

To Elizabeth, Amanda and Hermione

The Cybernetics of Human Learning and Performance

A Guide to Theory and Research

Professor Gordon Pask

Katholieke Universiteit Brabant	
Bandnummer	0997724
Signatuur	478 F 1



Hutchinson Educational

Contents

Preface	6
List of Plates	8
Acknowledgements	9
Introduction	11
1 Information	17
2 Machines	45
3 Aspects of Evolution and Reproduction	66
4 Relativism	81
5 Learning Models	100
6 Models for Learning with an Hierarchical Structure	132
7 The Steady State or Null-Point Technique	160
8 Adaptive Teaching Machines	194
9 Descriptions of Processes	213
10 Processes and Prescriptions for Action and Learning	222
11 Learning Strategies, Teaching Strategies, Matching and Mismatching	258
12 Points of Departure and Development	300
Appendices	306
Glossary	322
References	327
Index	339

Hutchinson & Co (Publishers) Ltd
3 Fitzroy Square, London W1

London Melbourne Sydney Auckland
Wellington Johannesburg Cape Town
and agencies throughout the world

First published February 1975

© Professor Gordon Pask, 1975

ISBN 0 09 119490 3

Preface

This book assumes a background knowledge commensurate with having read its predecessor *An Approach to Cybernetics* (Pask, 1961) of which some passages are a direct continuation. All that is needed from a system/cybernetic point of view is available in Ashby's (1965) lucid and still up-to-date *Introduction to Cybernetics*, though the reader with a bent and liking for mathematics will find Glushkov's (1966), *Introduction to Cybernetics* profound and comprehensive (the nearly identical title is due to translation). There is a glossary covering all essential technical terms at the end of the book. Readers may find this helpful, not so much because of obscure symbolism (very little is employed) but because ordinary language phrases are used, from time to time, with rather exact meaning; in order to avoid symbols. This trick is played quite often with logical and mathematical terms; sometimes with the relatively comprehensible jargon of psychology, educational science, and philosophy. The other offending speciality is electronics. Knowledge of the subject is unimportant, since the function of components is explained or illustrated. Some otherwise abstract notions are made tangible by the description of electrical machinery; people who are versed in the field may find the details interesting and amusing (especially in Chapter 5 where methods are quaintly redolent of the late 1950s and early 1960s). But there is no need to labour these points; only the function of the machinery bears directly upon the main theme.

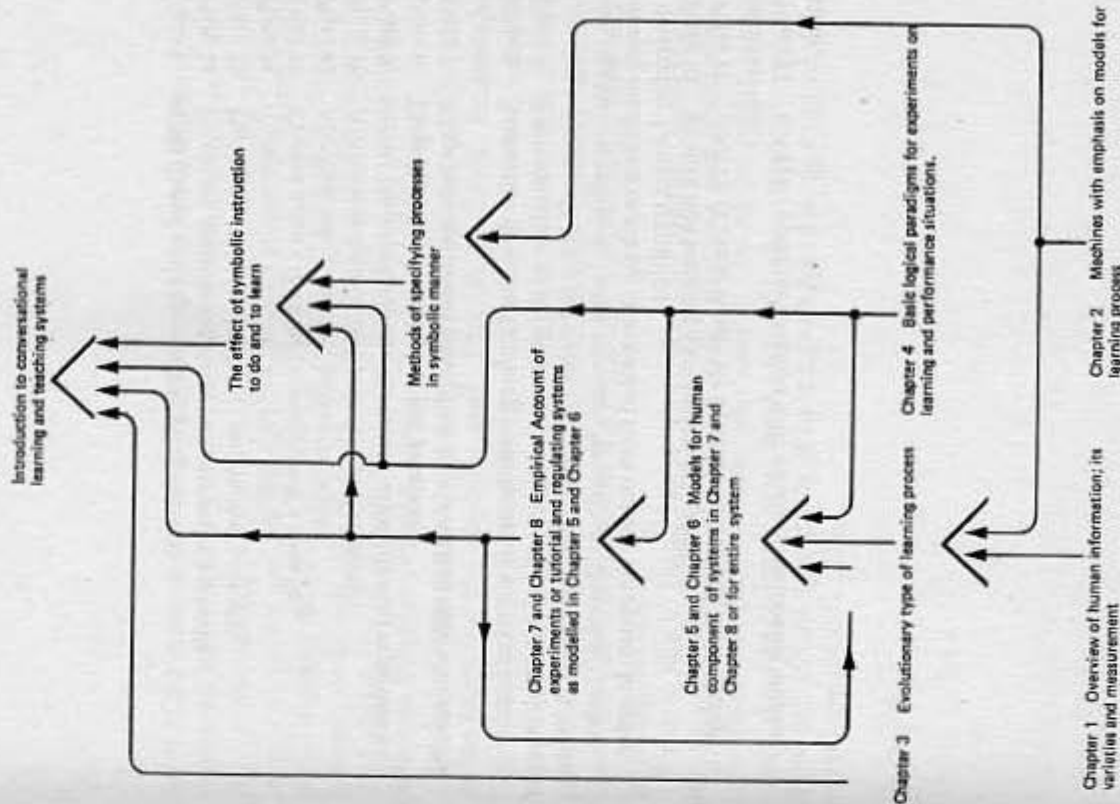
An overview of the argument is charted on the next page. Nothing about the chosen order of presentation is sacrosanct. Though several backtracking and forward-looking excursions are suggested in the text, other routes are possible. The chart shows the main prerequisites and precedences that any such forays need to observe.

