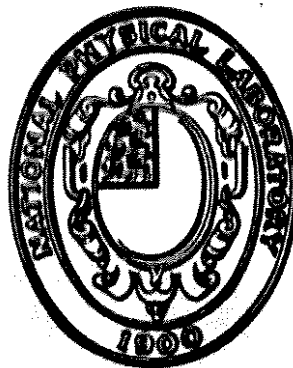


NATIONAL PHYSICAL LABORATORY

SYMPOSIUM No. 10

# Mechanisation of Thought Processes

VOLUME I



LONDON: HER MAJESTY'S STATIONERY OFFICE

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## P R E F A C E

This Symposium was the tenth in the present series of N.P.L. Symposia. Two are normally held each year - one on a subject of general industrial interest and the other on a theme of more academic research.

This Symposium was held to bring together scientists studying artificial thinking, character and pattern recognition, learning, mechanical language translation, biology, automatic programming, industrial planning and clerical mechanization. It was felt that a common theme in all these fields was "The Mechanization of Thought Processes" and that an interchange of ideas between these specialists would be very valuable.

It is unfortunate that meeting accommodation in the Laboratory is at present very restricted, and a very large number of people had to be turned away. Nearly 200 delegates attended and of these about one third came from overseas.

A total of 32 papers was presented, and on the fourth day there were parallel sessions - one covering implications for Biology and the other for Industry. With one exception these papers are reproduced here substantially as presented i. e. with only very minor revisions. Several authors have added appendices to their papers since the Symposium. The discussion was recorded and all contributors and authors were asked to edit their contributions. The discussion is reproduced in full.

There were also a number of Lecture-Demonstrations, and a list of these is included. Most of the demonstrations are described in the papers or appendices, and the others are described in short papers.

Kj: 9779

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DR. G. B. B. M. SUTHERLAND, NPL

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# THE MECHANIZATION OF THOUGHT PROCESSES

## OPENING ADDRESS

by

DR. G. B. B. M. SUTHERLAND

THE National Physical Laboratory occupies a position midway between a university and an industrial laboratory. One of the ways of carrying out our function is to organise symposia in fields in which we are actively engaged and in which universities, industry and other Government laboratories are interested. That this symposium is typical is shown by the fact that roughly one third of the delegates are from universities, one third from industry and one third from government institutions. This was not an administrative decision - it just came out that way.

For the National Physical Laboratory to organise a symposium on "The Mechanization of Thought Processes" is very appropriate, because the future program of the Control Mechanisms and Electronics Division is closely concerned with certain aspects of this problem. Our general aim is to develop equipment which will carry out many of the tedious but essential mental tasks which at present are performed by large numbers of human beings, e.g., pattern recognition, retrieval of information, language translation, and the control of complex operations by trial and error learning. How important is it to solve these problems? We are sometimes criticised for spending time on making, or trying to make, machines, the performance of which compares very unfavourably with that of a human being on the same task, e.g., language translation. There are, of course, three answers to this criticism. The first is that the performance of a child bears little relation to that of the adult into which it develops. The second is that it may not be necessary to do the task as well as the human being, provided the machine does it much more rapidly or at much less cost. The third is that in trying to solve problems of this kind one inevitably learns a great deal about the essential principles which are inherent in the biological solution of the problem, but which would otherwise have lain undiscovered. It is becoming clear that the language of the control engineer has a place in the thinking of biologists and, more generally, that the growing interaction between biology, physics and electronics is likely to prove extremely fruitful to science in the quite near future.

(Dr. G. B. B. M. Sutherland, F.R.S., is Director,  
National Physical Laboratory, Teddington)

The thinking process brings to mind Descartes' famous remark, "Cogito ergo sum" - I think, therefore I exist. We have as yet no glimmering of how a brain thinks about itself. Even after that stage is reached, we still have the problem of simulating a process carried out at the molecular level, by bits of electronic equipment. Our objectives this week are much more limited, but the problems are no less fascinating, and so let me invert Descartes' proposition and say that, since we exist, we can think, and let us now think to some purpose.