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ABSTRACT

Two experiments were conducted with children to determine the units of word perception used in recognizing isolated words. In the first experiment, kindergarten children practiced visually discriminating whole words (big, pig, dig), single letters (b, p, d), or geometric forms (triangle, circle, square) before learning to read three words (big, dig, pig). The children having whole word discrimination read the words more accurately than those under other conditions. The purpose of the second experiment was to determine if spelling patterns also operate in recognizing isolated words. The experiment involved a same-different reaction-time design in which second graders decided if a word semantically matched a picture. The words were typed with spaces that either preserved possible spelling patterns (bl ast) or were inconsistent with proposed units (b last). Reaction time to the "bl ast" condition was approximately 300 milliseconds faster than to the "b last" stimuli. No differences in reaction time occurred between the control (blast) and "bl ast" conditions. Both experiments showed that units larger than single letters seem to be used by children in word recognition. (Author)

Visual Discrimination: Implications for Reading Readiness and Word Recognition

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Abstract

Two experiments were conducted with children to determine the units of word perception used in recognizing isolated words. In the first experiment, kindergarten children practiced visually discriminating whole words(big,pig,dig) single letters(b,p,d) or geometric forms(triangle, circle,square) before learning to read three words(big,dig,pig). The children having whole word discrimination read the words more accurately than the other conditions. Implications were made for reading readiness programs and for models of word perception.

The purpose of the second experiment was to determine if spelling patterns also operate in recognizing isolated words. The experiment involved a same-different reaction time design where second graders decided if a word semantically matched a picture. The words were typed with spaces that either preserved possible spelling patterns(bl ast) or were inconsistent with proposed units(b last). Reaction time to the "bl ast" condition was approximately 300 milliseconds faster than to the "b last" stimuli. No differences in reaction time occurred between the control(blast) and "bl ast" conditions.

Both experiments showed that units larger than single letters seem to be used by children in word recognition.

What cues do children use in recognizing words? Obviously there are many different philosophies in voque such as the single letter blending systems of Open Court, the spelling pattern approach of Charles Fries and the more wholistic procedures characterizing many of our early basal programs. None of these instructional philosophies seem to be well grounded on basic research in word perception. We still do not know the cues children use in recognizing words.

One way to tackle the question of word recognition is to present children with different learning siutations and then determine if these varying procedures cause differential effects in subsequent word learning. Several investigators have used this procedure in assessing the effects of visual discrimination on word recognition. These studies have implications for reading readiness programs and they also might serve to evaluate whether children process words in a single letter by letter fashion or in larger units of analysis.

For example, a contrast of whole word vs. single letter visual discrimination training should provide evidence bearing on the credibility of various theories of word perception. If the unit of word recognition is the single letter, discrimination training on single letters should be most effective. On the other hand, theories positing units larger than single letters, would predict that discrimination training with larger units should have more transfer to word learning.

Experimental results relevant to these issues are inconclusive. Staats Staats & Schultz(1962) and King(1964) used kindergarten children as subjects in studies comparing various pretraining stimuli on transfer to later word learning. Staats et al. found children given visual discrimination training with the same words as those used in word learning did better in reading those words than subjects given visual discrimination practice with the letters making up the words. On the other hand, King found letter training to have more transfer to word learning than word discrimination training. In fact, pretraining with the test words was no better for word learning than discrimination training with geometric forms. Since both studies used highly discriminable word sets(Staats--door,bell,kite, fish; King--hand, coat girl, show), these dichotomous results may mean pretraining has little effect with easily differentiated words. The word discrimination tasks were probably too easy for any transfer effects.

Intuitively, it seems reasonable thatvisual discrimination training should facilitate word learning if the words are visually similar and potentially confusable. Samuels(1973) has shown that children given practice discriminating confusable letters(b,d,p,q) did better in learning the names of these letters than children whose attention was not focused on the features distinguishing the letters. Similar distinctive feature training with visually confusing words may also help children learn to read confusable words. Such pretraining may be particularly beneficial if the differentiating letter occurs in the first position. Such an assumption seems reasonable since the saliency of the first letter as a useful cue in word recognition is among the most clearly established facts in reading research(Shankweiler & Liberman, 1972;Weber,1968).

