Productive Morphology Skills of Children with Speech Delay

Compétences dans la production de la morphologie chez les enfants accusant un retard de la parole

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Abstract

Children's use of the plural, possessive, and regular third person singular morphemes was investigated in relation to their ability to produce the /s/ and /z/ phonemes. Twenty-three 4-year-old children with delayed expressive phonological abilities but average receptive vocabulary skills were asked to retell stories. All but 3 of the children omitted these morphemes more frequently than would be expected given their chronological age. Omission of the /s/ and /z/ phonemes occurred more frequently in inflected than uninflected words. Inclusion of the plural and third person singular morpheme was significantly correlated with mean length of utterance in words but was not significantly correlated with production accuracy for the /s/ and /z/ phonemes in uninflected words.

Abrégé

Une étude a été menée pour voir comment les enfants utilisaient les morphèmes marquant le pluriel, le possessif et la troisième personne du singulier en anglais. Cette recherche visait à vérifier leur capacité à produire les phonèmes /s/ et /z/. On a demandé à vingt-trois enfants de 4 ans accusant un retard des capacités de phonologie expressive mais ayant un vocabulaire correspondant à la moyenne de répéter une histoire. Tous les enfants, sauf trois, ont omis ces morphèmes plus souvent que ce à quoi on s'attendrait pour leur âge chronologique. L'omission des phonèmes /s/ et /z/ s'est produite plus fréquemment pour les mots fléchis que ceux qui n'étaient pas fléchis. L'inclusion du morphème pluriel et de la troisième personne du singulier correspondait largement à la durée médiane des énoncés en mots, mais n'était pas liée de manière significative à l'exactitude de la production des phonèmes /s/ et /z/ dans les mots non fléchis.

Key Words: expressive phonology, productive morphological skills, mean length of utterance, story retell task.

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Studies of morphological acquisition have particular significance to clinical work in speech-language pathology. In order to treat morphological deficits effectively it is necessary to know which children are at risk for delayed acquisition of grammatical morphemes and to have some understanding of the origin of morphological difficulties. In the case of children with speech delay (Shriberg, Austin, Lewis, McSweeny, & Wilson, 1997), the most appropriate form of treatment might depend upon the extent to which the children's morphological errors reflect their speech production errors and/or their overall morphosyntactic abilities. For example, a phonological error such as final consonant deletion will impact the production of uninflected words (e.g., *bus* → [bʌ]) and the production of all morphemes that should be appended to the ends of words such as the plural (e.g., *peas* → [pi]), the possessive (e.g., *mummy's* → [mʌmi]), and the third person singular (e.g., *ties* → [taɪ]). Other phonological

errors such as cluster reduction and stopping of fricatives will also lead to the omission or misarticulation of these morphemes. If the child fails to use these morphemes appropriately because he or she is unable to produce the associated phonological forms ([s], [z], and [əs]), one might assume that remediation of the phonological deficit will lead to spontaneous resolution of the morphological errors. In other words, teaching the child to say *bus* might also lead to correct articulation of *peas*, *mummy's*, and *ties*. Unfortunately, the clinician has very little scientific evidence on which to base the assumption that acquisition of phonological forms will generalize to morphological structures.

Paul and Shriberg (1982) suggested that treatment should focus on phonological targets when the child's morphological errors are associated with phonological processes such as cluster reduction and when the child's morphological skills are less developed than one would predict from the child's overall level of syntactic abilities. More recently, Tyler, Lewis, Haskill, and Tolbert (2002) recommended that the treatment program begin with a focus on morphology when the child presents with concomitant delays in the areas of phonology and syntax. However, no experimental studies have examined the relative efficacy of different treatment approaches in relation to children's patterns of phonological and morphological error. Furthermore, it would be premature to embark on a series of treatment efficacy studies in the absence of a solid background of descriptive research.

In contrast to the large number of studies that describe the morphological development of children with specific language impairment, we are aware of only one study that examined the expressive morphology of a large sample of children who present with speech delay (Paul & Shriberg, 1982). The purpose of the study described herein was to add to this research base with the expectation that further study of this topic will aid clinical decision making. If it can be demonstrated that these children's morphological errors are tied directly to their articulation abilities, Paul and Shriberg's treatment recommendations would be supported. On the other hand, if children with speech delay produce more morphological errors than would be expected given their articulation abilities, Tyler et al.'s treatment recommendations might be more prudent.

