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University of Auckland

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Center for the Study of Reading

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College of Education
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174 Children's Research Center
51 Gerty Drive
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MANAGING EDITOR
Technical Reports
Fran Lehr

MANUSCRIPT PRODUCTION ASSISTANT
Delores Plowman

Abstract

A study was conducted to identify poor readers and to characterize weaknesses in their knowledge and use of story structure in comprehension and recall. Subjects were 80 year-3 children, 20 good readers and 60 poor readers. The poor readers were then divided into relatively homogeneous subgroups, using measures of language-reading comprehension, according to a numerical classification procedure. This procedure helped identify specific weaknesses in their language-reading comprehension. All children listened to 3 stories and retold the stories under free- and probe-recall conditions. Comparison of recalls between the good readers and each of the subgroups of poor readers showed that poor readers in 2 subgroups evidenced reduced sensitivity to story structure. The children in these subgroups recalled less of the stories overall, recalled less information from story grammar categories to varying extents, and showed patterns of category recall which differed from those of normal readers. Children in one of the subgroups also displayed poor perception of causal relations across story episode boundaries. These results provide evidence of marked heterogeneity in poor readers' story comprehension and recall. Certain subgroups of poor readers may have qualitatively different problems processing stories, relative to other poor readers, which may require a more concerted approach to instruction in story structure.

INDIVIDUAL DIFFERENCES IN STORY COMPREHENSION AND RECALL OF POOR READERS

A common approach to research on children with reading difficulties is to compare the status of groups of readers of different ability. The research designs define "good" and "poor" readers according to some criterion and then compare the status of these readers on measures of cognitive performance. The goal of some of these studies is to identify the underlying cause(s) of children's reading difficulties. Such status studies have compared groups of readers on a wide variety of cognitive measures, including isolated word recognition, oral reading, vocabulary knowledge, and memory (for reviews, see Aulls, 1981; Kleiman, 1985; Lipson & Wixson, 1986). However, to date, such studies have failed to identify consistently an area of cognitive performance that is responsible for reading difficulty.

This inconsistency in findings has been particularly true of studies in the area of story comprehension and recall. In these studies, children listen to stories and then perform a comprehension or recall task. By comparing the good and poor readers' comprehension and recall, researchers are able to make inferences about children's relative sensitivity to aspects of story structure. The rationale for these studies is that if good and poor readers differ in sensitivity to story structure, independent of their decoding abilities, then deficiency in story schema, or failure to use story schema, may be responsible for some of the difficulties experienced by poor readers. Results have shown quantitative differences between readers of different ability--poor readers comprehend and recall less of a story than do good readers (although even here there is some inconsistency)--but results have been inconclusive as to whether there are qualitative differences in comprehension and recall. Thus, it is not yet clear whether good and poor readers differ in sensitivity to story structure.

Studies have employed a variety of methods to assess sensitivity to story structure. One group of studies has investigated students' awareness of relative importance of idea units in stories. Levels of importance of idea units have been empirically defined using Johnson's (1970) technique. This approach is largely atheoretical with respect to the role of idea units in story comprehension and recall. As such, the studies do not necessarily implicate story-specific knowledge. Results have been mixed. On the one hand, Smiley, Oakley, Worthen, Campione, and Brown (1977) and Wong (1979) found that poor readers recalled fewer idea units than did good readers and that they were sensitive to fewer gradations of structural importance than were good readers. On the other hand, Luftig and Greeson (1983) found no differences in sensitivity to gradations of importance between educable mentally retarded and normal children, and Worden and Nakamura (1982) found no such differences between learning-disabled and normal college students. Worden and Nakamura found no differences even in overall recall of the 2 groups (though these results may have been due to students' repeated exposure to the stories).

Another group of studies has investigated students' sensitivity to story structure using more theoretically motivated propositional analyses. Hansen (1978), using Kintsch's (1974) propositional model, found that learning-disabled children recalled fewer propositions overall and recalled fewer superordinate propositions than did normal children. The 2 groups did not differ in recall of subordinate propositions (see also Weisberg, 1979). By contrast, Feagans and Short (1984) parsed their stories in terms of "action units" and failed to find any major differences between reading-disabled and normal children in comprehension and recall of these units. Wolman (1991), using Trabasso, Secco, and van den Broek's (1984) causal network analysis, found that children with mild disabilities recalled less than did children without disabilities but, again, failed to find differences between the groups in sensitivity to causal connections in stories.

By far the largest group of studies has investigated students' sensitivity to story grammar categories. Story grammars are analytical tools that describe the structural components of narrative text (Mandler

& Johnson, 1977; Rumelhart, 1975; Stein & Glenn, 1979; Thorndyke, 1977). Although story grammars differ in detail, the categories of information are essentially the same. Stein and Glenn's (1979) well-known grammar proposes that a story consists of a *major setting* (main character), *minor setting* (time and place) followed by one or more *episodes*. The episodes comprise 6 categories: *initiating events, internal responses, internal plans, attempts, direct consequences,* and *reactions*. Story grammars are assumed to approximate the readers' (or listeners') cognitive schema that guide the encoding and retrieval of story information. As such, studies of readers' sensitivity to grammatical categories more closely implicate story-specific knowledge.

Results of studies comparing good and poor readers have again been equivocal. A classic study by Weaver and Dickinson (1982) (see also Weaver, 1978; Weaver & Dickinson, 1979) examined the story recall of 10- and 13-year-old "dyslexic" boys and compared their results with those from Stein and Glenn's (1979) normal grade-5 readers using the Stein and Glenn grammar. They found no differences between the younger disabled and normal readers in overall recall (comparison with the older disabled readers was not made because of the age difference) and only 2 differences in recall of information within categories--the disabled readers recalled somewhat less of the character's thoughts or feelings about the outcome (the *reaction* category) and of the story context (*minor setting*). Moreover, they found only minor differences in the pattern of recall of story grammar categories (the rank order of recall of the categories).

