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Assessing the productivity of tense marking in young children : language sample analysis versus parent report

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NORTHERN ILLINOIS UNIVERSITY

Assessing the Productivity of Tense Marking in Young Children: Language Sample
Analysis versus Parent Report

A Thesis Submitted to the
University Honors Program
In Partial Fulfillment of the
Requirements of the Baccalaureate Degree
With University Honors

Department of
Communicative Disorders

By
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DeKalb, Illinois

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Capstone Approval Page

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Assessing the Productivity of Tense Marking
in Young Children: Language Sample
Analysis vs. Parent Report

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ABSTRACT (100 - 200 WORDS):

1. INTRODUCTION

Parent report is a useful and time-efficient tool for obtaining a representative sample of young children's emerging communication abilities. Children in the earliest stages of language development are challenging to assess because young children tend to be reticent in formal testing situations and often use emerging linguistic forms only sporadically in language sampling situations (Dale, 1991). Parent report circumvents the infamous task of obtaining a representative sample from young children by tapping into parents' ability to reflect on a history of cumulative parent-child interactions and report on what their children most typically do (Dale, 1991). As such, parent report provides an ideal approach for sampling the emergent linguistic abilities of young children. However, parents have not been trained to be explicitly aware of specific linguistic structures (Dale, 1991). Therefore, it must be demonstrated that parents can validly report young children's linguistic skills.

Over the past 15 years, a considerable amount of scientific effort has been directed toward the development and validation of parent report tools (Rescorla, 1989; Squires, Potter & Bricker, 1990; Wetherby & Prizant, 1993; Fenson et al., 2007). The development of the MacArthur Communicative Development Inventories (Fenson et al., 1993) represents the most ambitious and comprehensive of these projects. The CDI: Words and Gestures (CDI: WG) gathers information on early communicative gestures, symbolic play, receptive vocabulary, and expressive vocabulary. The CDI: Words and Sentences (CDI: WS) gathers information on expressive vocabulary, sentences, and emerging grammatical complexity. The inventories were validated through a series of studies (cf. Fenson et al., 2007; Dale, 1991), were originally normed for children between

the ages of 8 and 30 months of age (Fenson et al., 1994) and have been recently renormed (Fenson et al., 2007).

The parent reporting format pioneered by the CDI creators has been used to develop other tools for assessing children's early communication skills. For example, Wetherby and Prizant (1993) have extended to a younger age range and refined this approach to focus upon more specific early communication and symbolic behaviors. The validity of their parent reporting tools relative to behavioral samples obtained through semi-structured communication sampling probes has also been established (Wetherby et al., 2002). Although initial efforts have been directed toward extending the approach to vocabulary and grammar to children between 30- and 36-months of age, this age range has not received focused attention. Further research and development is needed to explore how the content and reporting format of the CDI: WS could be adapted to assess the emergence of specific aspects of grammar for older toddlers and young preschoolers. Similarly, it has been demonstrated that parents can validly report on the lexica and grammar of typically developing 16 to 30 month old children using the CDI: Words and Sentences (Dale, 1991; Fenson et al., 1994). Researchers have also found the CDI: WS to be a valid measure of both vocabulary and grammar of children older than 30 months with language delay (Thal et al., 1999; Bryant, 2003).

The purpose of this capstone is to determine if certain items from the CDI: WS could be used to assess the productivity of tense marking in young children at risk for specific language impairment at 36 months. Recently, Hadley and Short (2005) devised cumulative measures of capturing the onset of tense marking during the earliest period of grammatical development. Their investigation was driven by the need to determine if the

late emergence and limited productivity of tense morphemes could be used to detect children at risk for SLI at younger ages. However, their methods, which rely upon comprehensive, longitudinal language samples, are not likely to be adopted by practitioners. As such, it is important to determine if similar results can be obtained using a parent report approach for documenting the emergence tense morphemes. The overall objective of this study will be to determine if a parent report approach to assessment will produce similar results. If less costly approaches can be devised and shown to be valid, this will have enormous utility for practicing speech-language clinicians.

The literature review is organized in the following fashion. The first section will address the validity and utility of parent report as a method of early identification. The following section will address the early identification of children at-risk for SLI, framed within a clinical marker approach. Finally, the results of previous parent report studies will be reviewed in detail providing the rationale for the current study and the methods used (Dale, 1991; Thal et al., 1999; Bryant, 2003; Heilman et al., 2005).

Utility of Parent Report as Early Identification Tool

The importance of early intervention was clearly established in US legislation through the Education of the Handicapped Act Amendment of 1986 (PL 99-457), currently known as Part C of IDEA (25th annual report to Congress, 2001). The mandate for early intervention is supported by the evidence for the critical brain development that occurs during the first three years of life (25th annual report to Congress, 2001). The use of parent report tools fits nicely into the implementation of Part C because their use inherently involves the family in the assessment process. Moreover, parent report enables

clinicians to gather information about emerging language abilities from young children in a time-efficient manner and reduces the assessment challenges related to young children.

