An analysis of preschool children's interpersonal behaviors by a longitudinal method

FUSAKO IIJIMA

Department of Psychology and Education, Faculty of Humanities, Meisei University, Hino, Tokyo 191

This study analyzed the structure and the developmental changes of interpersonal behaviors of 42 preschool children using a longitudinal method over a 3-year period. Four variables—sex (M.F.), enrolled year (1980, 1981), subcategory of interpersonal behaviors (solitary, parallel, same sex pair, same sex group, etc.) and term (1, 2, 3, 4, 5, 6, 7, 8, 9) were employed as the variables. As a result of factor analysis, five factors ("unoccupied behavior," "solitary behavior and teacher pair—same sex group," "same sex pair—mixed group," "same sex group with teacher," and "parallel behavior") were identified. Boys were likely to play in "same sex groups," while girls were likely to play with their teacher. Interaction between teacher and children resulted in specific interpersonal behavior. In the first term, the child was engaged in a variety of activities. However, beginning with the fourth term, "same sex groups" and "same sex pair" were ranked higher, followed by "parallel behavior." "Parallel behavior" sometimes represented the child's involvement in an activity. In future, multi-dimensional analysis of interpersonal behaviors and task-oriented behaviors should be performed.

Key words: interpersonal behavior, longitudinal method, kindergarten, same sex pair, same sex group, solitary behavior, parallel behavior.

In the field of interpersonal behavior of preschool children, Parten's classic study (1932) classified child behavior into six sub-categories. These ranged from unoccupied behavior to cooperative play and included solitary play, onlooker behavior, parallel play, and associative play. Studies using these categories have been widely accepted (Barnes, 1971; Smith & Connolly, 1980).

However, recent studies by Moore, Evertson, and Brophy (1974), Rubin, Maioni, and Hornung (1976), Smith (1978), Roper and Hinde (1978) and Bakenman and Brownlee (1980) have questioned the contention that interpersonal behaviors lie on a single dimension of solitary, parallel and group play through which the child gradually progresses. Smith (1978) and Roper and Hinde (1978), in particular, cast doubt on the classic idea by employing cross-sectional methodology. They contended that longitudinal method should be used to examine developmental trends of interpersonal behaviors. Moreover, experimental work in preschool environments offers another productive method for investigating this question. However, as with any experimental study, too much control of variables can render the experimental situation unnatural, and hence limit the extent to which findings may be generalized to other real-life situations.

This study analyzes the structure and the developmental changes of interpersonal behaviors of preschool children under natural conditions. And, to increase the longitudinal validity of the results, the observations were gathered over a 3-year period.

The children in one free activity program (a so-called Kurahashi program)
kindergarten in Tokyo were selected as the subjects. Although teachers monitored the children's activities, the children were allowed to engage in self-selected play. This situation enabled the researcher to observe individual development that was relatively unhindered by the control of the teacher.

Thus, this is an ecological study on interpersonal behaviors, and its findings are not directly applicable to all free-activity situations. In spite of this limitation, it is useful to examine longitudinal data from 3- to 5-year-olds under the controlled conditions of educational program, the number of children, teacher-children ratio, space density and facilities.

Four variables—sex (M.F.), enrolled year (1980, 1981), subcategories of interpersonal behaviors (wandering, solitary, onlooker, approaching, parallel, same sex pair, same sex group, mixed group, teacher pair, same sex group with teacher, and mixed group with teacher), and term (1, 2, 3, 4, 5, 6, 7, 8, and 9) were employed as the main variables.

Method

Subjects

The subjects were 10 boys and 10 girls who were enrolled in April, 1980, and 11 boys and 11 girls who were enrolled in April, 1981. All the subjects were enrolled after their third birthday and stayed in kindergarten until they entered elementary school.

All the subjects came from white collar families. The father's occupation included management, professional and clerical categories. Some 60% of the mothers graduated from a junior college or a university, and 80% of the fathers graduated from a university. About 90% of the mothers were housewives without any outside employment.

Kindergarten. The kindergarten is located in a Tokyo ward, and it had been in operation for 27 years when this study started. It is a private well-known kindergarten in its Tokyo community. It has three classrooms (3-year-olds, 4-year-olds and 5-year-olds), a hall and a teacher's room; and it is excellently equipped with toys. There was also a small playground well equipped with sand boxes, sliders, swings etc., and movable toys. The kindergarten also maintained some rabbits, chickens, guinea pigs and hamsters for the children to play with and tend. The area of the building was 254 m² and the total area of its land and premises was 765 m².

