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The development of morphosyntactic ability in atypical populations: The acquisition of tag questions in children with early focal lesions and children with specific-language impairment

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Abstract

We examined the development of some features of morphosyntactic ability, specifically the acquisition of auxiliaries and use of agreement marking, along with sentence processing capacity. We used a conceptually simple task called the Tags Question Task, which is a method for evaluating a number of language processes in the production of a commonly used, familiar linguistic device. We compared the performance of children with early focal lesions ($N = 21$), children with specific-language impairment ($N = 24$), and typically developing children ($N = 24$) matched in age and nonverbal ability; additional analyses involved comparisons of children matched on performance level. The data converge to support a "delayed" development of language behavior in our clinical groups, as overall patterns of performance and age-related changes on individual tag features and tag questions were strikingly similar in all three groups across a number of methods of comparison. Implications for theories of the development of brain–language relationships as they pertain to early focal brain damage, specific-language impairment, and the language acquisition process in typically developing children are discussed.

Keywords: Morphosyntax; Specific-language impairment; Language acquisition; Early focal brain injury; Tag questions; Plasticity

1. Introduction

Comparing the language behavior of children with specific-language impairment (SLI) and children who have sustained early focal brain damage (FL) provides a unique window from which to consider many fundamental issues in both the neural and functional organization of language. While children with SLI have no overt anatomical abnormalities or specific lesions that might be linked to their impairments, they exhibit a number of language deficits that are quite similar to patterns seen among adult aphasics who have suffered a clear neurological insult. Competing accounts of SLI have proposed a range of mechanisms: knowledge deficits, missing or malfunctioning components of grammar, or reduced processing capabilities as the source of this developmental difficulty. In contrast, children who have sustained focal brain damage early in infancy do have clear and localizable anatomical abnormalities, yet their language difficulties are more subtle, if non-existent, on many measures.

In the literatures of both the hemispheric specialization for language and the nature of specific-language impairment, the use of grammatical morphology has been a primary focus of inquiry. Using the Tags Question Task (Dennis, Sugar, & Whitaker, 1982), this study examines the acquisition of morphosyntactic abilities in the

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context of tag questions (You like ice cream, *don't you*?) in school-aged members of each of these populations and their typically developing peers. The production of tag questions involves some of the most well-studied components of English grammatical morphology. The gradual acquisition of this syntactic structure depends on not only the mastery of specific-morphological markers, but also coordinating those features simultaneously in an online, processing-intensive task. The hypothesized relationship between deficits in grammatical morphology and other language abilities in accounts of SLI and language functioning in children with early unilateral focal brain lesions provides a context for predicting the performance of each of these groups of children on tag questions. Results will be examined in light of: (1) the acquisition of individual tag features and tag questions in typically developing children, (2) the presence of qualitative deficits in children with SLI and children with early focal brain lesions on any aspect of tag questions, and (3) the quantitative differences in terms of the rate and quality of atypical language development.

1.1. Organization of language functions

The adult aphasia model has served as a point of reference in examining the language behavior of these children with early focal brain lesions. Specifically, children with early left-hemisphere damage were hypothesized to display similar difficulties to those observed in adults with comparable anatomical damage sustained in adulthood. To the extent that these deficits are similar, the earlier development of the left hemisphere is believed to be dominant for language functions. Deficits on language measures are also observed in studies of children and adults with right-hemisphere damage, most often in the use of non-literal language, metaphor, and discourse. Results such as these are often considered in accounts of hemispheric specialization. Some have argued that the integrity of specific-anatomical regions is required for the reliable function of certain language processes, suggesting the existence of distinct "modules" for varying aspects of language behavior.

The question of the existence of functional subdivisions within the language domain has also been investigated in studies of language performance of children with SLI. There is now substantial evidence that children with SLI have a relative weakness in the acquisition and use of grammatical morphemes. This weakness has been observed in children's performance on language production tasks, in which children with SLI often produce forms of nouns and verbs that lack the appropriate grammatical morphology. For example, children with SLI often use a verb without the obligatory third person agreement marking—*s* (*he buy* for *he buys*) in a context that requires such marking (Bishop, 1994; Rice & Oetting, 1993). Children with SLI also lag behind their age-matched peers in their mastery of the English auxiliary system (Cleave & Rice, 1997; Rice & Wexler, 1996). Such language forms have led to the comparison of the linguistic deficits in SLI to those observed in adults with aphasia.

According to some linguistic accounts of SLI, these core deficits can be attributed to a defective or missing grammatical module that is responsible for morphosyntactic markers, such as tense and agreement. For example, the Extended Optional Infinitive account identifies inherent knowledge-based difficulties with tense marking and auxiliary selection as a defining feature of this disorder (Rice & Wexler, 1996). In earlier work, Gopnik (1990) claimed that SLI deficits arise out of "feature blindness" to certain morphological constructions such as those involved in English tense, aspect, and agreement. Linguistic accounts of SLI explicitly or implicitly postulate the functional autonomy of a language "module" that is dedicated to grammatical morphology. However, such linguistic accounts of SLI primarily differ as to which grammatical markers are encompassed within this division and the scope of deficits that the dysfunction of such a module would entail. Both children with SLI and those with early left-hemisphere damage are hypothesized to have difficulties in grammatical morphology, although children with early left-hemisphere damage do not show the severity of deficits that are exhibited by children with SLI (Vargha-Khadem, O'Gorman, & Watters, 1985; Woods & Carey, 1978). Nevertheless, the comparison of the language behavior of these children may speak to the question of the existence of distinct language modules. If language "breaks down" in a similar way in two etiologically distinct populations, we would have further support for functional and perhaps, neurological subdivisions of language processes. As an example, if children with SLI and children with early left-hemisphere damage were to show selective deficits in the domain of morphology, while demonstrating intact performance on measures of syntax, it might be argued that these data support the existence of a "morphology" module and a "syntax" module.

