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ABSTRACT

Words were used as the stimulus factors to test the two-stage reading process. The first stage is a decoding stage in which the words are perceived and translated into an acoustic code, and the second stage is a semantic matching stage in which words were categorized into three phonological factors (word length, vowel complexity, and regularity) affecting only the decoding stage and two semantic component factors (word familiarity and concreteness) expected to affect the semantic matching stage only. An experimental session consisted of 6 blocks, 96 words altogether. Each block had two phases, a prefamiliarization or training phase followed by a test phase. Experiment 1, using second and fifth grade children, showed pictures and words; experiment 2, using first and third grade children, varied the sentences that were read and the amount of pronunciation practice. Results indicated that the phonological prefamiliarization and word factors affected decoding but not semantic matching and that the semantic prefamiliarization factors affected semantic matching but not decoding. However, the semantic word factors affected both decoding and semantic matching, possibly as a result of final consonants and consonant clusters confounding semantic factors. (HOD)

# Phonological and Semantic Components of Words in Beginning Reading

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Is the process of reading isolated words comprised of two or three independent stages? That is, can the reading process be divided into separate stages where each stage is affected by a different set of factors?

It is hypothesized here that at least two independent stages comprise the process. The first stage is a decoding stage in which words are perceived and translated into an acoustic code. The second stage is a semantic matching stage in which words are matched with meaningful associations. It is assumed that the model can be tested by using correct pronunciation responses to measure decoding stage processing and "correct" meaningful associations to measure semantic matching stage processing.

The procedure for testing stage processing independence is a variation of one developed by Sternberg (1969). A set of stimulus factors are included in the experiment with the expectation that each will affect processing of one stage but not the other.

For this study, the words become the stimulus factors used to test the two-stage model. The words are categorized according to five factors. Three factors, to be called phonological factors, are expected to affect the decoding stage process only. Two factors, to be called semantic component factors are expected to affect the semantic matching stage only. All the stimulus word factors consist of two levels.

The phonological factors are word length, vowel complexity, and vowel regularity. The word length factor consists of four letter words and five letter words. The vowel complexity factor is a comparison of one vowel words (e.g., BLAND) with two vowel words (e.g., BROOK). The vowel regularity factor is a variation of major vowel sound patterns with minor vowel sound patterns (Venezky, 1970). For example, STICK, SLOOP, SPEAK are major patterns; BIRD, SOOT, BREAD are minor patterns.

The semantic component factors are word familiarity and word concreteness. The word familiarity factor is based on frequency of usage rankings (Kucera and Francis, 1967). That is, very common words are compared with rare or uncommon words. The concreteness factor is a comparison of nouns that have a real object reference (e.g., BIRD, DRESS) with abstract nouns, verbs, or adjectives (e.g., TRUTH, BALK).

## Procedures for Experiments I and II

An experimental session consisted of 6 blocks, 96 words altogether. Each block had two phases, a prefamiliarization or training phase followed by a test phase. In the prefamiliarization phase, children were showed the words, were showed pictures describing the stimulus words, were read sentences in which the

stimulus words appeared, or rehearsed the pronunciation of the unfamiliar words. In the test phase children were asked to pronounce each of the 16 words in the block then to give a meaningful association to each word. If they made a pronunciation error, they were corrected before giving an association.

There were minor procedural differences in Experiments I and II. In the prefamiliarizations given in phase one, one factor--showing pictures or showing words--was used in Experiment I. Two factors--one varying the sentences that were read and the other varying the amount of pronunciation practice--were used in Experiment II.

Experiment I was carried out with second and fifth grade children, Experiment II with first and third graders. The children were from a lower middle-class neighborhood in a large city. Forty-eight children were tested.

## Results

An analysis of variance 9 factor mixed design was used to analyze the results. The results are summarized in Tables 1, 2, 3, and 4.

The results are largely consistent with the predictions of the model. In both experiments, the phonological prefamiliarization factors and phonological word factors affect decoding but not semantic matching. The semantic prefamiliarization factors affect semantic matching and not decoding. However, the semantic word factors affect both decoding and semantic matching.

## Discussion

The analysis of variance findings strongly support the hypothesis that reading isolated words has at least two independent stages. decoding and semantic matching. The only results that do not support the two-stage model are the semantic word factors that affect decoding and semantic matching instead of semantic matching alone. The results from both experiments show that familiar or concrete words are easier to pronounce than are unfamiliar or nonconcrete words.

One possible explanation for the apparent violation of the stage processing model will be explored here, namely, that the semantic factors are confounded with uncontrolled orthographic factors.