All the children attended the kindergarten 6 days a week (except Sunday). Classes ran from 9:00 a.m. through 1:30 p.m. Monday, Tuesday, Thursday and Friday, and from 9:00 a.m. through 11:30 a.m. Wednesday and Saturday.

The children normally played anywhere in the kindergarten. However, during lunch time and half an hour before going home, they stayed in their classrooms. These times were used for structured activities (e.g., listening to teachers' story telling, singing etc.).

One teacher each monitored the 4-year-olds and 5-year-olds and two teachers monitored the 3-year-olds. A headteacher and an assistant teacher handled administrative duties and substitute teaching.

All teachers were female.

Each group consisted of 30 to 38 children. However, some children transferred to other kindergartens, either due to the fathers' job mobility or parental quest for a more prestigious school. And some newcomers were enrolled at the beginning of the first term of some grades. When this survey started in 1980, 17 boys and 18 girls were enrolled, and in 1981, 17 boys and 17 girls were enrolled. However, the analysis was conducted on the data from only those 42 children enrolled for the entire observation periods.

The kindergarten used a three-term system; the first term ran from the beginning of April through the middle of July; the
second term, from the beginning of September through the middle of December; and the third term, from the beginning of January through the middle of March.

Data Collection

Each observation was conducted for about one and a half months at the beginning of each school term.

The observation time of each day was from 9:15 until lunch and after lunch until structured activity time before going home Monday, Tuesday, Thursday and Friday. It was from 9:15 until 11:00 Wednesday and Saturday. Observations were not performed when it rained or snowed, because the child's moving areas were limited to indoors.

Time sampling procedures were employed for data collection. Each child was observed for 20 minutes divided into 60 20-s periods. Thus, 60 sub-data were collected on each child in each term. The children were observed once a term by trained observers in roughly fixed order: an earlier observed group and a later observed group. As a result, nine observations were obtained per child. A child was observed by a rater.

At least three observers participated in each session. The child was accustomed to the observers' presence and paid little attention to them. Each observer was trained until reliability of agreement with the present writer (observer) on each category reached at least 90% over each year. The categories which had difficulty in observing agreements among raters in the preliminary study were elaborately checked (e.g., the number of children in group play, the difference between "wandering" and "approaching," etc.). Simultaneous sport checks were conducted between the present writer and each rater in each term, on a boy and a girl of each enrolled year group for ten minutes. The agreement index was computed as the number of agreed occurrences divided by the total number of recorded occurrences. The index indicated reliability ranging from .80 to .96 for each category.

Measure. The following 11 sub-categories, selected on the basis of the previous studies (Parten, 1932; Roper & Hinde, 1978; Smith & Connolly, 1980) and a three-month preliminary observation, were used.

1. wandering: the child is aimlessly wandering, or is more than temporarily inattentive to the activity of the group.
2. solitary: the child is playing, but has no neighbors engaged in a similar activity.
3. onlooker: the child is just watching peers' activities.
4. approaching: the child is approaching peers.
5. parallel: the child is engaged in an activity alongside other children similarly engaged but not otherwise influenced by them.
6. same sex pair: the child is playing with another of the same sex.
7. same sex group: the child is playing with two or more peers of the same sex.
8. mixed group: the child is playing with two or more peers, both male and female.
9. teacher pair: the child is communicating with a teacher.
10. same sex group with teacher: the child is playing with two or more peers of the same sex and the teacher.
11. mixed group with teacher: the child is playing with two or more peers, both male and female, and the teacher.

