences in expressive vocabulary knowledge were not statistically significant at the first point of measurement (age 5).

Differences in developmental trajectories for grammatical versus vocabulary knowledge might help to explain why some studies have found grammar to be a better predictor of future reading comprehension difficulties than vocabulary (e.g., Adlof, Catts, & Lee, 2010; Botting, Simkin, & Conti-Ramsden, 2006). Future longitudinal studies could utilize tasks such as those in the current study to explore whether morphosyntax difficulties are observable prior to reading difficulties in PCs and whether a combination of morphosyntax, vocabulary, and higher-level language tasks would lead to more accurate early identification of children at risk for the PC profile.

PCs and Children with SLI

Despite equivalent nonverbal cognitive skills, PCs in this study showed worse performance than TDs in all oral language domains except phonological memory. Five PCs (31%) also scored more than one standard deviation below the mean on the CELF-4 composite score, a commonly used cut-off for research studies of specific language impairment (SLI; Bedore & Leonard, 1998; Flax, Realpe-Bonilla, Hirsch, Brzustowitz, Bartlett, & Tallal, 2003; Proctor-Williams & Fey, 2007). Although this proportion is consistent with other studies of PCs (Catts et al., 2006; Nation et al., 2004), it could raise questions about whether the group differences observed in the experimental morphosyntax tasks in the current study were attributed to only those children who scored below this cutoff. To examine this possibility, we examined the individual subject data for each child in the PC group who scored at least one standard deviation below the mean on the CELF-4. There were no observable systematic differences in the grammatical performance PCs who did or did not fall below cutoff. As shown, in Table 5, PCs who scored above and below the cutoff evidenced similar performance across all of the morphosyntax tasks, with both groups displaying lower means than the TD group.

Taken together, these findings raise questions about the degree to which the label of PC is distinct from that of SLI. Traditionally, the two populations have been studied by researchers from different disciplines, and the labels are customarily applied to children of different ages. Whereas SLI is typically diagnosed in the preschool or kindergarten years, PCs cannot be identified until years later, after children have had time to demonstrate good word reading abilities. Additionally, whereas SLI is typically treated as a clinical diagnosis, PC is typically used as more of a descriptive label. In the past, researchers have suggested two reasons for maintaining a distinction between PCs and children with SLI (Nation et al., 2004; Nation et al., 2005). The first reason is that PCs show good nonword repetition skills. While it is true that nonword repetition difficulties have been proposed as potential markers of language impairment, it is important to note that many children with SLI—specifically, those without comorbid dyslexia—display intact nonword repetition skills (Baird, Slonims, Siminoff, & Dworzynski, 2011; Catts, Adlof, Hogan, & Ellis Weismer, 2005). The second reason is that it was previously unclear whether PCs displayed the same types of morphosyntax difficulties that are characteristic of children with SLI. Our results provide evidence that PCs do have difficulty with some aspects of morphosyntax that have been reported to be difficult for children with SLI, including the detection of omitted finiteness and over-regularization of irregular past tense verbs (Marchman, Wulfeck, & Ellis Weismer, 1999; Rice, Tomblin, Hoffman, Richman, & Marquis, 2004) as well as overt agreement errors and tense agreement errors (Betz, 2005; Miller et al., 2008; Wulfeck et al., 2004; but see Rice et al., 1995).