Aside from compliance with a federal law, why is the use of parent report important for early identification of developmental disorders? Parents can unobtrusively observe their children behaving naturally in a variety of settings that are familiar and comfortable. Therefore, parents are able to report on what their children most typically do, reflecting on a history of cumulative interactions, rather than what their children are willing to demonstrate in an unfamiliar clinical setting. In a formal clinical situation, children are asked to perform in the presence of strangers, which results in a more narrow and contrived sample of behavior. Clearly, parent report tools tap into a rich collective of observational knowledge. However, if the aspects of language parents are asked to report on are too subtle or difficult to attend to, then parent report may be less useful.

The pressing question is whether parents can report on specific aspects of early grammatical development or whether they are only able to report on a general sense of immature, telegraphic sentence structures. The importance of valid reporting on specific aspects of grammatical development, namely tense marking, is of critical importance to the proper identification of young children at-risk for specific language impairment.

Early Identification of Specific Language Impairment (SLI)

Children with SLI experience marked difficulty in acquiring language in the absence of any contributing neurological, biological, or cognitive conditions (Leonard, 1998). Challenging the axiom that all typically developing children acquire language relatively effortlessly, children with SLI are typical in all respects aside from language development. A recent epidemiological study estimates approximately 7% of 5-year-olds

are affected with SLI, yet only 29% of these children had been previously identified during the preschool years (Tomblin et al., 1997). Although the language difficulties of this population are heterogeneous, many affected children demonstrate a distinct profile of language limitations. They display an asynchronous developmental profile, reflecting pronounced difficulties with the development of morpho syntax. Specifically, children with SLI have conspicuous difficulty with the mastery of obligatory marking of grammatical tense (Rice, 2003; Rice & Wexler, 1996; Rice, Wexler & Hershberger, 1998). More recently, it has been established that toddlers at-risk for SLI experience a delayed onset of obligatory tense marking, even in comparison to slow typically developing peers (Hadley & Short, 2005). Although parents might have difficulty reflecting on the potentially abstract construct of children's degree of progress towards mastery of tense marking, parent report for currently emerging language structures seems quite likely. Indeed, Dale et al. (1989) found that the usefulness and validity of parent report was augmented when parents were asked to report on burgeoning skills or behaviors, rather than when they were asked to recall past behaviors. As such, an explicit focus upon these structures within parent report instruments might improve the differentiation of children at-risk for SLI from peers with slow, but synchronous profiles of language development.

This emphasis upon a specific symptom known to characterize a clinical population is consistent with a clinical marker approach to identification. A clinical marker is a characteristic or symptom, which can be used to distinguish individuals affected by a given condition from those who are unaffected, with a high degree of accuracy (cf. Hadley, 2006). Children's mastery of a subset of morphemes used to mark

tense in English (third person singular present tense *Is*, regular past tense *ed*, copula forms of BE, and auxiliary forms of BE and DO; henceforth referred to collectively as a "tense composite") has been examined by researchers and found to be highly useful in identifying children with SLI (Rice & Wexler, 1996; Rice et al., 1998; Bryant, 2003; Hadley & Short, 2005). Rice and Wexler (1996) used a tense composite variable to demonstrate that non-mastery of tense marking is a "plausible clinical marker" of SLI in 5-year-olds; the vast majority of typically developing 5-year-olds were shown to be using the tense-marking morphemes with mastery, which provides a clearly delineated contrast between typically developing children and those with SLI. However, when the same approach was applied to 3-year-olds, a high percentage of false positives and false negatives (23% and 20%, respectively) were observed (Rice & Wexler, 2001). This raises the question of whether a related, but different measure of tense marking would be more sensitive to proper identification at younger ages so that intervention can be provided at an earlier age.

Hadley and Short (2005) hypothesized that progress towards mastery of tense marking would be an insensitive clinical marker of SLI in young preschool children because the onset of tense marking typically occurs between 2 and 3 years of age. Given the wide variation in mastery of tense marking found among children at this age, the line between children with simple delay (or low average language abilities) and children at-risk for SLI can be easily blurred. Therefore, they used 4 different measures to assess the onset of tense marking in an attempt to sort typical children with slow language development from those at-risk for SLI. Two of the measures reflected incipient use of the tense morphemes (in this study, morphemes of interest were *Is*, *ed*, auxiliary BE &

DO, and copula BE) and two measures reflected the productivity (i.e., the extent to which the entire *system* of morphemes is being used, as well as the degree to which each morpheme is being used in different contexts).

The findings of Hadley and Short (2005) have several implications for the current study. They found that when the productivity of tense morpheme use was quantified, via the Productivity Score, the affected and unaffected children could be sorted with 79% sensitivity and 83% specificity. However, when Hadley and Short applied the two productivity measures in combination, the children could be sorted with 93% sensitivity. When used together, the productivity criteria assess the breadth and depth of children's tense-marking abilities (that is, how many different morphemes were used and how extensively each form was used). Hadley and Short concluded that, "a focus on the onset of tense marking is a valid approach for assessing early grammatical development" (pp. 1355). The current study will explore parent report for a subset of these same tense morphemes in comparison to the Productivity Score obtained from the longitudinal language samples computed in previous studies (Hadley & Short, 2005; Hadley & Holt, 2006).