An examination of the final consonants and consonant clusters of the words used in this study revealed systematic differences in the consonants typical to familiar and unfamiliar words and to the concrete and nonconcrete words. An analysis of error patterns revealed a tendency for errors to vary with these systematic differences, thus indicating a confounding between the semantic factors and a new factor, consonant cluster frequency.

To identify the confounding, final patterns of the 96 stimulus words were separated into three groups: 1) final consonant clusters that occur in more than 45 different monosyllabic English words (e.g., CH, ST, CK), 2) final consonant clusters that occur in less than 45 different words (e.g., LT, RF, LB), and 3) final patterns that do not contain a consonant cluster or that contain a doubled final consonant.

The final patterns in the words were then classified by the two semantic factors, familiarity and concreteness. This showed that consonant patterns are not evenly distributed among the word sets. Familiar words contain more of the common final consonant clusters while unfamiliar words contain more of the uncommon clusters. Concrete words tend to have a single final consonant while nonconcrete words have a consonant cluster.

Finally, a rank order correlational analysis was carried out between the ranked commonness of the final consonant clusters and the mean number of errors for each final cluster pattern. A significant correlation, .56 ($p > .02$) indicates that consonant cluster frequency and final consonant error frequency are related. Common consonant clusters tend to generate the fewest consonant cluster errors. Rare consonant clusters tend to generate the greatest number of errors.

This analysis shows that semantic factors are confounded by the commonness of the final consonant patterns. It shows also that a consonant cluster frequency factor contributes to the decoding errors presently attributed to the semantic factors. It is possible that if consonant frequency can be separated from familiarity and concreteness, the semantic factors will no longer affect decoding. If that is true, a stage processing model for reading isolated words can be fully supported.

## References

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Table 1

Pronunciation Error Analysis, Experiment 1

| Source | Level | Mean | df | F ratio | Significance Level |
|---|---|---|---|---|---|
| **Between Subjects Factors** | | | | | |
| Grade | gr 2 | .316 | 1,20 | $\frac{27.1}{1.8} = 14.4$ | .01 |
| | gr 5 | .099 | | | |
| Grade x | gr 2, 1 vowel | .252 | 1,20 | $\frac{1.00}{.14} = 7.0$ | .05 |
| # Vowels | gr 2, 2 vowel | .380 | | | |
| | gr 5, 1 vowel | .176 | | | |
| | gr 5, 2 vowel | .122 | | | |
| Sex x | girls, 1 vowel | .124 | 1,20 | $\frac{.92}{.14} = 6.4$ | .05 |
| # Vowels | girls, 2 vowel | .250 | | | |
| | boys, 1 vowel | .205 | | | |
| | boys, 2 vowel | .251 | | | |
| **Within Subjects Factors** | | | | | |
| Word Familiarity | familiar words | .115 | 1,20 | $\frac{19.5}{.68} = 28.7$ | .001 |
| | unfamiliar | .299 | | | |
| Word Concreteness | concrete | .192 | 1,20 | $\frac{.56}{.07} = 8.3$ | .01 |
| | nonconcrete | .223 | | | |
| Vowel Complexity | 1 vowel | .164 | 1,20 | $\frac{4.3}{.14} = 30.2$ | .001 |
| | vowel digraphs or dipthongs | .251 | | | |
| Vowel Regularity | major pattern | .184 | 1,20 | $\frac{1.3}{.12} = 11.3$ | .01 |
| | minor pattern | .231 | | | |
| Familiarity x Vowel Complexity | fam, 1 vowel | .120 | 1,20 | $\frac{5.3}{.07} = 79.8$ | .001 |
| | fam, 2 vowel | .112 | | | |
| | unfam, 1 vowel | .219 | | | |
| | unfam, 2 vowel | .391 | | | |
| Prefamiliarization | pictures | .221 | 1,20 | $\frac{.44}{.18} = 3.2$ | .10 |
| | words | .194 | | | |

Table 2

Association Error Analysis, Experiment 1

| Source | Level | Mean | df | F ratio | Significance Level |
|---|---|---|---|---|---|
| **Paradigmatic Association Error Analysis** | | | | | |
| Grade | gr 2 | .832 | 1,20 | $\frac{1.9}{.37} = 5.3$ | .05 |
| | gr 5 | .774 | | | |
| Grade x sex | gr 2 girls | .817 | 1,20 | $\frac{3.6}{.37} = 9.7$ | .01 |
| | gr 5 girls | .828 | | | |
| | gr 2 boys | .858 | | | |
| | gr 5 boys | .720 | | | |
| **Within Subjects Factors** | | | | | |
| Word Familiarity | familiar | .727 | 1,20 | $\frac{13.3}{.24} = 54.9$ | .001 |
| | unfamiliar | .879 | | | |
| Word Concreteness | concrete | .769 | 1,20 | $\frac{2.7}{.18} = 15.2$ | .001 |
| | nonconcrete | .838 | | | |
| Prefamiliarization | pictures | .769 | 1,20 | $\frac{2.7}{.266} = 11.9$ | .01 |
| | words | .838 | | | |
| **Syntactic Association Error Analysis** | | | | | |
| Word Familiarity | familiar | .637 | 1,20 | $\frac{25.8}{.18} = 141.4$ | .001 |
| | unfamiliar | .849 | | | |

