HESITATIONS IN THIRD GRADERS' PRODUCTIONS OF DERIVED WORDS

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ABSTRACT

This study examined third grade children's use of hesitations in elicited productions of derived words containing a stress-changing suffix (*-ity*). Eight derived words produced by 20 typically developing third-grade children were phonetically analyzed for five different hesitation types. The number of hesitations used differed significantly as a function of the children's linguistic skill. Children who were adept in their linguistic abilities used more false starts, but children who were weaker in their linguistic abilities used more glottal stops and pauses. Children's use of different hesitations, found only through a phonetic analysis, may reflect their stored representation of the derived words.

Keywords: school-aged children, hesitations, derivational morphology.

1. INTRODUCTION

1.1. Derivational morphology

The ability to process suffixed words is critical for vocabulary growth and academic skills such as spelling and reading [2, 8]. To be successful with derivational suffixation, children must learn to identify the suffix, know what the suffix means, understand its syntactic constraints, and determine its morphophonological constraints [2, 7]. This knowledge of suffixes and their relationships with stem words seems to emerge when children are in the third grade [7, 11].

English has two phonologically distinct types of derivational suffixes. Neutral suffixes do not change the phonological properties of the stem words (e.g., '*happy* and '*happiness*). In contrast, non-neutral suffixes change the phonological properties of the stem words to which they attach. One of the ways in which the phonological properties of the stem words can be altered is through predictable primary stress changes. For example, the suffix *-ity* predictably shifts the primary stress to the presuffixal syllable in derived words (e.g., '*active* to *ac'tivity*).

1.1.1. Derived word production task

The derived word production task (DWPT) [7] can be used to determine children's facility with primary stress assignment when formulating derived words. Children are directed to *"Put (suffix) on the end of (stem),"* which requires children to listen to both the suffix and the stem word, manipulate the sequence, and then produce the derived word. Production of accurate primary stress is reliably detectable [7, 8]. Stress accuracy is averaged across all derived word productions, resulting in an overall stress accuracy score.

1.2. Lexical frequency

Word frequency has been shown to influence one's ability to access a word form as high frequency words are recognized and spontaneously produced faster than low frequency words [4, 10].

1.3. Hesitations

Phonetic hesitations, such as pauses and false starts, vary in their function, type, and frequency, depending upon the task and individual speaker differences [5, 9]. For example, one such function of hesitant speech includes the possibility that it reflects an individual's cognitive processing [5, 9]. While both pauses and false starts have typically been examined as hesitations, this study takes a broader view of the types of phonetic events categorized as hesitations and examines hesitations as they occur *within* single words and not *between* different words. This type of hesitation has often been considered articulatory, yet it may also have a cognitive and linguistic role as well [6].

1.4. Research questions

Through a phonetic analysis, we investigated the cognitive-linguistic role of hesitations in children's productions of derived words that contain a

stress-changing suffix (-*ity*). When children complete this novel and difficult linguistic task, they may use hesitations in an effort to manage the cognitive and morphophonological demands of the task itself.

We had two primary research questions. First, we asked if linguistic skill influenced the children's use and frequency of hesitations. We hypothesized that children who demonstrate strong linguistic skills would use fewer and different types of hesitations than children who demonstrate weak linguistic skills. Second, we asked whether the use of hesitations changed as a function of word frequency, which also affects the strength of lexical representations and the spontaneous word production [4]. We hypothesized that children would produce more hesitations in low frequency words than in high frequency words.

2. METHOD

2.1. Participants

Twenty children were selected from a larger study of 76 monolingual (American English), third graders from Memphis, Tennessee [8]. Twelve girls and eight boys were included, with a mean age of 8 years, 7 months (range from 8;1 to 9;6). All children scored within age-acceptable limits on a language test and passed a hearing screening.