Grammar is Important for Identification of SLI

Researchers have explored the validity of a parent report approach to the assessment of grammar in several studies (Dale, 1991; Thai et al., 1999; Bryant, 2003). As stated earlier, since its conception, the CDI has been the subject of various studies attempting to determine whether several aspects of the CDI support its use as a means of obtaining valid information from parents (Dale, 1991; Thai et al., 1999). Each of these studies has examined a group of children with unique characteristics (see Table 1 for a

comparison). Dale (1991) focused on typically developing children within a narrow age-range who had widely-ranging MLUs, representing the normal distribution of language abilities. In contrast, Thai et al. (1999)'s sample consisted of children who were older and whose age-range was wider. However, Thai et al.'s sample was comparable to Dale's sample in language abilities, given their at-risk for SLI status. The inclusion of a wider age range also allowed for a larger variation in language ability, despite their uniform at-risk for SLI status. Bryant (2003)'s sample consisted of a group of children whose age and language abilities were mixed. This sample reflects the group of children who are most similar on both age and language abilities.

Table 1

	Participants	How PR was Measured	How Child Grammar was measured directly	Participant language characteristics	Findings
Dale, 1991	24 children <u>Status:</u> Typical development <u>Age:</u> <i>Mean:</i> 24 months <i>Range:</i> 2 months (23-25 months)	All 37 items of the "Complexity" portion from the CDI: WS	MLU in morphemes and IPSyn score, taken from 100-utterance spontaneous language sample	<u>MLU:</u> <i>Mean:</i> 2.20 <i>Range:</i> 3.4 (1.0-4.4) <u>IPSyn:</u> <i>Mean:</i> 37.0 <i>SD:</i> 14.3	CDI complexity score correlated at .76 with MLU and .79 with IPSyn.
Thai et al., 1999	20 children <u>Status:</u> At-risk for SLI <u>Age:</u> <i>Mean:</i> 44.86 months <i>Range:</i> 39-49 months	All 37 items of the "Complexity" portion from the CDI: WS	-MLU in morphemes and IPSyn score, taken from 100-utterance spontaneous language sample	<u>MLU:</u> <i>Mean:</i> 2.5 <i>Range:</i> 2.41 (1.51-3.92) <u>IPSyn:</u> <i>Mean:</i> 47.3 <i>SD:</i> 15.9	CDI Complexity score correlated at .69 with MLU and at .67 with IPSyn.

			-Memory for Sentences Subtest of the Stanford Binet Intelligence Scale (i.e. sentence imitation task)		
Bryant, 2003	18 children <u>Status:</u> Typical children with slow-developing language abilities; children at-risk for SLI <u>Age</u> (at outset of study): <i>Mean: 30.3</i> months <i>Range: 10</i> months (26-36 months)	6 items from the "Complexity" portion of the CDI:WS	Frequency of use grammatical morphemes (taken from utterances at all measurement points), IPSyn score, MLU taken from 100-utterance spontaneous language sample	<u>MLU:</u> <i>Mean: 1.95</i> <i>Range: 2.94</i> (1.28-4.22) <u>IPSyn:</u> <i>Mean: 34.4</i> <i>Range: 35</i> (19-54)	CDI grammar score correlated at .73 with IPSyn and at .78 with MLU
Block,, 2006	22 children <u>Status:</u> 6 Typical children with slow-developing language abilities; 18 children at-risk for SLI <u>Age</u> (at outset of study): <i>Mean: 36</i> months <i>Range: 0</i> months	Parent Report Tense Composite (5 items from the "Helping Verbs" portion of the CDI: WS and 4 items from the "Complexity" portion of the CDI: WS	MLU in morphemes and IPSyn score, taken from 100-utterance spontaneous language sample	<u>MLU:</u> <i>Mean: 2.92</i> <i>Range: 2.78</i> (1.71-4.49) <u>IPSyn:</u> <i>Mean: 57.1</i> <i>Range: 42</i> (32-74)	PRTC score correlated at .69 with Productivity score

The degree to which each study's sample varied for age and language abilities is significant, because the narrower the swath of the normal distribution that is examined, the more difficult it becomes to find highly contrasting characteristics among the sample. Oller (2006) demonstrated this phenomenon in a recent issue of *The ASHA Leader*. He discussed a hypothetical study of undergraduate grade point average (GPA) and successful practice in speech-language pathology (Success). He began by illustrating a strong positive correlation ($R = .71$) between undergraduate GPA, which could range from 1 to 4, and Success (see Figure 1 in Appendix A). However, when he reduced the range of acceptable GPA scores to 3-4 (representing a graduate program with more stringent acceptance requirements), the magnitude of correlation between GPA and Success was diminished ($R = .25$) (see Figure 2 in Appendix B). When the range was further reduced to 3.2-4, the relationship between GPA and Success was eradicated ($R = 0$) (see Figure 3 in Appendix B). Similarly, as children are selected from a narrowing range of ages and abilities, the more difficult it becomes to show a strong correlation between parent report and language sample.