The argument in this book is extended to cognition and innovation in a sequel provisionally entitled *The Cybernetics of Intellect, Imagination and Individuality*, Hutchinson (forthcoming). The phrase, 'the next volume', used from time to time in the text, refers to this book.

Professor Gordon Pask 1975

RELATIONSHIPS BETWEEN THE CHAPTERS

Main prerequisites and precedences.



List of Plates

- Plate 1 BOSS (Belief and Opinion Sampling System).
- Plate 2a Purchaser decision simulator: experimenter's console.
- Plate 2b Purchaser decision simulator: respondent's console.
- Plate 3a Compensatory tracking: subject's console.
- Plate 3b Compensatory tracking: experimenter's console.
- Plate 4a Attribute selection task: subject's console.
- Plate 4b Attribute selection task: experimenter's console.
- Plate 5 Special purpose computer for adaptively controlled experiments.
- Plate 6 Target interception task: subject's console.
- Plate 7 Adaptively controlled perceptual discrimination task with control equipment.
- Plate 8 Subroutine flow chart training instrument for a clerical task.
- Plate 9 Representation of the process of carrying out a clerical task: that of processing a customer's order for the installation of some equipment. Circular nodes represent conditions; boxes represent transitions; 'cloverleaf' nodes represent conditions requiring information from outside the system in order to determine the next transition.
- Plate 10 Subject free learning a zoological taxonomy.
- Plate 11 CASTE (Course Assembly System and Tutorial Environment): student system.
- Plate 12 CASTE: operator's station with window overlooking student station.

Acknowledgements

Most of the research into perceptual motor and complex skill learning was supported (under various grants) by the Office of Scientific Research, USAF. All the research into intellectual learning and the educational process was supported (under various grants) by the Social Science Research Council and is ongoing. Some of the more specific projects were supported by other patrons; as follows: the Ministry of Defence, Dept. of Employment and Productivity; Dept. of the Environment; Burroughs Research Corporation; Solartron Electronic Group; the Gas Council of Great Britain.

Several colleagues of exceptionally long standing have contributed both to the ideas and the empirical work: Prof. B. N. Lewis; Prof. H. Von Foerster; R. T. McKinnon Wood; A. D. Watts; Bernard Scott; and Dionysius Kallikourdis. Numerous associates, mentioned in the text or the references, are responsible for specialised findings. Particular thanks are due to Ms Elaine Hopton and Karl Acton of Hutchinson for their help in preparing the book.

I would like to thank Mr B. C. E. Scott for reading, correcting and editing the manuscript and placing both references and illustrations in good order and Miss Kirshner who assisted him in the earlier stages. I would also like to thank Miss Barsby without whose management of Mr Scott, me, and the typewriting of an unruly wodge of manuscript, we should never have got it to press.

Gordon Pask