2.2. Measures

The children were selected on the basis of four linguistic measures. First, performance on a derived word production task (DWPT) was used as a grouping measure. The DWPT stimuli were pre-recorded to control for task administration and included 8 real words suffixed with the stress changing suffix, -*ity*, resulting in a predictable rightward shift in primary stress in the derived words. Eight derived words were analyzed for this study: four high frequency (i.e., *activity, curiosity, equality, responsibility*) and four low frequency (i.e., *brutality, festivity, stupidity, tranquility*). Lexical frequency was based on texts written for school-aged children [3]. The children's productions of the derived words were digitally recorded, and primary stress placement was transcribed [8]. Based on DWPT stress accuracy scores, the children were grouped into either a poor stress-accuracy group (n = 10) or a good stress-accuracy group (n = 10). The mean scores for these two groups differed significantly (t_{18} = -14.436; $p < 0.001$).

For the three other measures, the children were selected to represent a continuum of performers. The Word Attack (WA) subtest from the *Woodcock Reading Mastery Test—Revised* [15] was used to measure reading abilities. Vocabulary skills were measured using a non-standardized, multiple choice test, which assessed the children's ability to select a synonym of the derived words in the DWPT. Lastly, morphological awareness (MA) was measured with a test that assessed the children's knowledge of bound and free morphemes through recognition and identification of base morphemes in monomorphemic and bimorphemic words [8].

2.3. Coding hesitations

The following five types of phonetic events were considered for this study:

- *Stop gap additions* included the insertion of an extraneous stop gap in the child's derived word production that is not typically found in the adult derived word target. A stop gap, associated with both voiced and voiceless stop consonants, was defined as the time interval prior to consonant release during which there was an interruption in acoustic energy. [cf. audio file 1].
- *Glottal stop gaps* were identified as the gaps in voicing associated with a glottal stop [cf. audio file 2].
- *Pauses* consisted of unfilled pauses, identified by the absence of voicing, and filled pauses, identified by the insertion of an interjection such as "um" [cf. audio file 3].
- However, *false start pauses* were pauses associated with an initial incomplete, unfinished attempt to produce the derived word and then a revised attempt at the derived word [cf. audio file 4].
- *Prolongations* included any vowel or consonant segment, with the exception of final segments, that was abnormally lengthened in relation to other similar productions of that vowel or consonant by that same speaker [cf. audio file 5].

In total, 275 words were coded across the 20 children. Each derived word was coded for the five hesitation types and hesitation boundaries through an acoustic phonetic analysis using the TF32 program [12]. Measurements were made by two

doctoral students trained in phonetic analysis. Reliability across the hesitation types was assessed on 55 randomly selected words (20% of the sample). Agreement on the detection of stop gaps, glottal stop gaps, pauses, false start pauses, and prolongations was 91%, 89%, 93%, 98%, and 97%, respectively. Agreement on the overall number of hesitations was 93%. Hesitation frequency was then calculated in two ways: (a) presence or absence of the different hesitation types and (b) the number of times a given hesitation type occurred in the derived word.

3. RESULTS

Statistical analyses were conducted on the average rates of hesitation use in each child's *first* attempt at the 8 derived words. Pearson correlations were used to examine the relationship between linguistic ability and hesitation types. Independent *t*-tests and chi-square tests were used to examine hesitations as a function of stress-accuracy abilities and word frequency, respectively. An uncorrected alpha of 0.05 was used to test for statistical significance.

3.1. Linguistic ability construct

Correlations were run with the scores on the MA, WA, and vocabulary measures. Significant positive relationships were found between WA and vocabulary ($r = 0.730$, $p < 0.01$) and between MA and vocabulary ($r = 0.576$, $p < 0.05$). Therefore, a factor analysis was used to reduce and to collapse the WA, MA, and vocabulary data into one construct, known as *linguistic ability*.

3.2. Word attempts

A strong negative correlation indicated that children who scored lower on linguistic ability made significantly more attempts at the derived words than the children who scored higher on linguistic ability ($r = -0.774$, $p < 0.001$).

3.3. Linguistic performance and hesitations

Children with poor stress-accuracy and linguistic abilities tended to use significantly more glottal stops ($t_{18} = -3.293$, $p < 0.01$, $d = 1.47$; $r = -0.632$, $p < 0.01$) and pauses ($t_{18} = -2.244$, $p < 0.05$, $d = 1.00$; $r = -0.614$, $p < 0.01$) than the high-performing children. In contrast, children with good stress-accuracy and linguistic abilities tended to use significantly more false start pauses than the lower performing children ($t_{18} = 2.161$, $p < 0.05$, $d = 0.96$; $r = 0.488$, $p < 0.05$).

