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ABSTRACT
                This paper examines the letter recognition
difficulties of 322 primary grade students with decoding problems.
Each student was asked to name all of the lower case letters, which
were presented in non-alphabetical order. Each response was
accurately recorded to determine which letters were taken for others.
All responses were then tallied, and an error frequency chart was
constructed. The incorrect responses were statistically studied to
differentiate between random and systematic errors. The systematic
errors were then analyzed to determine what factors made it difficult
for these letters to be learned. The results indicated that the most
difficult letters to identify were those which resembled other
letters in the visual and auditory modes. Error frequency of use were
unrelated, and no consistent direction of reversal was found in
groups or individual students. Inability to note subtle differences
between letters that resemble each other apparently accounted for
almost all of the systematic error. (WR)

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LETTER RECOGNITION DIFFICULTIES: THEIR REAL NATURE

(To be presented May 2nd, 1974   -   10:45 - 11:45 A.M.)

Purpose. The writer explored the letter recognition difficulties
of a group of largely first grade children from lower socio-economic families.

Objectives included the determination of a rank order of difficulty of correct
letter identification, an attempt to learn how frequency of letter use
affected ease of identification, and the gathering of information about both
the aspects of the appearance of the letters, and the perception of the students,
in an effort to better understand both the letter and word identification
problems of these students.

Sample Studied. Some 322 children who had failed to decode three
or more words in October, 1972 on the first grade word list of the Durrell
Analysis of Reading Difficulty were tested. Almost all of them were first
graders.

Method. Each child was individually asked to name all the lower
case letters. These were presented in scrambled order. Each response was
accurately recorded to find out which letters were taken for others. All
responses were tallied, and an error frequency chart was made. The figures
from this chart were correlated with figures for the frequency of letter
use in English derived by Friedman[1]. The incorrect answers were statistically
studied to differentiate between random and systematic errors. The systematic
errors were then studied in an effort to discover what factors made it
difficult for these letters to be correctly named. The errors of thirty-
four children were studied to determine if they made errors in consistent
ways as individuals, and/or as a group. The reversals noted were compared
with the reversals that could be predicted from Stratton's famous study[2],
which stated that all children go through a period in perceptual

development in which a specific type of reversal is made. Lastly,

certain frequently reversed pairs of letters were considered, such as <u>b</u> and <u>d.</u>

Since <u>d</u> was systematically given as the answers when children looked at <u>b</u>, did

these children make the error the other way also? That is, did they say "<u>b</u>"

when they looked at <u>d</u>?

      .Findings. A frequency chart of the errors made revealed surprising

findings. Space requirements do not permit the inclusion of all the findings,

but here is a rank order of the letters in order of decreasing difficulty of

correct identification, together with the percentage of error made in each case.

1. 1 - 76%	7. h - 42%	13. y - 27%	20. p - 21%
2. q - 64%	8. a 40%	14. r - 27%	21. k - 20%
3. g - 58%	9. j - 38%	15. f - 26%	22. e - 20%
4. d - 51%	10. u - 38%	16. w - 25%	23. x - 15%
5. t - 48%	11. v - 34%	17. i - 24%	24. c - 14%
6. b - 44%	12. n - 31%	18. m - 23%	25. s - 13%
		19. z - 23%	26/ o - 7%

(A complete table of findings will be sent to anyone sending a self-addressed,

stamped envelope to Dr. Marvin Cohn, Reading and Study Center, Garden City,

New York 11530.) Please note that by far the most frequently missed letter

was <u>1</u>. Only twenty-one children said "I don't know" when asked to name it.

Of the 225 who named it incorrectly, 146 said "I" (or "i"), and 86 said "one",

with 13 others making random errors. Apparently these two strongly systematic

errors represent inadequately differentiated perception. That is, the "1"

grossly resembles "I" (or "i") and "one", in that each of them have an

easily recognized long straight line as its major component. What differentiates

each of these froms from the others is the presence of smaller, less obvious

components which apparently do not get differentiated or perceived as easily. What mades "1" by far the hardest letter to identify is not reversal, but simply gross or undifferentiated perception! The complete table of errors sugges:s that many other errors are caused by gross perception.

Surprisingly, the rank order correlation between ease of letter naming and frequency of letter use was .076, which falls far short of statistical significance. Apparently, beyond a minimum of frequency of use, correct identification depends upon other factors.

An examination of the efforts of thrity-four individual children yielded 195 errors. Of these, sixty-three were apparently reversal errors and twice that many, 132 were grossdifferentiation errors. The sixty-three reversal errors were apparently made by going in three different directions, as follows:

Letter remains flat, as on a table top but is rotated 180°.	10 errors
Letter "lifted off paper" with top and bottom changing places.	17 errors
Letter "lifted off paper", with right and left edges changing places.	36 errors

The Stratton (or double reversal) error, which so far as is known occurs in all children until it is eliminated due to maturation, seems to account for 16% of the b, d, p, q reversals made by the 322 children. In fact, the evidence shows that these children do not reverse in any consistent directions at all.

This suggests that there is the possibility that the distinction we have been making between so-called reversal errors and letter recognition errors apparently due to gross or undifferentiated perception is an artificial

one. Reversal errors may not at all be due to reversals of the perceptual

process. They can equally as easily be due to failure to differentiate the

less obvious characteristics of letters which otherwise resemble each other.