1.2. Plasticity

Studies of children with early unilateral brain lesions have produced varying estimates of the onset and duration of observed language deficits. Some studies describe a pattern of early delays relative to age-matched peers that appear to resolve by the time these children reach school-age (Marchman, Miller, & Bates, 1991; Reilly, Bates, & Marchman, 1998). However, some studies have found that older children with early focal brain lesions show delays on higher-order or more complex language tasks compared to their same-age peers (Reilly, Weckerly, & Wulfeck, in press). Numerous patterns of language deficits across development are possible, including: (1) a longer course of normal

language acquisition, (2) deficits in the early stages of acquisition that diminish with increasing age, and (3) intact early language performance with evidence of deficits on more complex operations of language.

The onset and course of deficits is also a topic of discussion in the study of children with SLI, whose language performance has often been likened to the immature language observed in younger children (Leonard, 1998; Leonard, Camarata, Rowan, & Chapmpan, 1982). In many investigations, children with SLI are matched to (younger) TD children who have attained a similar level of language production, frequently measured in terms of Mean Length of Utterance (Cleave & Rice, 1997; Conti-Ramsden, Donlan, & Grove, 1992; Kelly & Rice, 1994; Rom & Bliss, 1981; Watkins & Rice, 1991). Qualitative differences in performance between children with SLI and older *or younger* TD children have been taken as evidence of "deviant" language organization, while quantitative deficits in the language of children with SLI measured against age-matched or younger typically developing children are more compatible with a picture of language delay.

The comparison of language behavior across development in these two clinical groups broadens the discussion of the nature of neural plasticity. Children with SLI are defined by their language behavior, while children with early focal brain lesions are defined by the residual neuroanatomical abnormalities that are evident long after injury was sustained. Although imagining studies have revealed neuroanatomical abnormalities in children with SLI (Jernigan, Hesselink, Sowell, & Tallal, 1991; Plante, Swisher, Vance, & Rapcsak, 1991), differences thus far are not comparable to the gross structural alterations verified in the FL group. Most agree that the neuroanatomical substrates that underlie the dysfunction in SLI are likely to be diffuse and probably evident in more fine-grained analyses of neural architecture. Considering that these two populations represent distinct groups in terms of neuroanatomical features, the language outcome of these populations has many implications for the study of the neural underpinnings of language behavior.

1.3. Language acquisition

Although there is considerable variability in the onset and duration of various stages of language acquisition, studies of typically developing children reveal a fairly orderly progression of the acquisition of simple to increasingly complex language functions. There is wide variability in the combinatorial abilities of children learning language and the acquisition of grammatical morphemes in word combinations begins early in language development. Brown (1973) was among the first to study syntactic and morphosyntactic development. He found that as soon as MLU approaches 2.0, or when children are consistently producing two-morpheme utterances (for example, *more cereal*), they are beginning to untangle the use of grammatical morphemes. Brown (1973) examined longitudinal data collected from the spontaneous speech samples from three children and tracked the acquisition of some of the most important closed-class items in English and found that children acquired these morphemes in the same order. For example, mastery over present progressive suffixes preceded the correct use of contractible and uncontractible forms of the copula and auxiliary verbs. deVilliers and deVilliers (1973) replicated Brown's findings with 21 children. From this line of research, it is generally accepted that English grammatical morphology develops in a more or less unchanging, predictable order.

There is far less known about the language acquisition process in atypically developing children, where deviations from the typical pattern could be evident in the rate and/or quality of the acquisition process (Johnston & Schery, 1976; Leonard et al., 1982; Rice & Bode, 1993; Weeks, 1975; Weiss, Leonard, Rowan, & Chapman, 1983). Measuring language development in atypically developing children tells us not only how "fixed" the acquisition process is, but also about how aspects of language functioning might be operating in the case of typically developing children. Ultimately, these results may help assess how both developmental changes in typical and atypical language behavior relate to the organization of language functions presumed to be operating in the "endstate" model of mature language users.

2. Tag questions

English speakers often append a tag question at the end of a declarative statement used to solicit confirmation from the listener (i.e., You have two daughters, *don't you*?). The tag question is a frequently used linguistic device, and as such, children are familiar with the pragmatic function that tag questions serve, and they have at least receptive familiarity with their use. While producing a tag question places relatively few demands on the speaker in terms of motor output (two words), it involves the analysis of a number of components of the stimulus clause, perhaps holding some of this information in working memory, and then synthesizing and transforming these features into the tag question. The Tags Question Task (Dennis et al., 1982) consists of 48 declarative statements, and in each of these the child is required to repeat the main clause statement followed by a tag question. In 24 primes, the main clause subject is a pronoun (*I* can play the guitar), with equal numbers of *I*, *you*, *he*, *she*, *it*, and *they*. In the other 24 sentences, children must correctly pronominalize the main clause subject in the tag question (The birds are building a nest,

aren't they?). As a tag question requires the use of an auxiliary verb, sentences are divided equally in targeting either the auxiliary verbs *do*, *be*, or *can*. Both *do* and *be* require agreement marking, whereas the auxiliary verb *can* is uninflected for number and person. Finally, half of main clause sentences were in the affirmative, and half were negative, appearing with *not* with the verb or with the adverb *never*.

