Reading Psychology, 25:261–272, 2004

0270-2711/04 $12.00 + .00
DOI: 10.1080/02702710490512307

Taylor & Francis
Taylor & Francis Group

ACQUISITION OF BLENDING SKILLS: COMPARISONS AMONG BODY-CODA, ONSET-RIME, AND PHONEME BLENDING TASKS

JERRELL C. CASSADY and LAWRENCE L. SMITH
Ball State University, Muncie, Indiana, USA

Following research on phonological awareness development, this study explores children's acquisition of blending skills using three types of stimuli: body-coda, onset-rime, and phonemes. The results demonstrated that kindergarten children consistently gained proficiency for blending body-coda stimuli prior to onset-rime stimuli and phonemes. The results are interpreted to support an instructional process where blending is treated as a generalizable skill, and children work with the simplest material first. Thus, our proposition is that children be trained to blend body-codas first, then progress to more phonologically difficult blending tasks such as onset-rimes and phonemes.

The formative phases of emergent literacy are dominated by the acquisition of phonological awareness skills ranging from rhyme recognition to substitution of phonemes to produce known and unknown words (Adams, 1990; Snow, Burns, & Griffin, 1998; Yopp & Yopp, 2000). These skills have repeatedly been demonstrated to be essential precursors to basic reading development (Ehri et al., 2001; Goswami, 2000). In our research, we have been building a model of phonological awareness that illustrates a predictable developmental pattern to acquiring discrete phonological awareness skills. Thus far, our program of research has confirmed that phonological awareness skill acquisition generally follows a continuous and progressive developmental process that can be reliably predicted in both longitudinal and cross-sectional analyses (Cassady et al., 2003). This developmental pattern is best explained within a framework that incorporates both task difficulty (e.g., phonological detection vs. manipulation or blending

Address correspondence to Dr. Jerrell C. Cassady, Department of Educational Psychology, Ball State University, TC 520, Muncie, IN 47306. E-mail: jccassady@bsu.edu

vs. segmenting) and linguistic complexity (e.g., onset-rime vs. phoneme-level manipulation).

These analyses have supported two general trends in phonological awareness development. First, as previously proposed by Yopp (1988) and Adams (1990), children tend to master blending tasks prior to segmenting tasks, regardless of linguistic complexity. However, our data supported a more complex representation of skill development that also incorporates issues of linguistic complexity. Specifically, children reliably demonstrated mastery for onset-rime blending tasks prior to blending three phonemes in C-V-C words. Generally, mastery begins during the middle to end portion of kindergarten, with some children continuing to resolve these skills into first grade. This nested skill acquisition pattern was replicated with segmenting tasks, with onset-rime segmenting mastery preceding phoneme segmentation.

The second general trend we have identified in our research is that children's phonological awareness mastery tends to follow a pattern based on position within the syllable (beginning, ending, middle) for both detection and manipulation tasks. The beginning-end-middle progression appears to be related primarily to the relationships shared between the middle phoneme and its adjoining partners in C-V-C words. In particular, the extreme difficulty children in kindergarten and first grade have shown in detecting and manipulating middle phoneme units can be reasonably explained either through what we refer to as the "noise hypothesis" or the "vowel hypothesis" (Cassady & Smith, 2003). The vowel hypothesis proposes that middle sound difficulties are based not on position, but on the fact that the middle units in our stimuli are always vowels, and vowels in general are more difficult to process than consonants for emergent readers (Adams, 1990). Our research has more directly supported the noise hypothesis, which asserts that the primary cause for poor performance in detecting and manipulating middle phonemes is that middle phonemes carry linguistic information about two adjacent phonemes (beginning and end), while the other phonemes in C-V-C words only have the complexity of carrying information about one adjacent phoneme (Liberman, 1973). This hypothesis is consistent with research on syllable internal units that has demonstrated that certain phonemic units tend to be more conceptually interrelated. That is, the middle phoneme (or peak) is typically linguistically "bound"

to the coda, forming a rime (Treiman & Zukoski, 1991, 1996). Thus, the difficulty our participants demonstrate in isolating and manipulating middle phonemes is driven in part by the additional difficulty in "uncoupling" a rime into the two phonemic units: peak and coda. The difficulty of this uncoupling task also explains why children have more difficulty detecting, isolating, and manipulating end units than beginning units (Cassady & Smith, 2003; Stanovich, Cunningham, & Cramer, 1984).