A number of other studies comparing good readers with various categories of poor readers have reported similar results, finding little evidence of differential sensitivity to story grammar categories (Backman, Lundberg, Nilsson, & Ohlsson, 1984; McConaughy, 1985; Summers, 1980; Worden, Malmgren, & Gabourie, 1982; see also Gold, 1983). These results stand in marked contrast to those of Fitzgerald (1984), Hinchley and Levy (1988) and Rahman and Bisanz (1986) who reported having identified poor readers who demonstrated reduced sensitivity to story grammar categories (see also Barnhart, 1990).

A fundamental problem with the above studies, and with status studies generally, that may account for the inconsistency in findings, is heterogeneity in the samples of poor readers. This was suggested by Wiener and Cromer (1967) and elaborated by Applebee (1971), Elkins (1978), Kleiman (1985), and Singer (1982). Most studies examining the performance of poor readers, relative to that of good readers, have ignored individual differences and assumed that the poor readers constitute a homogeneous group. However, Applebee and others pointed out that there may be considerable heterogeneity of reading difficulties in samples of poor readers. They argued that if there were relatively homogeneous subgroups within the poor reader sample, and these subgroups were ignored by averaging across the subgroups, then differences between the good and poor readers may be obscured. Comparison of the poor readers' performance with that of good readers may reveal no differences or differences that were unstable (i.e., sample specific) and that did not apply to any one subgroup (see also Backman, Mamen, & Ferguson, 1984; Harris, 1978-1979; Lipson & Wixson, 1986).

Note that this argument posits the existence of *systematic* individual differences. Individuals naturally differ from each other in a variety of ways. The existence of systematic differences suggests that there are similarities as well as differences in the ways students perform and that it is possible to distinguish subgroups reflecting the systematic rather than random component of variation between students. Students in any given subgroup should share a pattern of performance on variables that defines that subgroup and distinguishes its members from those of other subgroups (Applebee, 1971; Kareev, 1982).

There are indications that the problem of heterogeneity in samples of poor readers is implicated in story comprehension research. Weaver and Dickinson noted large variation in performance within their group of dyslexic students (see especially Weaver & Dickinson, 1979). Indeed, when they divided their dyslexics into subgroups based on verbal-performance IQ discrepancy scores, the few significant

differences obtained in their dyslexic-normal comparison seem to have been due to only one subgroup of disabled readers (the less verbally proficient) and the non-significant finding for total recall obtained only for comparison of the normal readers with another subgroup (the more verbally proficient). Hinchley and Levy (1988) also obtained results that suggest that there may be a large individual difference component in story comprehension and recall and that only some poor readers have deficits in story-structure knowledge.

Another problem that may account for the inconsistency in findings is that the measures employed may not have assessed relevant aspects of students' knowledge or use of story structure. Story grammars specify not only certain categories of story information but also the *relations* among the categories. Stein (1982) has argued that differences between good and poor readers may be found only if students are required to perform tasks that deal with the relational properties of stories. Indeed, studies that have used tasks requiring students to deal with the relational properties of stories, by having them anticipate upcoming story information or recall stories that deviate from the canonical form prescribed by a grammar, have found significant differences between good and poor readers in sensitivity to story structure (Fitzgerald, 1984; Hinchley & Levy, 1988; Rahman & Bisanz, 1986).

The purpose of the present study was to identify poor readers who show weaknesses in their knowledge and use of story structure. The study sought to address the 2 problems described above. First, to take into account individual differences among poor readers, we identified homogeneous subgroups within the poor reader sample by numerically classifying the children on the basis of the component structure of reading comprehension ability. There is ample evidence that poor readers can be grouped into distinguishable subgroups (e.g., Carr, Brown, Vavrus, & Evans, 1990; Doehring, Trites, Patel, & Fiedorowicz, 1981; Lovett, 1984; Torgesen, 1982), although it is uncertain whether knowledge of story structure relates to any of the groupings. We reasoned that if any deficits in story-specific knowledge could be found, they would obtain for only some subgroup(s) of poor readers.

We used the numerical classification procedure as a device to address the problem of heterogeneity in our sample of poor readers. Using this approach, we hoped to be able to separate systematic individual differences from differences due to random error and, thereby, detect ability-group differences in story comprehension and recall that heretofore may have gone unnoticed. Our point is that previous story grammar studies may have not only overlooked some interesting findings about differences *within* the group of poor readers, they may have also lumped the variance associated with these differences together with error variance, thus decreasing the power of tests of differences *between* groups of good and poor readers.

Second, to assess children's perception of relations among story information, in addition to assessing children's free recall of stories, we examined their probe recall of causal relations. The probes were designed to provide a more structure-dependent measure of recall. We decided to focus on causal relations as these have been found to be an important determinant of reproduction probability in summarization tasks (Graesser, 1981; Lehnert, Black, & Resier, 1981) and have received attention in recent systems of text analysis (Trabasso & van den Broek, 1985). Probe questions were constructed for each story and targeted at either inter- or intra-episodic causal relations. Higher order probes were also used so that the extent of a causal relation perceived by a child could be assessed.

METHOD

Sample

Eighty children were selected from an initial pool of 204 children attending year-3 classes in 4 schools in a lower middle class area of Brisbane. The children were selected according to their scores on 3 measures of reading ability administered at the beginning of the school year: the Southgate Word

Selection and Sentence Completion Tests (Form A) (Southgate, 1959) and teacher ratings of reading ability measured on a 5-point Likert scale. Measures of passage comprehension were not used in this initial selection, so as not to bias the sample in favour of children with strengths or weaknesses in story comprehension ability. A principal factor analysis of scores on the 3 measures for the 204 children yielded one factor that accounted for 74.4% of the variance and showed loadings of .79, .93, and .86, respectively. The 20 children with estimated factor scores above the 90th percentile were selected as "good readers" (6 boys and 14 girls), and the 60 children with scores between the 10th and 40th percentiles were selected as "poor readers" (28 boys and 32 girls). The reading ability of children below the 10th percentile was judged to be insufficient to cope with task requirements later in the study.

Materials

Classification measures. To classify the poor readers into subgroups, test measures were used to assess a number of components of reading comprehension. Based on a factor analytic study of the reading test performance of Australian primary school children (Spearritt, 1977), the domain of reading comprehension was defined in terms of 4 components: vocabulary knowledge, reading speed, sentence comprehension, and passage comprehension. In addition, because of the young age of the children, tests of oral language ability were included (see Aaron, 1980; Elkins, 1978).

