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Twins' Perception of Their Environment: A Cross-cultural Comparison of Changes Over Time

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Abstract. In a previous Swedish twin project (the SLU-project), approximately 300 MZ and DZ twin pairs and controls were followed through the Swedish compulsory school from grade 3 to grade 9. Results from this study indicated an increase of genetic influences on school achievement over time for children from a permissive home environment and a decrease for children from a restrictive home environment. These types of data have generated a more general model for studying heredity-environment interaction in educational settings. To test this model, a cross-cultural comparison over time of twins and controls in the Israeli kibbutz school and in the Swedish compulsory school has been made. Restrictions on the child were originally assumed to be more apparent in the kibbutz environment.

Key words: Permissive, Restrictive, Home environment, School achievement, Heredity

INTRODUCTION

The final purpose of this project is to relate environmental restrictiveness to intrapair similarity in ability and achievement scores. In order to make comparisons between Israel and Sweden a facet design was used involving the construction and use of a mapping sentence for observations on children's perception of environmental restrictions both at home and at school. Facet theory was developed by Guttman [8] and is decribed in further detail by Shye [12] and Canter [1]. It has also been used by other researchers [4] to investigate constructs and concepts as well as their interrelationships in the social research field. Facet theory and facet design use nonmetric data analysis procedures, such as, "Smallest Space Analysis (SSA) and Partial Order Scalogram Analysis (POSAC)" for exploring the meaning and interrelationships of similar constructs in different cultural settings (3,10,11).

In this study we investigated the extent of restrictions experienced in the home and school environment for Swedish twin girls and twin boys at two points in time. Facet theory is used to accomplish this and our next step will be to compare the Swedish outcome to similar data collected for the Israeli kibbutz twins Guttman et al [10]; Fischbein et al [7]. Finally this will enable us to test the application of the above-mentioned model in the two school systems.

METHODS

Sample

Approximately 70 pairs of Swedish twins participated in the study. The twins were first contacted when they attended grade 4-6 at the age of 11-13 years. They were followed up in grade 8 at the age of 15. About half of the twins are MZ and half DZ of the same sex. Similarity diagnosis was made using the Cohen and Dibble questionnaire method [2].

All the Swedish twins were living in the Stockholm area. When first contacted they were attending classes where one teacher gave most of the lessons, ie, the class-teacher system. On the second occasion in grade 8, a subject-teacher system was operating, which meant that the pupils had different teachers for different subjects. Originally, 78 twin boys and 70 twin girls were included in the analyses. These numbers had dropped, however, to 66 twin boys and 50 twin girls by the second round of analyses in grade 8. The reason for this was mainly due to refusal on the twins' part to participate in the investigation. This refusal to participate was more common among the girls which might be due to their earlier maturity and need of differentiation from their twin partner.

Questionnaires

Questionnaires were compiled to include background information and to assess permissiveness-restrictiveness in the school and home environments. The conceptual framework of the design for observations on children's restrictive environment was constructed with the aid of the *mapping sentence*. This was given in Fischbein et al [7] (see also Canter [1]).

Data analyses

The investigation of structural properties of a space containing profiles generated in response to questions has been made by POSAC (*Partial order scalogram analyses*). This is a method of analysis especially suited for investigating structural relationships among profiles of subjects who differ in degree and type with respect to some well-defined behaviour [4]. In this study, where twins' perceptions of restrictions at home and at school are the specific target under investigation, POSAC offers a theoretical

framework for examining the individual profiles, and for representing each profile in a two-dimensional space.

The response categories for all items in this study have a common direction, going from high to low, in terms of perceived restriction. Thus, the items have a *common range* and so structural relationships among twin girls and twin boys can be examined at two different points in time. This is done in terms of degree and type of restrictions perceived by the participants.

The six items selected for profile analyses from the pupil questionnaire differed according to the degree of getting or asking for help at home and feelings about teacher deciding at school. The items were:

1. Do you get a reward when you are good at test?
2. Do your parents help with home-work?
3. Do you ask for help with home-work?
4. Do your parents ask about school?
5. Do you tell your parents how you are doing in school?
6. How do you feel about teacher deciding?

The results from the POSAC analyses are presented in a space diagram and 6 different diagrams for the six items. This is done separately for twin boys and twin girls at 13 years of age and for all at 15 years of age.