There was neither a significant difference between the two stress-accuracy groups in number of stop gap additions ($t_{18} = 0.852$, ns) nor a significant relationship between linguistic abilities and stop gap additions ($r = 0.097$, ns). Prolongations were also not significant ($t_{18} = -0.208$, ns; $r = 0.138$, ns). In summary, children who demonstrated weak linguistic and stress assignment abilities typically reacted to this phonological task by producing glottal stops and pauses. However, children who demonstrated strong linguistic and stress assignment abilities typically reacted to this task by producing false start pauses.

3.4. Word frequency and hesitations

Word frequency had no statistical effect on the presence of glottal stop gaps, pauses, and prolongations ($\chi^2_1 = 0.102$, ns; $\chi^2_1 = 0.100$, ns; $\chi^2_1 = 2.558$, ns, respectively). These types of hesitations were just as likely to occur on low frequency words as they were on high frequency words. A word frequency effect was not seen with stop gap additions; however, because every child produced a stop gap deviation, this variable was analyzed in a different manner. We considered the average rate of stop gap additions as a function of word frequency, and again, no significant effect was found either for the good stress-accuracy group or for the poor stress-accuracy group ($\chi^2_1 = 0.952$, ns; $\chi^2_1 = 0.833$, ns, respectively).

Word frequency, however, influenced the number of false start pauses, especially for the good stress-accuracy group. For these children, false start pauses were more likely to occur on high frequency words than on low frequency words ($\chi^2_1 = 7.500$, $p < 0.01$; $\Phi = 0.61$). This effect was not found for the poor stress-accuracy group.

4. DISCUSSION

The original goals of the study were to determine (a) what, if any, linguistic factors affected hesitation use during a derived word task, and (b) whether word frequency affected hesitation use. Each of these is briefly discussed in turn.

The children in this study reacted to the DWPT task by using certain hesitations. Each child produced extraneous stop gaps, and they selectively used glottal stop gaps, pauses, and false start pauses. Prolongations were infrequent,

suggesting that other hesitation types were more prevalently used as reactions to the task.

The findings in this study emphasize the importance of hesitations as reactions to a derived word task and provide insight into how these children process the demands of the task, based upon linguistic skill and word frequency. False start pauses were used more often by children who demonstrated strong linguistic and stress-accuracy skills, yet glottal stops and pauses were used more often by children who demonstrated weak linguistic and stress-accuracy skills.

One possible reason for this finding is that children with strong linguistic abilities had more complete and more accurate mental representations of the derived words, including primary stress placement, than children with weak linguistic abilities. Adult lexical models [10, 13] and research with young children [1] both suggest that the lexicon is variable in how much specificity a given word might have and is sensitive to repeated exposure. Hence, children's frequent use of false start pauses may indicate that they are purposefully working to match their derived word productions with their correct, stored mental representations of the derived words; however, they need additional time to produce an accurate production, which the false start pauses afford (cf. the suggestion that adults use more repetitions than deletions when they have a better formulation plan [14]).

Since their mental templates seem to be more accurate and complete than children with weaker linguistic and stress-accuracy skills, the high-performing children may be able to better concentrate on accurately assigning primary stress to the derived words, especially for high frequency words, which presumably are well represented. Low frequency words, however, may have a leveling effect as the children produce fewer false start pauses on low frequency words, suggesting that the low frequency words might not be as well represented as the high frequency words.

Children with weak linguistic abilities may have had incomplete and inaccurate mental representations for the derived words. Thus, they may not have a correct stored representation of the derived words, resulting in the need to construct the words both segmentally and morphophonologically. If this is true, the frequent use of glottal stops and pauses and increased word attempts may reflect low quality lexical representations. Word frequency did not have an effect for low-performing children, suggesting that these children's mental templates for both high and low frequency words may not be well-represented. In conclusion, the acoustic characteristics of the children's derived words reflect different levels of their sophistication of linguistic knowledge. The framework of a phonetic analysis is, therefore, essential for the detection of differential usage of hesitations, thus providing a clearer picture of children's cognitive and linguistic processing.

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