The measures used were: the Auditory Association, Grammatic Closure, and Sound Blending subtests of the Illinois Test of Psycholinguistic Abilities (ITPA) (Kirk, McCarthy, & Kirk, 1968), selected to approximate oral language assessment at the semantic, syntactic, and phonological levels respectively; the vocabulary subtest of the Progressive Achievement Test (Elley & Reid, 1969); a test of reading speed constructed by the authors, which comprised 3 passages of grade-appropriate difficulty from a reading program not used by the participating schools (Hart, Walker, Gray, & Walker, 1977; Walker, Walker, & Hart, 1979); and measures of sentence and passage comprehension, also constructed by the authors, which were derived from a cloze version of a 308-word story from the same reading program (deleting every seventh word for a total of 40 deletions).

Stories. For purposes of comparing results with previous studies, 3 of the 4 stories employed by Weaver and Dickinson (1982) and Stein and Glenn (1979) were used: "Epaminondas," "The Tiger's Whisker," and "The Fox and Bear." These stories have a readability ranging from early grade-2 to early grade-3 level (using Spache's 1974 formula). The stories had been parsed according to the Stein and Glenn grammar and showed little departure from canonical form. For purposes of illustration, "The Fox and Bear" and corresponding tree structure for one of its episodes are shown in Figure 1.

[Insert Figure 1 about here.]

Probe questions. Five or 6 probe questions were constructed for each story. The questions were written to assess children's comprehension of both inter- and intra-episodic causal relations. Questions concerning inter-episodic relations measured perceived causality between 2 episodes. Questions concerning intra-episodic relations measured perceived causality between statements within an episode. The latter contained statements from the internal response, attempt, direct consequence, and reaction categories. Setting and initiating event questions were not used as these categories have no causal referent according to the Stein and Glenn (1979) grammar. Internal plan questions were also not used as this category occurred in only one story.

Higher order probes were also constructed to assess the extent to which a child could retrace steps in a causal sequence. Use of the higher order probes was conditional on a child's correct response to the initial question and the probes followed the network of categories and causal relations postulated by the hierarchical structure of each story. An example from "The Fox and Bear" is as follows (*E* = experimenter, *C* = child; numbers in parentheses correspond to statements in the story):

E (*initial question*): Why did the fox want to run out of the henhouse? (21)

C: Because he was frightened. (19)

E: Why was the fox frightened?

C: Because he heard a noise. (18)

E: What made the noise?

C: The bear on the roof made the roof crack. (17)

Initial questions were chosen to minimize interdependencies among the questions and yet maximize the opportunities for higher order responses. All questions were piloted with a sample of year 3 children. Questions were phrased as *WHY* questions whenever possible; *WHAT* or *HOW* questions were asked occasionally.

Procedure

Following initial selection of the children, the study was conducted in 2 phases. First, the tests were administered to the 60 poor readers for the purpose of classifying these readers into subgroups. Children were tested individually on the tests of oral language and reading speed and in small groups on the tests of vocabulary knowledge and sentence/passage comprehension. For the test of reading speed, children read the 3 passages orally and were asked to indicate which passage they liked best. The latter device was used to encourage the children to read the passages for meaning. For the test of sentence/passage comprehension, the cloze test was untimed and every assistance was given to children in decoding words and spelling answers.

Second, all children, both good and poor readers, were asked to listen to each story and orally retell it. Standard recall procedures were used. Children were interviewed individually and told that they would be asked to retell each story exactly as they heard it, and that they would have to answer questions about the story. They then listened to the first story read by the experimenter. Immediately following the presentation, they were asked to count to 50 by 3s, after which they retold the story and answered probe questions. This procedure was repeated for the second and third stories, with brief rest periods between each story. Order of presentation of the stories was randomized, as was order of presentation of the initial questions for each story. All recalls were tape-recorded and later transcribed.

Scoring

Scores on the Auditory Association, Grammatic Closure, and Sound Blending subtests were retained as raw scores, and results of the reading speed measure were expressed in words per second averaged over the 3 passages. Three variables were obtained from the cloze test: the proportion of blanks attempted that were answered with exact-replacements, the proportion of not-exact-replacements that were contextually (syntactically and semantically) acceptable within the sentence, and the proportion of not-exact-replacements that were contextually acceptable with prior sentence context only (blanks beginning a sentence did not figure into calculation of this variable). The exact-replacement score was intended to reflect comprehension at the passage level, and the latter 2 scores, comprehension at the sentence level. On a random sample of 100 replacements, interrater agreement on judgments of contextual acceptability was 90%.

Scoring of the free and probe recalls was undertaken without knowledge of children's reading ability (good or poor) and of their performance on the classification measures. Free recalls were scored for

the number of statements within story grammar categories that were accurately recalled, using gist criteria. On a random sample of 24 protocols, interscorer agreement in coding statements according to the grammar was 93%. Probe recalls were scored for the maximum "height" attained in a causal sequence. An incorrect response to the initial probe was given a score of 0, a correct response to the initial probe was given a score of 1, a correct response to the second probe was given a score of 2, and so on. If a child gave a correct response one or more steps removed from the immediate answer, credit was given for the "skipped" information. Height of response was expressed as a proportion of the maximum height possible. The maximum height was 2 for questions concerning inter-episodic relations and 3 for questions concerning intra-episodic relations. No formal estimate of reliability was obtained in scoring the probe recalls. Instead, a second scorer was consulted for a consensus judgment when there was doubt about a child's response.

Results

Numerical Classification

The 60 poor readers were classified into subgroups using Ward's (1963) minimum variance method of hierarchical agglomerative clustering. The proportions resulting from the cloze test were first normalized using an arcsin transformation; all 8 classification variables were then standardized for the cluster analysis. The procedure started with each child as a separate cluster and successively combined clusters that were most similar using squared euclidean distance as the dissimilarity criterion. The result was a set of groupings having similar profiles on the classification variables. The performance of the poor readers was best described by a 7-cluster solution, as indicated by a marked discontinuity in the dissimilarity coefficient in the transition from a 7- to a 6-cluster solution (cf, the scree test in factor analysis). We chose to discard 2 children as outliers, and to place a cluster of 4 children with another cluster, because they showed highly similar profiles and combined later in the clustering sequence. The final result was a set of 5 subgroups for a classification of 58 (97%) of the poor readers. A similar set of subgroups was obtained for a classification of 52 (87%) of these poor readers using an alternative clustering algorithm (Johnson's 1967 maximum method).