Table 3

Pronunciation Error Analysis, Experiment 2

| Source | Level | Mean | df | F ratio | Significance Level |
|---|---|---|---|---|---|
| **Between Subjects Factors** | | | | | |
| Grade | gr 1 | .269 | 1,20 | $\frac{17.89}{1.75} = 10.2$ | .01 |
| | gr 3 | .093 | | | |
| **Within Subjects Factors** | | | | | |
| Word rehearsal prefamiliarization | rehearsal | .157 | 1,20 | $\frac{1.31}{.23} = 5.8$ | .05 |
| | no rehearsal | .205 | | | |
| Word rehearsal prefamiliarization x familiarity | fam, rehearsal | .139 | 1,20 | $\frac{3.9}{.20} = 19.1$ | .001 |
| | fam, no rehearsal | .100 | | | |
| | unfam, rehearsal | .175 | | | |
| | unfam, no rehearsal | .306 | | | |
| word familiarity | familiar | .122 | 1,20 | $\frac{8.15}{.14} = 58.02$ | .001 |
| | unfamiliar | .240 | | | |
| word concreteness | concrete | .164 | 1,20 | $\frac{.66}{.06} = 11.2$ | .01 |
| | nonconcrete | .198 | | | |
| vowel complexity | 1 vowel | .137 | 1,20 | $\frac{4.4}{.24} = 18.2$ | .001 |
| | 2 vowel | .225 | | | |
| vowel regularity | major pattern | .148 | 1,20 | $\frac{2.57}{.05} = 51.67$ | .001 |
| | minor pattern | .214 | | | |
| familiarity x vowel complexity | fam, 1 vowel | .101 | 1,20 | $\frac{1.22}{.18} = 6.8$ | .05 |
| | fam, 2 vowel | .142 | | | |
| | unfam, 1 vowel | .174 | | | |
| | unfam, 2 vowel | .308 | | | |
| word length x vowel complexity | 4 letter, 1 vowel | .140 | 1,20 | $\frac{1.13}{.065} = 17.2$ | .001 |
| | 4 letter, 2 vowel | .185 | | | |
| | 5 letter, 1 vowel | .135 | | | |
| | 5 letter, 2 vowel | .263 | | | |

Table 4

Association Error Analysis, Experiment 2

Paradigmatic association analysis

| Source | Level | Mean | df | F ratio | Significance Level |
|---|---|---|---|---|---|
| **Between Subjects Factors** | | | | | |
| Grade | gr 1 | .788 | 1,20 | $\frac{20.25}{2.2} = 9.1$ | .01 |
| | gr 3 | .501 | | | |
| Sex x Familiarity | girls, fam. word | .405 | 1,20 | $\frac{5.8}{.61} = 9.5$ | .01 |
| | girls, unfam. word | .810 | | | |
| | boys, fam. word | .485 | | | |
| | boys, unfam. word | .685 | | | |
| **Within Subjects Factors** | | | | | |
| word meaning prefamiliarization | paradigmatic assoc. | .540 | 1,20 | $\frac{2.30}{.40} = 5.8$ | .01 |
| | sent. + parad. assoc. | .594 | | | |
| | sent. w/out parad. assoc. | .650 | | | |
| word familiarity | familiar word | .445 | 1,20 | $\frac{51.9}{.61} = 84.9$ | .001 |
| | unfamiliar word | .745 | | | |
| word concreteness | concrete word | .529 | 1,20 | $\frac{10.03}{.27} = 37.1$ | .001 |
| | nonconcrete word | .661 | | | |
| familiarity x vowel complexity x vowel regularity | major, 1 vowel familiar | .480 | 1,20 | $\frac{5.6}{.07} = 78.7$ | .001 |
| | minor, 1 vowel familiar | .375 | | | |
| | major, 1 vowel unfam. | .650 | | | |
| | minor, 1 vowel unfam. | .785 | | | |
| | major, 2 vowel familiar | .424 | | | |
| | minor, 2 vowel familiar | .500 | | | |
| | major, 2 vowel unfam. | .813 | | | |
| | minor, 2 vowel unfam. | .740 | | | |