In the first experiment the children learned to read three confusable stimulus words:big,dig,pig. Prior to the word learning task, they had practice visually discriminating either the words, the first three letters of the words or geometric forms. I chose these three similar words to insure sufficient task difficulty so that the children would have to pay close attention to the stimuli in order to differentiate them. In addition, the stimulus words seemed to provide an optimal test of the potential effects of single letter discrimination. Since the only cue differentiating the words was the first letter, visual discrimination training focusing on just these critical features should provide the most transfer to word learning. Intuitively, single letter pretraining would appear to have an advantage. However, if even under these conditions the whole word training produced better word learning, the utility of single letters as cues to word recognition would be of some question for the beginning reader.

Experiment I

Method

Thirty kindergarten children were randomly chosen as subjects through a stratified random sampling procedure with intelligence used as a blocking variable. The resulting three groups of ten children had approximately equal intelligence as measured by the Slosson Intelligence Scale. Children were omitted from the sample who had IQ scores of 90 or less and/or had failed to meet a 50% accuracy criterion on a lower case letter recognition test.

The three groups were given different visual discrimination tasks before learning a common set of three words(big,dig,pig). All tasks were individually administered to each subject. The word trained subjects received discrimination training on the three words, the children in the letter condition had training with the letters differentiating the words(d,p,b), and the control group had practice discriminating geometric forms(circle, triangle,square). Except for the different stimuli used in training, the discrimination and word learning tasks for each group were identical. The target was always in the left hand portion of the paper and the three alternatives were spaced consecutively across the page. The sequence of target items was randomized and the correct responses were counterbalanced across position. Each letter, word or form served as the target five times, leaving a possible score of 15 correct for each condition.

The word learning followed directly after the child finished the discrimination task. The materials were the three words printed on separate 5 x 8 cards and three additional cards containing pen and ink drawings representing the words. The task consisted of three parts: picture familiarization, word learning and testing.

After teaching the child the picture labels, I placed one word card on the table and demonstrated the word learning procedure. The subjects pronounced the words, traced and pronounced the word and then pronounced the word once more. After each child repeated this procedure twice for each word, I randomly presented thewords for the subject to read and then match with the correct picture. Feedback occurred after each trial. One test trial consisted of two random presentations of the three words making a possible score of six correct for each trial. There were four test trials in all with tracing occurring only before the first trial.

Results and Discussion

Training. The mean number of correct responses for the word, letter and geometric form conditions was 11.1, 13.6 and 15, respectively. An analysis of variance of the number of correct training responses showed a significant effect of Training $F(6,81)=3.01, p<.01$. Post-hoc comparisons using the Tukey statistic showed that subjects given letter training did significantly better on the first trial than those receiving word discrimination training. However, by the second trial a complete reversal occurred with the word trained subjects doing significantly better than the controls and somewhat better than the letter group. No significant differences occurred on trial three, but by the fourth trial the children having word training again performed at a level significantly better than the control subjects. All other comparisons between the three conditions within each learning trial were not significant.

Insert Figure 1 about here

Inspection of Figure 1 indicates both letter and word pretraining lead to better overall performance. However, it is interesting to note that the word trained subjects showed more improvement over trials than did other conditions. In fact, the whole word group performed the worst on the first trial but shifted to the best performance by trial two. The letter tracing, which only occurred before the first reading trial, probably forced the children to attend to the single letters, creating a temporary interference with their previous focus on the whole word. In any case, performance on the fourth trial indicates whole word discrimination was ultimately even more effective than single letter training.