Both generalities in our research have supported existing explanations for phonological awareness development that assert phonological awareness skill development progresses from larger units to smaller units (Fox & Routh, 1975; Goswami, 2000; Moustafa, 1995; Seymore, Duncan, & Bolik, 1999). Three interrelated explanations for the development of phonological awareness skills that explicitly support this trend are onset-rime theory (Treiman, 1985), linguistic complexity (Stahl & Murray, 1994), and linguistic status (Treiman & Zukowski, 1996). For simplicity, we refer specifically to the onset-rime theory, as this body of research is more developed and can be extended to account for the relevant predictions offered by the other two bodies of research.

The onset-rime theory states that splitting words in the English language occurs most easily at the point between the onset and rime (Fudge, 1987; Seymore et al., 1999; Treiman & Kessler, 1995), where the onset is all phonemic information up to the vowel, and the rime is composed of the peak and the coda. Support for this view comes from several analyses of natural tendencies of children and adults to break and blend syllable units in English words. Treiman's (1983, 1985) classic word game experiments with children and adults provided early empirical and theoretical ground for the presence of an onset-rime internal syllable structure. The data revealed that adults had more difficulty breaking up cluster onsets than cluster codas, and that they preferred syllable-splitting tasks that maintained an intact rime. The summary of 8 related studies demonstrated that the onset-rime boundary was a conceptual break point in the syllable, and provided further evidence that the onset was a psychologically cohesive unit while the coda did not function as such (Treiman, 1983).

Kelly (1998) further supported the strength of an onset-rime syllable internal structure by testing participants' blending patterns for an intentional word-blending task (i.e., breakfast +

lunch = 'brunch' not 'brench'). The results extended earlier work by MacKay (1972) that revealed accidental blends that broke the syllable structure of words more commonly preserved the integrity of rimes than bodies. Kelly's (1998) analyses revealed that subjects were over 6 times more likely to pair an onset from one word with the rime from the next than to "stitch together" a body and coda.

Extensive analyses of syllable internal structures typically concluded that there was a hierarchical structure to the internal sounds of a syllable, but empirical tests were lacking (Dow & Derwing, 1989; Fudge, 1987). Detailed empirical work on the onset-rime model was undertaken by Treiman and Kessler (1995; Kessler & Treiman, 1997) in response to 'flat' syllable structure arguments (Iverson & Wheeler, 1989), including moraic theories (Hayes, 1989; Hyman, 1985) that proposed all phonemes in a syllable hold equal linguistic weight, meaning there are no true "body" or "rime" units. Treiman and Kessler demonstrated again that the English language tends to (a) preserve the status of the onset and (b) keep rimes intact when possible. They went on to assert their data were in concurrence with Randolph's (1989) finding that vowels are more likely to be bound to the postvocalic consonant than the prevocalic (given the condition that the postvocalic consonant is also the last consonant in the word). This is supported by their analysis of the occurrences of consonants in identified phonemic positions, revealing greater variability in onset-peak combinations than peak-coda combinations (Kessler & Treiman, 1997). Their work concludes on this point stating that "the first two-thirds of the syllable (onset and vowel) are largely unpredictable, that is informative and distinctive, and that the last third (the coda) is largely predictable, that is, redundant" (p. 309).