Thus, for example, b, d, p, and q all share certain obvious characteristics -

a long striaght line which is tangenc to a circle. What is probably more

difficult to perceive is somewhat more subtle - is the circle to the right

or left of the straight line; is the circle tangent at the top or the

bottom of the line; is the bottom of the line lower or at the same height as

the bottom of most other letters? Of course difficulty in naming these

four letters correctly could come from reversal of perception; it could also

come from failure to differentiate and observe the small differences that

identify one letter rather than the others. A careful examination of the

systematic errors made suggests that even if we were to attribute all

possible reversal errors to a process of perceptual reversal, these same

children still made a much larger number of gross differentiation errors on

other letters which could not have involved such reversals. In any case, such

perceptual twisting does not occur on a consistent basis. About as many

children say "b" for "d" as say "d" for "b", but this does not obtain for

other such letter pairs. Not one of the 322 children who looked at "b", "p",

or "d" said "q", in spite of the fact that of the 150 incorrect guesses for "q",

137 children said "b", "p", or "d"! Similarly t was miscalled "j" forty times,

but of sixty-nine children who miscalled j, only two said "t". Other examples

abound.

"Ockham's Razor" (the principle of parsimony) is a principle of economy

in offering explanations of causality. "Plurality is not to be assumed without

necessity. What can be done with fewer assumptions is done in vain with more."[3]

Gross differentiation can easily account for the non-reversal errors we see -

it may also account for most of the errors that look like reversals. And in fact, gross differentiation is commonly regarded as a characteristic of immature perception. Werner says "...whenever development occurs it proceeds from a state of relative globality and lack of differentiation to a state of increasing differentiation, articulation, and hierarchic integration."[4] Gibson states that perception develops "...by differentiation of stimuli already rich in information." It consists of "...learning to extract the information...that has not already been detected and utilized. What is learned are distinctive features, invariants, and higher orders of both..."[5] We cannot rule out the possibility that some small proportion of our sample suffers from abnormal distortion of perception. The vast majority of the evidence collected here and in other studies suggests that for most of the children the problem is one of delayed maturity of perception. The writer has found four studies which compare the ability of children of increasing age to identify letters. They agree in showing that this ability improves with age, as would be the case if the problem is primarily one of learning to increasingly differentiate perception as one grows older.[6,7,8,9]

The children's errors found in this study suggest that errors of gross differentiation are also made in other areas as well as in the visual area. Thus many systematic errors are found in which the wrong answers do not resemble the original letter visually, but do resemble it in that the letter names rhyme, or otherwise resemble each other in an auditory way. It might be expected that letters that resemble each other in both the visual and auditory modes would be extremely difficult for children to name correctly. Indeed, of the letters b, d, p, and q, all but p are amoung the seven hardest letters to identify. Further, in identifying the three letters b, d, and p, whose names

rhyme, although wrong letters were guessed 259 times, not a single child ever said q, the visually similar but non-rhyming response! Oddly enough, of the 150 wrong letters guessed when the children looked at q, 119 said "p", twelve said "b", and six said "d".

It seems reasonable to assume that letters which have two different forms, depending on whether they are in upper or lower case, would be more difficult to identify than letters which have the same form in both cases. This study's error frequency chart shows that of the ten easiest letters to name, nine have the same or almost the same form in both cases. Of the ten hardest letters to name, nine have substantially or completely different forms in both cases. Of the letters b, d, p and q which are generally recognized as being difficult to name correctly, only p has the same form in both cases.

It is not necessary to assume the existence of perceptual reversal to account for the general difficulty in naming b, d, p, and q. All of them are look-alikes. Three of them are sound-alikes. And three of them necessitate learning two different forms for the upper and lower case instead of one single form as many other letters do.

Still another apparent problem in gross differentiation was found. Many systematic errors were made which do not reflect either visual or auditory resemblance. If the children were not yet sure of these letters, they might tend to say one for the other simply because they were associated with each other by being studied at the same time.

Educational Implications. In teaching the alphabet, it will be useful, hopefully, to know rather than guess which letters are the most difficult to learn. When dealing with easily confused letters, it can also be helpful to call attention to the less readily perceived visual and auditory cues that differentiate them. It might be helpful too, to teach the letters in carefully selected groups designed to minimize confusion.

The teaching of decoding goes on frequently before the child has completely learned to identify all the letters. It might be helpful to teachers to know that the child is often unaware of the specific nature of some of the simplest looking letters, such as <u>l</u>. Even <u>a</u>, the first letter of the alphabet, is not easily recognized. Lastly, it might be quite helpful to recognize that letter and word recognition difficulties more probably represent immaturity of perception which can naturally change with time and patience, than they do distorted, abnormal perception. We may be doing an enormous disservice by identifying many children as having "reading problems" or "learning disabilities" on the assumption that their perception has matured and is distorted or otherwise faulty. Possibly many of them would not have long-term learning problems if we recognized that they were just maturing more slowly than others, instead of inaccurately labeling them and putting them through learning programs they were not yet ready for. We may thus be producing unnecessary failures. At least, the presence of abnormal perception should never be assumed simply because youngsters manifest delayed letter and word recognition.

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