Drawing from these results, one hypothesis is that the present distinction between the classification of PC and SLI is more continuous rather than categorical, and may be largely due to a different focus of assessment. That is, when non-phonological oral language abilities are assessed, a PC might be classified as having a mild form of SLI, depending on the severity of the overall oral language deficits. Likewise, when reading comprehension is assessed, a child with SLI and good word reading abilities could be classified as a PC. The fact that all PCs showed lower language skills than TDs but just under a third of them scored more than 1 SD below the mean on the CELF-4 is consistent with a continuous variation hypothesis. However, the data from the morphosyntax tasks are difficult to interpret within this framework, as performance on these tasks did not appear to be linked to language status. We recruited participants in fourth grade, when they were 9-10 years old. This time point was important for reliably assessing reading comprehension. In contrast, most studies of children with SLI have focused on differences in the early childhood years, which appears to be an optimal developmental period for distinguishing the two groups based on morphosyntax (cf. Bedore & Leonard, 1998; Rice & Wexler, 2001). Longitudinal studies suggest that the degree of morphosyntax deficit in children with SLI relative to age-matched peers changes across development (Rice et al., 1998; 1999; 2009). It is difficult to make comparisons about PCs who do or do not meet research criteria for SLI at older ages in the current study because developmental changes in morphosyntax may obscure differences that may have been present at earlier ages. Ultimately, longitudinal data are needed to test whether PCs and children with SLI show distinct developmental profiles.

We note that slightly less than half of the PCs were flagged by traditional risk factors such as previous speech-language services, parent concerns, or family history, consistent with previous studies of PCs (Catts et al., 2006; Nation et al., 2004). Nation et al. (2004) described the language deficits of PCs as "hidden deficits" because none of their PCs had been previously identified as having speech or language difficulties; they hypothesized that this was because all of the PCs exhibited accurate and fluent speech. This notion of "hidden" language deficits in PCs is also consistent with studies of children with SLI, which show that parents and teachers are unlikely to recognize language difficulties in children who have good speech articulation skills (Tomblin, Records, Buckwalter, Zhang, Smith, & O'Brien, 1997).

Conclusions and Future Directions

Consistent with prior research, we found that PCs and TDs show similar levels of phonological memory (as measured by nonword repetition), but significantly differed on three experimental assessments of morphosyntax, as well as on vocabulary, semantics, and broader oral language skills as measured by standardized assessments. Overall, these results provide support for the model of language and reading difficulties proposed by Catts et al. (2005), whereby phonological processing difficulties are associated with word reading problems (i.e., dyslexia) and non-phonological language difficulties are associated with broader language deficits (such as those seen in SLI) and subsequent reading comprehension problems. Longitudinal data are needed to determine whether similar morphosyntax difficulties are present prior to reading instruction in children who later become PCs, and if so, to determine whether early assessments of morphosyntax could help to improve the early identification of children at risk for the PC profile, and to compare the grammatical profiles of PCs to children with SLI.

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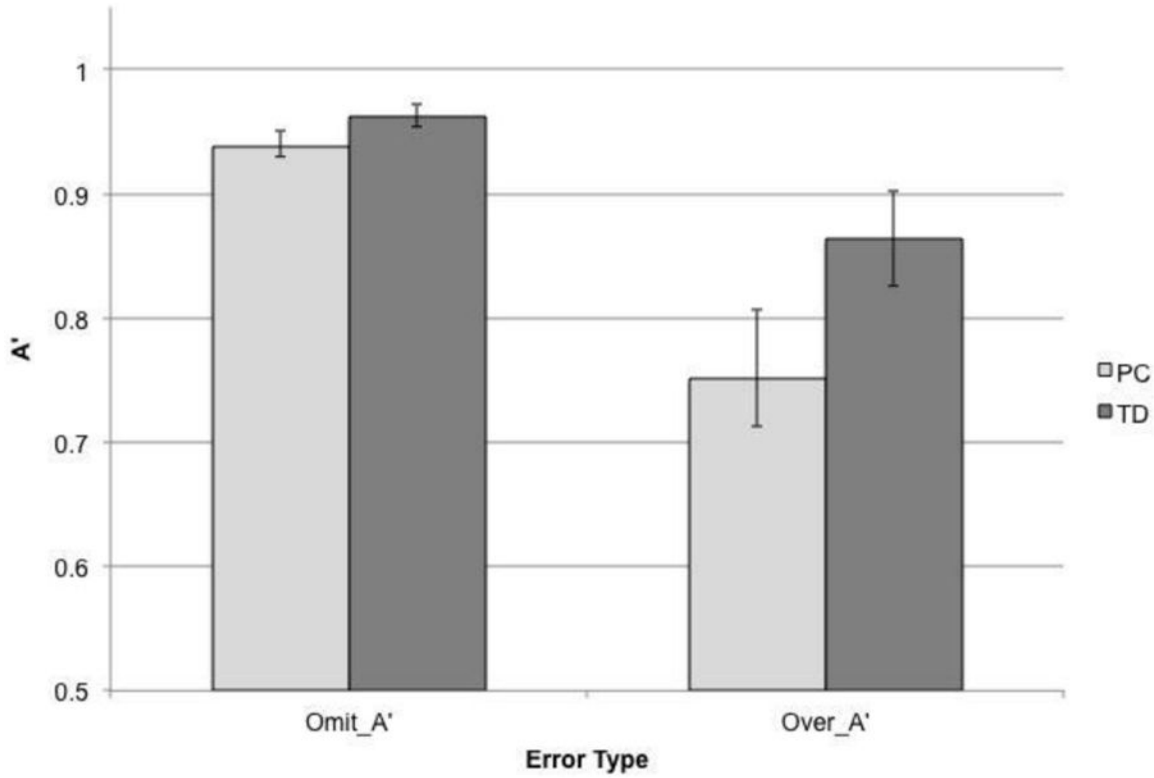