The results of another study of parent report and child grammar, which was conducted by Heilman et al. (2005), demonstrates a similar statistical occurrence. A sample of 100 30-month-olds, consisting of both late-talkers and children with typical language skills, were examined. All 37 of the CDI: WS "Complexity" items were used as a measure of parent report on grammar (Heilman et al., 2005). Various cut-off scores (in the form of percentile ranks) on the CDI: WS parent report measure were used to create an array of likelihood ratios. In other words, they examined how well a child's percentile rank on the "Complexity" section of the CDI could be used to accurately

classify him as a late-talker or as having typical language abilities (see Table 2). Again, it is evident that it is much easier to identify children whose abilities place them at the extremes of the standard distribution. When a child achieved a midrange score, the parent report tool became much less adept at accurately labeling him as affected or unaffected.

Table 2

TABLE 6..Additional measurement properties at three CDI cutoffs.

Percentile	Sensitivity	Specificity	PPV	NPV
11th	0.68	0.98	0.96	0.81
19th	0.81	0.79	0.10	0.89
49th	1.00	0.44	0.51	0.91

Note. PPV= positive predictive value; NPV = negative predictive value.

(Heilman et al., 2005)

The current study aims to improve upon the CDI: WS's ability to accurately sort the children whose grammar abilities fall within the far less sharply-defined low to low-average range. The methods for the current study build directly upon the findings of Bryant (2003). Bryant (2003)'s study was focused on the emergence of tense-marking, so her subjects were controlled for expressive vocabulary size (≥300 words) to increase the likelihood that the sample included children who were already beginning to use the tense marking morphemes of interest. The subjects of the current study will be controlled for age (36 months) because the focus is to determine if parents can validly assess productivity of tense marking in 3-year-olds (see Table 1 for a comparison of Bryant

(2003)'s and Block (2006)'s sample characteristics). The tense composite used in the current study is taken directly from Bryant's recommendations, and consists of 5 items found on the Helping Verbs portion of the CDI and 4 items found on the Grammatical Complexity portion of the CDI.

The research questions examined in this study include:

1. Is there a relationship between the productivity scores based on the language sample analysis and the parent report tense composite score?
2. What PRTC cut-off score yields the best sensitivity and specificity indices relative to the children's original status at 24 months (low-average language ability vs. at-risk for SLI)?
3. How accurately can the PRTC score (determined by answering question 2) classify children as affected and unaffected, relative to language sample productivity cut-off score established in Hadley & Short (2005)?

II. METHOD

Database

All data for the current study was drawn from an archival database (see Hadley & Short, 2005; Hadley & Holt, 2006 for complete description). The database contains a sample of 22 children observed every three months between 2 and 3 years of age. All children were recruited from the DeKalb, IL county and surrounding counties. Parents of potential participants were asked to complete the *Language Development Survey* (Rescorla, 1989). Children included in the study came from exclusively English-speaking

households and had no more than six cases of otitis media by two years of age. Only children with relatively slow vocabulary growth were eligible for the study, operationalized at two years of age as an expressive vocabulary of 120 words or less for boys and an expressive vocabulary of 150 words or less for girls. To be included in the study children were also required to have: (a) no history of neurological, emotional, or behavioral impairments; (b) pass a hearing screening by a certified audiologist (c) no oral-motor dysfunction.

Participants

Of the 22 children, 16 were identified as at-risk for SLI. To be included in the "at-risk" group a child had to display at least two of four criteria, which included scoring below the 16th percentile on the receptive portion of the Test of Early Language Development-3 (TELD-3; Hresko, Reid, & Hamill, 1999); scoring below the 16th percentile on the MCDI vocabulary portion (MCDI-WS; Fenson et al., 1993); scoring below the 16th percentile for mean length of utterance (MLU; Miller & Chapman, 1981); reporting a positive family history of language, speech, or learning disabilities (Lewis & Freebairn, 1993; Rice, Haney & Wexler, 1998) and/or enrolling in early intervention for language prior to the study (Hadley & Short, 2005). The other six children were considered to have low average language abilities. They displayed one or fewer of aforementioned risk factors (Hadley & Short, 2005).

Procedure

Parents' assessments of their children's use of tense morphemes were obtained from the CDIs completed at the time of a comprehensive evaluation at 36-months. It is important to point out that the parents were not asked to explicitly focus upon this set of

morphemes. As such, the instructions parents were given for completing the CDI are provided first, followed by a description of the computation of the Parent Report Tense Composite (PRTC).

The instructions on the Vocabulary Checklist portion of the CDI are as follow: "Children understand many more words than they say. We are particularly interested in the words your child SAYS. Please go through the list and mark the words you have heard your child use ..." (Fenson et al., 1993). There are 680 words on the checklist parents must consider. On the Grammatical Complexity portion of the CDI, parents are presented with two similar sentences, one being more grammatically complex than the other. The instructions for this section are as follows: "In each of the following pairs, please mark the one that sounds MOST like the way your child talks right now. If your child is saying sentences even longer or more complicated than the two provided, just pick the second one," (Fenson et al., 1993).

Parent Report Measure: The parent report tense composite (PRTC) used in this study was comprised of nine items found on the CDI. These items were based upon Bryant's (2003) previous recommendations. Five forms of copula BE found in the "Helping Verbs" portion of the Vocabulary Checklist (i.e., *am, are, is, was, and were*) and 4 items from the Complexity portion of the Sentences and Grammar section were used. (Regular past-tense *led: Doggie kissed me, Daddy picked me up; auxiliary BE: Baby is crying; and auxiliary DO: Where did mommy go?*).