Although our study adds to the efforts of Paul and Shriberg (1982) to describe the morphological skills of children with speech delay, there are a number of significant differences between the two studies. The first major difference is in the focus of the study: Whereas Paul and Shriberg were primarily concerned with the relationship between the children's expressive morphology and their overall syntactic abilities, our study is concerned with the relationship between the children's expressive morphology and their articulation errors.

A second major difference concerns the sample collection and analysis procedures. Paul and Shriberg (1982) recorded free speech samples from their participants. Frequently, these samples did not contain more than one obligatory context for the grammatical morphemes of interest. Recently, Balason and Dollaghan (2002) confirmed that free speech samples often yield an inadequate number of obligatory contexts for reliable assessment of the children's morphological skills. For example, only 8% of the samples recorded for their study contained more than three obligatory contexts for the possessive morpheme. They concluded that "other methods for obtaining data on inflectional morphology are necessary (p. 966)". Furthermore, we studied children whose speech was largely unintelligible unless the context was known. Therefore we chose to use a story retell task to obtain speech samples from the children.

The analysis of the resulting samples was restricted to a small set of complex morphemes that can be linked directly to the phonemes /s/ and /z/, specifically the plural, the possessive, and the regular third person singular morphemes that are realized as [s] or [z] or [əs]. The relative proportion of omissions, misarticulations, and correct productions of the [s] and [z] phonemes were compared for word final position across inflected and uninflected contexts.

The purpose of the study was to determine if the children's productions of the plural, possessive, and third person singular morphemes were a simple reflection of their ability to articulate the /s/ and /z/ phonemes. If this is the case, we expect the following findings: (a) percentage of omission and misarticulation of the morphemes in inflected words will be roughly equivalent to the percentage of omission and misarticulation of the phonemes in uninflected words; (b) percentage of omission and misarticulation of the morphemes will be roughly equivalent across the three morphemes examined; and (c) correct production of the morphemes will be correlated with correct production of the phonemes as articulated in uninflected contexts.

Method

Participants

The participants in this study were 23 monolingual English-speaking children (11 boys and 12 girls). Their mean age was 55 months (range = 49-61; *SD* = 3.5). At the time of referral the children were receiving treatment from a speech-language pathologist (S-LP). The treating S-LP assessed each child prior to referral and provided us with the child's standard scores for the Goldman-Fristoe Test of Articulation-II (GFTA-II; Goldman & Fristoe, 2000) and the Peabody Picture Vocabulary Test-III (PPVT-III; Dunn & Dunn, 1997). The mean GFTA-II percentile was 4 (range = less than 1 to 10; SD = 5.7) and the mean PPVT-III standard score was 107 (range = 87 to 127; SD = 12.10). We have no information about the intensity, the duration, or the focus of the children's treatment program and thus no inferences about the impact of their treatment experience on their test performance can be made.

Procedure

The children were asked to retell stories about three picture books that were constructed by us to provide many opportunities for the children to produce the targeted morphemes. The story scripts are shown in the Appendix. The research assistant recited each story exactly as written in the script and in the order as shown. The child was asked to retell each story after it was recited, using the pictures in the appropriate book as a guide. The children were recorded on a portable minidisk recorder (SONY MZ-B50) while they retold the stories. Any other speech produced by the child during this procedure was also recorded and submitted to the same analyses that were applied to their story retellings. In other words, the analyses reported below are based on all of the speech produced by the child, including their story retellings and any unprompted speech that occurred during the assessment session.

Speech Sample Analysis

The speech samples were transcribed and analyzed by authors N.B. and G.C. when they were graduate students in speech-language pathology.

Consonant production

The percentage of correct production of the /s/ and /z/ phonemes was determined as a function of word position. A consonant was coded as a correct production if the consonant was accurately produced, and it was coded as an incorrect production if a substitution, distortion, or omission error occurred for the target sibilant. Voicing confusions were not counted as misarticulations because devoicing is dialectically appropriate in the word final position that was of particular interest in this study and because voicing errors were not expected to impact on the child's inclusion of the morphemes of interest. The number of correct /s/ and /z/ tokens was divided by the total number of obligatory contexts to yield a Percent Correct score for articulation of these phonemes (hereafter referred to as PC/s,z/). This score was determined for each of four contexts: word initial singleton (e.g., *some)*, word initial cluster (e.g., *story*), word final singleton (e.g., *house)*, and word final cluster (e.g., *toybox*).