Figure 1.
Group A' values for Irregular Past Tense Grammaticality Judgment task. Error bars indicate standard error of the mean.

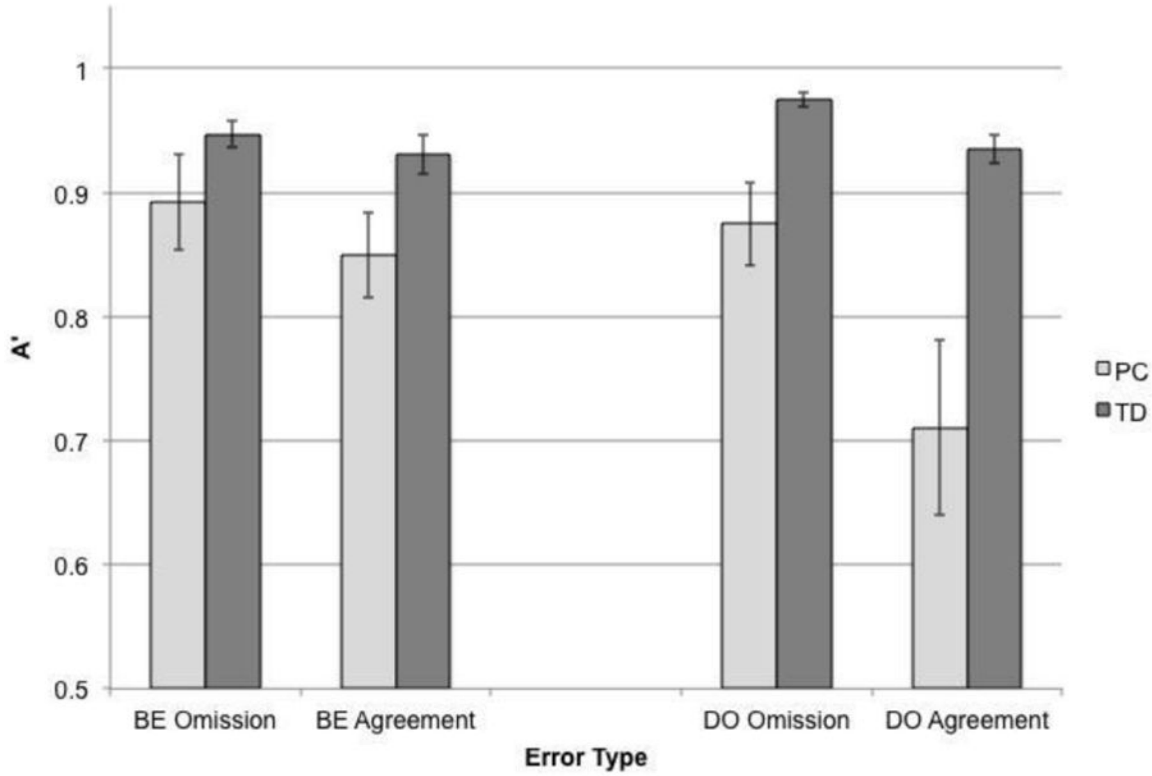

Figure 2.
Group A' values for BE-DO Questions Grammaticality Judgment task. Error bars indicate standard error of the mean.