All parent report forms were examined by hand, recording a 1 or 0 for each of the nine parent responses. A 1 was recorded when the parent reported the presence of a word form. If the word was not marked, a score of 0 was recorded. For the complexity items,

one point was awarded when the parent marked the more complex sentence (indicating the use of the tense morpheme). If the less complex form was marked, a 0 was recorded. If neither sentence was marked, a score of 0 was also recorded. The scores corresponding to the parent responses were summed, with the possible scores ranging from 0 to 9.

Language Sample Measure. The scores on the PRTC were compared to the archival productivity scores based upon longitudinal language samples (Hadley & Short, 2005; Hadley & Holt, 2006). The productivity score was computed from all sufficiently different uses of five tense morphemes (i.e., third person singular present, past, copula BE, auxiliary BE, auxiliary DO) that appeared cumulatively in the longitudinal language samples obtained between 24 and 36 months of age. For the majority of children, this reflected approximately 40 minutes of caregiver-child interaction obtained every three months (See Hadley & Short for a complete description).

The Productivity Score was calculated from computerized analysis of the spontaneous language samples, extracting all uses of the tense morphemes of interest. Because the Productivity Score was derived from language samples taken at each of the 5 measurement points, the score reflects a cumulative measure. The Productivity Score was determined by summing the child's sufficiently different use of each grammatical form (Hadley & Short, 2005). In order for a form's use to be considered sufficiently different, it was required to meet certain requirements: *Is* and *led* had to be produced on at least two different lexical verbs (i.e., one use of "jumped" and one use of "walked" would earn a child one point); at least two different subject-tense marker combinations were required for auxiliary DO & BE and copula BE; the auxiliary and copula forms could appear in a nominal, but not pronominal, contraction (Scarborough, 1990). The maximum number of

points that could be earned for each grammatical form was 5; therefore, the Productivity Scores could range from 0 to 25 (5 forms x 5 different uses = 25).

Reliability. Two individual raters computed the PRTC scores. Given 22 children and 9 items per child, both raters identified 2178 items as present or absent. The two raters agreed on 2172 of the judgments (99.7% interrater reliability). The six coding disagreements were examined and corrected before any data analysis was completed.

Results

PRTC "Helping Verbs": For the 22 children, the mean scores for copula BE were: .59 for *am*, .45 for *are*, .64 for *is*, .5 for *was*, .32 for *were*; the mean score for copula total was 2.7. The range of scores encompassed the full range of possible scores (0-5), with the mean score achieved also being the arithmetically average score.

PRTC "Complexity": The mean score for *kissed* was .59; the mean score for *picked* was .55; the mean *led* total score was 1.1. Children achieved the full range of possible scores (0-2). The mean score for auxiliary DO was .73; the mean score for auxiliary BE was .55; the mean total auxiliary score was 1.3. The children achieved the full range of possible scores (0-2).

PRTC Total Scores: The mean PRTC total score was 4.9. Children earned the full range of possible scores (0-9).

Productivity Score: The mean Productivity Score was 11.0. No child earned the maximum score of 25; the scores ranged from 0-24.

Table 1

Participant		COP total	led total	AUX DO	AUX toE	PRTC total	Productivity Score (Hadley & Short, 2005)
				did	~s		
LA	1204	5	2	1	1	9	20
LA	1208	2	2	1	1	6	18
LA	1218	5	2	1	1	9	24
LA	1226	5	2	0	1	8	15
LA	2219	3	2	1	1	7	16
LA	2221	5	2	1	1	9	12
AR	1102	3	2	1	1	7	24
AR	1106	2	2	0	0	4	8
AR	1109	5	2	0	1	8	12
AR	1110	1	0	0	1	2	0
AR	1111	0	2	1	0	3	13
AR	1112	0	0	0	0	0	16
AR	1113	0	0	0	1	1	1
AR	1116	0	0	0	0	0	1
AR	1122	1	2	0	1	4	4
AR	1123	0	0	0	0	0	5
AR	2105	4	1	1	1	7	17
AR	2114	2	0	1	1	4	7
AR	2115	2	0	1	1	4	14
AR	2125	5	2	1	1	9	14
AR	2129	3	0	1	1	5	1
AR	2130	2	0	0	0	2	1
total		60	25	16	12	108	243

LA= Low-average language ability (status at 24 months)
AR= At-risk for SLI (status at 24 months)
PRTC= Parent Report Tense Composite (taken from the CDI: WS)

To answer the first question, the PRTC composite scores were compared to the Productivity Scores using a Pearson product-moment correlation coefficient. The PRTC scores were tabulated and compared to the Productivity Scores. A moderately-strong positive correlation was found to exist between the two measures ($r = .69$).

To answer the second research question, each child's classification as low-average or at-risk was compared to his or her status at the outset of the study. A PRTC cut-off score of 6 was determined to yield the best sensitivity and specificity indices, relative to the children's original status (At-Risk vs. Low Average), determined at the outset of the Hadley and Short study (2005). The cut-off PRTC score of 6 resulted in 75% sensitivity and 100% specificity. A cut-off score of 7 yielded the same sensitivity, but worse specificity (see Table 3).