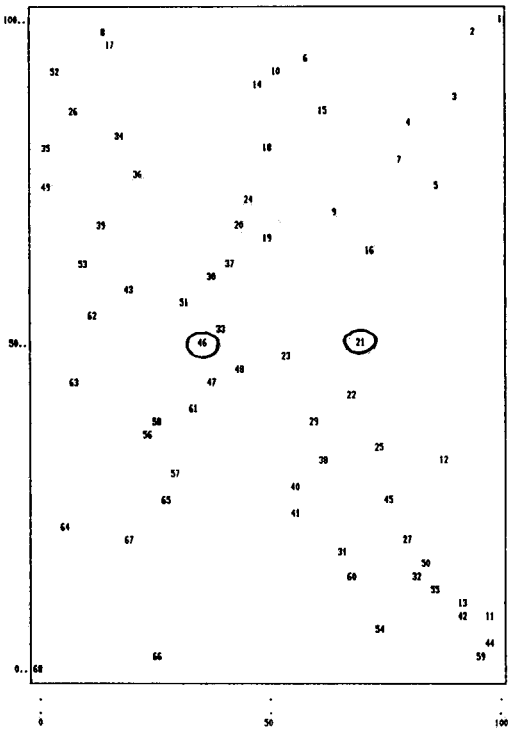
In the space diagram, each unique profile for the six items jointly is represented by a point labelled with a subject identification number, and the configuration of points reflects the partial order relations among the profiles. The item diagrams illustrate the regional properties of each item separately. Items whose regions run parallel to the X- and Y-axes are called X- and Y-base items. These are considered particularly informative items because in the framework of Guttman's facet theory, the position of a multivariate profile can be viewed as a function of rank on these base items alone.

RESULTS

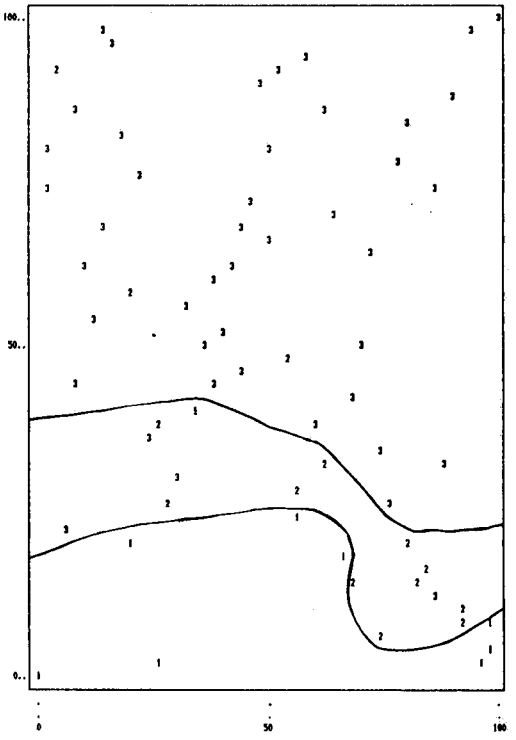
Twin boys

The profile analyses made for the twin boys (N = 75) generated 68 different profiles, ranging from profile number sixty-eight with the response string "111111" to profile number one with the response string "343334". The space diagram showing the positions of the 68 unique profiles together with the 6 item diagrams are given in Fig. 1 (a-g).

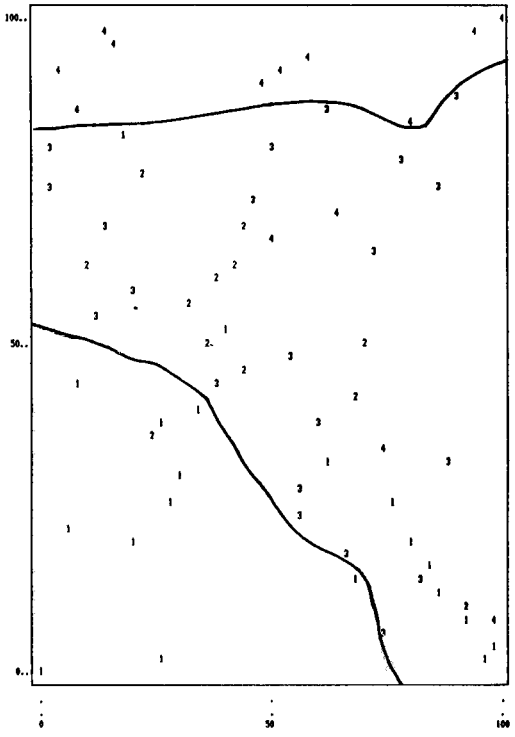
Profile 68, located in the southwest corner of the space, is the response string "111111" and represents the highest degree of perceived restriction. The lowest degree is exhibited by profile 1, with the response string "343334" positioned in the northeast corner. The diagonal running from profile 68 to profile 1 gives the joint direction of the solution space, and represents varying degrees of perceived restrictions. Since profiles 21 ("322233") and 46 ("322122") occupy positions intermediate to profiles 1 and 68



