3. The methods of popularization

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mathematics have come to life again after a long period of lying dormant. To trace the history of a topic may be an easy and useful approach to popularization at every level. Alternatively, to see how the same demands in different societies have led to similar, even if superficially different, mathematical ideas can show the extent to which mathematics is culturally based.

(c) *New applications*

In the past twenty years mathematics has been recognised as a useful, indeed essential, tool in many disciplines and technologies. ICMI Study 3 *(Mathematics as a service subject)* considers the implications of this within higher education. Yet the implications are equally great for continuing education and for popularization. The interest of the public in the applications of mathematics — in their contribution to societal well-being — can well stimulate an interest in the mathematics involved.

What other "positive" features are there to be considered?

3. The methods of popularization

The methods used must depend on the kind of public on which particular efforts are being targetted. We want to set the switches so that people will look forward to mathematics, and to the use of mathematics, in a great variety of circumstances. If one is young, this means that one looks forward to mathematics in one's own education; if older, to the use of mathematics in everyday life, in one's job and in civic responsibilities, and to the part mathematics will play in the education of one's children or grandchildren.

Popular lectures, television, museums, travelling exhibitions, films, plays, ... may all be used in order to create this favourable mental association with mathematics. We hope that one outcome of this study will be the collection of a set of good examples coming from different parts of the world. We suggest that there should be a careful study of specific displays, films or books about mathematics or mathematicians from different points of view: their aims and objectives, their quality, the positive impact they have made ("favourable mental association"), their negative impact ("mark all Mathematical heads ...") and, in general, the reactions of the target audience.

Many people, through their careers and professions, are provided with important motivation for renewing contact with some areas of mathematics. Popularization may provide a "second chance" for those whose previous

educational experiences of mathematics have not been successful. Many "popular books" on mathematics can serve this end. Popularization may satisfy a specific need in relation to new technologies (robotics, computer graphics, computer assisted design, ...), statistical methods in social sciences, agriculture, biology, ... , operations research in management, ...; part of it may be included in continuing education, in self- educational software, or in the general scientific and technical information contained in professional journals. How is this kind of popularization best organised? What are the potential traps to be avoided? How can one estimate the needs of the users and their reactions towards the books, etc., which they use?

Scientists are a particular case, as is the community of professional mathematicians and mathematics teachers at all levels of education. Are we satisfied with the expository papers and books on new trends in mathematics? If not, what can we suggest?

Involving others in mathematical activities is a very special way of popularization to some extent unconnected with trends in modern mathematics, for much use can still be made of classical concepts and puzzles. The wolf, goat and cabbage problem has entertained countless people for over a thousand years and will no doubt continue to do so. Mathematical columns in newspapers, mathematical puzzles such as Rubik's cube and many games, for example mweso or wari in Africa, have excited the interest and curiosity of millions. How can we make best use of these opportunities for popularization? Can we analyse the relation between "savoir faire" in puzzles and games, and mathematical modes of thought? If we use such methods of popularization, how do we prevent mathematics from being associated with the solution of inconsequential problems?

Recently mathematical competitions have developed and attracted public attention in many countries. What is the impact on society of such competitions as the very selective International Mathematical Olympiads and of competitions which are open to a much wider section of children, such as the Australian National Competition?

The links with history and culture are not always used as they might be. There are vast mines to explore. The history of mathematics is beginning to be treated as part of general human history and references now appear in books or collections. Greater emphasis is being placed on the study of mathematics in different societies and cultures. How can this new knowledge be exploited? Are there good examples of popularization which can be described and commented upon? In what ways can the multicultural aspects of mathematics be used as a stimulus for its study? As we have written above, new technologies provided new

stimulation and new tools. Computer graphics have enabled new and advanced mathematics to be introduced to vast numbers of people: think of the interest aroused because of the great beauty of the graphics associated with Julia and Mandelbrot sets. A new range of mathematical activities can also be introduced through the computer. How can the micro best be used in the popularization of mathematics? What software exists for this purpose? How effectively does it involve the user in mathematics, rather than, say, in art?

Not all of these questions will be appropriate for those in developing countries. Yet there is a rich amount of mathematical experience in each ethnic group, often described as ethnomathematics. To what extent is this experience related to the public image of mathemtics and how can it be employed in popularizing the subject?

Methods are nothing without practitioners. This study provides an opportunity to gather personal experiences and views, to appreciate the specific rôle of a few gifted personalities (adept popularizers or popular figures from the mathematical world), and to stimulate the participation of all mathematicians and mathematics teachers in the process of popularization. In particular, the responsibility of professional mathematicians for popularization must be more carefully spelled out. What personal part should each play? How can mathematics teachers be best involved in the process?

How can writers and dramatists be encouraged to develop mathematical themes? How can reading and publishing be stimulated? How can we build on the very best examples of popularization which can be seen, read, heard and participated in today?

CALL FOR PAPERS

We hope that readers of this discussion document will respond to it by writing papers on specific themes or questions. These will be welcomed both from those who cannot participate in the closed international seminar and from those who would like an invitation (the number of which will be limited) to do so. Papers should be submitted *no later than* 30 April, 1989. Copies should be sent to

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