Initially, another category, routine, was also used. Routine was defined as "the child was engaged in routine activities, e.g., going to a rest-room, washing his / her hands, or changing his / her clothing etc." However, routine scores were discarded from the analysis since they were not related to play activity. Further, the sub-categories of "quarrel" and "rough and tumble play" etc. were also employed.
An analysis of preschool children's interpersonal behavior

Table 1

Factor analysis on each category of interpersonal behaviors

<table>
<thead>
<tr>
<th>Category</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>h²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. wandering</td>
<td>.715</td>
<td>.150</td>
<td>.042</td>
<td>-.016</td>
<td>-.077</td>
<td>.542</td>
</tr>
<tr>
<td>2. solitary</td>
<td>.126</td>
<td>.687</td>
<td>.232</td>
<td>-.372</td>
<td>-.138</td>
<td>.699</td>
</tr>
<tr>
<td>3. onlooker</td>
<td>.743</td>
<td>.118</td>
<td>-.086</td>
<td>.050</td>
<td>.032</td>
<td>.576</td>
</tr>
<tr>
<td>4. approaching</td>
<td>.538</td>
<td>.105</td>
<td>-.068</td>
<td>-.263</td>
<td>-.235</td>
<td>.430</td>
</tr>
<tr>
<td>5. parallel</td>
<td>-.177</td>
<td>-.039</td>
<td>-.008</td>
<td>-.151</td>
<td>.918</td>
<td>.890</td>
</tr>
<tr>
<td>6. same sex pair</td>
<td>-.101</td>
<td>-.018</td>
<td>.646</td>
<td>.175</td>
<td>-.034</td>
<td>.611</td>
</tr>
<tr>
<td>7. same sex group</td>
<td>-.104</td>
<td>-.815</td>
<td>.278</td>
<td>-.030</td>
<td>-.060</td>
<td>.757</td>
</tr>
<tr>
<td>8. mixed group</td>
<td>-.335</td>
<td>.057</td>
<td>-.538</td>
<td>-.458</td>
<td>-.389</td>
<td>.766</td>
</tr>
<tr>
<td>9. teacher pair</td>
<td>.200</td>
<td>.642</td>
<td>-.084</td>
<td>.263</td>
<td>-.049</td>
<td>.530</td>
</tr>
<tr>
<td>10. same with teacher</td>
<td>-.127</td>
<td>.064</td>
<td>-.063</td>
<td>.796</td>
<td>-.164</td>
<td>.684</td>
</tr>
<tr>
<td>11. mixed with teacher</td>
<td>-.046</td>
<td>.159</td>
<td>-.749</td>
<td>.315</td>
<td>.012</td>
<td>.686</td>
</tr>
</tbody>
</table>

| Contributions                   | 1.743 | 1.629 | 1.424 | 1.276 | 1.110 |
| Cont. Ratio                     | .243  | .227  | .198  | .178  | .151  |
| Cum. Cont.                      | .243  | .170  | .668  | .846  | 1.000 |

But the occurrences of these categories were small, so they were discarded. Three additional categories—just forming group, associative behaviors or cooperation—produced a number of recorded instances, but too few to adequately analyze. These were collapsed into the similar categories of No. 6: same sex pair, No. 7: same sex group and No. 8: mixed group.

Results

Factor Analysis

Totaled individual scores on each measure were divided by 60 and transformed into arc sine transformation scores. Pearson's correlation coefficients were estimated on the 11 categories over sex, enrolled year and term. The resulting number of estimated data for analysis totaled 378.

Factor analysis was performed by employing a principle factor method. Five factors with eigen value over 1 were extracted. These factors were rotated by means of a varimax rotation. The first factor accounted for 21.66% of the total variance; the second factor, 13.15%; the third factor, 11.28%; the fourth factor, 9.87%; and the fifth factor, 9.33%, respectively. Together the five factors accounted for 65.29% of the total variance.

The categories loading on the first factor all reflected "unoccupied behavior."

The second factor represented a category concerned with "solitary behavior and teacher pair—same sex group."

Inspection of the third factor identified this category as related to "same sex pair—mixed group."

Inspection of the fourth factor suggested that these items address "same sex group with teacher."

The examination of the fifth factor represented a category related to "parallel behavior."

Analysis of Variance on Sub-Categories after Factor Analysis

First, a three way analysis of variance (sex x enrolled year x term) on each factor was conducted. The analysis of the second factor identified a significant main effect on term. However, the second factor included bi-polar categories (solitary and teacher pair—same sex group), and it declined, as the child became older. Thus, the changing process over term on the negative category (same sex group) was not specified. The bi-polar categories in the second and third factors were individually selected. As a result, seven su-
categories were employed. For the "unoccupied behavior" (No. 1.), each raw score of wandering, onlooker and approaching was totaled, divided by 60 and transformed into arc sine transformation scores. For the "solitary behavior and teacher pair," (No. 2.) each raw score of "solitary behavior and teacher pair" was totaled and the same procedure as in "unoccupied behavior" was employed. Similar procedures were used to compute scores for "mixed group" (No. 5.). "Same sex group" (No. 3.), "same sex pair" (No. 4.), "same sex group with teacher" (No. 6.), and "parallel behavior" (No. 7.) were single item categories, and subtotals of the transformations were not necessary.