Morpheme production

The mean length of utterance was calculated with the Systematic Analysis of Language Transcripts software (SALT; Miller & Chapman, 1984). The morphemes were coded as being produced correctly, omitted, or mispronounced. Most analyses refer to the mean length of utterance in morphemes (MLU), although mean length of utterance in words (MLUW) was used for the correlation analyses reported below.

Reliability

Ten percent of the speech samples were selected randomly and recoded by a second observer. Point-by-point agreement was 88.50% for transcription of the consonants and 86.76% for the identification of morphemes. Disagreements typically arose due to differences in the gloss (e.g., [i po] might be glossed as "he pours" or "they pour" resulting in a disagreement about the presence or absence of the third person singular morpheme).

Results

Summary of Raw Data

Language sample sizes ranged in length from 42 to 114 intelligible utterances (M = 69.39, SD = 14.27). MLU ranged from 2.31 to 9.45 (M = 5.38, SD = 1.90). SALT analysis indicated that MLU was age-appropriate for 15 children and below the normal limit of approximately 4.5 for the remaining 8 children. However, the MLUs derived from the story retell task may overestimate the children's MLU in spontaneous conversation and thus we have no appropriate normative reference for judging the adequacy of the children's overall syntactic abilities.

Table 1 shows the individual scores for each of the following variables: percent correct production of /s/ and /z/ by word position (word-initial singleton, word-initial cluster, word-final singleton, and word-final cluster); mean length of utterance; and percent correct use and percent omission of the plural, possessive, and third person singular morphemes. Group means and standard deviations are shown at the bottom of this table. Figure 1 shows the mean percentage of omissions, misarticulations, and correct productions of the /s/ and /z/ phonemes in each word position in uninflected words. Percentages of omissions, misarticulations, and correct productions of each morpheme in singleton and cluster word-final contexts are also shown in Figure 1. This figure also indicates the total number of obligatory contexts produced by all 23 children for each word position and for each morpheme.

Relationships Between Accuracy of Phoneme and Morpheme Production

The first hypothesis was that the percentage of omissions and misarticulations of the morphemes in inflected words would be roughly equivalent to the percentage of omissions and misarticulations of the phonemes in uninflected words. An examination of Figure 1 indicates that this hypothesis was not supported. Although omission of the plural morpheme was similar in frequency to omission of /s/ and /z/ in word final position, this morpheme was misarticulated more frequently than would be expected given the rate of misarticulation of /s/ and /z/ in the final position of uninflected words. The frequency of correct productions of the plural, possessive, and third person singular morphemes was less than the frequency of correct /s/ and /z/ articulation in uninflected words.

The second hypothesis was that the percentage of omissions and misarticulations of the morphemes would be roughly equivalent across the three morphemes examined. Figure 1 shows that this hypothesis was also not supported. Omission of the third person singular morpheme occurred with 10 percent greater frequency than omission of the possessive morpheme and with 40 percent greater frequency

Table 1

Individual data for the variables, percent correct articulation of sibilants by word position and overall, MLU in morphemes, percent correct use of each morpheme, and percent omission of each morpheme

Child	/s,z/ Production Accuracy				MLU	Morpheme % correct			Morpheme % omission		
	SI	SF	CI	CF		Plural	Poss	3/S	Plural	Poss	3/S
01KA	100%	100%	100%	100%	6.03	67%	0%	6%	5%	8%	94%
03NS	18%	50%	0%	50%	6.58	83%	57%	24%	13%	35%	71%
05PL	0%	56%	0%	100%	8.22	67%	67%	25%	27%	33%	58%
08PN	80%	50%	40%	25%	4.25	27%	0%	14%	55%	100%	86%
09MT	100%	100%	100%	100%	6.35	47%	0%	4%	35%	100%	92%
10JL	0%	75%	25%	100%	3.53	78%	71%	0%	13%	29%	100%
11SS	100%	0%	38%	0%	3.73	0%	0%	0%	100%	100%	100%
13ED	100%	100%	100%	67%	7.21	93%	100%	40%	0%	0%	60%
14VT	50%	100%	13%	50%	7.48	100%	92%	81%	0%	8%	13%
15NM	100%	100%	100%	100%	4.83	88%	100%	50%	6%	0%	42%
16WL	0%	100%	0%	0%	2.64	42%	50%	0%	16%	50%	93%
17MM	100%	100%	100%	100%	6.61	100%	100%	90%	0%	0%	0%
18KF	11%	100%	0%	100%	6.54	100%	17%	0%	0%	83%	100%
20CL	25%	25%	20%	0%	9.45	0%	0%	9%	0%	0%	0%
21CL	0%	0%	0%	0%	2.56	0%	0%	0%	100%	100%	83%
22JT	88%	100%	14%	100%	6.55	50%	8%	16%	38%	91%	58%
23NS	0%	14%	29%	0%	6.43	4%	0%	6%	13%	0%	38%
24CM	40%	50%	33%	67%	3.3	18%	17%	23%	24%	17%	38%
02MM	0%	100%	0%	100%	2.31	0%	0%	0%	60%	100%	100%
06JH	50%	33%	33%	0%	4.54	14%	0%	8%	14%	17%	92%
08BM	38%	60%	67%	50%	4.34	30%	15%	0%	35%	69%	100%
10KM	0%	33%	50%	33%	5.22	0%	0%	0%	60%	100%	100%
11ST	100%	100%	100%	100%	5.00	94%	50%	83%	6%	50%	17%
Mean	48%	67%	42%	58%	5.38	48%	32%	21%	27%	47%	67%
S.D.	43%	36%	39%	43%	1.90	39%	39%	29%	30%	41%	34%