The connection of onset-rime theory to our construction of a developmental model of phonological awareness is centered in the issue of order of acquisition of blending skills. Following the history on phonological blending, our initial research tested onset-rime blends and phoneme blends alone. However, a recent empirical presentation of blending tasks demonstrated that the body-coda might be the first blending skill mastered by emergent readers, prior to blending onset-rimes with and without the schwa (Murray, Brabham, Villaume, & Veal, 2003). The practical conclusion offered by Murray and his associates in this preliminary presentation of this effect was that blending is a skill that should

be taught at the easiest level of complexity, which had traditionally been considered to be onset-rime. Although the proposition that it is easier to blend body-codas than onset-rimes seems to contradict the onset-rime model of internal syllable structure, it is consistent with the propositions that (a) rimes are psychologically cohesive and preserved linguistic units (so the listener is driven to bring the peak and coda back together as required in body-coda blending), and (b) codas are largely predictable or redundant once the listener has identified both the onset and vowel (Kessler & Treiman, 1997). That is, blending a body-coda stimulus should prove easier than blending onset-rimes simply because of the limited number of possible conclusions to an onset-peak stimulus.

Our search of the published literature found no explicit test of body-coda and onset-rime blending skills acquisition. Therefore, consistent with our theoretical orientation of examining discrete phonological awareness skills for clues regarding the acquisition of emergent literacy, we tested participants' overall performance levels on the blending subscales (Blend Onset-Rime, Blend Body-Coda, Blend Phoneme) offered in our phonological awareness skills measure.

Method

Participants

One hundred eighty-nine kindergarten students at three elementary schools were participants in this study. All children attended programs that followed a classic academic calendar, and completed all materials in January of their kindergarten year (roughly halfway through the academic year). The three schools were within a 75-mile radius, but differed on populations served. Schools A and B were located in small communities and were served a population consisting of almost all Caucasian students. School C was located in the suburbs of a large Midwestern city, and served a more diverse population. All children included in this study were identified as proficient in English.

All three schools targeted blending tasks as a primary literacy building activity, consistent with state standards for kindergarten. Reviews of curricula and discussions with the teachers revealed that instruction for blending tasks was focused on onset-rime sets,

with minimal attention to blending phonemes in C-V-C stimuli. Phonemic blending was a planned activity in the curriculum for later in the academic year or in the first grade year. No curricular focus was devoted to blending body-coda pairs. Although each teacher maintained control over day-to-day instructional decisions and the classes varied within typical limits on available materials and instructional style, the instructional environments were reasonably equivalent across settings. All classrooms employed a programmed reading curriculum based on an adopted reading series. In addition, all three schools were involved in ongoing professional development opportunities due to their involvements in a university-sponsored professional development school network.

Instrument

The blending subset of the Standardized Assessment of Phonological Awareness (SAPA) was used in this analysis. The SAPA is a 14-subscale measure that examines discrete phonological processing skills that develop in the formative emergent literacy period (see Cassady et al., 2002, for full description of scale formerly called the Phonological Awareness Test, including psychometric properties). The blending subset of the PAT involves 3 of these subscales: Blending Body-Coda (BBC), Blending Onset-Rime (BOR), and Blending Phonemes (BP). Each subscale has one example item, 2 practice items, and 5 test items that ask the children to blend components of C-V-C words. The test is administered by asking the child to listen to the component parts of the target word, then blend those parts together and report what the whole word is. The difference between the three subscales is determined by where the breaks in the word are established in the presentation of the auditory stimuli. For instance, the word "cat" would be pronounced with 1-second delays in the following manner for the Body-Coda, Onset-Rime, and Phoneme blending tasks, respectively: ca/t, c/at, c/a/t. Presentation order of the three subscales was manipulated to control for response bias.

Administration of the PAT was conducted in one testing session by literacy experts (professors and advanced doctoral students) visiting the child's kindergarten classroom. The students were taken to a location convenient to the classroom (e.g., study area, teacher office, designated testing room) and rapport was

established. Once students were comfortable with the testing situation and directions, assessment began. Each of the subscales takes the average kindergarten student less than 5 minutes to complete, and testing was generally in the range of 10–15 minutes in one sitting.

Results

To explore the order of acquiring proficiency in the three blending tasks, the eligible participants were first restricted to those who did not show mastery for all three tasks. Including participants who attained full mastery (5/5 correct) on all three subscales would provide no meaningful information to the analyses, and would merely inflate the means for all three subscales. Analysis of the three subscales revealed that 78 students across the three schools met the criterion for exclusion, and all reported analyses were conducted on the remaining 111 students.