Table 2

		GOLD STANDARD	
		(Original Status)	
		LA	AR
P R T C	LA	6	4
	AR	0	12

Table 3

Cut-off score	Sensitivity	Specificity
6	12/16 = 75%	6/6 = 100%
7	12/16 = 75%	5/6 = 83%

Finally, the third research question was addressed. The classification of children as affected or unaffected via the PRTC cut-off score of 6 was compared to the classification affected or unaffected as determined by the Productivity Score cut-off of 15 (see Table 3). There were 4 classification disagreements. The subjects who were disagreed upon were 2221, 1109, 1112, and 2125. A discussion of these disagreements is in the following section.

Table 3

IPRTC cut-off score (6) vs. 2Productivity Score (15)	Total
Agree Cat-risk!lat-risk)	11
Agree Clow-average/ ² 10w-average)	7
Disagree Cat-risk! ² 10w-average)	1
Disagree Clow-averagePat-risk)	3

Discussion

Young children whose language abilities fall within the realm of below average to low-average are remarkably difficult to differentiate from one another. In early stages of language development, when normally developing children display a wide range of abilities, it is especially difficult to identify those children at risk for persistent language impairment. Parent report is a desirable method for assessing the emerging language systems of young children, due to parents' ability to report on a cumulative history of their child's behavior (Dale, 1991). The earlier children are identified, the earlier intervention can be implemented. Early identification and intervention of all disabilities, including language disorders such as SLI, are consistent with current federal mandates. A clinical marker approach, namely non-mastery of tense marking, has been demonstrated to be a highly accurate means of identifying children with SLI at 5 years of age (Rice & Wexler, 1996).

However, at age 5 children are entering kindergarten and are expected to have mastered tense marking. If children could be identified as at-risk for SLI at 3 years of age, there would be time for intervention to occur before the beginning of formal schooling. There is robust evidence for parents' ability to validly report on the grammar of their young children (Dale, 1991; Thal et al., 1999; Bryant, 2003; Heilman et al., 2005), including those with typically-developing language abilities and those with disordered language. The findings of this study further indicate that items from the CDI: WS could be modified in such a way that allow clinicians to cost- and time-effectively screen for this condition.

The research of Hadley & Short (2005) indicates that productivity of tense marking in 36-month-old children is a characteristic that differentiates children at-risk for SLI from those with low-average language abilities with acceptable sensitivity and specificity. The purpose of this

study was determine if items from an existing parent report tool could be used to assess the productivity of tense marking in 3-year-olds. Data from a longitudinal late-talker study was used for this purpose. The information parents gave regarding their children's ability to mark verbs for tense (specifically, 4 items from the "Complexity" portion of the CDI: WS and 5 items from the "Helping Verbs" portion of the CDI) was compared to the cumulative measures taken from language samples derived from naturalistic caregiver-child interactions. The parent report results (PRTC) were compared to Productivity Scores (a measure created by Hadley and Short (2005), taken from the language sample).

Parent Report for Tense Marking: A moderately strong correlation was found between the PRTC scores and Productivity scores ($r=.69$). This is consistent with the findings of previous studies, which compared parent report for child grammar to the conventional gold standard of language sample analysis (see Table 1 in the "Grammar is Important for Identification of SLI" section for comparisons of correlations) (Dale, 1991; Thal et al., 1999; Bryant, 2003; Heilman et al., 2005). Parents were generally able to attend to the grammatical constructs their children were using at the time.

Parent Report for Productive Tense Marking: For a child to be considered to be productively using a form, he had to score at 6 or higher on the PRTC; the way in which a child could be considered to be using a form productively was to score a 15 or higher on the Productivity Score, which was derived from the cumulative language sample (Hadley & Short, 2005). There were 4 children whose PRTC scores did not reflect the same degree of productivity as the Productivity Score did (see Table 1).

Table 1

ID#	Status at 24 months	PRTC score	Productivity Score	/s<<	/ed*	/ed+	AUX DO*	AUX DO+	AUX BE*	AUX BE+	COP *	COP+
2221	AR	9 (LA)	12 (AR)	3	2	2	1	1	1	1	5	5
1109	AR	8 (LA)	12 (AR)	4	2	2	1	1	0	0	5	5
1112	LA	0 (AR)	16 (LA)	4	0	3	0	3	0	1	0	5
2125	AR	9 (LA)	14 (AR)	3	2	1	1	4	1	1	5	1

*As reported by the parent on the 36-month CDI
 +As reported from the cumulative language sample

Parent Underreporting: One of the disagreements between PRTC and Productivity Score was clearly caused by parent underreporting. Child 1112 achieved a PRTC of 0; however, his Productivity Score was 16 and he was originally classified as having low-average language abilities at 24 months of age (Hadley & Short, 2005). This child's parent did not report him using *led* at all, and yet he was found to be using the form productively 4 times in the language sample (Hadley & Short, 2005). Similarly, the parent did not report that the child had used auxiliary *be* or *do* at 36 months; the child achieved a Productivity Score of 3/5 for auxiliary *do*, indicating that he was regularly using the form. Language sample analysis measures indicate he did use auxiliary *be* once. Finally, this child's parent did not report him as using any forms of copula *be*; his Productivity Score indicates his use of this form was fully productive. This was the only instance of such pronounced patterns of parent underreporting. As such, this was considered an isolated occurrence and was not considered to be indicative of a trend of underreporting.