Note: SI = single initial, SF = single final, CI = cluster initial, CF = cluster final, Poss = possessive, 3/S = third person singular

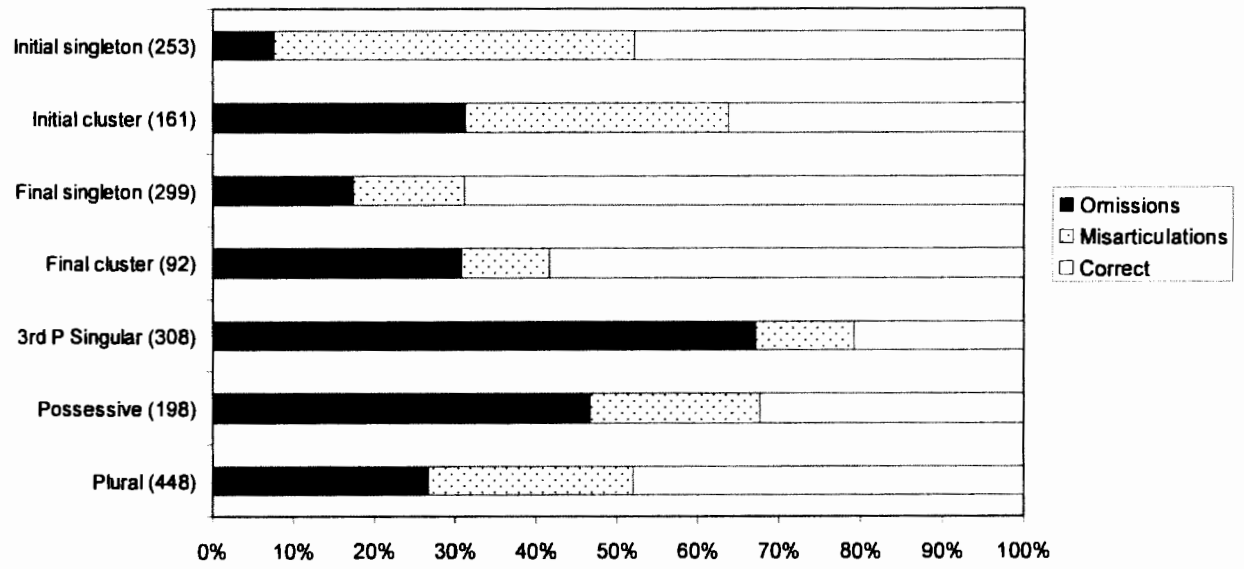

Figure 1. Percent occurrence of omissions, misarticulations, and correct productions of the /s/ and /z/ phonemes in uninflected words (by word position) and in inflected words (by morpheme). The numbers in brackets indicate the total number of obligatory contexts that were observed for each item type.

than omission of the plural morpheme. Similarly the rate of misarticulation of these morphemes varied markedly with the specific morpheme, with the rank order again being the third person singular, the possessive and then the plural.