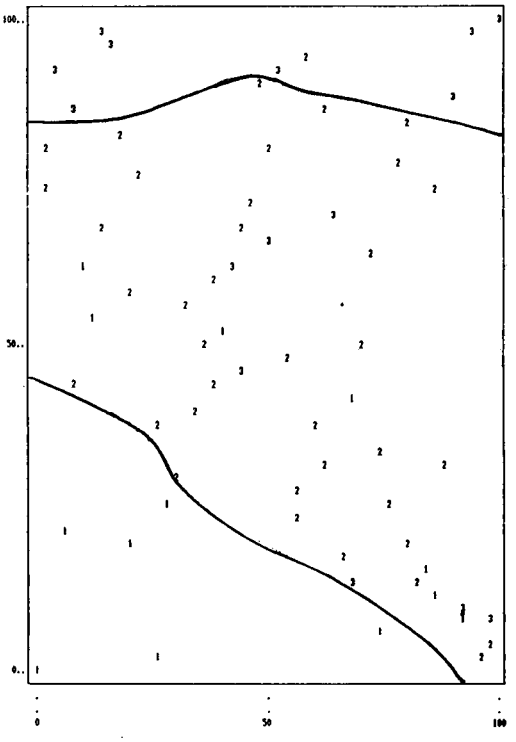
a. SPACE DIAGRAM



b. ITEM 1 DIAGRAM
Do you get a reward when you are good at tests?



c. ITEM 2 DIAGRAM
Do your parents help with home-work?



d. ITEM 3 DIAGRAM
Do you ask for help with home-work?

Fig. 1. POSAC-1 Space and Item Diagrams for Twin Boys (a-g).

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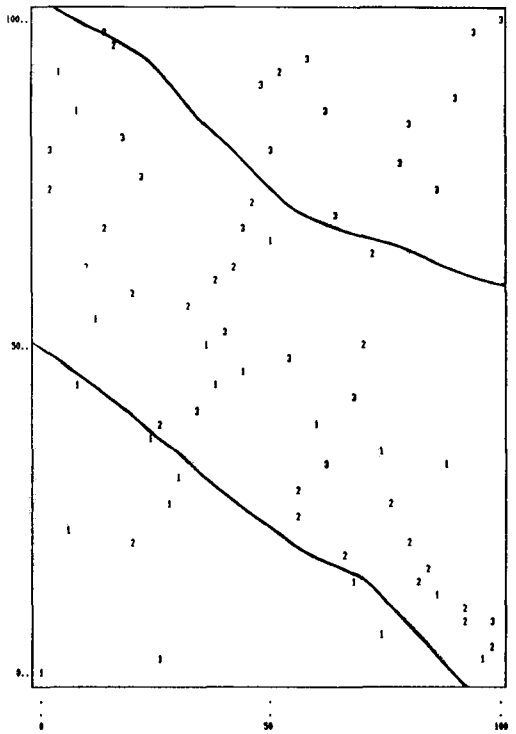
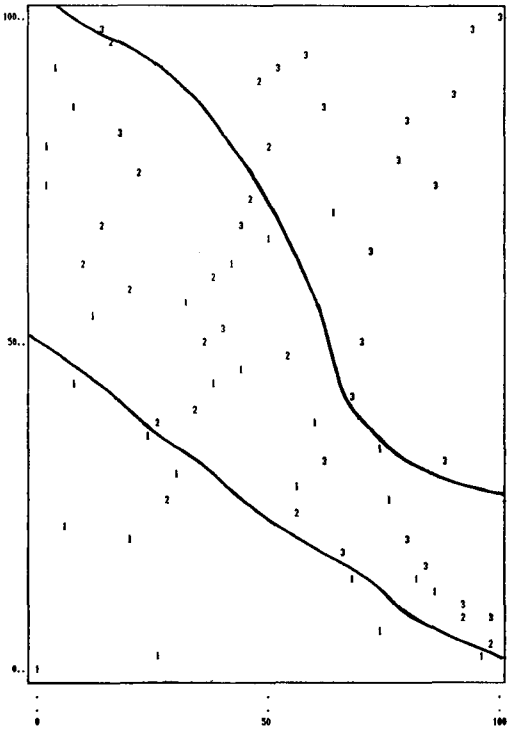
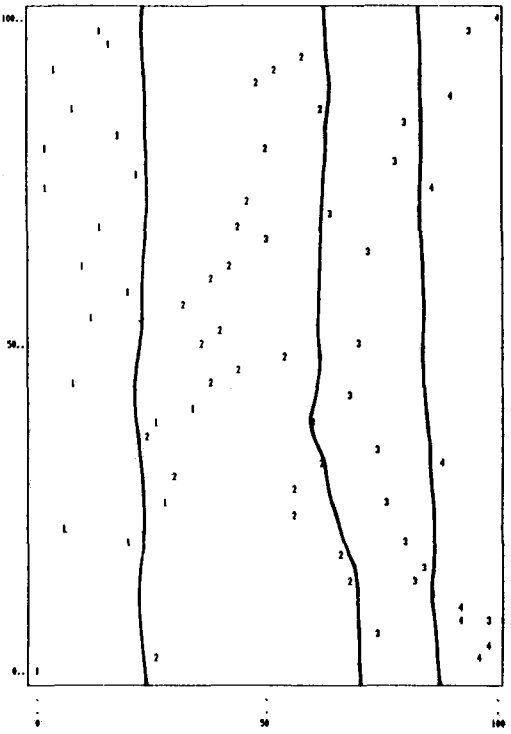


e. ITEM 4 DIAGRAM
Do your parents ask about school?



f. ITEM 5 DIAGRAM
Do you tell your parents how you are doing in school?



g. ITEM 6 DIAGRAM
How do you feel about teacher deciding?