Parent Report for Copula BE vs. Auxiliary BE & DO: In the other three instances of disagreement, the PRTC score indicated the child was using the tense marking system productively, but the Productivity Score did not (see Table 1). All three of these children received a total copula PRTC score of 5. On the CDI: WS "Helping Verb" section there are 5 questions that pertain to forms of copula *be* (*am, are, is, was, were*). Conversely, there are only two items, found on the "Complexity," portion, which pertain to auxiliary forms (number 15, "Baby *is* crying," and number 22, "Where *did* mommy go?"). The CDI provides explicit examples of each form of copula *be*, effectively informing the parent of all the ways in which the child could use copula *be*. Conversely, in the "Complexity," section the parent is provided with a highly specific example. This may lead the parent to believe he or she is expected to report on only the form provided (only *is* and *did* and not other forms, such as *was* or *does*); or perhaps because each form is not explicitly listed, those parents who are not familiar with verb forms simply did not know to include all forms (*was, were, am, is; do, does, did*). The way in which the parent is asked to report on copula *be* versus the way in which he is asked to report on the auxiliary forms may inflate the child's score without representing the child's ability to use the entire tense-marking system.

It has been demonstrated that children with SLI can simultaneously have average MLUs and inadequate tense-marking systems (Hadley & Rice, 2006). Therefore, a future tool would have to give the parents a chance to adequately report on structures or patterns of usage that would distinguish children at risk from SLI from those with simple delay. Of particular interest is auxiliary *be*, because it is a later-emerging form and tends to be particularly difficult for children with SLI to adequately acquire and use, in relation to other tense markers (Hadley & Rice, 2006).

Suggestions for a Parent Report Tool: The results of this study indicate that the CDI: WS could be adapted to assess the productivity of tense marking in young children with 100% specificity, but only 75% sensitivity. As such, it is highly recommended that the items used in the tense composite be adapted in order to create an instrument that would be capable of sorting children at risk for SLI from children with low average but typically-developing language abilities with improved accuracy.

The format of a future tool could be designed so that all forms of auxiliary *be* and *do* were represented, as they are for copula *be* in the helping verbs section. This would provide parents with explicit examples of the way in which each form could be used. This could be done within the format of the "Complexity" section, in which the parent is given two different sentence choices. If each form of auxiliary *be* and *do* were expanded in this recognition format, the parents may be able to more adequately report on the extent to which their child is using the forms. Because children typically develop auxiliary *be* and *do* later than all the other forms assessed, persistent nonemergence of those forms has been suggested to be an especially sensitive measure of a protracted emergence of tense marking (Rice & Wexler, 1996).

Hadley and Short (2005) found that when the Productivity Score and Productive Type Total score were used as dual criteria for productivity, the specificity was increased from 83% to 93%. This approach measures both the "depth" (the child's ability to productively use a single morpheme) and "breadth" (evidence that the child is beginning to use all of the morphemes in the tense marking composite productively) (Hadley & Short, 2005; Hadley, 2006). An instrument that was capable of measuring both of these aspects of emerging tense marking systems could possibly be highly sensitive and specific to those children at risk for SLI.

In order to achieve this, the CDI would have to be expanded and modified. The ability to measure a child's ability to productively use any morpheme (as measured by the PRTC) would have to be coupled with an ability to measure his emerging ability to use the entire tense marking system productively (Hadley & Short, 2005). In order to do this, the instrument would have to have items distinguishing between the emergent productive use and the fully productive use of each morpheme. Within a sentence recognition format, examples of emergent productivity could be provided ("The bottle is wet"), as well as examples of more masterful productive use ("The bottles are in the sink"). Bryant (2003), made similar recommendations, suggesting that different types of sentences be used (declarative vs. non-declarative).

The CDI: WS is a good base, for which one could build a new tool, aimed at identifying those children at-risk for SLI with improved accuracy. The findings of this and other studies regarding the CDI and child grammar suggest that there are items from that tool that are suitable for assessing child grammar in children with language delay; with the proper modifications, a new tool, highly sensitive to the productivity of tense marking, could be developed. Such a tool could allow parents to report on their child's behavior and allow a clinician to hone in on those tense marking characteristics that distinguish children with SLI from children with simple language delay; this could be done in a fraction of the time it would take to elicit and analyze a language sample. Identification and intervention for children who are at risk for SLI at age three would be a highly instrumental step in improving the language abilities of affected children.

