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## The Acquisition of Tense and Agreement Morphemes by Children with Specific Language Impairment During Intervention: Phase 3

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### Abstract

**Purpose**—The goals of this investigation were to determine whether gains in the use of tense and agreement morphemes by children with specific language impairment (SLI) during a 96-session intervention period would still be evident one month following treatment, and whether these treatment effects would be greater than those seen in children with SLI receiving otherwise similar treatment that did not emphasize tense and agreement morphemes.

**Method**—Thirty-three children with SLI (age 3;0 to 4;8) served as participants. The children participated in one of three treatment conditions. The conditions emphasized third person singular *-s*, auxiliary *is/are/was*, or general language stimulation. The children's use of third person singular *-s*, auxiliary *is/are/was*, and past tense *-ed* was assessed through probes administered throughout treatment, and one month later.

**Results**—The children in the conditions that targeted third person singular *-s* and auxiliary *is/are/was* showed significant gains on their respective target morphemes and these gains were maintained one month later. These gains were significantly greater than the gains seen on the same morphemes by the children receiving general language stimulation. For most children, use of the target morphemes did not approach mastery levels by the end of the study.

**Conclusions**—Intervention that emphasizes morphemes that mark both tense and agreement can be relatively successful, with gains still apparent at least one month following intervention.

This report presents data from the third phase of a research project on the acquisition of tense and agreement morphemes by children with specific language impairment (SLI) during intervention. The first two phases were presented in this Journal by Leonard, Camarata, Brown, and Camarata (2004) and Leonard, Camarata, Pawłowska, Brown, and Camarata (2006).

In the previous studies (Leonard et al., 2004; Leonard et al., 2006), children with SLI aged 3 to 4 years participated in one of two treatment conditions. One condition focused on the target morpheme third person singular *-s*; the other condition centered on the target morphemes auxiliary *is/are/was*. (Hereafter, children assigned to these conditions are referred to as the 3S and AUX children, respectively.) All of the children showed limited or no use of these morphemes prior to treatment. Other developmentally appropriate morphemes used rarely if at all by the children were also monitored during this period, but

were not included in the intervention activities. In each treatment session, children heard a story (acted out with toys and props) containing 12 examples of the target morpheme. Following the story phase, the child and clinician played with the toys and the clinician provided 12 recasts of the children's preceding utterance, each including a conversationally appropriate example of the target morpheme.

In the first study (Leonard et al., 2004), it was observed that after 48 intervention sessions, both the 3S and AUX children made significantly greater gains in the use of their respective target morphemes than on the other morphemes being monitored. In addition, each group showed greater use of both third singular *-s* and auxiliary *is/are/was* than another tense-related morpheme being monitored, past tense *-ed*. Because past tense *-ed* involved tense but not agreement, Leonard et al. speculated that the finding of greater use of both third person singular *-s* and auxiliary *is/are/was* than past tense *-ed* might have been due to the fact that the target for both the 3S and AUX children involved agreement as well as tense (hereafter, tense + agreement), and treatment focused on the target may therefore have facilitated children's awareness of these two features, leading to gains in the non-target morphemes that shared both features. In contrast, because past tense *-ed* shared only the tense feature with the target, it benefited significantly less from treatment.

Another major finding from the Leonard et al. (2004) study was that, for most children, gains were rather modest, despite 24 presentations of the target in each of 48 treatment sessions. This finding was further investigated in the second study (Leonard et al., 2006), in which treatment was extended from 48 sessions to 96 sessions. In other respects, the procedures remained the same as in the earlier Leonard et al. (2004) study. The results showed continued improvement in the use of the target and related morphemes. However, even after 96 sessions, many children's gains fell well short of mastery. Average use of the target form changed from approximately 30% after 48 sessions to approximately 50% after 96 sessions. For the children whose pre-treatment use of the target was 0%, use of the target after 48 sessions was approximately 25% with use increasing to approximately 45% after 96 sessions. Leonard et al. (2006) concluded that, at least with the approach that was employed, gains in tense + agreement morphology are hard won, and perhaps influenced greatly by maturation over and beyond treatment.