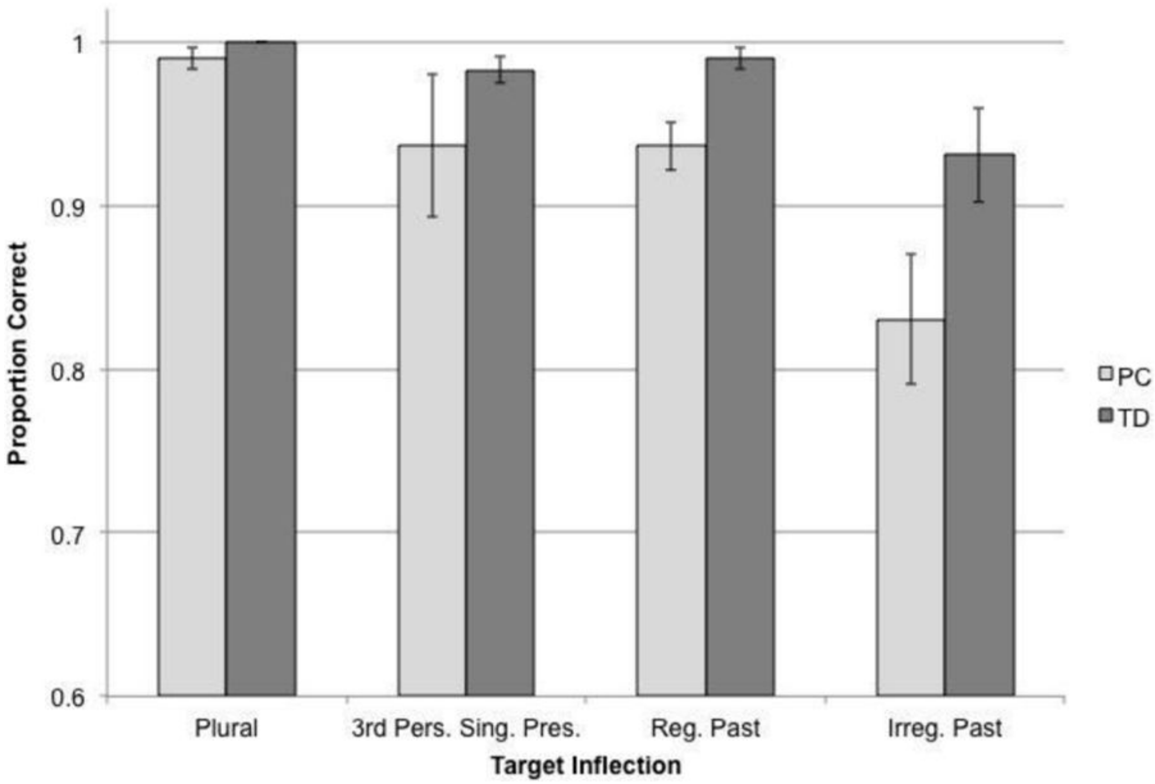

Figure 3.
Proportion correct scorable responses by group for Finiteness Elicitation Task. Error bars indicate standard error of the mean.