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with respect to joint direction, it can be inferred that they represent intermediate levels of perceived restriction with profile 46 showing a higher degree of restriction than profile 21. Profiles 52 ("243111") and 44 ("112224"), on the other hand, exhibit equivalent levels of perceived restrictions, as shown by the roughly equivalent positions they occupy in the joint direction. However, these two profiles differ in the type of perceived restriction they represent as indicated by their positions at opposite ends of the lateral direction.

The role played by each of the six items in structuring the partially ordered space can be seen from their item diagrams and the regions formed by their response categories. One item measuring effective behaviour "How do you feel about teacher deciding?" (1 = very good; 2 = rather good; 3 = rather bad; 4 = very bad) is found to be an X-base item. Thus, item 6 is orthogonal to the other items. This is also the only question of the six which relates to *teacher* rather than *parent* and reflects a different domain of the child's perception of his/her environment. On the other hand, item 1 asking about parental support for school achievement "Do you get a reward when you are good at tests?" (1 = very often + often; 2 = sometimes + seldom; 3 = never) can be considered a Y-base item. All of the other items, dealing with parental interest in the child's school work by asking, telling or helping the child, tend to partition the solution space into regions aligned in the joint direction.

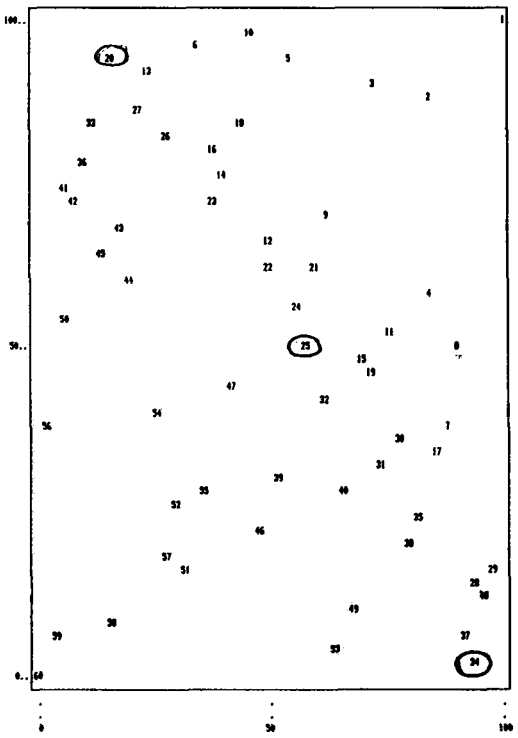
Twin girls

The profile analysis of the answers to the same six questions given by the twin girls (N = 69) is shown in Fig. 2 (a-g). The analysis generated 60 different profiles ranging from number 60 with the response string "111111", representing the highest degree of perceived restriction to number 1 with the response string "343334" representing the lowest degree. Profile 25 ("222233") represents an intermediate level of perceived restriction, while profiles 20 ("332331") and 34 ("131224") show equivalent levels but different types of perceived restriction.

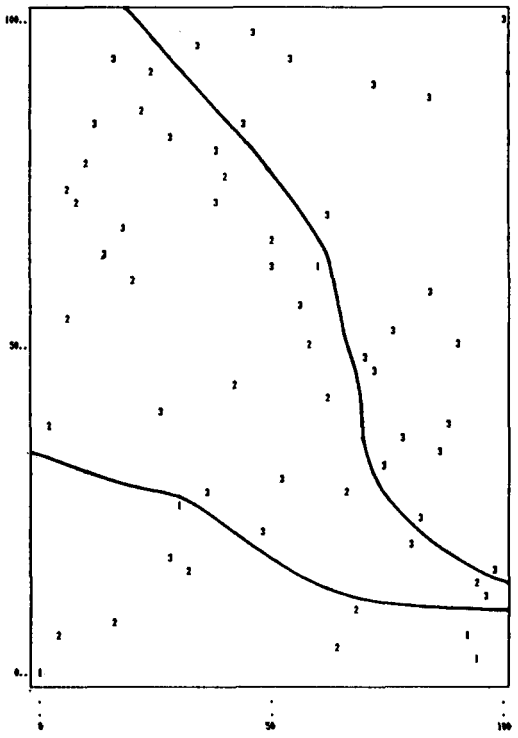
In comparing the item diagrams of the twin girls with those of the twin boys, it can be seen that item 6 is found to be an X-base item for both groups although more boys than girls are positive to teacher deciding. Item 1, relating to parental reward for good test results, shows that this type of restriction is less frequently perceived by the girls than by the boys. However, this item together with the other four tend to partition the solution space into regions aligned in the joint direction, a result which was also evident for the boys.