One-way analyses of variance demonstrated no differences among the three schools on any of the three blending skills tasks, so all analyses were conducted on the sample as a whole. Comparisons of performance means on the three subscales were conducted using three paired samples *t*-tests. The analyses demonstrated that the participants did significantly better on the Blending Body-Coda subscale items than Blending Onset-Rime ($t = 4.97$, $p < .001$) and Blending Phonemes ($t = 6.00$, $p < .001$). No statistically significant difference was noted on performances for the phoneme and onset-rime blending tasks ($t = 1.63$, $p > .10$). The means and standard deviation for all three subscales are presented in Table 1.

A further exploration of individual performance patterns was undertaken to test the order of acquisition of the body-coda and onset-rime blending skills. Given the theoretical and empirical support for phoneme blending arising last in the blending skills set,

TABLE 1. Blending Skills Subscale Performance Summary.

Subscale	Range	*M*	*SD*
Blending Body-Coda	0–5	2.83	1.96
Blending Onset-Rime	0–5	1.91	1.81
Blending Phonemes	0–5	1.68	1.95

our attention was focused on exploring differences only in the onset-rime and body-coda subscales. This examination was undertaken to ensure that the significant *t*-test results were not artificial inflations driven by overall group effects rather than individual students' performance patterns. To examine order of acquisition, we subtracted the Blending Onset-Rime subscale score from the Blending Body-Coda subscale score (BBC − BOR). A negative score (−5 to −1) indicates that the participant had a higher score on the onset-rime activities than the body-coda activities. A score of zero reveals the same score was achieved on both subscales (recall that those with perfect scores on both were removed from all analyses). A positive score (+1 to +5) reveals that the participant scored higher on the body-coda items. Figure 1 illustrates that 53% of students did better on Blending Body-Coda, 28% performed the same on both tasks, and 19% performed better on Blending Onset-Rime. Thus, we can conclude with confidence that the group trends reported in the *t*-tests are representative of typical individual performance patterns, specifically that blending body-coda sets was easier than blending onset-rimes.

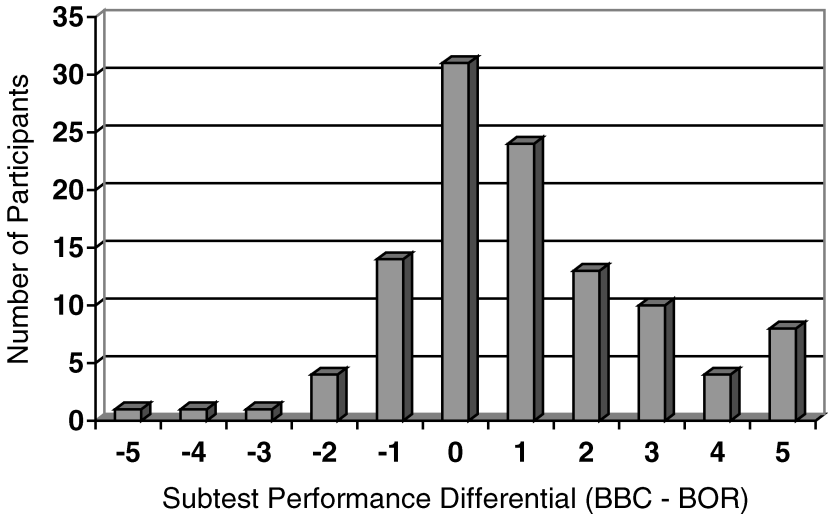

FIGURE 1. Comparisons of individual students' performance patterns on Blending Body-Coda (BBC) and Blending Onset-Rime (BOR). *Note:* Calculation was BBC-BOR; positive score indicates superior performance on BBC.

Discussion

The data provided converging evidence that children were acquiring blending skills through the middle portion of their kindergarten years, and that the simplest of the blending tasks was the body-coda blending activity. Consistent with Kessler and Treiman's (1997) work, we propose that the ease demonstrated in blending body-coda stimuli is derived from the predictability imposed by having the phonemic information from both the onset and peak.