The analysis of tag question production offers a number of measures of some of the fundamental elements of English morphology, such as agreement marking and auxiliary selection, along with measures of subject selection and polarity, as well as the simultaneous processing and coordination of these components. The overall number of correctly produced tag questions can be considered a measure of how well the various tag features were synthesized and coordinated in the response. In this sense, the production of tag questions offers "tests" of both linguistic knowledge and language processing. Thus, the Tags Questions Task is especially well-suited for the investigation of language development in typically and atypically developing children. Based on previous findings of the language behavior of children with SLI, children with early focal lesions, and typically developing children, a number of predictions can be generated about each group's performance on the Tags Task with the aim of organizing the interpretation of results in relation to some of the broader theoretical issues discussed above.

3. Predictions about the acquisition of tag questions in typically developing children

In the original Tags Question study (Dennis et al., 1982), 50 typically developing children ranging from 6 years of age to age 14 were administered the Tags Task. Consistent with the results of normal language acquisition studies, Dennis et al. found that features of correct tag production were mastered at different ages. Children's performance on the dimensions of subject selection and agreement marking on the auxiliary continued to show improvement at every age, in line with the finding that children master agreement marking for third person present tense forms before they fully master the use of auxiliaries or pronouns (Brown, 1973). In contrast, measures of polarity revealed that this aspect of tag production proved to be difficult even in the oldest age groups, compatible with the observation that the acquisition of negation in conjunction with auxiliary verbs is attained well after mastery of most grammatical morphemes (Bellugi & Brown, 1964; de Villiers & de Villiers, 1973).

The original Tags study did not explicitly test performance on the individual tag features compared to the number of completely correct responses. However, it seems reasonable to assume that performance on each of the individual features would be better than rates of totally correct tag questions. The acquisition of the morphological markers represented in tag features would be expected to precede the abilities necessary for the simultaneous coordination of a number of features, especially if tag features are acquired at different rates. We hypothesize that as the ability underlying the simultaneous coordination of multiple features improves, the number of correctly produced tags should approach rates of (mean) performance on individual tag features. In other words, younger typically developing children will score lower on overall total correct compared to their mean performance on tag features, while older children will score comparably on total correct and on the averaged tag features.

4. Predictions of group comparisons

4.1. SLI

It will be of particular interest to gauge the performance of children with SLI on tag features that target grammatical morphology in the context of additional ongoing linguistic analysis and amid strenuous processing demands. Based on competing accounts of SLI, if the morphological deficits are primarily attributable to deficits in grammatical knowledge for particular morphological markers such as agreement or auxiliary selection, we might hypothesize that children with SLI will demonstrate deficits compared to TD children on auxiliary and agreement, while their performance on polarity may be intact. In the comparison of within-group profiles of performance (performance on features in relation to each other), we hypothesize that children with SLI will perform disproportionally worse on agreement and auxiliary than their performance on features such as polarity and subject when compared to the profiles of typically developing children.

4.2. FL

If children with early focal brain lesions are delayed in their acquisition of grammatical morphemes (Bates et al., 1997; Stiles & Thal, 1993; Thal et al., 1991), we might predict that from an early age, their performance on tag features and tag questions as a whole will be poorer than that of typically developing children. The difficulties observed in younger children may resolve by the end of school-age, as children with early focal brain lesions "catch up" on the grammatical morphemes tested in tag features (Reilly et al., 1998). However, deficits of children with early focal lesions may be in terms of more general language processing limitations, and such diminished capacity might only be apparent in a

comparison with the performance of older typically developing children on a complex language task, as the Tags Task arguably is. In this scenario, we might hypothesize that older typically developing children have become more efficient and sophisticated language users, whereas children with early focal lesions lack sufficient language processing resources to achieve comparable facility on more difficult tasks. Given that there is evidence for both delays in the acquisition of some grammatical morphemes as well as comparative deficits on higher-order tasks, we predict that children with early focal brain lesions will show deficits in overall correctly produced tag questions across development.

We might expect that children with left-hemisphere damage will perform below children with right-hemisphere damage on features such as agreement and auxiliary. As early right-hemisphere brain damage is associated with greater delays on tasks that require integration of multiple sources of information (Reilly et al., 1998; Stiles, Stern, Trauner, & Nass, 1996, 1993, 1997), we might also predict that children with early right-hemisphere damage will perform worse than children with left-hemisphere damage on tag features that require more global analysis of the prime sentence such as polarity or subject selection.

5. Predictions about atypical language development

As well as comparisons between clinical groups and age-matched controls, there is interest in comparisons with younger typically developing children, as these will indicate whether or not any impairment corresponds to a simple delay. As the processing demands of tag production may exceed processing capacity, especially for younger children as well as for atypically developing children, qualitative differences in performance between either children with SLI or children with early focal lesions and *younger* typically developing children could be used to evaluate the question of whether the language of atypically developing children is "deviant" or simply delayed. A finding of "deviant" language, or dissimilar patterns of acquisition, may suggest an organization of language that includes a malfunctioning "morphology module" along with the mechanisms related to other tag features that are operating normally. In contrast, finding a pattern of performance that is qualitatively similar to patterns of acquisition observed in younger typically developing children with a similar overall score on the Tags Questions Task would support the idea of language delay. Given the number of tag features and the number of potential dissociations that might be observed, we predict that atypically developing children will demonstrate a different profile of strengths and weaknesses for tag components not observed in younger typically developing children who achieve the same overall score. A summary of predictions is shown in Table 1.