COMPARISON OVER TIME

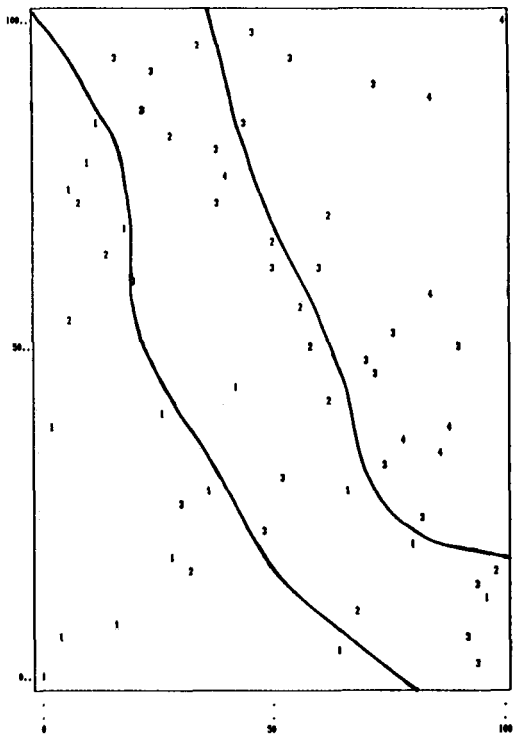
At the followup in grade 8 there is a general trend to perceive less restriction from the parents and to be more negative towards teacher deciding. This trend is, however, the same for both boys and girls. Therefore in Fig. 3 we will present the joint space and item diagrams for boys and girls together.



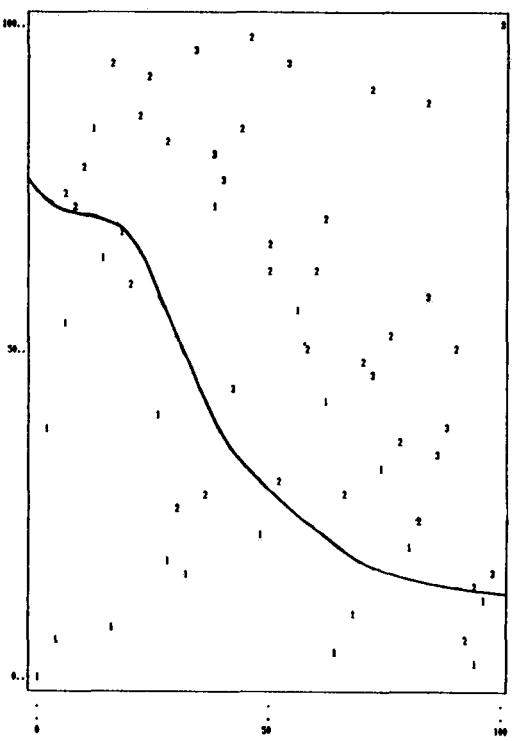
a. SPACE DIAGRAM



b. ITEM 1 DIAGRAM
Do you get a reward when you are good at tests?



c. ITEM 2 DIAGRAM
Do your parents help with home-work?



d. ITEM 3 DIAGRAM
Do you ask for help with home-work?

Fig. 2. POSAC-1 Space and Item Diagrams for Twin Girls (a-g).