The standard score profiles of the subgroups are shown in Figure 2. The triangled data points indicate small within-group variance relative to total variance, so they are most diagnostic for interpreting subgroup characteristics. Subgroup 1 showed average performance on the sentence comprehension variables, but children had difficulty achieving coherence at the passage level. This subgroup also showed low scores on the Auditory Association and vocabulary tests that suggest a lack of world knowledge. Subgroup 2 was marked by the contrast between relatively good sound blending ability and relatively slow reading speed, which suggests an over-reliance on within-word and phonic cues. Subgroup 3 showed above-average performance on almost all variables, suggesting that these readers had learned to integrate cues at the word, sentence, and passage levels. Subgroup 4 showed extremely poor comprehension at the sentence level and low performance on the Auditory Association test. Subgroup 5 was marked by extremely poor performance on all but the oral language variables. Although small (n = 3), this subgroup proved particularly robust in the cluster analyses.

[Insert Figure 2 about here.]

There are various criteria for judging the adequacy of a classification. Ideally, the subgroup profiles should be validated on an independent sample. In place of this, we performed a discriminant analysis to confirm that the subgroups were qualitatively distinct. Great care should be taken in interpreting the significance levels, because the subgroups have already been made different on the basis of the classification variables. However, if the discriminant analysis failed to show separation at conventional significance levels (α = .05), there would have been little point in retaining the classification.

The discriminant analysis indicated that 3 significant discriminant functions explained 59%, 23%, and 10% of the variance respectively (Wilks' Λ = .04, $F(32,171) = 7.23, p < .05$). Table 1 shows the discriminant function loadings. Discriminant Function I loaded substantially on all variables except Sound Blending and Prior Sentence. Discriminant Function II loaded positively on all oral language variables, especially Sound Blending, and negatively on all written language variables, especially reading speed. Discriminant Function III was defined by positive loadings on Grammatic Closure and Prior Sentence and a negative loading on Sentence. The discriminant scores for the 58 children and the group centroids were plotted on the first 2 discriminant functions (Figure 3). Subgroups 1 and 3 showed low and high respectively on the first discriminant function and Subgroup 5 was high on the second. Variability in Subgroup 2 was accounted for by the second function. Subgroups 1, 2, 3, and 5 were distinct, but there was some overlap between Subgroups 1 and 4 (all subgroups were distinct in 3 dimensions).

[Insert Table 1 about here.]

[Insert Figure 3 about here.]

As a further check on the classification, we performed a weighted-means ANOVA of the 5 subgroups using children's principal factor scores from the 3 initial measures of reading ability as the dependent variable. This would indicate whether the subgroups reflected nothing more than differences in reading ability. The ANOVA revealed a significant difference among subgroups, $F(4,53) = 4.22, p < .05$, but post hoc Scheffe' tests showed that the difference was due entirely to Subgroup 5 scoring lower than Subgroup 3, $F(1,53) = 13.73, p < .05$. Thus, differences in reading ability alone could not account for the classification.[1]

Story Recall

Approach to analysis. The research question required pairwise comparison of the good readers with each of the subgroups of poor readers on recall variables. Accordingly, we performed univariate and multivariate *planned* comparisons on the Group factor. To reduce the opportunity for Type-I error, the 5 pairwise comparisons were computed only if the omnibus F was significant (cf, Fisher's "protected t" strategy for a posteriori comparisons). Because there was little interest in the Story factor, and no significant Group x Story interactions were found, results were collapsed over the 3 stories. Unless otherwise noted, results reported are for the untransformed scores. Analyses were also performed of normalized scores, using an arcsin transformation, but they produced the same results in all but one case. The nominal alpha was .05.

Free recall. The mean proportions of statements recalled by each group of readers from each story as a whole are shown in Table 2. On average, the good readers recalled 53% of each story compared with 40% by the poor readers. The low performance of the poor readers was by no means uniform, however. Univariate planned comparisons (following a significant omnibus F) showed that their lower recall was due largely to Subgroup 1, $F(1,72) = 19.71, p < .05$. The next lowest recall was shown by Subgroup 4, but the difference relative to the good readers was not significant, $F(1,72) = 3.68, p > .05$. There was a statistically significant difference between the good readers and Subgroup 2, $F(1,72) = 5.83, p < .05$, but this was probably due to the enhanced power of the F-test for this effect (n = 20 for Subgroup 2).

[Insert Table 2 about here.]

The mean proportions of statements recalled within each story grammar category are also shown in Table 2. These were analyzed in a series of multivariate planned comparisons with 7 dependent variables, one for each story grammar category (*internal plan* statements were included in the *internal response* category). The results largely paralleled those for total story recall. There were significant

differences between the good readers and each of Subgroup 1 (multivariate $F(7,66) = 4.84, p < .05$) and Subgroup 4 (multivariate $F(7,66) = 2.56, p < .05$).

Following procedures recommended by Pedhazur (1982) and Stevens (1972), we performed post hoc discriminant analyses to determine which categories contributed most to these differences. Correlations of variables with the discriminant functions are shown in Table 3. The discriminant function separating the good readers and Subgroup 1 showed that all types of story information contributed to the difference, especially *internal response* and *initiating event*. The discriminant function separating the good readers and Subgroup 4 showed a different pattern; children in Subgroup 4 had most difficulty recalling information from the *major setting* and *internal response* categories whereas *initiating event* and *direct consequence* information did not contribute to the difference.

[Insert Table 3 about here.]