The third hypothesis was that correct production of the morphemes would be correlated with correct production of the phonemes as articulated in uninflected contexts. Table 2 shows the correlations among each of the following variables: mean length of utterance in words, percent correct production of /s,z/ in all word positions, and percent inclusion of the plural, possessive, and third person singular morphemes. These correlations must be interpreted cautiously because of the small sample size. In general, however, our hypothesis does not appear to be supported by the data. Table 2 shows that inclusion frequencies for the three grammatical morphemes were intercorrelated. This means that even though all children were more likely to include the plural morpheme than the third person singular morpheme, relatively high rates of plural inclusion predicted relatively high rates of inclusion for the third person singular morpheme. Contrary to our hypothesis, however, inclusion of these morphemes was not predicted by percentage of correct articulation of the /s/ and /z/ phonemes in uninflected words. Mean length of utterance in words was modestly correlated with inclusion of the plural and third person singular morphemes.

The results for individual children also support the impression that these children's morphological errors are not a simple reflection of their articulation errors. Only one child showed consistent (i.e., at least 90%) inclusion of /s,z/ in both inflected and uninflected words and only 2 children showed consistent (i.e., at least 90%) omission of these phonemes in both inflected and uninflected contexts. Thirteen children showed consistent inclusion of /s,z/ in word final uninflected words but frequently omitted one or more of the grammatical morphemes. The remaining 7 children omitted these phonemes on an inconsistent basis in both inflected and uninflected words but omissions were more frequent in grammatical morphemes in all but one case.

Table 2

Correlations Between Mean length of Utterance in Words (MLUW), Percent Correct Production of /s and /z (PC/s,z), and Percent Inclusion of the Plural, Possessive, and Third Person Singular (3rdPS) Morphemes

	MLUW	PC/s,z/	Plural	Possessive	3rdPS
MLUW	1.00	.10	.48*	.34	.46*
PC/s,z/		1.00	.37	.21	.07
Plural			1.00	.77*	.50*
Possessive				1.00	.62*
3rdPS					1.00

Note: Correlations marked with an asterisk are statistically significant, with probability values varying from .016 to .0001.

Discussion

The purpose of this study was to describe morpheme use in relation to articulation accuracy in children with speech delay. It was hypothesized that children whose morphological errors were directly related to their phonological errors would show similar proportions of omissions in both contexts. The results can be summarized as follows: (1) omission of grammatical morphemes was

typically greater than omission of the /s,z/ phonemes in uninflected words while correct production of the grammatical morphemes was less than observed for /s,z/ in uninflected contexts; (2) inclusion and correct production rates were superior for the plural morpheme in comparison with the third person singular morpheme even though both of these morphemes are similar in terms of phonetic complexity; (3) mean length of utterance in words was significantly correlated with inclusion of the plural and third person singular morphemes while articulatory accuracy was not correlated with grammatical morpheme use; and (4) 13 children showed frequent omission of grammatical morphemes but consistent inclusion of the /s,z/ phonemes in uninflected contexts. Overall these results do not support the hypothesis that these children's morphological errors are simply a reflection of their articulation errors.

The clinical implication of these findings is that speech-language pathologists cannot assume that children with speech delay omit grammatical morphemes as a direct result of their articulation errors. Furthermore, it cannot be assumed that remediation of articulation errors will result in spontaneous resolution of expressive morphological errors. Consequently, the most cautious approach to the remediation of these errors would be to assess and treat expressive morphology directly. Tyler et al. (2002) reported that a treatment program that targeted morphosyntax produced significant change in phonology and morphosyntax abilities whereas a treatment program that targeted phonology produced significant improvements only in phonological abilities. In contrast, Fey, Cleave, Ravida, Long, Dejmal, & Easton (1994) found that a language intervention did not lead to significantly improved phonological skills. Further experimental investigations of treatment efficacy are required to determine the optimum treatment strategies for different subgroups of children with speech delay.

Neither Paul and Shriberg's study nor the one reported herein provide an explanation for the frequency of morphological errors among children with a primary speech delay. Consequently, the theoretical and evidentiary base upon which a program of treatment efficacy research should be founded is lacking in the case of children with speech delay. Further studies with these children could employ similar assessment procedures to those used with the population of children with specific language impairment (SLI) and investigate similar hypotheses about the source of the children's morphological errors. Three types of models have been proposed in the context of SLI: (1) those which propose that an interaction between certain properties of the acoustic input and the child's input processing limitations reduce access to the information that is required for adequate development of morphosyntactic skills; (2) those that posit that some children have a non-adult-like underlying grammar; and (3) those that suggest that production constraints prevent the child from consistently applying their knowledge of the adult grammar (see Leonard, Eyer, Bedore, & Grela, 1997; Rice, Wexler, & Redmond, 1999, for further discussion of these models).