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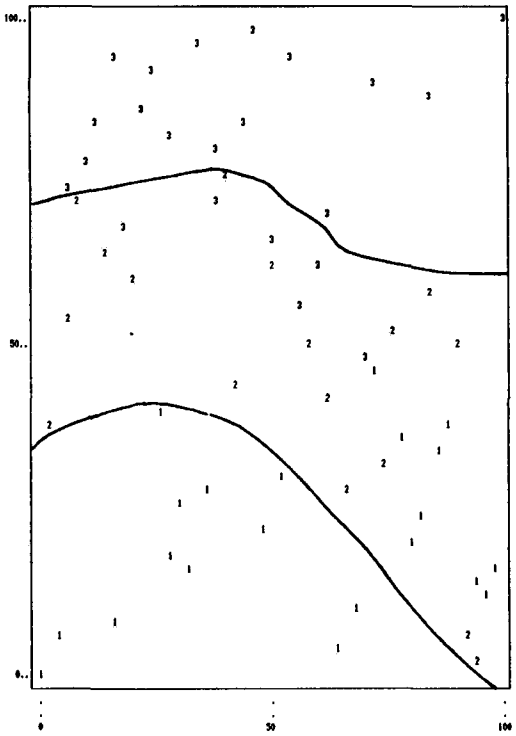
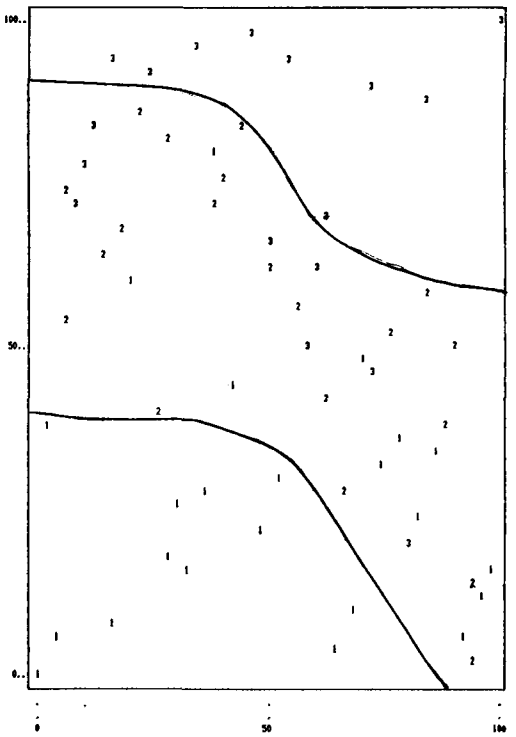
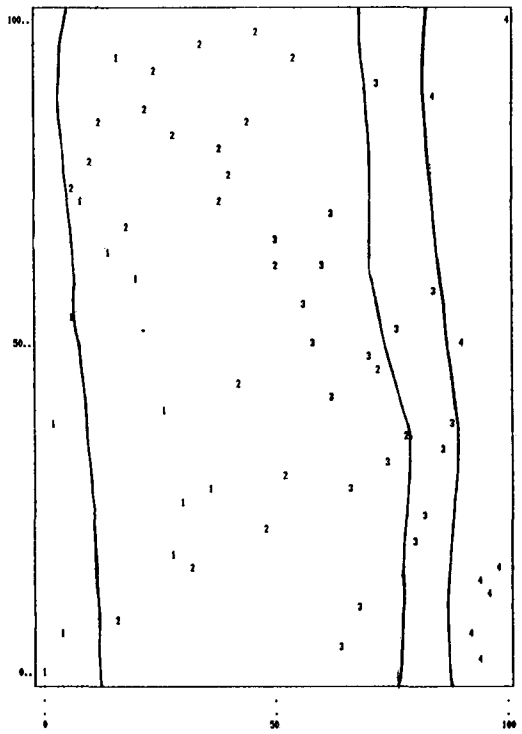


e. ITEM 4 DIAGRAM
Do your parents ask about school?



f. ITEM 5 DIAGRAM
Do you tell your parents how you are doing in school?



g. ITEM 6 DIAGRAM
How do you feel about teacher deciding?

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Figure 3 is based on 116 cases with 13 cases omitted due to missing data. Eighty-seven different profiles were found and their location is shown in Fig. 3a. Profile 87 is the response string "111112" and represents the highest degree of perceived restriction and profile 1 "343334" the lowest. Profile 29 ("332134") occupies an intermediate position and profiles 61 ("223232") and 83 ("312144") are located at opposite ends of the lateral directions.

From the item diagrams it can be seen that item 6 "How do you feel about teacher deciding?" still functions as an X-base item, even though the whole scale is transferred in the negative direction. Item 5 "Do you tell your parents how you are doing in school?" now functions as a Y-base item indicating the importance of own initiative as age advances. All the remaining items partition the solution space in the joint direction, although the answers indicate a lower degree of perceived restriction than on the earlier occasion at 13 years of age.

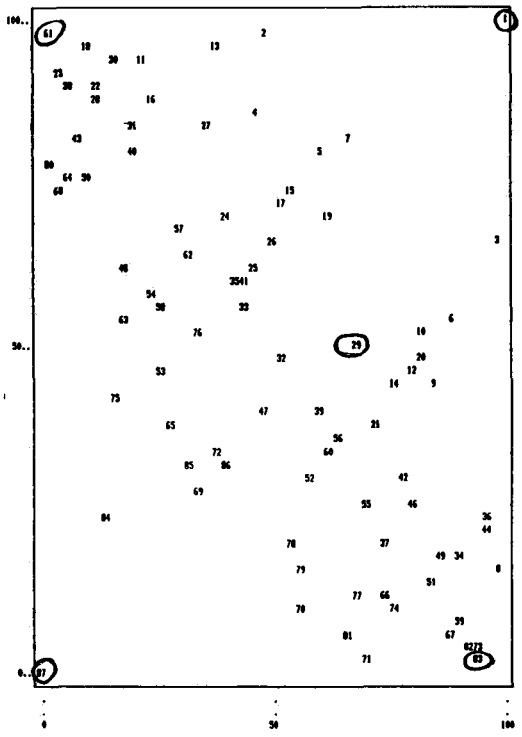
DISCUSSION

Partial Order Scalogram Analysis is used as a tool for understanding and constructing individual profiles on perceived restriction at school and at home. A comparison of these profiles is made for a sample of Swedish twin boys and twin girls at two different periods in time. For both boys and girls the question "How do you feel about teacher deciding?" seems to have an X-base function. This was evident also on the second occasion though negative answers were much more frequent for both boys and girls. All the other items partitioned the solution space in a joint direction on both occasions. It was, however, evident that the girls experienced less restrictions than the boys. This is probably due to the fact that girls tend to be more cooperative and well-adjusted at school, irrespective of parental restrictions.