None of these results conclusively implicates deficits in story-specific knowledge. The depressed performance of Subgroups 1 and 4 might reflect simply poorer verbal memory in a global sense. Therefore, to minimize the effects of any general memory differences, we performed multivariate planned comparisons using analysis of covariance in which we covaried within-category recall on total recall (tests of parallelism of regression planes were satisfied in all cases). This approach most likely overcompensates for differences in total recall because it confounds treatment (i.e., the groupings) with the covariate and because of the positive within- and between-subjects correlations between the dependent variables and covariate. Our reasoning was that if any between-group differences remained after covarying on total recall, this would be fairly strong evidence in favour of story-specific effects. Results again paralleled our earlier findings but only for the normalized scores. There were significant differences between the good readers and each of Subgroup 1 (multivariate $F(7,65) = 2.35, p < .05$) and Subgroup 4 (multivariate $F(7,65) = 2.15, p < .05$). No significant differences were obtained with the untransformed scores, although the pattern of adjusted means was the same.

A further test of story-specific effects was obtained by inspecting the rank orders of category recall (see Table 2). The order of recall shown by the good readers and each of Subgroups 2, 3, and 5 is similar to that reported by Stein and Glenn (1979) for normal readers. Indeed, the orderings shown by the good readers and Subgroup 5 are identical to those of Stein and Glenn. However, the patterns shown by Subgroups 1 and 4 depart substantially from the typical ordering. Subgroup 1 shows an inversion of *reaction* and *minor setting* (adjacent categories); recall of statements from these 2 categories was almost equivalent. Subgroup 4 shows an inversion of the *major setting* and *initiating event* categories, an even more substantial reversal. It is interesting to note that *major setting*, the category that is typically most well-remembered, ranked relatively low in the recalls of children in Subgroup 4.

Probe recall. Separate analyses were performed for questions concerning inter-episodic causal relations and questions concerning intra-episodic causal relations. In each case, height of response in a causal sequence (expressed as a proportion of the maximum height possible) was averaged over those questions of a given grammatical type. There were 3 initial probes for inter-episodic relations, and 3 or 4 initial probes for each of 4 categories for intra-episodic relations. We chose to conditionalize height of recall on the accuracy of response by averaging over only those initial probe questions that were correctly answered. Otherwise, height of recall would have been confounded with response accuracy, because a child who provided only the immediately prior causal referent for most questions (i.e., scoring low in the sequence) would receive a similar score to that of a child who retrieved information further back from the probe (i.e., scoring high in the sequence) but on only 1 or 2 questions. Necessarily, children scoring 0 on all questions of a given type were excluded from the analysis, resulting in a reduced sample size.

For questions concerning inter-episodic causal relations, univariate planned comparisons showed that there was a significant difference in mean height of probe recall between the good readers (mean = .74) and Subgroup 1 (mean = .56) ($F(1,71) = 10.84, p < .05$). There were no significant differences between the good readers and each of Subgroups 2,3,4, and 5. The means for these subgroups were in fact highly uniform (means = .73, .73, .69, .69, respectively).

For questions concerning intra-episodic causal relations, there were 4 categories: *internal response*, *attempt*, *direct consequence*, and *reaction*. Because of the conditional metric, sample sizes varied and the omnibus tests were performed using separate weighted-means ANOVAs for each category of question. There were no significant differences among groups on any category and planned comparisons were not pursued. Table 4 shows that the mean heights of probe recall in categories within a story episode were remarkably similar across groups.

[Insert Table 4 about here.]

DISCUSSION

The purpose of the present study was to identify poor readers who show weaknesses in their knowledge and use of story structure. Using a traditional story recall paradigm, combined with numerical classification procedures, we were able to show that only *some* poor readers evidenced reduced sensitivity to the structure of stories, namely those represented by Subgroups 1 and 4. Children in Subgroup 1 ($n = 13$) performed poorly on the Auditory Association and vocabulary tests and on the passage-level cloze task. Children in Subgroup 4 ($n = 7$) performed poorly on the Auditory Association test and on the sentence-level cloze task. The diagnostic profiles of both subgroups reveal difficulties in integrating information from a story at a macro-level. These findings provide evidence of marked heterogeneity in poor readers' story comprehension and recall, and they suggest that deficiency in story schema or failure to use story schema may be responsible for the reading problems experienced by some poor readers.

The finding of significant and meaningful differences between good and poor readers in sensitivity to story grammar categories is at variance with the findings of Backman et al. (1984), McConaughy (1985), Summers (1980), Weaver and Dickinson (1982), and Worden et al. (1982). Our results are, however, consistent with those of Fitzgerald (1984), Hinchley and Levy (1988) and Rahman and Bisanz (1986).

Using measures of probe recall, we were also able to show that readers in one of the subgroups (Subgroup 1) had difficulty retrieving information *high* in a causal sequence, but only when the sequence crossed story episode boundaries. Height of response to questions about causal relations within story episodes was not a source of variability for these poor readers. This finding seems in agreement with the evidence concerning the constituent structure of story grammar models. Previous studies have found evidence of longer processing time at episode boundaries than within episodes (Haberlandt, 1980; Haberlandt, Berian, & Sandson, 1984; Mandler & Goodman, 1982; Thorndyke, 1978; Yekovich & Thorndyke, 1981). Boundary effects for constituents within the episode are less common, although some effects for story grammar categories have been reported (Mandler & Goodman, 1982).

The finding of no such trend in the probe recall for Subgroup 4 is interesting. The difference between Subgroups 1 and 4 in probe but not free recall may lie in the nature of the recall tasks. Organization of retrieval is important in free recall and less so in probe recall where the retrieval cues are provided. Hence, children in Subgroup 4 may have had little difficulty encoding and storing story information, but may have had trouble accessing it in free recall. Children in Subgroup 1, on the other hand, may have had difficulties in both encoding and storage as well as retrieval.

Despite the refinements employed in the present study, there are still a number of conceptual problems attendant upon the design. Although the study examined readers' sensitivity to story grammar categories, the evidence is not conclusive as to whether story-specific deficits are implicated in the reduced performances of poor readers in Subgroups 1 and 4. Children might have had a poorer verbal memory in a global sense. We believe that 4 outcomes from the study point to there being story-specific deficits. First, results of the discriminant analyses showed that not all story grammar categories were equally at risk for children in the 2 subgroups. Noteworthy was the finding that information concerning the protagonist's goals, plans, and thoughts (the *internal response/plan* categories) presented major difficulties for both subgroups. Second, children in Subgroups 1 and 4 showed substantial departures from the usual pattern of category recall, whereas the patterns shown by all other children were consistent with that predicted by the Stein and Glenn (1979) grammar. Third, even when we tried to control for memory differences using overall recall as a covariate, we failed to eliminate all between-group differences in category recall (at least for normalized scores). Fourth, the results from the probe recall for Subgroup 1 revealed differential retrieval of story information within and between episodes, a finding that previous research suggests is consistent with story-specific effects (e.g., Haberlandt, 1980).