This simple empirical analysis contributes to the general knowledge base of emergent literacy by extending the prior theoretical and empirical work on the onset-rime theory, supporting the presence of a syllable-internal hierarchy. Furthermore, the data demonstrate that children are able to blend body-coda stimuli prior to onset-rime stimuli. This holds practical significance when considering blending as a generalizable skill that children employ on a number of phonological units. Given these data, we concur with Murray et al.'s (2002) preliminary proposal that children beginning to work on the blending skills should be given the simplest blending task as the first step in their skill development. Hence, we propose that curricula that attempt to establish skills in blending sounds should begin with body-coda stimuli, then progress to onset-rimes, and conclude with phoneme blending.

The instructional process we propose to promote blending proficiency in children is analogous to many other domains of academic instruction. For instance, in mathematics it is considered reasonable and pedagogically sound to begin children's instruction on the general process of addition using single-digit numbers rather than three-digit number sets. However, we do not promote the orientation that simply acquiring a series of emergent literacy "basic skills" is sufficient to become a good reader. Naturally, the discrete phonological awareness skills addressed in this paper are pre-reading auditory tasks that provide an indication of preparedness to master reading skills. Decontextualizing reading instruction in order to simply provide a series of body-coda blends would likely produce a child with polished blending skills and little knowledge for using the skill to promote better reading. We believe that the skills developed through body-coda blending activities will become most useful only after the child has developed

alphabetic insight and begins to transfer auditory-bared blending skills to bring textual (i.e., visual) stimuli.

Additional research would undoubtedly add to this developing line of inquiry. First, replication of this study is in order to further substantiate the findings. Second, it is important to test the core assumption underlying our proposition that body-coda blending should be taught. Specifically, further analyses of children's likelihood to generalize blending skills from one task to another (i.e., body-coda to onset-rime) would establish that students develop a "blending insight" (Murray et al., 2002). The educational benefits of instruction focused on the easiest blending task is naturally dependent upon the proposition that such an insight exists and students will become masters at blending regardless of the phonological units to be combined. These data may require case studies of children at the critical point of acquiring blending skills, using teacher observations as a primary method of documenting skill development. An alternative method that may prove more reliable is capturing data from computer-based applications that can be used to deliver instructional activities in a predetermined pattern as well as track students' daily progress in specific phonological processing activities (Cassady & Smith, 2004; Murray et al., 2002). These data monitoring processes would allow researchers to unobtrusively observe the rates of progress among students at varied points of emergent literacy development and overcome the unreliable factor of teacher-managed data collection.

References

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print.* Cambridge, MA: MIT Press.

Cassady, J. C., & Smith, L. L. (2004). The impact of a reading-focused integrated learning system on phonological awareness in kindergarten. *Journal of Literacy Research, 35*, 947–964.

Cassady, J. C., & Smith, L. L. (2003). Development of phonological awareness: The trouble with middle sounds. *National Reading Conference Yearbook, 52*, 139–149.

Cassady, J. C., Popplewell, S. R., Walker, C. A., Bouserman, K., Jordan, F., & Smith, L. L. (2002). *Developmental Models of Phonological and Phonemic Awareness: A Comparison and Reformulation.* Paper presented at the National Reading Conference 2002 Annual Meeting, Miami, FL.

Dow, M. L., & Derwing, B. L. (1989). Experimental evidence for a syllable-internal structure. In E. F. K. Koerner (Gen. Ed.) & R. Corrigan, F. Eckman, &

M. Noonan (Vol. Ed.), *Linguistic categorization: Current issues in linguistic theory* (Vol. 61, pp. 81–92). Philadelphia, Jonh Benjamin's.

Ehri, L., Nunes, S., Willows, D. Schuster, B. B., Yaghoub-Zadeh, Z. & Shanahan, T. (2001). Phonemic awareness instruction helps children learn to read: Evidence from the National Reading Panel's meta-analysis. *Reading Research Quarterly, 36*, 250–287.