6. Materials and methods

6.1. Participants

Participants in this study were monolingual English-language speaking children with specific-language impairment (SLI), children with focal brain lesions (FL), and typically developing children serving as controls (TD) from the Center. Children from the three study populations were ages 4–16 years and were divided into three age groups: 4–7, 8–11, and 12–16 years. Before being recruited for the study, children underwent careful screening to ensure that they had hearing and vision (corrected) within normal limits and that they met specific-selection criteria for their group. Parents of typically developing children first completed medical, developmental, and educational questionnaires to verify that their child had a normal developmental and educational history and was performing at grade level in a regular classroom. In addition, control children underwent testing to ensure that they were performing within normal limits in language and cognition.

The SLI group, recruited from area speech-language pathologists, psychologists, and physicians had a documented-language impairment. They were tested and had to meet the following selection criteria: (1) performance IQ (PIQ) of 80 or higher; (2) no major neurologic abnormalities; (3) expressive language composite score 1.5 or more standard deviations below the mean using the CELF-R (Semel, Wiig, & Secord, 1987); and (4) absence of known developmental disorders such as mental retardation or autism.

Table 1
Summary of predictions by clinical group

Group	Tag features	Overall correct	Pattern of performance (vs. score-matched peers)
Children with SLI	SLI < TD on agreement, auxiliary SLI = TD on subject, polarity	SLI < TD at every age	Agreement, auxiliary < subject, polarity
Children with FL	LHD < RHD on agreement, auxiliary RHD < LHD on polarity	FL < TD at every age	LHD: agreement, auxiliary < subject, polarity RHD: no difference

Children in the FL group were recruited from area pediatric neurologists and pediatricians and had the following characteristics: (1) documented evidence of a unilateral left or right-hemisphere focal lesion, in most cases consistent with stroke; (2) lesion onset was prenatally, perinatally or within the first 6 months of life; and (3) identification of lesion site was based on CT, MRI or both.

All children included in this study were administered the WISC-R or WISC-III within 18 months of the Tags Question Task testing. While children with SLI by definition meet selection criteria with respect to adequate performance IQ (PIQ), there are no such selection criteria for children with early focal lesions. Instead, these children are defined by their neurological impairment and we have no a priori reason to exclude individual children with early focal lesions from the study based upon PIQ. Table 2 shows age ranges and non-verbal intelligence and language standard scores of our groups.

6.2. Task administration

For children over age 8, a task administrator introduced the Tags Question task by explaining that there a number of ways to say things, followed by a sample declarative statement, such as "*He has a pen.*" A task administrator continued by adding that when one is not sure of something, the same statement might be said, "*He has a pen, doesn't he*?" After the presentation of another sample main clause, the examiner asked the child to pretend he or she is unsure about the statement and to repeat the sentence according to the demonstration (i.e., with a tag question). For younger children, these same instructions were introduced using two puppets. When the administrator was able to elicit a tag question in the response, all children practiced on nine sample items before attempting the 48 target sentences of the Tags Task.

Children were reminded to repeat the entire prime clause before they produced a tag question. If the child was unable to produce varying responses to at least five of the practice items after extensive training and feedback, the task was discontinued. In other words, the administrator stopped the protocol if the child gave only one answer (*isn't it*?) for each of the practice items. The task was also discontinued if the child repeatedly (five or more times) gave only the tag question as a response or refused, or was unable to repeat some version of the prime sentence before the tag. The child was given every opportunity to perform this task; the task administrator continuously offered feedback and encouragement by saying *You're good at this*!" or "*That was a hard one, try another*". If the child's answer was incorrect, a correction was offered once (on practice trials only). If a child misunderstood or did not hear the prime sentence, items were repeated once. Children were helped in every way possible before concluding that they were unable to do the Tags Question task. All prompts and repeated items were noted in session transcripts. Responses were transcribed and scored by research assistants trained on the Tags Questions procedures.

6.3. Scoring

The individual tag features (auxiliary, polarity, subject, and agreement) were scored as described below. The overall number correct was calculated for each child's protocol. In order to be scored as correct, a response not only had to be correct in terms of tags features, but could not include errors of tense (*will they*?), inversion (*they don't*?), failure to produce the contracted form of the auxiliary plus negative marker (*do not* they?), or the addition of extraneous material (*Why doesn't he*?). Errors in the repetition of the main clause were not analyzed in the scoring of The Tags Task. All tag responses were tallied independently for each of the features: auxiliary, polarity, subject, and agreement. Hence, for each response, a child may have been able to generate a correct response in terms of the choice of auxiliary and local agreement, but incorrect in terms of polarity and subject. *Auxiliary* was scored according to

Table 2
Descriptive features of children with SLI and FL and typically developing children