Another problem is that the evidence relating weaknesses in story knowledge to differences in reading ability arising from the present study is correlational and no causal connection can be inferred. Several interpretations are possible. As previous studies have suggested, lack of story knowledge may be a cause of the reading difficulties. Alternatively, it is possible that lack of story knowledge may be a consequence of the reading difficulties. Poor readers may read less, experience less exposure to stories, and thus fail to develop adequate knowledge of the structure of stories. Indeed, several researchers have speculated that memory differences between good and poor readers might be a consequence of differential reading practice (Bjorklund & Bernholtz, 1986; Torgeson, 1985). Also likely is that story knowledge and reading difficulty are reciprocally related. Still another interpretation is that both story knowledge and reading ability may be related to a third variable, such as the experience of being read to in the home (for useful discussions of the ways in which good-poor reader differences and their relationship to reading achievement may be interpreted, see Backman et al., 1984; Kleiman, 1985; Stanovich, 1986; Valtin, 1978-1979).

A third problem is that the present results do not deny the existence of subgroups within the good reader population as well as the poor reader population (see Lipson & Wixson, 1986; Singer, 1982).

Implications of the present results for classroom practice need to be considered carefully. We used the numerical classification procedure as a descriptive, rather than predictive, device to address the problem of heterogeneity in our sample of poor readers. Using this approach, we were able to detect ability-group differences in story comprehension and recall that heretofore may have gone unnoticed. Nevertheless, our findings leave open the possibility that some test measures (especially the cloze tasks) may have a predictive, possibly diagnostic, power in the identification of children who lack sensitivity to story structure. Our classification tests are very traditional measures and have a history of use in schools.

Most research shows that some form of instruction in story grammar elements promotes children's comprehension and recall of stories (for a review of instructional studies, see Baumann & Bergeron, 1993). How can these results be reconciled with findings from the present study? We believe that for many children sensitivity to story structure is a form of tacit knowledge; any instruction that formalizes knowledge of story structure should enhance the likelihood that they will use this knowledge when next they are asked to demonstrate comprehension and recall of story elements. However, few studies have examined the differential response of children to story grammar instruction, beyond using fairly gross measures of ability, and few studies have separated out effects of such instruction for children for whom knowledge of story structure is developed but underutilised from those for whom it is lacking. The implications of the present study are that *some* poor readers may have qualitatively different problems

processing stories, relative to other poor readers, which may require a more concerted approach to instruction in story structure. Teachers may wish to select children for story grammar instruction (cf, Fitzgerald & Spiegel, 1983) and to include in such instruction not only explicit teaching of story elements but also emphasis on the causal relations among the elements, especially between episodes.

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Footnote

[1]Of course, it is still possible that the subgroups reflect developmental differences in the acquisition of reading ability, and that these differences are not well described by a single metric.

Table 1

Correlations of Variables with Discriminant Functions

Variable	Discriminant Function		
	I	II	III
Auditory Association	.45	.52	-.22
Grammatic Closure	.58	.55	.34
Sound Blending	.27	.62	.19
Reading Speed	.52	-.58	-.05
Vocabulary	.81	-.16	.08
Exact Replacement	.82	-.19	-.17
Sentence	.54	-.26	-.45
Prior Sentence	-.05	-.53	.69

Table 2

Mean Proportions of Story Information Recalled by Group

Category	Good Readers	Subgroup 1	2	3	4	5
Major setting	.83	.46	.60	.62	.38	.78
Direct consequence	.77	.51	.60	.73	.65	.75
Attempt	.62	.33	.49	.57	.48	.60
Initiating Event	.54	.23	.43	.52	.50	.46
Reaction	.50	.20	.40	.35	.25	.33
Minor setting	.43	.22	.27	.25	.21	.07
Internal response	.31	.09	.21	.29	.17	.21
Total	.53	.28	.41	.47	.40	.48

Table 3

Correlations of Variables with Discriminant Functions

Category	Good Readers vs Subgroup 1	Good Readers vs Subgroup 4
Major setting	.63*	.81*
Direct consequence	.57*	.19
Attempt	.67*	.42
Initiating Event	.76*	.09
Reaction	.65*	.54*
Minor setting	.45*	.55*
Internal response	.81*	.58*

* Significant univariate F-test of difference in recall, $p < .05$

Table 4

Mean Height of Probe Recall of Intra-Episodic Relations by Group

Category	Good Readers	Subgroup 1	2	3	4	5
Internal response	.96	1.00	.94	.99	.95	1.00
Attempt	.95	.87	.94	.89	.96	.75
Direct consequence	.86	.83	.89	.88	.83	.78
Reaction	.91	.88	.87	.95	.86	.81

Figure Captions

Figure 1. "The Fox and Bear" parsed into story grammar categories, Figure 1b. tree structure for Episode 3 of "The Fox and the Bear."

Figure 2. Standard score profiles of 5 subgroups of poor readers on eight classification measures (AA=Auditory Association, GC=Grammatic Closure, SB=Sound Blending, SPEED=Reading Speed, VOCAB=Vocabulary, ER=Exact Replacement, SENT=Acceptable within Sentence, PRIOR SENT=Acceptable in Prior Sentence Context).

Figure 3. Plot of 5 subgroups of poor readers on Discriminant Functions I and II (Subgroups 1, 2, 3, 5 circled).