Fox, B., & Routh, D. K. (1975). Analyzing spoken language into words, syllables, and phonemes: A developmental study. *Journal of Psycholinguistic Research, 4*(4), 331–342.

Fudge, E. (1987). Branching structure within the syllable. *Linguistics, 23*, 359–377.

Goswami, U. (2000). Phonological and lexical processes. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of reading research*, (Vol. 3, pp. 251–268. Mahwah, NJ: LEA.

Hayes, B. (1989). Compensatory lengthening in moraic phonology. *Linguistic Inquiry, 20*, 253–306.

Hyman, L. M. (1985). *A theory of phonological weight.* Dordrecht: Foris.

Iverson, G. K., & Wheeler, D. W. (1989). Phonological categories and constituents. In E. F. K. Koerner (Gen. Ed.) & R. Corrigan, F. Eckman, & M. Noonan (Vol. Ed.), *Linguistic categorization: Current issues in linguistic theory* (Vol. 61, pp. 93–114). Philadelphia, Jonh Benjamin's.

Kelly, M. H. (1998). To "brunch" or to "brench": Some aspects of blend structure. *Linguistics, 36*, 579–590.

Kessler, B., & Treiman, R. (1997). Syllable structure and the distribution of phonemes in English syllables. *Journal of Memory and Language, 37*, 295–311.

Liberman, A. M. (1973). The speech code. In G. A. Miller (Ed.), *Communication, language, and meaning* (pp. 128–140).

MacKay, D. G. (1972). The structure of words and syllables: Evidence from errors in speech. *Cognitive Psychology, 3*, 210–227.

Moustafa, M. (1995). Children's productive phonological recoding. *Reading Research Quarterly, 30*, 464–476.

Murray, B. A., Brabham, E. G., Villaume, S. K., & Veal, M. (2002, December). The effect of three segmentation options on ease of blending for prealphabetic and partial alphabetic readers. Paper presented at the 2002 National Reading Conference, Miami, FL.

Randolph, M. A. (1989). *Syllable-based constraints on properties of English sounds.* Unpublished doctoral dissertation, Massachusetts Institute of Technology, Cambridge, MA.

Seymore, P. H. K., Duncan, L. G., & Bolik, F. M. (1999). Rhymes & phonemes in the common unit task: Replications and implications for beginning reading. *Journal of Research in Reading, 22*(2), 113–130.

Snow, C. E., Burns, M. S., & Griffin, P. (Eds.). (1998). *Preventing reading difficulties in young children.* Washington, DC: National Academy Press.

Stahl, S. A., & Murray, B. A. (1994). Defining phonological awareness and its relationship to early reading. *Journal of Educational Psychology, 86*, 221–234.

Stanovich, K. E., Cunningham, A. E., & Cramer, B. B. (1984). Assessing phonological awareness in kindergarten children: Issues of task comparability. *Journal of Experimental Child Psychology, 38*, 175–190.

Treiman, R. (1983). The structure of spoken syllables: Evidence from novel word games. *Cognition, 15*, 49–74.

Treiman, R. (1985). Onsets and rimes as units of spoken syllables: Evidence from children. *Journal of Experimental Child Psychology, 93*, 161–181.

Treiman, R., & Kessler, B. (1995). In defense of an onset-rime syllable structure for English. *Language and Speech, 38*(2), 127–142.

Treiman, R., & Zukowski, A. (1991). Levels of phonological awareness. In S. A. Brady & D. P. Shankweiler (Eds.), *Phonological processes in literacy: A tribute to Isabelle Y. Liberman* (pp. 67–83). Hillsdale, NJ: Erlbaum.

Treiman, R., & Zukowski, A. (1996). Children's sensitivity to syllables, onsets, rimes, and phonemes. *Journal of Experimental Child Psychology, 61*, 193–215.

Yopp, H. K. (1988). The validity and reliability of phonemic awareness tests. *Reading Research Quarterly, 23*, 159–177.

Yopp, H. K., & Yopp, R. H. (2000). Supporting phonemic awareness development in the classroom. *The Reading Teacher, 54*, 130–143.