	Age	PIQ	Expressive	Receptive	CELF Total
SLI ($N = 24$)	9.0 [2.4]	104.8 [11.8]	70.0 [7.7]	78.1 [9.3]	72.5 [7.3]
4–7 years ($N = 8$)	6.6 [0.5]	102.3 [11.3]	73.9 [9.0]	84.3 [6.0]	78.1 [7.2]
8–11 years ($N = 11$)	9.1 [0.9]	104.4 [11.4]	68.9 [7.8]	78.2 [7.1]	72.0 [4.9]
12–16 years ($N = 5$)	12.8 [1.1]	110.0 [14.4]	66.0 [3.1]	69.2 [11.2]	65.6 [5.6]
FL ($N = 21$)	8.6 [3.2]	97.5 [17.5]	80.9 [17.4]	90.8 [16.7]	85.1 [17.8]
4–7 years ($N = 8$)	5.5 [1.2]	100.6 [18.3]	93.5 [20.9]	101.7 [19.4]	97.8 [21.7]
8–11 years ($N = 8$)	9.6 [1.2]	92.3 [21.1]	72.1 [10.8]	82.7 [9.8]	76.1 [9.4]
12–16 years ($N = 5$)	13.0 [1.0]	100.6 [11.3]	78.2 [13.8]	89.0 [16.6]	82.2 [15.3]
TD ($N = 24$)	8.6 [3.0]	105.5 [12.1]	90.2 [8.8]	101.1 [11.1]	95.0 [10.0]
4–7 years ($N = 9$)	5.7 [0.5]	101.2 [11.5]	81.0 [2.1]	92.5 [5.6]	85.0 [3.9]
8–11 years ($N = 9$)	8.7 [1.0]	107.1 [11.5]	92.4 [8.7]	101.6 [9.6]	96.8 [8.1]
12–16 years ($N = 6$)	13.0 [3.0]	109.3 [12.1]	96.2 [5.9]	109.0 [12.3]	95.0 [10.0]

whether children used the correct auxiliary verb (*do*, *be*, or *can*), regardless of whether the form occurred in the right tense or matched in agreement markings with the subject. *Agreement* was scored according to whether the auxiliary matches in agreement with the subject produced in the tag, regardless of whether it is the correct subject. In other words, agreement was scored as correct if the auxiliary and the subject agree in the limited context of the tag question only. *Polarity* was scored according to whether the child produced an auxiliary verb in the tag with the negation marker *not*, in contracted form. *Subject* was scored according to whether the correct pronoun appeared in the tag response. Examples of scoring on tag questions are shown below. Each child's response set was tallied for number correct on each of the four features, the number of errors of tense, inversion, or the addition of extraneous words, as well as the number of completely correct responses.

He takes the morning train, *don't he*? (correct auxiliary, subject, polarity; incorrect agreement)	He takes the morning train, *isn't he*? (correct agreement, subject, polarity; incorrect auxiliary)
He takes the morning train, *doesn't she*? (correct auxiliary, agreement, polarity; incorrect subject)	He takes the morning train, *does he*? (correct auxiliary, agreement, subject; incorrect polarity)

7. Results

Not all children involved in the Center study were able to complete the Tags Questions Task. A much larger percentage of children with SLI and children with early focal lesions were unable to complete the Tags Task compared to TD children at younger ages. Although a number of children with SLI were tested at age 4 and 5, we did not find valid Tag protocols from any child with SLI under the age of 6. Children with SLI as old as 9 years were not able to perform the task, while nearly all of typically developing children past the age of 5 years were able to perform the task. Of the children who were able to successfully complete the Tags Task, children with SLI and typically developing children (TD) were then matched one-to-one on age and PIQ; pairs of subjects were no more than two years difference in age and attained PIQ scores with no more than a 5 point difference. Twenty-four subjects with SLI and TD subjects were successfully matched. Although children with SLI were matched one-to-one on PIQ and age, typically developing children were on average 1–2 years younger in this age group. This inequality was unavoidable. As there were comparatively fewer children with FL tested, no attempt was made to match on PIQ with the other two groups. The Tags protocol of children with early focal lesions protocols were selected according to availability of IQ data and age at testing. Three of 19 children with early focal lesions had PIQs below 80 (two scores missing). In the present study, 21 children with FL, 11 with left-hemisphere damage (LHD) and 10 with right-hemisphere damage (RHD) participated. No significant differences in age or PIQ between groups were observed on tests using a one-way (ANOVA).

Results from the Tags Question Task are presented according to the predictions outlined in the introduction. For all measures, where violations of normality were discovered, corrections were attempted by examining the kurtosis and skewness values of each distribution before and after transformations to scores (logarithmic transformation). Separate analyses of performance on overall total correct and pattern of performance on the individual

Table 3
Mean number correct with standard deviations out of 48 on tag features by group

