more appropriate for testing memory of nonlinguistic information. When we used the Kimura figures in a test of memory for recurring designs, we found no difference in performance between good and poor readers (3).

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The study by Morrison et al. (1) lacks relevant controls. If, as the authors claim, the poor readers “appear to suffer from a basic information-processing deficiency,” a normal comparison group is inadequate to reveal this. A normal group differs in two ways from a group of poor readers. It does not suffer from some basic deficit which would have prevented it from reading normally, and it reads normally. This means that certain skills connected with reading have received a larger amount of practice in the normal readers than in the poor readers. In other words, the differences found between normal and poor readers may be an effect rather than a cause of any differences that may be found. Here, as in most studies of the basic cause of dyslexia, a control group consisting of illiterate children, otherwise normal but not taught to read, is necessary to evaluate the information-processing changes brought about by reading.

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With regard to the methodological questions raised by Rothenberg and Gross:

1) The fixation dot did reappear during the interstimulus interval. In addition, before commencing each trial, the experimenter reminded the child to stare at the fixation dot throughout the presentation sequence. Further, there was a 750-msec delay between the warning signal and presentation of the array. If poor readers had trouble maintaining steady eye fixations longer than 300 msec they would have performed poorly at all interstimulus intervals. The fact that their performance equaled that of good readers at short intervals argues persuasively that the problems in eye fixation cannot account for the lower performance of poor readers.

2) A total of 80 different cards per stimulus set was presented, eight per interstimulus interval. Hence, on each trial the subject saw a completely different configuration of forms. Since there was no correlation between a given item and its position in the array, learning of stimulus position could not occur.

3) Order of presentation of delay intervals was randomized.

Restrictions on length and format of reports in Science limits presentation of certain methodological points. Further details on these methodological features are presented elsewhere (1, 2).

Although, as Liberman et al. point out, the abstract forms are potentially labelable, the more relevant question is whether subjects did in fact use verbal labeling to code the stimulus forms. We have one piece of evidence from the Science study (3) and several other pieces of evidence from a related study [(1), also cited in (3)] that differences in verbal labeling were not responsible for performance differences in the partial report task. In the Science report we mentioned (1, p. 78) that the predominant basis of confusion for both reading groups across all sets of figures was visual. For example, the letters most often confused with each other were P and F, N and W, D and S, and B and P. The similarity of the first three pairs seems exclusively visual while that of B and P is both visual and auditory. For the geometric forms the items confused most frequently were eight and circle, square and triangle, and X and wheel; items in each pair overlap in one or more visual features. Similar patterns of confusions on the basis of a shared perceptual feature were observed for the abstract forms. Comparable analyses in (3) also found no evidence for acoustic confusions and strong evidence for visual confusions. In addition, at the end of that experiment we recorded latencies for the adults to verbally label the forms on the simple assumption that if verbal labeling was being used to code the figures, naming latencies would have been approximately equal across the three sets of stimuli. We found that average latency to begin a verbal label was around 1 second for a set of common objects and geometric forms compared to more than 5 seconds for the abstract forms. We were persuaded by these data that verbal labeling was not occurring to a substantial degree in the partial report procedure. Thus we are hesitant to conclude that verbal mediation alone can account for the effects found across age and reading groups in the partial report procedure.

Finally, in many studies in which labelability of forms is varied, the forms are not equated on dimensions such as complexity or discriminability-confusability. These dimensions often covary with degree of labelability and can influence performance in information-processing tasks. Sets of nonlabelable forms are often more confusable than are sets of labelable forms. The inability of subjects to adequately discriminate the forms could wipe out potentially real differences between groups.

The point raised by Deutsch about the direction of causality is appropriate and pertains to most research comparing groups of self-selected subjects. However, it is virtually impossible to find a group of completely illiterate children who are comparable in all other respects, lacking only the opportunity to read. Differences in nutrition, social environment, and a host of other factors could account for performance differences between illiterate and reading children. Hence, the value of such a group in untangling the cause-effect relation is minimal. More promising, we believe, is an examination of information-processing differences among prereading children coupled with a longitudinal investigation of the contribution of these skills to early reading acquisition. In this way we should be able to pinpoint and trace the underlying deficits.

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