In this paper, we provide a third report that constitutes both an extension and an expansion of the previous investigations. The expansion is the addition of a treatment condition that was not employed in the earlier studies. In this condition, children received the same types of stories and recasts as in the 3S condition, but with no emphasis on grammatical morphology. If the children assigned to this condition made gains on the morphemes reflecting both tense and agreement that were as large as those seen for the children in the other conditions, the evidence would suggest that tense + agreement morphemes do not require focused intervention attempts. Instead, broad-based language intervention (without emphasizing tense + agreement morphology) might be sufficient to produce changes in the use of these morphemes.

The element in this paper that represents an extension is our assessment of the children's use of the grammatical morphemes one month following the termination of treatment. Recall that in our previous work, the gains made by many of the children were rather modest, even after 96 intervention sessions. The substantial number of children who fell short of mastery raises the possibility that the gains observed were only transient, constituting modifications that did not reflect insights that the children incorporated into their linguistic systems. We evaluated this possibility by assessing the children's use of the target and non-target morphemes one month after treatment concluded. By comparing the children's use of these morphemes at this point relative to their use immediately after treatment, we could

determine whether the gains were maintained or, alternatively, dropped to levels that approximated their pre-treatment use.

## Method

### Participants

Thirty-three children who completed all 96 treatment sessions and returned one month later for testing served as participants. From this larger group, we selected 8 children from each of the three conditions (3S, AUX, general language stimulation, see below) whose pretreatment scores on third person singular *-s* and auxiliary *is/are/was* were very low and highly similar. For past tense *-ed*, we found 7 children in each group who formed excellent matches. Somewhat different sets of children were used for the comparisons involving the three different morpheme types, for several reasons. First, for five children, we lacked a score for one morpheme type for one time period. Two additional children had pretreatment scores for third person singular *-s* (27%, 42%) that were dramatically higher than those of the remaining children. The same was true for another child's pretreatment score for auxiliary *is/are/was* (21%), and still another child's pretreatment score for past tense *-ed* (40%). Of the remaining cases, if more than one child might have been selected as a close match for the morpheme of interest, we selected the child whose pretreatment scores on the other morphemes were closest to the children in the other condition. This strategy was employed to guard against the possibility that differences in children's progress with the target morpheme were due to unintended differences in the children's pretreatment ability with the other morphemes. As can be seen in Tables 1, 2, and 3, the children in the three conditions were closely matched on their pretreatment scores. At the beginning of the study, the children ranged in age from 3;0 (years; months) to 4;8, with a mean age of 3;6. Seven of the children were girls, and 26 were boys. All of the children were raised in a monolingual English-speaking home. Two of the children were African American and the remaining children were non-Hispanic Caucasian. The pre-, mid- and post-treatment data for 17 of these children (10 3S and 7 AUX) were reported in Leonard et al. (2006). For these children, the new data reported here are the data from the one month post-treatment probes. The remaining children have not been included in previous reports.

All children met the customary selection criteria for SLI and also met criteria established specifically for this study. Each child passed a hearing screening, had no episode of otitis media in the 12 months prior to their enrollment, they scored well within the "Non-Autistic" end of the continuum on the Childhood Autism Rating Scale (CARS, Schopler, Reichler, & Renner, 1988), and scored from 83 to 127 ( $M = 106$ ) on the Leiter International Performance Scale – Revised (LIPS-R, Roid & Miller, 1997). All children showed at least 80% accurate use on a 53-item screening test of word-final /s/, /z/, /t/, and /d/.

The children exhibited a significant limitation in expressive language ability as measured by both the Structured Photographic Expressive Language Test – Preschool (SPELT-P, Werner & Krescheck, 1983) and Developmental Sentence Scoring (DSS, Lee, 1974). All children scored below the 10<sup>th</sup> percentile on each of these measures. Although the children's grammatical skills were quite limited, each child showed evidence of some degree of use of noun plural *-s* and/or progressive *-ing*. The two African American children showed 0% use of auxiliary *was* on our probes (described in the next section), a morpheme that is obligatory in African American English.