Two implications arise from the data: First, in terms of reading readiness programs, visual discrimination exercises with verbal materials appear more closely related to word learning than exercises using geometric forms. Therefore, the discrimination component of readiness programs should be composed primarily of word discrimination tasks. Second, the data provide some evidence against single letter models of word recognition.

By the fourth learning trial the subjects having initial training with single letters did no better than the controls in learning the words. Apparently pretraining with the whole words provided the subjects with the opportunity to abstract some global word features which then allowed them to more easily learn to read the words. These whole word features may include the overall pattern of the letters and perhaps even configuration cues.

With slightly more complex word stimuli other units of processing may emerge as viable cues. For example, in teaching the word, "blast", the reading teacher might emphasize a multiplicty of cues such as single letters, whole words or the spelling patterns in the word. In this case, the spelling patterns would probably be the initial consonant cluster(bl) the medial vowel(a) and the final consonant cluster(st).

In the second experiment, I wondered whether children would take a longer time processing words typed with spaces breaking up hypothetical spelling patterns compared to words printed with spaces preserving spelling pattern units. For example, if children use spelling patterns as processing cues, a space between the two letters forming the initial consonant cluster should be more disruptive than spaces falling after the cluster. On the other hand, if children use single letters as processing cues, it really shouldn't matter where the break occurs. The time to process words typed as"b last" and "bl ast " should be the same.

Experiment II

Method

The fifteen second graders serving as subjects were all reading at second grade instructional level. The reading level was established by applying the Bett's criteria to their performance on the Temple Informal Reading Inventory (Kress & Johnson,1965).

The experimental procedure involved a same-different reaction time design where each child judged whether or not a word semantically went with a picture.

The stimuli, which were presented in a tachistoscope, consisted of word-picture pairs printed on separate 5 x 7 cards. The subject decided whether or not the picture went withthe word. If the word and picture were semantically the same, the child responded by pressing the "yes" button and if dissimilar the subject reacted by pressing the "no" button. The experimenter recorded the child's response and reaction time.

The word stimuli consisted of fifty words following the same consonant-consonant-vowel-consonant-consonant sequence. Intuitively, each word could be broken into three potential spelling patterns: the initial consonant cluster, the medial vowel and the final consnant cluster. The words were equally divided between same and different judgments, and each subject was tested on the whole word and four break conditions (s tand, fl ash, spa nk, chil d, blast). Before confronting the children with the task, I made sure they could read all the word stimuli and knew the verbal labels for the picture stimuli.

Results and Discussion

As seen in Figure 2, the children responded approximately 300 milliseconds faster to the whole word and to stimuli broken after the initial consonant cluster than to the other conditions. The children reacted with about the same speed to the "blast" and "bl ast" conditions even though they had previously seen in practice all of the stimuli as whole words. Considering this familiarity advantage, the equally fast processing to the "bl ast" stimuli is even more impressive.

Further inspection of the figure indicates that splitting the initial consonant cluster proved extremely disruptive, producing the slowest processing time. Furthermore, the final consonant cluster did not emerge as a processing unit;

the reaction time to the final consonant pattern(bla st) was much slower (100 milliseconds) than to the break patterns splitting the cluster(blas t).

Insert Figure 2 about here

According to these data, children use the initial consonant cluster and whole words as processing cues. With these particular stimuli, single letters did not function as processing units.

Considering both experiments, children at the beginning stages of reading appear to use fairly large units of processing. Without having any formal reading instruction, prior practice with whole word discrimination had more transfer to word learning than did practice differentiating the critical first letters. In the secondexperiment, the whole word and initial consonant cluster emerged as useful word recognition cues.

Taken together, these experiments make me question instructional practices based on thephilosophy that beginning readers process words in a single letter by letter fashion. Obviously, these data allow no firm conclusions, but I am questioning whether single letter blending programs are founded more on "heresay" than on convincing experimental evidence.