	Total	Auxiliary	Agreement	Polarity	Subject
SLI ($N = 24$)	16.4 [6.2]	40.0 [8.0]	41.1 [7.2]	25.0 [3.6]	38.1 [7.0]
4–7 years ($N = 8$)	14.0 [3.3]	42.3 [4.1]	42.4 [3.5]	23.0 [2.7]	37.8 [6.4]
8–11 years ($N = 11$)	15.3 [6.4][a,b]	38.2 [10.3]	38.9 [9.5]	25.2 [3.6][a]	36.5 [7.3]
12–16 years ($N = 5$)	22.8 [5.9][a,b]	40.6 [7.7]	43.8 [5.2]	27.8 [3.6][a]	42.4 [6.9]
FL ($N = 21$)	24.4 [11.3]	1.9 [7.5]	42.3 [8.4]	30.2 [3.6]	43.2 [7.0]
4–7 years ($N = 8$)	19.3 [11.1]	39.5 [10.5]	40.0 [11.8]	26.5 [6.4]	42.5 [4.5]
8–11 years ($N = 8$)	24.1 [9.2]	42.4 [5.4]	42.3 [6.5]	30.5 [5.5]	41.5 [7.8]
12–16 years ($N = 5$)	33.4 [10.8][c]	45.0 [3.7]	46.2 [2.4]	35.6 [9.6]	47.0 [1.4]
TD ($N = 24$)	29.7 [14.2]	42.5 [10.2]	43.7 [8.1]	33.9 [10.0]	42.6 [8.3]
4–7 years ($N = 9$)	17.6 [0.3][d]	36.1 [14.5]	38.8 [11.6]	26.2 [3.7]	38.3 [11.5]
8–11 years ($N = 9$)	30.9 [9.8][d]	45.3 [3.5]	45.8 [3.1]	33.1 [8.9]	43.7 [4.8]
12–16 years ($N = 6$)	46.2 [3.1]	48.0 [0.0]	48.0 [0.0]	46.7 [2.8]	47.5 [0.5]

[a] SLI vs. TD, $p < .001$.
[b] SLI vs. FL, $p < .05$.
[c] FL vs. TD, $p < .05$.
[d] TD-age 1,2 vs. TD-age 3, $p < .001$.

tag features were conducted. Summary scores for all groups on tag features are shown in Table 3.

8. Group comparisons on tag features

8.1. SLI

Collapsed across tag features, no differences were observed in comparisons of the youngest children with SLI and TD children, while children with SLI in the older age groups scored below their age- and PIQ-matched peers. Children with SLI generally scored within the same range as age-matched typically developing children on the tag features of auxiliary, agreement, and subject. A test of group at each feature at each age revealed that typically developing children outscored children with SLI only on measures of polarity. Furthermore, both SLI and TD children scored significantly lower on polarity than they did on each of the other tag features (see Fig. 1). In other words, children with SLI did not show a profile of disproportionally poorer performance on agreement and auxiliary compared to subject and polarity.

8.2. FL

No significant differences in performance between right-hemisphere-damaged and left-hemisphere-damaged children were observed on any measure of the Tags Question Task. For all of the remaining analyses, data from children with RHD and children with LHD were collapsed into a single group representing children with early focal lesions (FL). No differences in performance on individual tag features (or across features) were observed in the comparison of children with early focal lesions and typically developing children in any age group.

All three groups demonstrated the same ranked order of difficulty across tag features, scoring lowest on polarity responses and highest on agreement, with performance on auxiliary and subject falling in between (see Fig. 2). All children across all ages almost always score highest on agreement. At every age and group by age comparison, children scored worst on polarity. Children with SLI and children with FL scored significantly lower on polarity than they did on the other three tag features across all ages, while only the two younger age groups of typically developing children showed a disproportionally poorer performance on polarity. It is interesting to note that typically developing children's responses on polarity show a significant improvement by the oldest age group (ages 12–16, ages 8–11, ages 4–7), while neither clinical group demonstrated significant improvement on polarity in within-group comparisons of age.

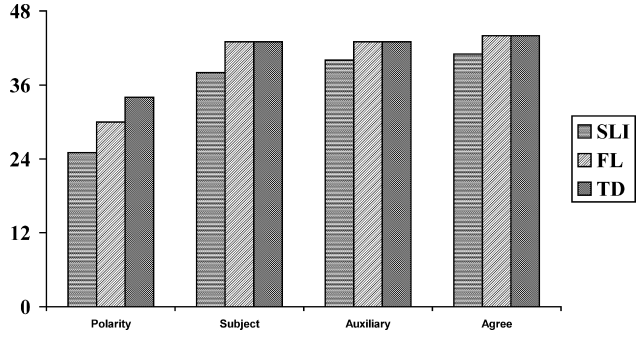

Fig. 1. Accuracy rates on agreement and polarity for all groups.

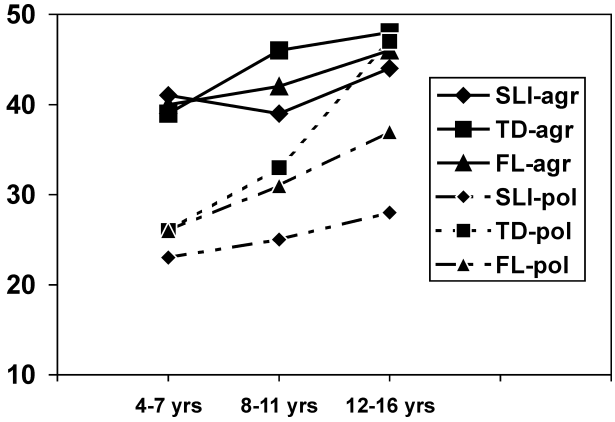

Fig. 2. Ranked order of difficulty of tag features by group.

9. Performance on overall correct

No significant differences were observed between groups for overall total correct at the youngest ages. At ages 8–11, typically developing children and children with early focal lesions score higher on overall total correct than children with SLI. In the oldest age group (ages 12–16), the TD group outscores both clinical groups, with children with early focal lesions outscoring children with SLI.