### Probe Tasks

The probe tasks employed in this study are described in detail in Leonard et al. (2004) and Leonard et al. (2006). Each probe task employed toys and props that were acted on and

described in a manner designed to create obligatory contexts for the children's use of the target grammatical morpheme. The probe tasks for third person singular *-s* and past tense *-ed* consisted of 12 items each. For the auxiliary *is/are/were* probe task, 6 items were used for each of the three auxiliary forms.

The probes were administered to the children immediately prior to treatment (hereafter, Time 1), after 48 treatment sessions (Time 2), after 96 treatment sessions (Time 3), and one month after the Time 3 probes (Time 4). The individual who transcribed the probe responses was not aware of the treatment condition to which a child was assigned and therefore did not know which morpheme type, if any, served as the target. A judge who had not taken part in the probe sessions scored the children's probe responses.

Transcription reliability was evaluated by randomly selecting the recordings from 15 children and having them transcribed a second time by an independent judge. Separate calculations were made for auxiliary *is*, *are*, and *was* as well as for third person singular *-s* and past tense *-ed*. Percentages of agreement across the children ranged from 90% to 98%. The percentages across the grammatical morphemes ranged from 95 (for auxiliary *is*) to 98 (for auxiliary *was*).

### Treatment Conditions and Procedures

The children were assigned to one of three treatment conditions. One condition emphasized third person singular *-s*; a second condition focused on auxiliary *is/are/was*, and the remaining condition was a general language stimulation (GLS) condition. All assignments were made without regard to the children's ages, test scores, or pre-treatment levels of use of either third person singular *-s* or auxiliary *is/are/was*. As described in detail in Leonard et al. (2004) and Leonard et al. (2006), the method used to assign children to treatment conditions was designed to keep the personnel serving as clinicians naïve both to the hypotheses of the study and to the other (non-target) morphemes of interest.

Identical procedures were used for the 3S, AUX, and GLS treatment conditions with the exception of the choice of targets. Four treatment sessions were scheduled per week, each approximately 30 minutes in duration. Each treatment session included two types of activities. In the first activity, the clinician read a story to the child while acting out the events in the story using toys and props. The second activity took the form of the clinician providing conversational recasts of the child's utterances during play.

For 3S treatment, each story contained 12 examples of third person singular *-s*. During play, the clinician provided 12 recasts that included a third person singular *-s* form. AUX treatment followed the same pattern, with 12 examples in stories and 12 recasts provided during the play portion of the session. However, as there were three different auxiliary forms of interest (*is*, *are*, *was*), four examples of each were used in the stories and recasts for a total of 12. Details of the procedure are provided in Leonard et al. (2004) and Leonard et al. (2006).

The GLS treatment was designed to closely resemble the other treatment procedures with the important exception that specific morphemes were not targeted. We adapted the 3S stories by converting all third person singular subjects to third person plural subjects (e.g., "They walk really quickly"). The latter subjects do not require an overt inflection on the verb. Similarly, during the recasting portion of the session, the clinician provided a recast that employed a third person plural subject.

We assessed procedural validity by randomly selecting recordings for 34 treatment sessions and scoring them for accuracy of implementation. More than 98% of the words in the stories

were read accurately; likewise, over 98% of the target verbs were presented as originally scripted. The clinicians' responses to the child during the play portion of the session were designed to be conversationally appropriate but avoid the use of the non-target morphemes being monitored in the study (e.g., third person singular *-s* for the AUX and GLS children). However, we identified 65 unintended productions of this type across the 34 sessions. Considering that these sessions contained a total of 408 recasts of the target form by the clinician (34 sessions with 12 recasts each), as well as 408 productions of the target in the stories, it seems doubtful that the 65 productions of non-target morphemes reduced the impact of the treatment focused on the target.

## Results

Separate ANOVAs were performed for each of the morpheme types, third person singular *-s*, auxiliary *is/are/was*, and past tense *-ed*, using arc-sine transformations of percentages correct. Assumptions of homogeneity of variance were met. As noted earlier, the children in each condition were carefully matched on their pretreatment (Time 1) use of the morpheme serving as the dependent variable. For both third person singular *-s* and auxiliary *is/are/was*, 8 children in each condition could be closely matched. For past tense *-ed*, close matches were possible using only 7 children in each group. In Tables 1, 2, and 3, we provide the children's Time 1 scores – the basis for matching – as well as the children's scores on each subsequent probe administration.

