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INTRODUCING CHILDREN TO TOPOLOGY, by Pierre de Latil

Editor's Note: This article comes to us from UNESCO. It is a report of a daring pedagogical experiment - daring in that instead of a cautious approach to the teaching of a new subject, a radical approach was used. The old was completely abandoned and replaced by a new system. Members may find this article of interest.

When she had finished handing round red or blue paper hats, some of them with cockades, to the little girls, the nursery school teacher said to them: "At the signal, all the red hats form together on this

side! All the blue hats on the other side!" And all the little girls scampered happily to their places when she clapped her hands. "Now, we'll put a rope around those who are together!" And each of the groups was roped in. Then the teacher said: "Next, we'll tie all those wearing a cockade together".

This was more difficult because there were children with cockades on their hats in both groups, and the cord around them had to cut across the other two ropes.

Is this a new game for the kindergarten? Not quite. We've just imagined a little science fiction story about a nursery school class in advanced mathematics, where young children are put in contact with a fundamental concept of human reasoning.

For the theory of groups illustrated by this very simple example is located in the vanguard of modern mathematics, on the peaks where generalizations merge arithmetic, algebra, geometry, topology, and even logic. At present, it is almost never approached before the university.

A "group" may be defined as a "neighborhood or assembly of several entities which together become elements of a new group entity". Here, the "entities" were the little girls. But they could equally well have been hairs on a head, books in a library, the claws of a cat, figures of a multiplication table, points located inside a rectangle, or lines of light rays converging on the same point.

From Concrete Games to Abstract Reasoning

In the example above, the formation of a group of little girls with cockades on their hats from the two other groups was designed to illustrate another fundamental concept, the idea of "intersection".

With slightly older pupils, the teacher might draw colored lines on the blackboard to represent the cords enclosing the groups. She would then ask each of the pupils in turn to come to the board and mark her place inside one of the circles. "No, Mary, you're not there! You are wearing a blue hat, and you don't have a cockade. So you're not in the intersection of the 'blue' group with the 'cockade' group. You're here!"

And so, gradually, the children would progress, effortlessly, from concrete games to the most abstract conceptions, considered today as belonging to the realm of advanced mathematics.

Papy, the Pioneer

Perhaps, our story is not so farfetched after all. Today, the teaching of mathematics dominates the scientific future of all countries; it is decisive in training engineers and scientists, in short supply everywhere. Already, several countries are moving towards a large-scale reform of mathematics teaching. And one of them, Belguim, is determinedly charting the way. A university professor, Georges Papy, who teaches "modern algebra" at Brussels University, has done pioneering work to introduce these modern theories into secondary, and even primary, schools. And top officials at the Belgian Ministry of Education are supporting his efforts by encouraging a large-scale experiment with the new methods.

To proceed cautiously in a matter like this is to court failure. Usually, when schools decide to teach new subjects, they offer them as optional courses which the pupils take - or don't - without any great interest. Or else, a few notions, so summary that they are useless, are added to the old course. The fact is, one cannot add new material to old without dangerously overloading the syllabus.

The solution consists of abandoning the old system completely and replacing it by the new. But if this were done, would not pupils run the risk of flunking entrance examinations and finding themselves barred from higher education? And how would they be able to pass examinations in subjects which they have stopped studying but which are still being taught? Changing the entire mathematics syllabus of the national school system has been suggested. But one can't launch out into such a reform without prior testing; and further, the subject is so new that it would be impossible to find sufficient teachers right away to take all the new classes.

The Test Laboratory

The Belgian solution is remarkable in that it takes account of all these difficulties. To test the new teaching, schools were chosen which are an end in themselves, since they do not prepare for higher

studies. They are the Ecoles Normales Gardiennes which train young girls to be nursery school teachers. These girls are not particularly gifted for mathematics; they are not even especially bright pupils. Therefore, if the experiment were to succeed, it would be highly convincing, and no one would be able to say that the instruction was too difficult for an average class. And even if it should fail, the careers of the young girls would in no way be harmed.

What are the results to date? After two years of experimentation, Professor Papy finds them eminently satisfactory. These girls of 14 to 16 are perfectly at home in the abstruse universe of groups. They handle problems the mere statement of which is incomprehensible to most adults.

The Belgian authorities fully realize this. In choosing the Ecoles Gardiennes as a testing ground for their new methods, they are pursuing what may develop into a long-term project. By educating future teachers in the theory of groups, they are paving the way for the introduction of these concepts into nursery schools. That may explain Professor Papy's quip: "Perhaps the crowning point of my career will be to teach one day in a nursery school."

Spare the Young

But why so much importance attached to this famous theory of groups? It was first outlined some 80 years ago by the Russian-born German-educated mathematician, George Cantor, who suggested a new conception of geometry in which every figure was conceived as a "group of points" Later the French mathematician Maurice Fréchet generalized the theory, extending it to "abstract groups" comprising any kind of object. Since then, groups have become increasingly important in mathematical thinking. Today, they are considered the common trunk of all branches of mathematics; and the principles of the theory are regarded as the very foundations of reasoning which works best starting from groups of objects rather than from an object taken singly.

By dint of abstractions, through the discovery of principles which are common to all mathematical disciplines - the principles of logic - mathematics have succeeded in achieving an extremely high degree of generalization. This took centuries of groping and hesitation. But now that the discoveries are made, young people should be spared the

tortuous paths followed by past generations. They should be launched from the start on the straight road of modern mathematics.

CALGARY HIGH SCHOOL STUDENTS ATTEND A COMPUTING CONFERENCE, by B. A. Hodson

Editor's Note: B. A. Hodson, a graduate of the University of Manchester, England, is supervisor of technical computer programming for Imperial Oil. He teaches two classes on computer programming at the University of Alberta, Calgary.

The Calgary Computing and Data Processing Society was inaugurated in January of 1961 and the first board of directors was elected to office in May of that year. At the suggestion of the new president, [the author], it was decided to form a committee to study the possiblity of holding a conference on computing for high school students later in the year. A committee of three was formed under the chairmanship of Dr. J. E. L. Peck of the University of Alberta. The result of this committee's work was a conference held at the University of Alberta, Calgary, January 13, 1962.

Registration of students began at ten o'clock with campus students and members of the Society assisting in registering some 140 students before 10:30. Each student was given a program of the day's activity and an identification badge supplied by the Alberta Wheat Pool. Each badge was one of seven colors, a code to establish which computer installation was to be visited later in the day.

At 10:30 the students were welcomed by the president on behalf of the Computing Society and by Dr. Peck on behalf of the University. The meeting was then handed over to the chairmanship of Bill Taylor of CES Computing Centre in Calgary. Mr. Taylor explained the purpose of the conference, to make students familiar with electronic computers and also to introduce to them the possibility of a career in this rapidly expanding profession. This was followed by an address by this author entitled "Introduction to the Electronic Computer".

He explained that an electronic computer is made up of five basic elements: input units, memory, arithmetic unit, control unit, and output units. He explained how the computer works internally by means