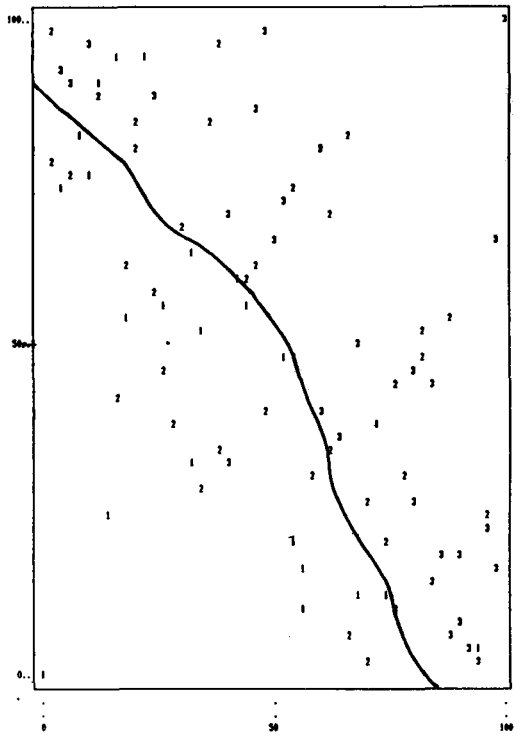
On the second occasion, at age 15, the questions dealing with telling or asking parents about school seemed to be the most relevant. This would probably imply children's greater need for independence and expression of personal initiative with impending puberty.

Generally, these results indicate that restrictions experienced at home concerning help with, and interest in, school work as well as rewards for being successful at school tend to generate similar profiles for twin boys and twin girls. Value statements concerning restrictions at school seem to have other structural properties, where positive as well as negative values can be linked to both many and few restrictions perceived at home. There is a tendency for twin girls to experience less restrictions than twin boys and for restrictions to be evaluated more negatively at 15 than at 13 years of age.

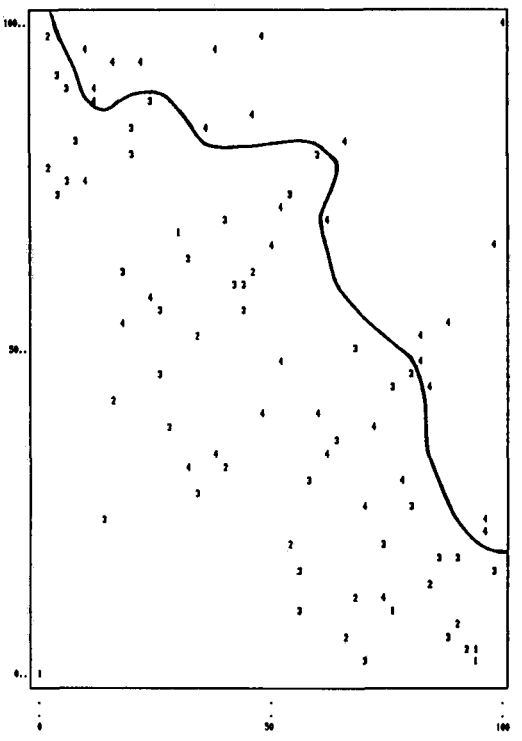
In the model and facet design constructed to compare data from Sweden and Israel, experienced restrictions are a basic dimension being studied in both countries. The results presented here for Sweden are only a first step toward analysing this dimension on the basis of answers also from parents, teachers and classmates. We later intend to explore the relationship between these results and genetic and environmental influences on achievement and ability test results in the two countries.



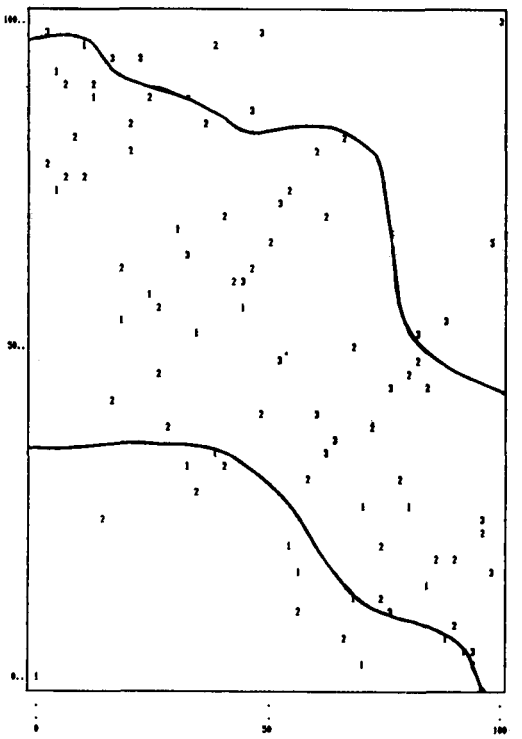
a. SPACE DIAGRAM



b. ITEM 1 DIAGRAM
Do you get a reward when you are good at tests?



c. ITEM 2 DIAGRAM
Do your parents help with home-work?



d. ITEM 3 DIAGRAM
Do you ask for help with home-work?