APPENDIXA

Table 1

Participant	COP	COP	COP	COP	COP	COP total	led	led	led total	AUX BE	AUXDO	AUX total	PRT C total	
	Am	are	is	was	were		kissed	picked		is	did			
LA	1204	1	1	1	1	1	5	1	1	2	1	1	2	9
LA	1208	1	0	1	0	0	2	1	1	2	1	1	2	6
LA	1218	1	1	1	1	1	5	1	1	2	1	1	2	9
LA	1226	1	1	1	1	1	5	1	1	2	0	1	1	8
LA	2219	0	1	1	1	0	3	1	1	2	1	1	2	7
~A	2221	1	1	1	1	1	5	1	1	2	1	1	2	9
AR	1102	1	1	1	0	0	3	1	1	2	1	1	2	7
AR	1106	0	1	1	0	0	2	1	1	2	0	0	0	4
AR	1109	1	1	1	1	1	5	1	1	2	0	1	1	8
AR	1110	1	0	0	0	0	1	0	0	0	0	1	1	2
AR	1111	0	0	0	0	0	0	1	1	2	1	0	1	3
AR	1112	0	0	0	0	0	0	0	0	0	0	0	0	0
A/	1113	0	0	0	0	0	0	0	0	0	0	1	1	1
AR	1116	0	0	0	0	0	0	0	0	0	0	0	0	0
AR	1122	1	0	0	0	0	1	1	1	2	0	1	1	4
AR	1123	0	0	0	0	0	0	0	0	0	0	0	0	0
AR	2105	1	1	1	1	0	4	1	0	1	1	1	2	7
AR	2114	0	0	1	1	0	2	0	0	0	1	1	2	4
AR	2115	0	0	1	1	0	2	0	0	0	1	1	2	4
AR	2125	1	1	1	1	1	5	1	1	2	1	1	2	9
AR	2129	1	0	1	0	1	3	0	0	0	1	1	2	5
AR	2130	1	0	0	1	0	2	0	0	0	0	0	0	2
Tot.		13	10	14	11	7	60	13	10	25	12	16	28	108

AR=At-risk	1= form present
v=Low Average	0= fonD. absent

APPENDIX B

Figure 1: Correlation of undergraduate GPA with Success in the field, $R = 0.71$

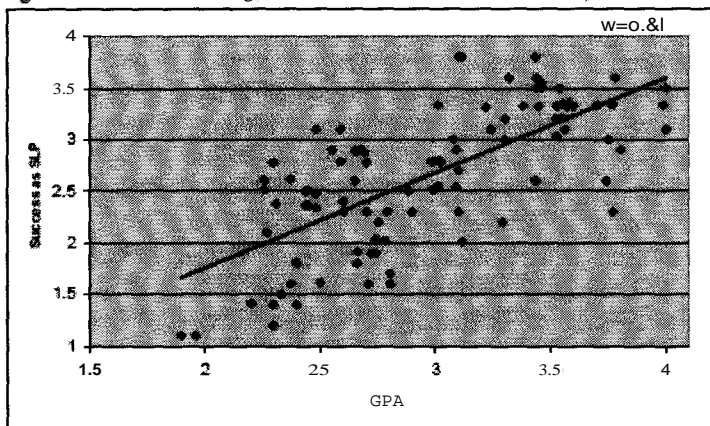


Figure 2: Correlation in the restricted range of GPA from 3.0 to 4.0, $R = 0.25$

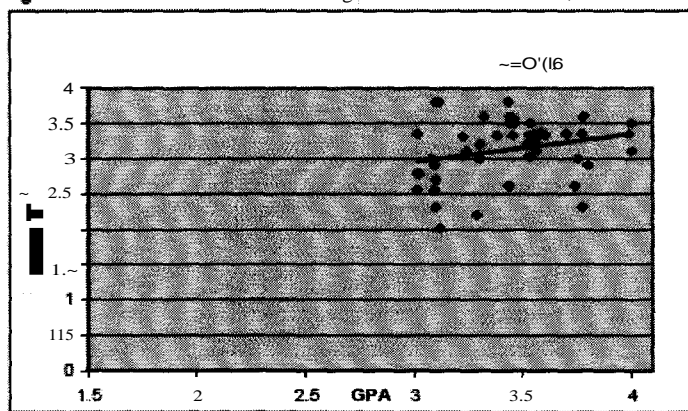
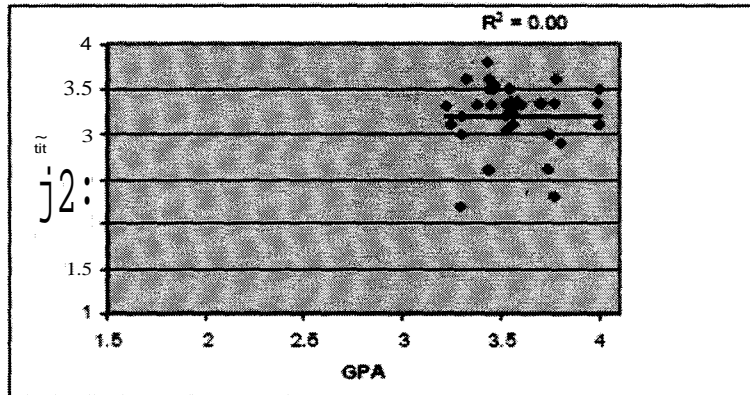


Figure 3: Correlation in the restricted range of GPA from 3.2 to 4.0, $R = 0$



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