Recall that scoring procedures specified that in order to be counted as correct, a response required not only the appropriate tag features (auxiliary, agreement, polarity, and subject), but also the absence of other kinds of errors, such as tense (They aren't buying the car, *will they*?) and inversion errors (They don't like apple pie, *they don't*?), the production of an uncontracted tag in the negative (They don't like apple pie, *do not* they?), or the addition of extraneous material (He doesn't like apple pie, *why doesn't he*?). Tense was not explicitly included in the analysis of tag features, because all primes were in the present tense, and many children in all groups scored near or at ceiling on this tag feature. Because violations of normality could not be corrected by transformation, no analysis of variance was attempted.

Table 4
Summary of results based on initial predictions

Group	Tag features	Overall correct	Pattern of performance (vs. score-matched peers)
Children with SLI	SLI = TD for youngest children SLI < TD on all features for 8–11 years SLI < TD on polarity for over 12 years	SLI < TD at every age	No difference in profile of performance
Children with FL	No differences between LHD and RHD	FL < TD at oldest age	No difference in profile of performance for LHD or RHD

A qualitative analysis of error types reveals that some children in all three groups made errors in tense of the auxiliary in the tag question. Four of the TD children (17%), five of the children with FL (24%), and eleven of the children with SLI (46%) made errors in tense marking on the auxiliary verb used in the tag question. Roughly the same number of children in each group made errors at the youngest ages. No typically developing children above 7 years made errors in tense, while three children with FL and five children with SLI in the 8–11 age group made such errors. In contrast, rates of inversion and extraneous errors are similar across groups.

10. Atypically developing language

The pattern of performance across tag features of each clinical group was compared to the younger group of TD children (i.e., performance of children with SLI, FL ages 12–16 vs. performance of TD children ages 8–11, etc.). The overall total correct of each group in the comparison was roughly equivalent, as no significant differences between paired comparisons were observed (one-way ANOVA, all $p < .1$). A MANOVA analysis with 4 levels of a within-subjects factor of feature (auxiliary, agreement, polarity, subject) and a between-subjects factor group was conducted for each clinical group (SLI or FL vs. score-matched controls) with no significant feature by group interaction ($p < .10$), indicating that both groups were similar in the level and pattern of performance on tag features. A summary of results corresponding to initial predictions is presented in Table 4.[1]

11. Discussion

The Tags Question task proved to be an informative way of tracking the acquisition of a number of morphosyntactic processes in the context of gradual mastery of tag questions. It was not until after 11 years of age that the performance of typically developing children began to approach ceiling level. Responses on the Tags Task from adult English speakers would be important in the ultimate determination of "tag mastery." In this section, we will return to each of our original predictions. The implications of our findings for broader issues in the study of SLI, the language outcome of early focal brain injury, and the language acquisition process in these atypically developing children will be discussed.

11.1. Group comparisons

We predicted that children with SLI would score lower on overall tags correct compared to TD group at each age comparison. We found that the youngest children with SLI did not score significantly lower on overall correct than the youngest TD children. It could be that there is considerable variability in performance on the Tags Task for all younger children, such that significant differences in performance are difficult to detect. Another possible explanation is that although children with SLI were matched one-to-one on PIQ and age, typically developing children were on average 1–2 years younger in this age group. This inequality was unavoidable, as a much larger percentage of children with SLI and early focal lesions were unable to complete the Tags Task compared to TD children at younger ages.

Linguistically based accounts of SLI most often attribute language difficulties to some form of knowledge deficit of morphological markers (Clahsen, 1989; Gopnik, 1990). Based on these accounts, we hypothesized that the Tags Question Task is precisely a language form in which underlying deficits in a particular aspect of grammatical development would be most apparent. Specifically, we predicted that children with SLI would demonstrate deficits on agreement and auxiliary relative to TD children, while their performances on subject and polarity would be intact. The results of the performance of children with SLI on tag questions provides some evidence for deficits relative to peers on some tag features, but agreement, the most classic aspect of grammatical morphology, as a source of particular difficulty

[1] The patterns of performance described in this study were consistent with the findings of the same analyses in a larger sample of children from these populations who were not matched on PIQ. These results have not been reported elsewhere.

in SLI is not supported. Group differences in performance were not observed on measures of agreement or auxiliary, whereas children with SLI consistently demonstrated deficits in polarity compared to peers.

Similarly, we hypothesized that not only are there many patterns and dissociations possible in the Tags Questions Task, but that a profile of performance within tag features that somehow reflected a disproportional difficulty with agreement marking would support the notion of specific deficits in grammatical morphology. We hypothesized that children with SLI would show a profile of poorer performance on agreement and auxiliary compared to subject and polarity. We found the opposite pattern. Features such as agreement and auxiliary selection were most robust to the challenges of multiple feature coordination, while performance on polarity suffered to a greater degree than the other tag features.

Both a pattern of early deficits that gradually disappear and a pattern of deficits observed at older ages on more complex language tasks have been found in studies of the language development of children with early focal brain lesions. Given the multiple dimensions of the Tags Task, we hypothesized that both patterns might be observed and predicted that children with FL would perform lower than TD children on overall correct at every age. In the youngest age group, children with FL perform comparably to their same-age TD peers. However, in this cross-sectional dataset the middle age FL group show a performance disadvantage. In the adolescent group, performance is significantly lower than for the TD children on correctly produced tags, but still better than for the SLI group. As performance on polarity tended to drive scores on overall total correct for all groups, there was also a trend for older children with FL to perform below age-matched peers on number of correct polarity responses. While children with FL scored comparable to controls on many tag features, performances on polarity and overall correct provides some evidence of the presence of deficits on more complex operations of language.