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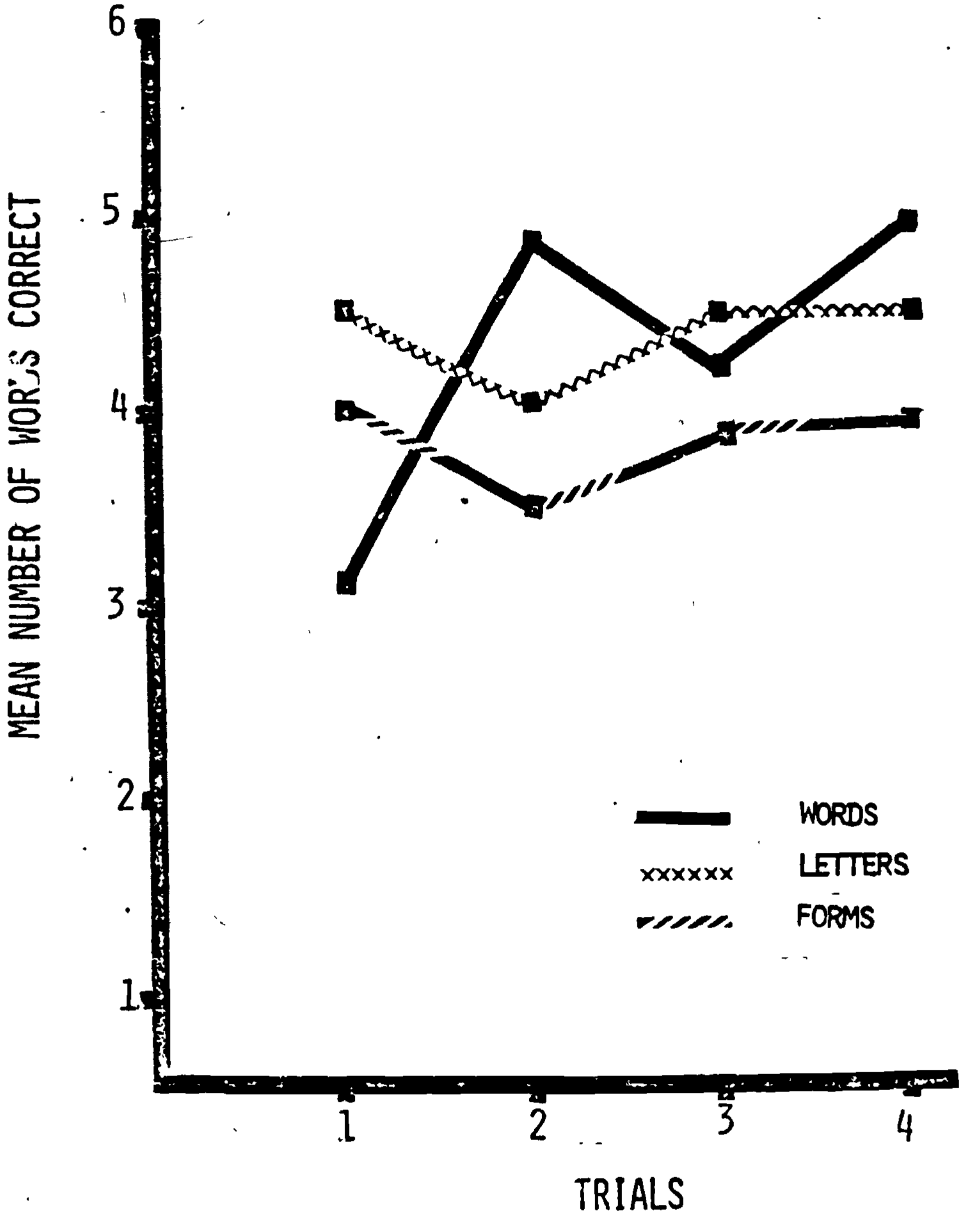

Figure 1. The mean number of words correct as a function of word learning trial.