All investigations relevant to these theoretical positions have been conducted with children who are significantly different from the children described in this report and thus direct generalizations from the SLI literature to children with speech delay cannot be made. Rather, it is important to conduct more descriptive studies of morphological development in children with speech delay. These studies should include assessments of the children's speech perception skills in order to address the possibility that phonological processing limitations underlay both their phonological and morphological errors. In-depth assessments of the children's receptive language skills with a particular focus on comprehension morphology would help to determine if children's error patterns reflect difficulties with the underlying grammar. Finally, sentence imitation tasks (e.g., Panagos, Quine, & Klich, 1979) would help to understand the production constraints that may determine differences in morpheme use across sentences that vary in phonetic, prosodic, and syntactic complexity.

In addition to research to determine etiological factors and to identify the most efficient treatment strategies, more research is required to develop the most appropriate techniques for the assessment of morphological development among children with speech delay, in both clinical and research contexts. As noted earlier, free speech samples are highly problematic for use with unintelligible children and furthermore, this technique often results in insufficient opportunities to observe the morphemes of interest regardless of the population being sampled. The consequences of using a story retell task are not known however. A number of studies have shown that sampling context has little impact on the frequency and accuracy of phoneme production (Kenney, Prather, Mooney, & Jeruzal, 1984; Shriberg & Kwiatkowski, 1986). Similar studies that examine the use of grammatical morphemes by children with speech delay as a function of sampling context would be valuable.

Conclusions

This study joins only one other published study that has described the expressive morphology of children with speech delay. Paul and Shriberg reported that these children produce more morpheme errors than would be expected given their overall level of syntactic ability. We found that these children produce more morpheme errors than would be expected given their ability to articulate the associated phonological forms. More research is required in order to understand why these children have such difficulty with expressive morphology. A larger research base would form the foundation for a program of treatment efficacy research directed at the development of optimum treatment strategies for the remediation of these children's phonological and morphological error patterns. In the meantime, the most prudent course of action for the speech-language pathologist would be to target both phonology and morphology when the client has concomitant delays in both areas of language functioning.

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Appendix

Story Scripts

Kubler, A. (1999). The Babysitter. Sydney: Child's Play International.

The little girl waves bye-bye! Mommy and Daddy wave bye-bye! They get a snack. The baby sitter pours the milk and the girl brings the cookies. They sit on the couch. The baby sitter plays with puppets and the girl eats the cookies. They make a truck with blocks. The little girl pulls the truck. The doggie watches. The toys watch too. They read a book and the doggie sleeps. Look, a parade! They march upstairs. The girl plays the drums, and the baby sitter plays the flute. The baby sitter puts pyjamas on the girl. They play in the girl's room. She has a lot of toys. There's a book, an alligator, some crayons, and some blocks. The girl pees and brushes her teeth. The baby sitter brushes the girl's hair. They read a story. The babysitter goes downstairs and falls asleep. The girl wakes up and sneaks downstairs. She goes back to bed. Mommy and Daddy come home and say goodnight.

Savary, S. (2000). Caillou: One or Many. China: Éditions Chouette.

This is Caillou's truck. Look, more trucks are in his toy box! Caillou is hungry. Here is Caillou's banana. Oh look! More bananas are behind the box! Look, there is a frog. Caillou is drawing the frog.

Here is Caillou's crayon. Oh look! More crayons are behind the bear!

Kubler, A. (1999). Man's Work. Sydney: Child's Play International.

The boy's toys are everywhere! Daddy and the little boy are going to clean the house.

It is a mess! They are throwing the toys in the toy box. Daddy is wiping the table. The boy is wiping the chair. They are having fun. Daddy is vacuuming the boy's leg! He is laughing.

The boy is vacuuming Daddy's feet! They are washing the dishes. Daddy is bringing the plates, and the boy is bringing the bowls. Uh-oh. Mommy's plant is on the floor. Daddy is sweeping up dirt, and the boy is pushing a big broom. They are cleaning the bathroom. Daddy is washing the tub and the boy is washing the sink. They are polishing their shoes. Look: Mommy's shoes, Daddy's shoes, the boy's shoes. They are doing the laundry. The boy is putting the clothes in the washer. Now they are hanging the clothes up to dry. Here are the boy's socks, and here are Daddy's pants. The boy is folding the clothes. Daddy is ironing them. All done! They are having some juice. They are happy to be finished.

Author Note

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