An analysis of the children's use of third person singular *-s* revealed a significant main effect for Participant Group,  $F(2, 21) = 4.91, p = .017$ . Post-hoc (LSD) testing at the .05 level revealed that the 3S children's scores were significantly higher than those of both the AUX children and the GLS children. The latter two groups did not differ significantly. The main effect for Time was also significant,  $F(3, 63) = 17.07, p < .001$ . Post-hoc testing indicated that at each point in time, scores were significantly higher than at the preceding time point. However, both of these main effects are best interpreted in light of the Participant Group by Time interaction that approached significance,  $F(6, 63) = 1.99, p = .079$ . Post-hoc testing indicated that the only significant differences between successive points of time were seen for the 3S children (Time 1 < Time 2  $d = 3.49$ ; Time 2 < Time 3  $d = 1.00$ ; Time 3 = Time 4); for each of the other groups, only the difference between Time 1 and Time 4 was significant (for AUX children,  $d = 2.94$ ; for GLS children,  $d = 1.58$ ). Testing also revealed that at Time 1 and Time 2, the third person singular *-s* scores did not differ among the three groups. However, at both Time 3 ( $d = 1.56$ ) and Time 4 ( $d = 0.89$ ), the 3S children's scores were significantly higher than those of the GLS children. The 3S children's scores were also significantly higher than the scores of the AUX children at Time 3 ( $d = 1.34$ ). The scores of AUX and GLS children did not differ.

For the analysis of the children's use of auxiliary *is/are/was*, only Times 2, 3, and 4 were included because all children showed 0% use at Time 1. The results indicated a significant main effect for Participant Group,  $F(2, 21) = 3.81, p = .039$ . Post-hoc testing indicated that the AUX children's scores for this morpheme type were significantly higher than those of the 3S ( $d = 1.21$ ) and GLS ( $d = 1.26$ ) children. The latter two groups did not differ. A significant main effect for Time was also found,  $F(2, 42) = 9.43, p < .001$ . According to post-hoc testing, significantly higher scores were earned at Time 3 than at Time 2 ( $d = 0.82$ ), but the difference between Time 3 and Time 4 was not significant. Time 4 scores were, of course, significantly higher than those of Time 2 ( $d = 1.19$ ). The Participant group by Time interaction was not significant,  $F(2, 42) = 0.17, p = .951$ .

Recall that past tense *-ed* did not serve as a target for any of the children. Because all children's pre-treatment scores were 0 for this morpheme, only Time 2, 3, and 4 data were

included in the analysis. The main effect for Participant Group was not significant,  $F(2, 18) = 0.35, p = .710$ . Likewise, neither the main effect for Time,  $F(2, 36) = 1.92, p = .161$ , nor the Participant Group by Time interaction was significant,  $F(2, 36) = 0.94, p = .450$ .

## Discussion

One of the aims of the present study was to determine whether the facilitative effects seen immediately after treatment are still apparent one month later. This appears to be the case. The 3S and AUX children's scores on their respective target forms showed a clear increase during the intervention period and did not show a decrease in use from Time 3 to Time 4. In addition, the Time 4 scores for these children were higher than the Time 4 scores on the same morpheme types by the GLS children. We interpret these findings as reflecting facilitative effects that extended beyond the period of treatment. An assumption that treatment effects endure beyond the intervention period is certainly not a new one. However, it is useful to find empirical support for this common assumption, as was found in the present study.

The second aim of this study was to determine whether increases in the use of tense + agreement morphemes can be fostered even when intervention is of a less focused nature, and whether any such increases are comparable to those seen when overt tense + agreement morphemes serve as the target. Increases in the use of third person singular *-s* were seen by the GLS children, but these were very gradual, with the difference reaching statistical significance only when Time 1 and Time 4 were compared. After Time 1, the GLS children's use of third person singular *-s* was consistently lower than that of the 3S children. In the analysis for auxiliary *is/are/was*, the absence of a Participant Group by Time interaction did not give us a basis for singling out the GLS children's gains across time. From an inspection of Table 2, it appears that the GLS children's scores increased steadily across time. However, after Time 1, the GLS children's use of auxiliary *is/are/was* consistently lagged behind that of the AUX children. We interpret these findings as evidence for the efficacy of intervention that focuses on the use of overt tense + agreement morphemes.