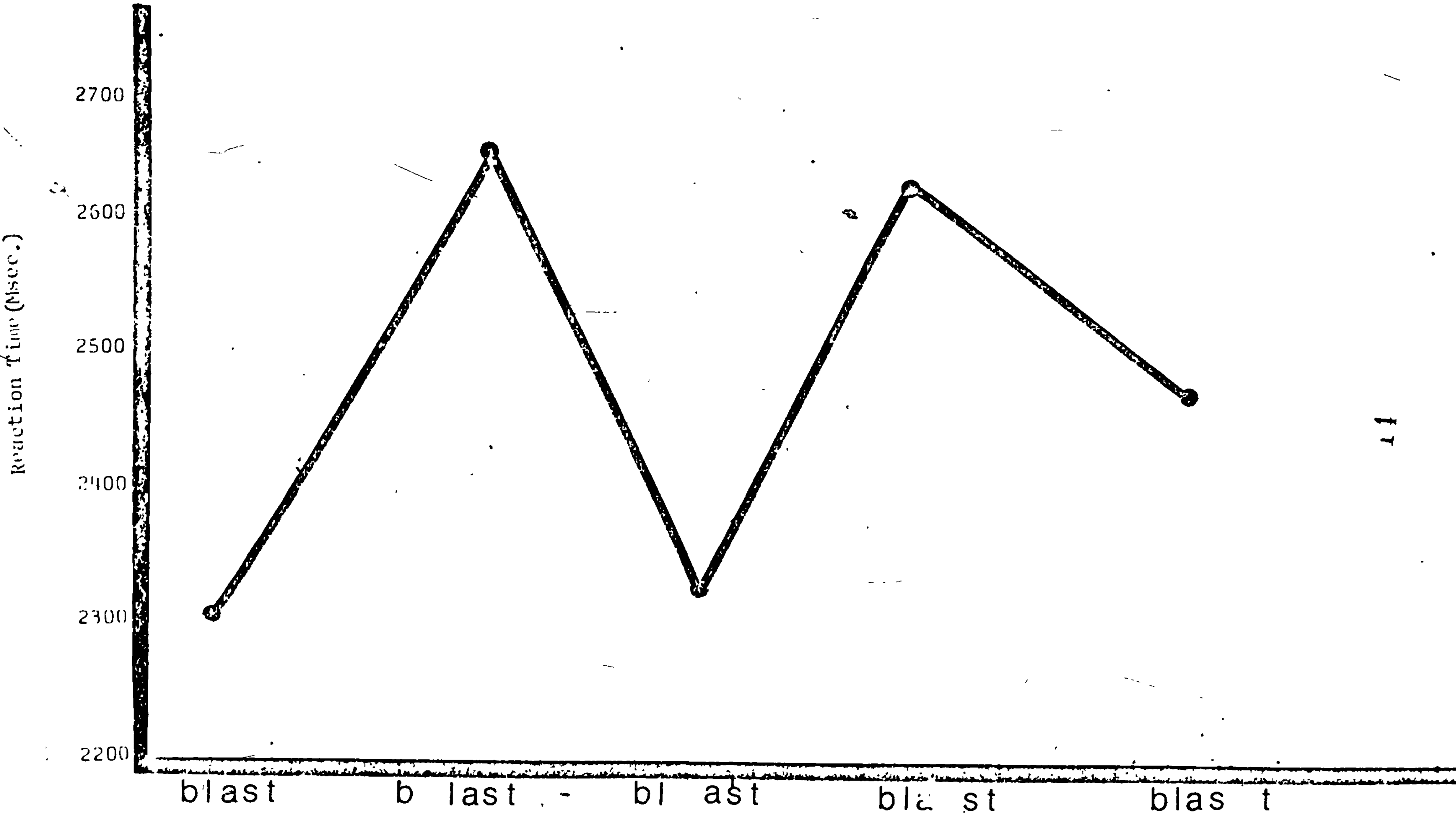

Figure 2. Mean Reaction time for same judgments.