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MANUAL SKILL
ITS ORGANIZATION AND DEVELOPMENT
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BY

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PREFACE

The study of manual skill with which this volume is concerned would seem to require little justification. Facility with the hand has always been an essential factor in human progress. To-day, as in former times, the amenities of life, and even life itself, depend upon man's ability to acquire the manual and other bodily skills necessary to the execution of his ideas. Modern conditions of existence call for a readiness of eye and hand not less than those of the past. If many of our older crafts have now disappeared, this has been offset, in some measure, by the introduction of skills unknown to former generations, and engendered by the same modern machine methods as have done so much to displace the older forms of craftsmanship. The assembling operations which have been selected for special study in this book are a case in point.

In addition to these claims to scientific study on the grounds of its practical importance, manual skill possesses a further and special interest for the psychologist. This it derives from the close connection between manual and mental development. The appearance in man of the higher mental powers which distinguish him from other animals has been largely determined by his ability to develop and to make effective use of the hand. In the early years of the individual, manual control serves as an index to mental growth, the hand constituting one of the chief sources of experience to this end. Various kinds of handwork have long been recognized in the schools as important educational media.

The present volume, however, will not be concerned with the general problem of mental and manual development, but with problems relating to the acquisition of certain manual skills after normal control of the hand has been developed. Nor will it be possible to consider every kind of manual operation, since, for reasons given in the first chapter, an intensive study of a limited region promises more useful results than a more cursory examination of a wider field.

The manual operations here chosen for study are those involved in the manipulation and adjustment of objects to one another. As such, they represent a large and important class. There are, indeed, few skilled operations which do not call for some measure of manipulative skill of this kind. Such operations include not only the use of the hand as a tool, but also the use of tools by the hand, and extend from the
simple placing of a lid on a tin, or a nut on a bolt, to the high degree of skill needed by the surgeon.

Even here, however, experimental conditions have necessarily imposed limitations upon the number of operations which it has been possible to investigate. The operations involved in assembling work, together with certain simpler tests of manual dexterity, have been chosen for special study as representing a wide class of manipulative operations.

To study these operations from the point of view of practical measurement will be our first concern. Hence the first step will be to investigate the conditions under which the operations could be employed as tests, and to secure reliable measures of individual ability. The next step will be to investigate the relations between the various measures thus secured. Such measures of ability I have termed ‘static functions’; and the investigation of their inter-relations forms the principal topic of the second part of this book. This part will be concerned with the nature of the underlying factors which determine ability at the various operations, and with respect to which individuals may be differentiated and measured. The way in which skill at these manual operations is related to such non-manual activities as mechanical aptitude and general intelligence will also demand careful consideration.

The third step will be to investigate the nature of the changes in ability which are brought about, first by more or less mechanical ‘practice’, and secondly by a special course of ‘training’. Such changes in ability brought about by practice, or by training, I have termed ‘dynamic functions’. An examination of their nature, and of their more important relations, will occupy the third part of this book.

The fourth part will be devoted to an account of the mental processes involved in ability and in improvement at the operations. This is based on observations and introspections which were taken throughout the research, and it includes a short excursion into the psychology of shape. The analysis given in this part describes the cognitive activity in manual work. It indicates that mental processes play a larger part in the acquisition of manual skill than is commonly supposed, and provides the basis of the course of training described in the third part.

Briefly, then, I shall consider first the problem of measuring manual skill. Next, I shall consider the nature of the underlying factors which

1 The first part is introductory in character.
PREFACE

determine its organization. This will be followed by an investigation of the conditions under which manual skill is best developed. Finally, in my analysis, I shall consider an aspect of manual skill which is intimately related to its measurement, its organization and its development.

In concluding this preface, I have many acknowledgments to make. The research was carried out by the aid of a grant made by the Rockefeller Foundation to the National Institute of Industrial Psychology, supplemented by a small grant from the British Association for the Advancement of Science.

The wide programme of testing, practice and training made heavy demands upon the time and attention of my subjects. My best thanks are due to all for so kindly acting in this capacity, and for their detailed observational and introspective notes.

I have also to thank the London and Tottenham Education Committees for permission to carry out work in their schools. To the heads of these schools, Miss M. Manuel and Mr G. H. Thurlay, my thanks are specially due for their careful provision of suitable conditions for testing; and also to their staffs for valuable information about the pupils.

Mr V. Gosden, B.Sc., of the staff of the National Institute of Industrial Psychology, has assisted throughout with the calculations and the preparation of the figures for the press. That I can recall only one minor error in all the checking, and sometimes re-checking, to which his figures were subjected, affords the best tribute to the efficiency with which this work has been done.

Anyone who is at all familiar with ‘tetrad differences’, and with ‘fundaments’ and ‘correlates’, will readily appreciate how much certain parts of the research owe to the writings of my former teacher, Professor C. Spearman, F.R.S. But I am alone responsible alike for the conclusions and for the faults of the present research.

Finally, these acknowledgments would be incomplete without an expression of my gratitude to Dr C. S. Myers, F.R.S., Principal of the Institute. The benefit of his wide knowledge and experience has been freely enjoyed by me throughout the research. It was under the stimulus of his encouragement that the training scheme evolved. Every word has been carefully read by Dr Myers before going to press, and the book owes a great deal to his careful editing.

July 1934

J. W. C.
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PLATE. (Fig. 53)  facing page 208

Design by a boy aged eight years.