In spite of the fact that scores continued to increase from Time 3 to Time 4 for the 3S and AUX children, the mean percentages of use fell well short of mastery levels. There are at least two possible reasons for the generally modest gains made by the children. The first is that our intervention program was in some way ill-designed. However, the procedures incorporated into the program – focused stimulation and conversational recasting – are associated with favorable findings in the language intervention literature, and the number of sessions per week and overall duration of the program represent relatively intensive treatment. One element not included in our procedures – opportunities for the children to produce the target morphemes – may well be an important factor and should be considered in future intervention studies.

A second possible reason for the modest gains is that tense + agreement morphemes are subject to maturational processes to a greater degree than other details of language that are frequently targeted for intervention. Certainly, this possibility is in line with Wexler's (2003) proposal that the inconsistent use of tense and agreement by children with SLI may be the result of a maturational principle that has not yet taken hold. Without this significant change in the child's maturational state, progress in this area of grammar may be limited, and the child will remain in the “optional infinitive stage” (Rice & Wexler, 1996; Wexler, 2003).

However, although we acknowledge that maturation may have played a significant role in this study, the steady if modest increases in most of the children's percentages of use of each

target morpheme suggest that gains can be made even if children have not yet acquired the knowledge that tense and agreement are obligatory in main clauses. The children's changes in degree of use across time were unidirectional (e.g., 20% to 30% to 40% rather than 30% to 20% to 40%) and therefore they do not resemble the kind of random non-developmental fluctuations that one might expect if each time period reflected the same ability level.

Future research should be directed at discovering factors that can lead to gains that exceed those reported here. Although the systematic increases in the children's degree of use of the target morphemes provide comfort that intervention is beneficial, it seems possible that alternative procedures might yield better results. In addition, it may prove to be the case that predictors of a child's readiness to acquire tense and agreement morphemes in intervention might be discovered through further research. We are currently pursuing these issues in our laboratory.

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**Table 1**

Mean percentages (and standard deviations) for each participant group on the probes for third person singular *-s*.

Participant Group	Time 1	Time 2	Time 3	Time 4
3S Children	<b>2.13 (3.94)</b>	<b>39.75 (30.44)</b>	<b>67.13 (36.08)</b>	<b>69.85 (40.55)</b>
AUX Children	2.14 (3.97)	9.33 (17.50)	20.67 (33.67)	46.02 (34.03)
GLS Children	2.10 (3.90)	10.51 (13.90)	20.46 (23.95)	32.29 (44.86)

Values appear in bold for the 3S children, as this morpheme was the target for this group.

N = 8 for each group.



**Table 2**

Mean percentages (and standard deviations) for each participant group on the probes for auxiliary *is/are/was*.

Participant Group	Time 1	Time 2	Time 3	Time 4
3S Children	0.00 (--)	4.88 (11.56)	32.88 (36.65)	36.97 (40.03)
AUX Children	<b>0.00 (--)</b>	<b>39.08 (18.09)</b>	<b>52.77 (36.79)</b>	<b>67.27 (27.91)</b>
GLS Children	0.00 (--)	10.05 (18.97)	25.69 (30.71)	35.47 (33.66)

Values appear in bold for the AUX children, as this morpheme type was the target for this group.

N = 8 for each group.

**Table 3**

Mean percentages (and standard deviations) for each participant group on the probes for past tense *-ed*.

Participant Group	Time 1	Time 2	Time 3	Time 4
3S Children	0.00 (--)	7.14 (13.11)	9.19 (8.99)	8.93 (18.70)
AUX Children	0.00 (--)	10.57 (18.50)	6.29 (12.47)	25.19 (22.30)
GLS Children	0.00 (--)	4.64 (8.22)	14.06 (24.29)	15.40 (25.20)

This morpheme was not a target for any of the participant groups.

N = 7 for each group.