A four way analysis of variance (sex x enrolled year x category x term) was conducted using unweighted-means and unequal cell frequencies. The design employed two independent variables, sex (M. F.) and enrolled year (1980, 1981), and two repeated variables, category (unoccupied behavior, solitary behavior and teacher pair, same sex group, same sex pair, mixed group, same sex group with teacher, parallel behavior) and term (1, 2, 3, 4, 5, 6, 7, 8, 9).

The analysis identified significant main effects on enrolled year (F=7.591, df=1/38, p<.01), category (F=42.802, df=6/228, p<.01) and term (F=6.160, df=8/304, p<.01). As shown in Fig. 1, the group enrolled in 1981 had more observed scores than the group enrolled in 1980. Concerning sub-categories, as a whole, "same sex groups" and "same sex pairs" had higher scores, whereas "unoccupied behavior" and "same sex groups with teacher" had lower scores.

As shown in Fig. 2, the first term had slightly fewer observed scores, compared with the other terms.

A significant interaction was observed between sex and the sub-categories (F=4.074, df=6/228, p<.01). As shown in

---

**Fig. 1. Enrolled year and category (Tukey).**

The difference between category 2 and 3 is significant at .01 level or better.


---

**Fig. 2. Term (Tukey).**

The difference between terms 1 and 9 is significant at .05 level or better.
Fig. 3, boys had higher scores in “same sex groups” than did girls, whereas girls had higher scores in “same sex groups with teacher” than did boys.

A significant interaction was observed between enrolled year and the sub-categories \( F = 2.351, df = 6/228, p < .05 \). As shown in Fig. 4, the group enrolled in 1980 had higher scores than the group enrolled in 1981 in “same sex groups.” On the other hand, the group enrolled in 1981 had higher scores than the group enrolled in 1980 in “same sex pairs,” “mixed groups,” “same sex groups with teacher” and “parallel behavior.”

A significant interaction was observed between category and term \( F = 5.717, df = 48/1824, p < .01 \). As shown in Fig. 5, “unoccupied behavior” declined as the child became older. “Solitary behavior and teacher pair” also declined, as the child became older. “Same sex groups” increased with a slight fluctuation. “Same sex pairs” increased with fluctuation. “Same sex groups with teacher” declined with fluctuation, as the child became older. “Mixed groups” showed fluctuation, as the child became older. “Parallel behavior” fluctuated and specific rules were not observed.

Generally, in the first term, “solitary behavior and teacher pairs” and “unoccupied behavior” were dominant and other categories were almost equally observed.

But, in the second term, “same sex pairs” and “solitary behavior and teacher pairs” were dominant.

In the third term, “solitary behavior and teacher pairs,” “parallel behavior,” “same sex pairs” were almost equally observed, and “same sex groups with teacher” was lowest, although significant differences were not observed.

In the fourth term, “same sex groups” and “same sex pairs” were dominant, followed by “solitary behavior and teach-
er pairs”; “unoccupied behavior” was ranked lowest.

After the fifth term, “same sex groups” were ranked highest, followed by “same sex pairs” and “parallel behavior,” whereas “unoccupied behavior” and “solitary behavior and teacher pairs” declined. In addition, “mixed groups” and “same sex groups with teacher” fluctuated.

Discussion

As a result of the factor analysis, five factors, (“unoccupied behavior,” “solitary behavior and teacher pair—same sex group,” “same sex pair—mixed group,” “same sex group with teacher,” and “parallel behavior”) were identified.

The first factor implied that the child was engaged in no activities, aimlessly wandering, watching peers’ activities or approaching peers.

The second factor suggested that how much the child played alone, or asked help or acceptance to his/her teacher was negatively related to how much that child interacted with two or more peers of the same sex.

The third factor indicated that how much the child was engaged in tasks with another of the same sex was negatively related to how much that child interacted with two or more peers, both male and female.