Fig. 3. POSAC-1 Space and Item Diagrams for Twin Boys and Twin Girls (a-g).

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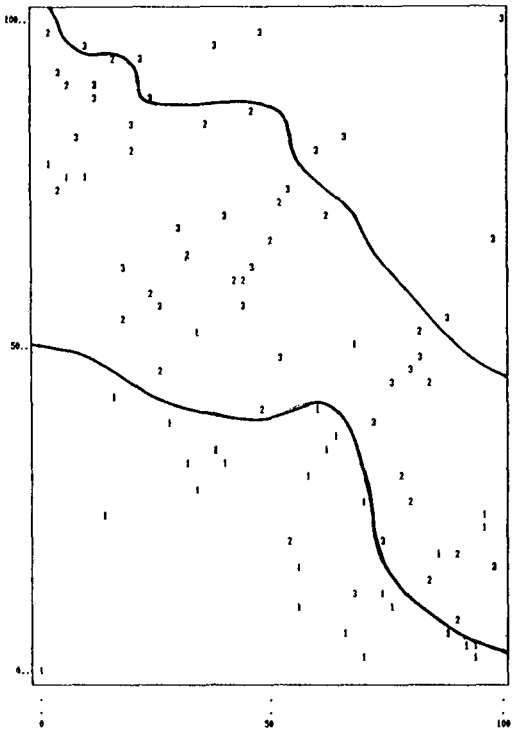
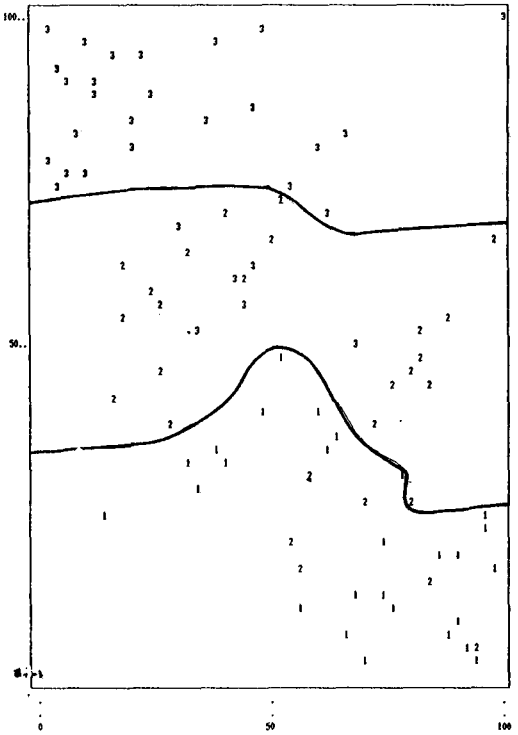
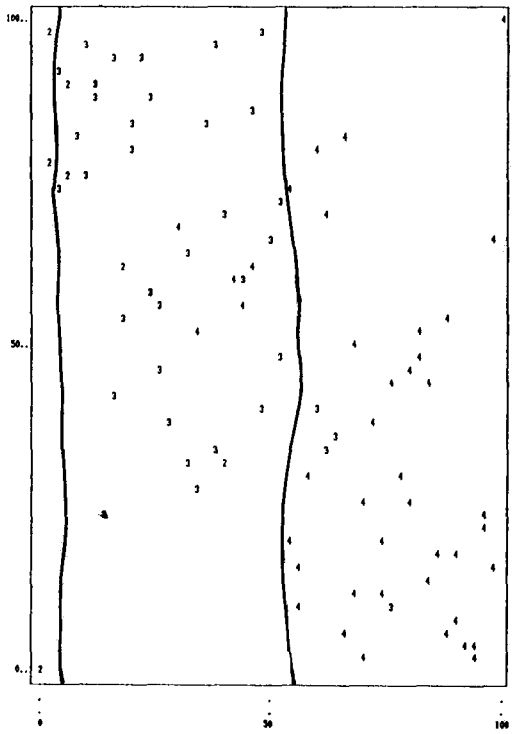


e. ITEM 4 DIAGRAM
Do your parents ask about school?



f. ITEM 5 DIAGRAM
Do you tell your parents how you are doing in school?



g. ITEM 6 DIAGRAM
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