Table 1

Means, Standard Deviations, and Significance Tests for Eligibility Assessments

	Poor Comprehender n = 16		Typically Developing n = 24				
	Mean	**SD**	**Mean**	**SD**	***F***	***p***	***d***
TOWRE Sight Words (SS)	101.94	5.17	105.17	5.58	3.41	.073	.61
TONI (SS)	92.69	7.22	94.00	9.64	.22	.65	.15
GRADE Pass. Comp. (raw)	10.44	2.42	22.63	2.41	244.56	<.0001	5.18
GRADE Pass. Comp. (stanine)	3.19	.75	6.54	1.14	106.89	<.0001	3.42

Table 2
Group Demographic and Educational Characteristics

	Poor Comprehender N = 16	Typically Developing N = 24
Mean Age in Years	9.9	9.8
Gender		
Males	11 (69%)	8 (33%)
Females	5 (31%)	16 (67%)
Race		
African American/Black	4 (25%)	3 (13%)
Caucasian/White	11 (69%)	19 (79%)
Multi-racial	0	1 (4%)
"Other"	0	1 (4%)
Not indicated	1 (7%)	0
Risk Factors		
Previous special education or tutoring services	7 (44%)	0
Parental concerns about reading or language	6 (38%)	2 (8%)
Family history of reading or language difficulties	3 (19%)	1 (4%)

Table 3

Norm-referenced Language Assessments Means, Standard Deviations, and Significance Tests (controlling for TOWRE SS covariate)

	Poor Comprehender n = 16		Typically Developing n = 24				
Assessment	**Mean SS**	**SD**	**Mean SS**	**SD**	***F***	***p***	***d***
CELF-4 Subtests							
Concepts & Directions	7.31	2.52	9.83	2.44	7.09	.011	1.05
Recalling Sentences	7.81	1.68	9.54	2.41	4.85	.034	.82
Formulated Sentences	10.00	2.37	11.79	2.18	4.62	.038	.81
Word Classes Rec.	8.31	.95	11.04	2.25	16.88	<.001	1.51
Word Classes Exp.	9.31	1.92	11.61	2.13	8.72	.006	1.15
PPVT-4	91.94	9.12	108.54	11.77	24.18	<.001	1.58
CTOPP: Nonword Rep.	8.94	1.95	9.00	2.70	.035	.852	.03

Table 4

Number and Percentage of Participants in Each Group who Exhibited Omission Errors, Incorrect Inflection Errors, or Regularization Errors in the Finiteness Elicitation Task

Inflection Type		Poor Comprehender n=16	Typically Developing n=24
Plural	Omitted Inflection	1 (6.3%)	0
	Incorrect Inflection	0	0
Third Person Singular Present	Omitted Inflection	2 (12.5%)	2 (8.3%)
	Incorrect Inflection	3 (18.8%)	2 (8.3%)
Regular Past	Omitted Inflection	8 (50%)	1 (4.2%)
	Incorrect Inflection	1 (6.3%)	1 (4.2%)
Irregular Past	Omitted Inflection	2 (12.5%)	1 (4.2%)
	Incorrect Inflection	0	2 (8.3%)
	Regularization	13 (81.3%)	5 (20.8%)

Table 5

Descriptive Statistics for PCs Who Scored More than One Standard Deviation Below the Mean on the CELF-4, PCs Who Scored Above this Cutoff, and TDs

	PC below CELF-4 cutoff (n=5)		PC above CELF-4 cutoff (n=11)		TD (n=24)	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Irregular Verb Grammaticality Judgment (A')						
Omission Errors	.94	.08	.94	.04	.96	.04
Regularization Errors	.78	.07	.74	.27	.86	.19
BE-DO Grammaticality Judgment (A')						
BE Omission Errors	.85	.27	.91	.07	.95	.05
DO Omission Errors	.92	.10	.86	.15	.97	.03
BE Overt Agreement Errors	.81	.19	.87	.12	.93	.08
DO Overt Agreement Errors	.78	.18	.68	.32	.93	.06
Finiteness Elicitation Task (Proportion Correct)						
Plurals	.98	.05	1.00	0	1.00	0
3rd Person Singular Present Tense	.96	.06	.93	.21	.98	.04
Regular Past Tense	.94	.06	.94	.06	.99	.03
Irregular Past Tense	.85	.10	.82	.18	.93	.14