Human motor development is an integral part of individual development as a whole. Consequently, much is to be learned from the study of motor function throughout childhood, and an understanding of the normal development process is vital for the evaluation and treatment of patients in whom motor function is abnormal.

This volume describes theories and methods applicable to longitudinal research in human motor development. The approach taken relates basic scientific knowledge of nervous system growth to motor function in normal children and those at risk. The first part of the book considers the biological basis of motor development and looks at mechanisms of embryonic and fetal growth. Fetal movement patterns, developmental processes and adaptations which continue throughout childhood are then described. Subsequent chapters deal with the mechanisms which underlie such functions as the development of posture, goal-directed behaviour, movement patterns for communication and the acquisition of tool use and writing skills. Possible risk factors for abnormal motor development are considered, along with the adaptive processes which accompany motor deficiencies in childhood and later life.

Researchers from many different backgrounds and disciplines have been brought together to make this a broad-ranging analysis of human motor development. The subject is reviewed from both the practical and the theoretical standpoint, and the book will be of the greatest interest to paediatricians, developmental psychologists, child psychiatrists and neurologists, as well as to research scientists in these fields.
Motor development in early and later childhood: longitudinal approaches
European Network on Longitudinal Studies on Individual Development (ENLS).

The European Science Foundation is an association of its 59 member research councils and academies in 21 countries. The ESF brings European scientists together to work on topics of common concern, to co-ordinate the use of expensive facilities, and to discover and define new endeavours that will benefit from a co-operative approach.

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Motor development in early and later childhood: longitudinal approaches

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Foreword

Motor control per se is a fundamental aspect of individual adaptive behaviour in the course of ontogeny. In the view of individual development as a multiformed stochastic process, in which individual and environmental factors are in continuous reciprocal interaction, motor and sensorimotor organization are closely linked to social-interactive and cognitive development. With this knowledge as a starting point, motor development formed a natural theme for the European Science Foundation’s Network on Longitudinal Studies on Individual Development (ENLS) when the Coordination Committee of the Network decided on its original programme for future activities.

Although the importance of motor development as a subfield of individual development is well established, there is still a conspicuous lack of systematic empirical studies and the sound knowledge that ensues from this type of research. As far as such studies have been carried out they concern mainly the earliest periods of pre- and postnatal development (up to approximately 2 years of age). Most longitudinal studies have concentrated on clinical follow-ups into preschool and school age of groups at risk (due to pre- or perinatal risk factors). This field of research is also characterized by lack of a theoretical framework to guide research on motor development over a wider age range.

The workshop from which the main parts of this volume emanate was organized in order to stimulate theoretical and empirical research on motor development, applying a longitudinal research strategy. The purpose was to integrate knowledge of the fundamental principles for the development of central motor functions and skills (such as postural control and goal-directed reaching) with clinical evidence of the later effect of risk factors for motor and adaptive development. This was done in an interdisciplinary perspective, since any real understanding of motor development presupposes contributions from different disciplines, such as paediatrics, neurology, ethology and psychology. Such an inter-disciplinary approach to research in this field is indispensable.

By organizing the workshop on motor development and by the
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publication of this volume, the Coordination Committee of ENLS has
drawn attention to the importance of motor development as a sig-
nificant field for continued longitudinal research.

David Magnusson
Chairman of the ENLS Coordination Committee
Preface

This volume is concerned with the role of longitudinal studies in promoting understanding of the processes involved in motor development during childhood. It is the result of a workshop entitled ‘A longitudinal approach to the study of motor development in early and later childhood’, held in Groningen in June 1989 under the auspices of the European Science Foundation network on ‘The longitudinal study of individual development’. Here, researchers from quite different backgrounds and disciplines were brought together: behavioural endocrinologists, biologists, developmental neurologists and neuro-paediatricians, clinical and developmental psychologists. Some participants were experimentally or methodologically oriented, others more practically so. They prepared and precirculated their papers which were intensively discussed and reviewed and which provided the basic material for this volume.

The organizers were aware that bringing such different scientific species together would imply a challenge as well as a risk. Participants were challenged to ‘cross their borders’ so as to test the limits of their principles and methodologies. Such an enterprise would, they hoped, result in creative discussions, leading to new openings and connections between disciplines concerned with, and relevant to, the study of motor development. However, there was a risk that participants would remain within the traditions of their own square disciplines, nobody taking any real profit from other people’s insights and approaches. In our opinion, the first hurdle was successfully crossed and we hope that this volume reflects this outcome. Central questions addressed in the intensive discussions were the following:

1. What are the main merits and problems of longitudinal and interdisciplinary studies on motor development, in particular in relation to early risk factors? How can such studies be optimally designed and how do they relate to other (cross-sectional) approaches?