The fourth factor suggested that the child was engaged in some tasks with two or more peers of the same sex and the teacher.

The fifth factor indicated that the child was engaged in an activity alongside other children similarly engaged but not otherwise influenced by them.

There have been a few studies of preschool behavior employing factor analysis (Blurton Jones, 1972; Nakano, 1984; Roper & Hinde, 1978; Smith & Connolly, 1972). Among them, Roper and Hinde (1978) used the sub-categories: unoccupied, changes, self-play, parallel play, group play, watching or scanning, talking with peers, talking with adults, talked to
An analysis of preschool children's interpersonal behavior

by adults, and not communicating with neighbors. These categories are similar to those employed in this study. Comparing the results of this study with Roper and Hinde's (1978), "unoccupied behavior" and "solitary behavior" were observed in both studies, although in this study, "solitary behavior" was tied with "teacher pair." And, the factor "group behavior vs. parallel behavior" was observed in their study, whereas "solitary behavior and teacher pair—same sex group," "same sex group with teacher," and "parallel behavior" factors were observed in this study. Thus, this study identified a more elaborate factor structure.

Some of differences between Roper and Hinde's study (1978) and this study could have been attributed to the differences in group-size, staff-to-student ratio, space, the length of period of observation and situations.

Group-size ranged from 10 to 15 children in Roper and Hinde's (1978) study, whereas there were about 35 children in this study.

Two or more staff members monitored a group in Roper and Hinde's study, while one teacher monitored a larger group in this study, except in the 3-year-old group.

Roper and Hinde did not describe their spatial environments, only describing the classrooms as large. However, we employed a very small kindergarten with a larger number of children.

In addition, Roper and Hinde (1978) collected data in two classes over two consecutive terms of 12–13 weeks, but we collected the data over three years.

In terms of the situational constraints, the child was observed during free-play session in Roper and Hinde's study (1978), whereas the Kurahashi program kindergarten was employed in this study. In the Kurahashi program, the teachers accept the child's feeling or desires, and encourage him/her to cope with events or tasks, according to individual differences.

Thus, this study indicated that interpersonal behavior will develop specific differences, according to the above-mentioned variables.

The result that boys exhibited more group behaviors than girls was in agreement with those of Blurton Jones (1972), McGrew (1972) and Smith and Connolly (1980). On the other hand, girls scored higher than boys in "same sex groups with teacher." This is the same result as reported by Smith and Connolly (1980).

In general, the teachers are female in kindergarten. And student-teacher identification is more easily attained for girls. Thus girls showed more attachment to their teachers. This result also reflected girls' dependent or person-oriented trait.

The group enrolled in 1981 outscored the group enrolled in 1980. This applied to the overall number of routines, but the 1980 group had more incidences in the categories discarded from the computing because of low numbers of observations, e.g., quarrel. The 1980 group was rated higher than the 1981 group in observations of "same sex groups," whereas the 1981 group was rated higher in "same sex pairs," "mixed groups," "same sex groups with teacher," and "parallel behavior," although significant differences were not observed. The teacher for the 1980 group gave the children the responsibility for developing their own activities within a defined framework. She seldom gave active instructions to the children, when they were engaged in activities. Moreover, an autistic boy was attending her class in 1980 and 1981. She sometimes looked after him, although an assistant teacher devoted herself to take care of him. The teacher for the 1981 group controlled the children's activities more than the 1980 teacher, by asking them questions or trying to encourage them to cope with tasks. As a result, higher scores were obtained in "same sex groups" by the 1980 group and in "parallel behavior," "mixed groups" and "same sex groups with teachers" by the 1981 group.
In terms of category, "same sex groups" and "same sex pairs" were ranked highest, whereas "unoccupied behavior" and "same sex groups with teachers" were ranked lowest. This result is in agreement with Smith and Connolly (1980), in that same sex playmate preference was revealed in a larger group (about 30 members).

The finding that "unoccupied behavior" declined supports McGrew's (1972) report that children first showed "unoccupied behavior," but were soon engaged in group activities.

In the first term, the child was engaged in a variety of activities. This apparently resulted from the teacher's efforts to acclimate the child to the kindergarten. She devoted more efforts to activities than in the other terms; and when the child was engaged in some task, she allowed him/her to continue his/her play.