Within the FL group, we predicted that children with left-hemisphere damage would perform more poorly on agreement and auxiliary compared to children with right-hemisphere damage, while children with right-hemisphere damage would perform worse on polarity and overall correct. We did not find any differences in performances as a function of site of lesion. This could be an issue of statistical power. Yet, significant differences in performance were observed in other group comparisons in this data set with similar numbers of subjects in each group, similar to findings on a narrative task. While there are statistical procedural differences in the comparisons in question, it does raise the point of effect size or the existence of true differences given that not even slight trends in performance as a function of site of damage were apparent. Issues of the presence of very subtle deficits and insufficient statistical power notwithstanding, the Tags Task appears to elicit a strikingly similar pattern of responses to the demands of multiple feature coordination for a variety of children hypothesized to have aberrant brain organization and/or atypical language behavior.

11.2. Deviant vs. delayed language

Patterns of performance of both age-matched and younger TD children are crucial in characterizing the language acquisition process in our two clinical groups. Clear age-related changes were evident in the examination of totally correct tags. Typically developing children demonstrated consistent improvement, whereas clinical groups did not show significant improvement at any age comparison. Although all groups start off scoring within the same range at the youngest ages, both children with SLI and children with early focal lesions score below TD children at ages 12–16 years. In terms of changes on individual tag features, we found that there were no differences in how groups performed over age on the features of agreement, auxiliary, and subject. However, there were group differences in the acquisition of polarity. All groups scored within the same range at younger ages, but TD children showed significant improvement for the oldest age group, whereas the rate of improvement on this tag feature in either of our clinical groups did not reach significance. Hence, if performance on any one feature is suggestive of dissimilar age-related changes across groups, it is polarity.

We also predicted that atypical children would demonstrate a different profile of strengths and weaknesses for tag components that is not observed in age-matched or younger TD children. There were a number of potential patterns of performance among the individual features that could have been observed among our groups. Yet, more than anything, the overall pattern across groups was strikingly similar. All groups make similar errors with the same ranked difficulty. As well, all groups scored lowest on polarity and highest on local agreement, with remaining features showing basically the same ranked order of difficulty. In terms of the analysis of other errors (i.e., tense, inversion), we found that all children make all types of errors. This suggests that all children experienced difficulties in analyzing and synthesizing tag features in a similar way.

As discussed earlier, polarity shows the most protracted development compared to the other morphosyntactic features in studies of typical language acquisition. In many ways, it should not come as a surprise that of the various features investigated in the Tags Question Task, performance on polarity was the measure that most distinguished our groups. We found that younger TD children perform significantly lower on

polarity compared to the other tag features, whereas older typical children make few polarity errors, but errors occur with the same frequency as on the other tag features. Both clinical groups, however, make more polarity errors than on other features at every age comparison. In other words, whereas TD children appear to "outgrow" their relative weakness on polarity, children in our clinical groups show consistent difficulties on this feature. The profile of performance across tag features in our clinical groups is the same pattern that we observed in a younger group of typically developing children.

These findings are consistent with the notion that what is harder for typically developing children is even harder and more protracted in atypical language development. Both Leonard (1998) and Tomblin and Pandich (1999) have proposed that what appears to be deviant language performance may be accounted for by a more protracted course of mastery for those features that are hardest for TD children. These findings also underscore the importance of the task-dependent nature of linguistic knowledge. Looking at language behavior across tasks and under varying processing demands is a more ecologically valid representation of language performance, as the generative nature of linguistic forms and the range of functions subserved by these forms means that any given linguistic form can be found in a number of contexts.

12. Conclusions

For many years, comparing the outcome of left-sided brain damage to results of homologous injuries on the right was the only avenue of investigation of brain–language relationships. It is a logical backdrop from which to consider the evolution of the brain–language relationships that we observe in adults. The seemingly qualitative differences in language ability we observe in adults as a function of site of damage are not apparent in the performances of school-age children with similar injuries sustained at or just after birth.

The picture emerging in this study is that both clinical groups demonstrate a protracted development of mastery of tag questions, but the pattern of this lengthier acquisition departs little from the pattern of acquisition that we observe in typically developing children at younger ages. In the acquisition of tag questions, it appears that the analogous language-learning starting point with regard to children with early left-sided focal lesions does not appear to culminate in morphosyntactic ability comparable to the results found in adult aphasics, who purportedly have sustained very similar neuroanatomical damage later in life.

We might tentatively conclude that the continually emerging snapshot of language ability in children with SLI is more similar to that of aphasics who have sustained left-hemisphere damage in adulthood, whereas children with left-hemisphere damage fare better than their adult counterparts. Although we are far from a precise neurological characterization of SLI, these results are consistent with the notion that the consequences of the biological substrates of this disorder for language acquisition seem to be far greater than those that result from substantial early brain damage in either hemisphere. At the very least, relationships between linguistic deficits and features of brain abnormalities take various forms from early development to adulthood. Our data suggest that all children appear to be "solving" the tag quandary with similar strategies and compromises. As a next step, our new studies comparing adults with left- or right-hemisphere damage, and adults with a history of developmental language disorder on the Tags Task should further our understanding of the relationship between "processing" factors vs. "knowledge" factors in both fully developed and developing language users.

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