2. What can be gained from longitudinal research on normal and abnormal individual development which focuses either on basic
Preface

principles of development or on mechanisms which underlie specific functions (e.g. postural control, goal-directed reaching), the use of tools and the acquisition of skills? Related to this question is how ethology, information-processing theory and dynamic systems theory can contribute to our understanding of motor development and play a role in longitudinal interdisciplinary studies.

Both sets of questions are exemplified in the structure of this book.

STRUCTURE OF THE VOLUME

Setting the scene

Two large-scale interrelated longitudinal programmes on motor development carried out in Groningen in the Laboratory for Experimental Clinical Psychology and the Institute of Developmental Neurology are taken as a starting point to set the scene for this volume. Chapters 1 and 2, by Kalverboer and Touwen, respectively, serve to indicate some theoretical and methodological issues involved in longitudinal research on motor development. Questions are formulated with respect to:

• the risk concept – risk indices versus risk mechanisms;
• the problem of early brain–behaviour relationships;
• the need for conceptually well-founded measuring instruments, applicable over a large age range;
• the issue of continuities/discontinuities in motor development;
• the necessity of well-established normative data.

In the final section of this volume, these questions are taken up again, integrating information obtained in this workshop and stressing the necessity of longitudinal approaches to the study of motor development.

Section I: Biological bases of motor development

Attention is paid to ontogenetic adaptations and transformations in the early phases of motor development. Principles of motor development are discussed, on the basis of insights obtained in behavioural embryology (Provine, Chapter 4) and in the study of fetal motility in the human (Prechtl, Chapter 3). The main issues in these chapters are how prenatal movement patterns develop, which mechanisms may underlie their development and how they relate to motor development in the early phases of extrauterine life. The ethologists Baerends and Groothuis (Chapter 5) deal with fundamental issues on pre-established action patterns and their roles in adaptative behavioural development.
Preface

Section II: Development of body posture and
goal-directed reaching

In this section on early postnatal development (the first 2 years of life), the focus is on two essential functions in the behavioural repertoire of infants: namely, the development of (antigravity) posture (Woollacott, Chapter 6; Casaer, Chapter 8) and the development of (voluntary) goal-directed and perceptually controlled, movements (von Hofsten, Chapter 7; Casaer, Chapter 8). The main questions to be discussed are how such functions relate to the development of the central nervous system and what internal–external control mechanisms are involved.

Section III: Motor development, early
communication and cognition

Here the focus is on the communicative significance of well-articulated movement patterns. Emphasis is given to the role of motor patterns as a source of signals in interactional development (Papoušek and Papoušek, Chapter 9) and to the role of flexibility in the orientation and control of body posture in early cognitive development (Butterworth and Franco, Chapter 10). How a reduced motor development may interfere with the child’s adaptation to the social and physical environment is discussed by Hopkins (Chapter 11).

Section IV: Acquisition of skills

Two example are selected, namely, spoon use (Connolly and Dalgleish, Chapter 12) and handwriting (Van Galen, Chapter 14; Sovik, Chapter 15). Tool use raises questions about its phylogenetic origins and the role of learning in the acquisition of this skill. Writing is a suitable example of a skill which is typically human, has a high adaptive value and allows for rather detailed longitudinal studies from the viewpoints of information-processing and self-organizing systems. A fundamental discussion of the issues of analogy and homology is given by Vauclair (Chapter 13) on the basis of his work on non-human primates (chimpanzees).

Section V: Motor development and handicap

Motor development in clinical groups is discussed on the basis of empirical data obtained in longitudinal studies (Largo, Kundu and THAN-Hohenstein, Chapter 16; Michelson and Lindahl, Chapter 17). Pre- and perinatal complications are considered as biological risk factors for later motor development. The contributions by Henderson (Chapter
Preface

18) and by Geuze (Chapter 19) consider the development of clumsy children selected when the motor problems have emerged (≥5 years). An important issue is how various approaches (neurophysiological, ethological, information-processing models) can contribute insights into deviant motor development.

Section VI: Methodological and conceptual considerations

In this section the main questions raised in the introduction to the section are discussed, integrating information obtained during the workshop. Schneider (Chapter 20) concentrates on methodological issues involved in the longitudinal study of motor development, while Hopkins, Beek and Kalverboer (Chapter 21) discuss conceptual problems associated with longitudinal and interdisciplinary research. In the Epilogue, Hopkins, Kalverboer and Geuze discuss the contributions to this volume in the light of different theoretical and philosophical orientations.

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