In the second term, "same sex pairs" were ranked highest, followed by "solitary behavior and teacher pairs." This term was in September, and the favorable weather and ecological stimuli (flowers and insects) could have encouraged the child to explore the environment with a friend. In this term, the child was accustomed to the kindergarten environment and could be engaged in self activity. But he/she still sometimes depended on the teacher.

In the third term, "solitary behavior and teacher pairs," "parallel behavior" and "same sex pairs" were almost equally observed. This implies the child was developing from dependent behavior to trying to communicate with peers.

In the fourth term, "same sex groups" and "same sex pairs" were dominant, followed by "solitary behavior and teacher pairs." This indicates the child was engaged in group activities and sometimes showed dependent behavior or self-involvement.

This study indicated that, beginning with the fifth term, "same sex groups" were ranked highest, followed by "same sex pairs" and "parallel behavior," while "unoccupied behavior," "solitary behavior and teacher pairs" declined. In addition, "mixed groups," and "same sex groups with teacher" fluctuated.

Another recent study using a longitudinal method over nine months was reported by Smith (1978). According to this study, "some 2-year-olds went through successive stages of predominantly solitary, then parallel, then group play, but many others did not. Some 3- and 4-year-olds alternated between periods of predominantly group play and periods of predominantly solitary play" (Smith, 1978, p. 517).

Generally, since Moore et al. (1974), "solitary behavior" has been seen as a mature coping behavior for older children and "parallel behavior" was considered as an immature one (Moore et al., 1974; Rubin et al., 1976). On the other hand, Bakeman and Brownlee (1980) pointed out that parallel play was not a stage of development, but a transient pattern of activities, which functions as a bridge from solitary play to group play in the stream of activities.

According to Fig. 5, this study would appear to be in agreement with the classic idea, showing developmental progresses from solitary, parallel, to group behaviors. However, there are some problems in this conclusion if "solitary and parallel behaviors" are considered related to task-oriented behaviors. The child was involved in more "same sex groups" or "same sex pairs," as he/she became older, but "parallel behavior" remained relatively consistent during this time. And, "solitary behavior and teacher pairs" declined as the child became older. When the child was younger, he/she could not communicate well with peers and depended on adults. As the child became older, he/she was involved in individual activity, but still required information from the teacher, or went to the teacher to show his/her "masterpieces" (e.g. drawings
An analysis of preschool children's interpersonal behavior

...and handcrafts), with expectation of acceptance from the teacher. However, the finding that "parallel behavior" was ranked 3rd, implies that this behavior is not an intermediate stage between "solitary behavior and group behavior." This kindergarten has operated under a Kura-hashi program. The teacher encouraged spontaneity, individuality, and spontaneous group activities. One result of the spontaneous group activities was an increased amount of simultaneous activity (e.g., groups all making the same toys). And, this behavior was categorized as "parallel behavior" (the child is engaged in an activity alongside other children similarly engaged but not otherwise influenced by them). Thus, the specific educational program of the observed kindergarten created a larger amount of "parallel behavior." This finding suggested that we should consider the positive implication of "parallel behavior," as Moore et al. (1974) discovered in solitary behavior. And its relationships to both interpersonal and task-oriented behaviors should be studied.

Some problems remain unsolved. First, the intra-individual changes over term on each category should be analyzed. Second, the interpersonal behaviors of newly enrolled children should be examined to verify the generalizability of the results. Third, a follow-up study on the subjects would provide data on the predictive value of preschool interpersonal behaviors on future social activities.

Fourth, Rubin et al. (1976), Rubin and Watson (1978), Rubin (1982) and Nakano (1984) have proposed the importance of multi-dimensional analysis of interpersonal and task-oriented behaviors. In this study, first, the attempt to cope with varied type of activities, such as functional play, symbolic play, or educational play etc. was carried out. However, it was difficult to cover an elaborate factor structure over multiple dimensions of behaviors, because a relatively large number of categories were employed. The number of categories was reduced to seven by this study. In the future, more in-depth multi-dimensional analysis of interpersonal behavior and task-oriented behavior should be performed.

References


Smith, P. K., & Connolly, K. J. 1980 *The ecology of preschool behavior*. Cambridge: Cambridge University Press. (Received Feb. 20, 1985; accepted Sept. 14, 1985)