Major Setting	1.	There was a fox and a bear
Minor Setting	2.	who were friends
Internal Response	3.	One day they decided to catch a chicken for supper
	4.	They decided to go together
	5.	because neither one wanted to be left alone
Minor Setting	6.	and they both liked fried chicken
Attempt	7.	They waited until night time
	8.	Then they ran very quickly to a nearby farm
Internal Response	9.	where they knew chickens lived
	10.	The bear, who felt very lazy
Attempt	11.	climbed upon the roof
Internal Response	12.	to watch
Attempt	13.	The fox then opened the door of the henhouse very carefully
	14.	He grabbed a chicken
Direct Consequence	15.	and killed it
Initiating Event	16.	As he was carrying it out of the henhouse
	17.	the weight of the bear on the roof caused the roof to crack
	18.	The fox heard the noise
Internal Response	19.	and was frightened
Minor Setting	20.	but it was too late
Internal Response	21.	to run out
Direct Consequence	22.	The roof and the bear fell in
	23.	killing five of the chickens
	24.	The fox and the bear were trapped in the broken henhouse
Attempt	25.	Soon the farmer came out
Internal Response	26.	to see what was the matter

Figure 1a

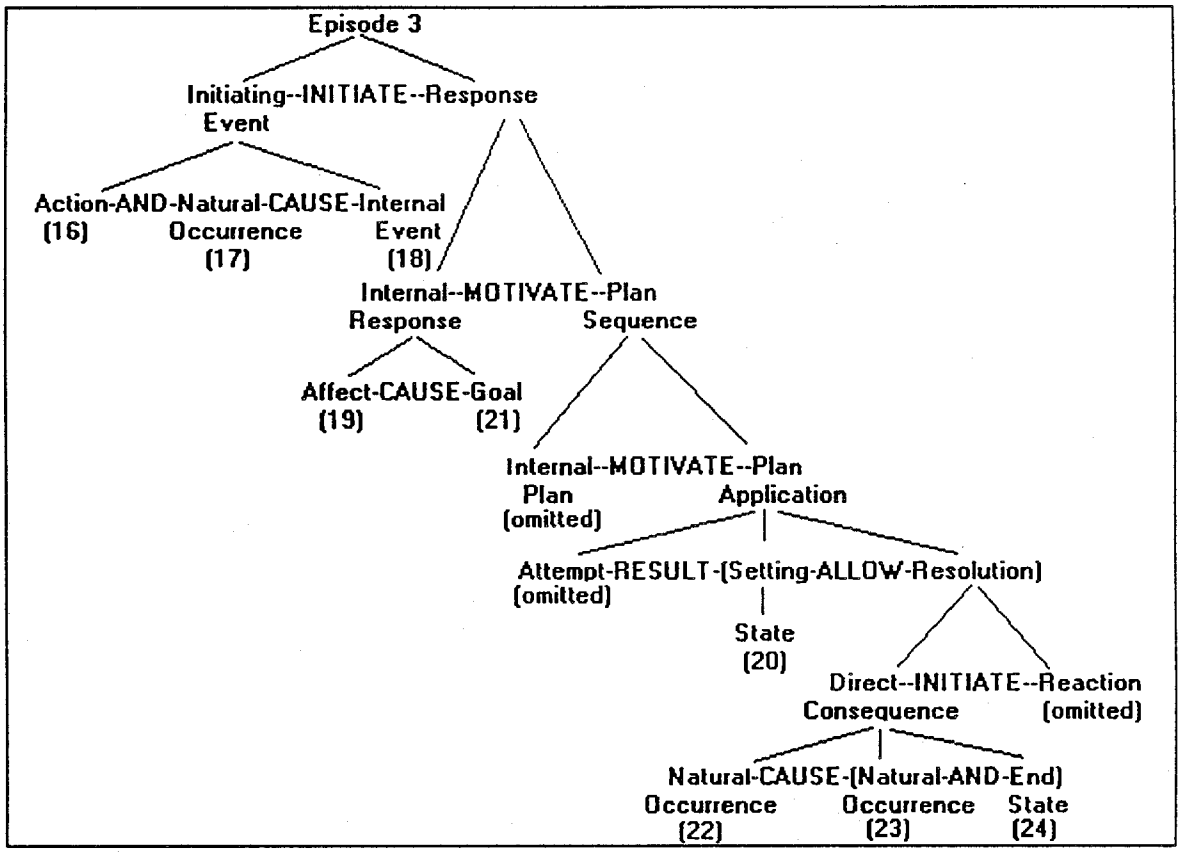
Episode 3
Initiating--INITIATE--Response
Event
Action-AND-Natural-CAUSE-Internal
(16) Occurrence Event
(17) (18)
Internal--MOTIVATE--Plan
Response Sequence
Affect-CAUSE-Goal
(19) (21)
Internal--MOTIVATE--Plan
Plan Application
(omitted)
Attempt-RESULT-(Setting-ALLOW-Resolution)
(omitted)
State
(20)
Direct--INITIATE--Reaction
Consequence (omitted)
Natural-CAUSE-(Natural-AND-End)
Occurrence Occurrence State
(22) (23) (24)

Figure 1b

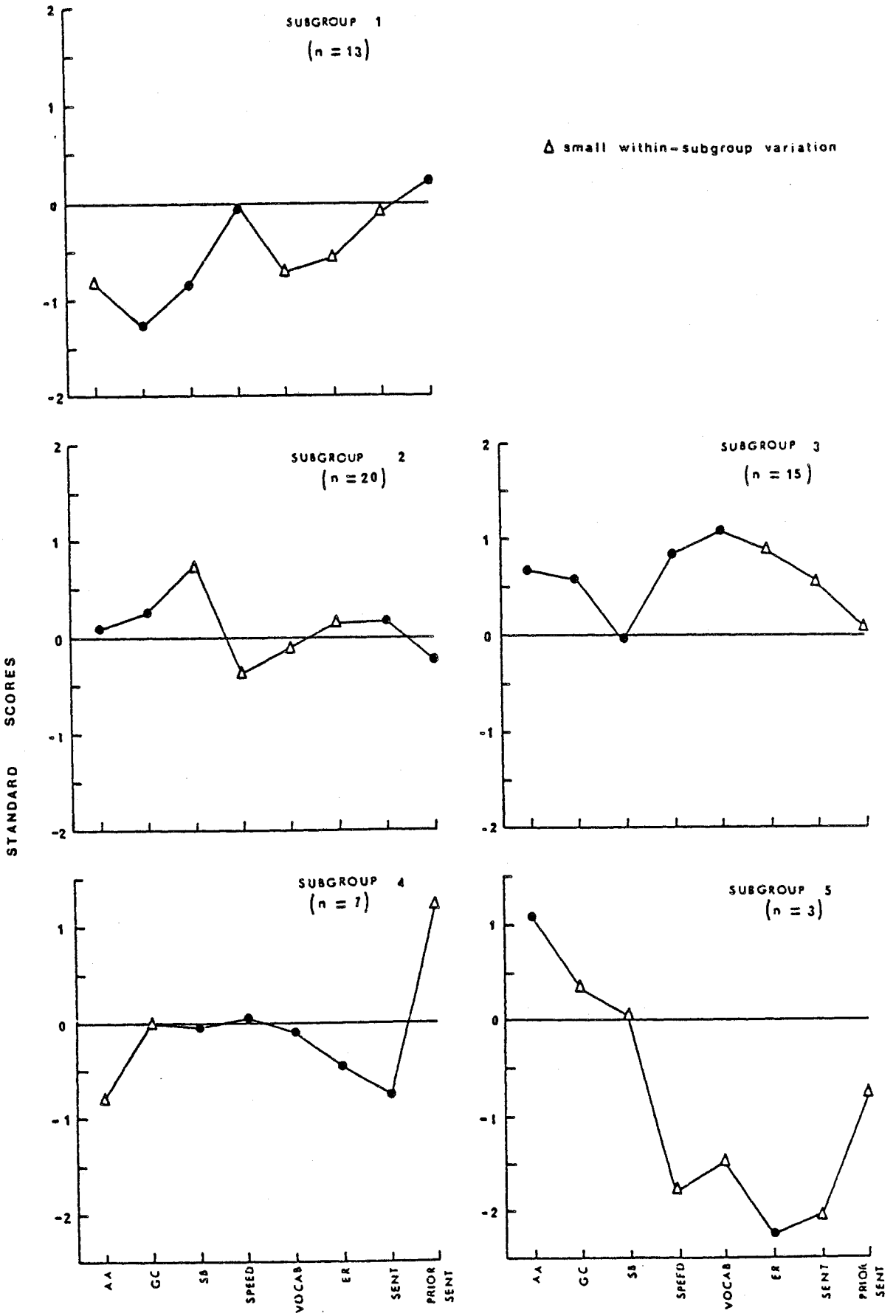
SUBGROUP 1
(n = 13)
Δ small within-subgroup variation
SUBGROUP 2
(n = 20)
SUBGROUP 3
(n = 15)
SUBGROUP 4
(n = 7)
SUBGROUP 5
(n = 3)
STANDARD SCORES
AA
GC
SB
SPEED
VOCAB
ER
SENT
PRIOR SENT
TEST MEASURES

Figure 2

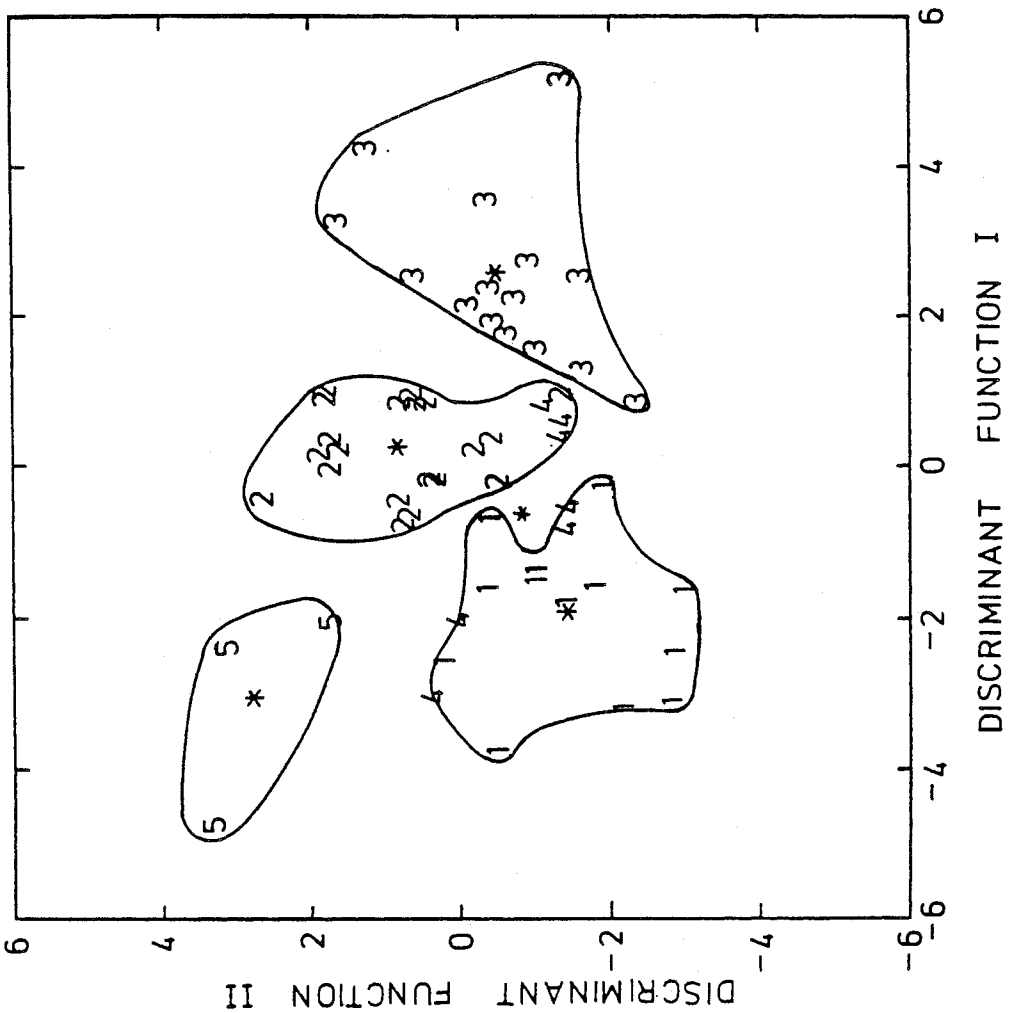
DISCRIMINANT FUNCTION II
DISCRIMINANT FUNCTION I
6
4
2
0
-2
-4
-6

Figure 3