The concept “executive function,” which broadly refers to the psychological processes involved in the conscious control of action and thought, occupies a central place in the study of cognition and cognitive development. However, while adequate as a working definition, this understanding is vague and imprecise. In this chapter, we examine contemporary approaches to executive function development that operate as behavioral descriptions, and as biological or psychological explanations. We argue that, in order to avoid reductionism to a single level of explanation, a relational perspective is necessary. This perspective emphasizes that description and multiple explanatory levels of analysis are complementary features of a complete explanation. Thus, any complete explanation may entail all levels, but no level represents a competing alternative to other levels. Within this context, we explore the advantages of this approach for executive function research, and conclude with suggestions uniting the levels into an integrated system of explanation.

Epistemic Flow and the Social Making of Minds
Charlie Lewis, Jeremy I. M. Carpendale, John Towse, and Katerina Maridaki-Kassotaki

in Self- and Social-Regulation: Exploring the Relations Between Social Interaction, Social Understanding, and the Development of Executive Functions
Correlations between an understanding of self and other in psychological terms, often referred to as “theory of mind,” and the control of action, often labeled “executive functions,” have been reported and debated. We suggest that claims about such relations rest on a prior assumption that these are two separate, coherent domains and children have stable, measurable abilities in these areas. Examining relevant research, however, indicates variability in a number of ways, suggesting that both social understanding and executive skills are substantiated and develop within the flow of interaction with people and objects. According to our alternative approach to social cognitive development, social understanding develops within social interaction as children learn to talk about situations of shared understanding. We suggest that executive function and social understanding may be interdependent and emerge through the same processes within social interaction.

Self- and Social-Regulation
Bryan Sokol, Ulrich Muller, Jeremy Carpendale, Arlene Young, and Grace Iarocci (eds)

New research on children's executive functioning and self-regulation has begun to reveal important connections to their developing social understanding (or “theories of mind”) and emotional competence. The exact nature of the relations between these aspects of children's social and emotional development is, however, far from being fully understood. Considerable disagreement has emerged, for instance, over the question of whether executive functioning facilitates social-emotional understanding, or vice versa. Recent studies linking the development of children's social understanding with aspects of their interpersonal relationships also raise concerns about the particular role that social interaction plays in the development of executive function. Three key questions currently drive this debate: Does social interaction play a role in the development of executive function or, more generally, self-regulation? If it does play a role, what forms of social interaction facilitate the development of executive function? Do different patterns of interpersonal experience differentially affect the development of self-regulation and social understanding? In this book, the contributors address these questions and explore other emerging theoretical and empirical links between self-regulation, social interaction, and children's psycho-social competence. It will be a valuable resource for student and professional researchers interested in executive function, emotion, and social development.
This chapter argues that the HQ of APV — and possibly also many other MNC HQs — did not participate in the managerial processes whereby contributions and inducements may be balanced, constitutional ordering may proceed, authority may be exercised without overstepping the boundaries of zones of indifference, and goal setting may generate mutual commitment. Thus, they did not create or cultivate the infrastructure for institutionalizing the collaboration that may emerge spontaneously from the informal organization of their subsidiaries or by their mutual interactions conducive to cooperation, such as those associated with repeated games.

Executive Functions after Frontal Lobe Injury: A Developmental Perspective

Vicki Anderson, Harvey S. Levin, and Rani Jacobs

in Principles of Frontal Lobe Function

This chapter contrasts normal cerebral and cognitive development with that of children who have sustained frontal pathology. It focuses specifically on the domain of executive function, with the assumption that frontal regions are essential to the development and implementation of efficient executive skills. It discusses two studies from that illustrate the impact of frontal lobe pathology during childhood and the problems of assessing these skills accurately with current methodologies. The first study describes an ongoing program of research that examines the range of executive deficits exhibited by children who have sustained traumatic brain injury involving the frontal regions. The second study investigates the impact of focal frontal lesions during childhood, with an emphasis on approaches to the measurement of executive function.
Research on executive function faces a variety of theoretical issues and challenges. In this chapter, we begin with a survey of definitions, methods, and conceptions that currently resist integration and raise the specter of theoretical incoherence. We move on to tackle broader issues of psychologism, reductionism, and mechanism. We then conclude with a general suggestion that might provide an initial platform for theoretical advance in research on executive functioning. What we recommend is the development of theories of executive function (EF) that privilege descriptions of the functional activities of individuals in particular task environments and social contexts over premature postulations of generously, but imprecisely, endowed psychological and neurological explanatory mechanisms of dubious ontological status.

Object-Based Set-Shifting in Preschoolers: Relations to Theory of Mind
Daniela Kloo, Josef Perner, and Thomas Giritzer

This chapter focuses on children's ability to shift between different ways of thinking about an object, which is termed object-based set-shifting. First, we outline crucial developments in social cognition (theory of mind) and executive functions in the preschool years. At around age 4, children master the false belief task and the Dimensional Change Card Sorting (DCCS) task; the latter being a measure of object-based set-shifting. We describe studies showing that these developmental advances are related. And we present evidence suggesting that both executive abilities (inhibitory control) and conceptual abilities (re-description understanding) play a role in the development of object-based set-shifting. Finally, we discuss various theories aiming to explain...
the general developmental link between theory of mind and executive functions.

What Is Attention? Navigating Its Complex History and Facing the Challenges Ahead
Kim Cornish and John Wilding

in Attention, Genes, and Developmental Disorders
Published in print: 2010 Published Online: September 2010

Chapter 2 introduces the notion of attention and examines the various taxonomies of attention that have been proposed. Selective processes are the core of attention; some are automatic but most require control processes to organize selection. Control processes (executive functions) marshal excitation and inhibition to select inputs and actions and organize complex sequences of behavior. Interactions between executive functions and arousal systems ensure that alertness and efficient functioning are maintained. An outline is given of current research and theory on each of these aspects of attention. Future research must continue to disentangle component processes involved in complex tasks and the hierarchical systems that enable selective behavior.

The Development of Self-Regulation: A Neuropsychological Perspective
Marianne Hrabok and Kimberly A. Kerns

in Self- and Social-Regulation: Exploring the Relations Between Social Interaction, Social Understanding, and the Development of Executive Functions
Published in print: 2010 Published Online: May 2010

This chapter begins with discussion of some of the definitional and conceptual issues relevant to executive function (EF) from a neuropsychological perspective. This is followed by a discussion of functions of regions of the prefrontal cortex (PFC) believed to be important for self-regulation, based primarily on lesion studies in adults. Following this, a model of self-regulation as it relates to attentional networks in the brain developed by Posner and his colleagues (e.g., Posner and Rothbart, 1996, 2007) is described. EF as it relates to self-regulation, the development of self-regulation, neuroplasticity, and
the role of learning is also discussed. The chapter concludes with a discussion of limitations of neuropsychological research regarding self-regulation, discussion of potential enhancement of self-regulation in children, and areas important for future research.

Assessment of executive function
Paul W. Burgess

in The Handbook of Clinical Neuropsychology

Executive function is probably the newest of the fields of neuropsychology. Although observations of patients showing symptoms of executive dysfunction have existed for over 150 years, and experimental investigation for at least half of that time, the area has only really become the focus of very widespread investigation in the last twenty years or so. And, since the translation of scientific findings into clinically useful techniques occurs relatively slowly, it is only recently that the experimental findings are being translated into procedures for clinical use. As a consequence, the practising clinician should take special care to follow the latest developments in this fast-moving field. This chapter describes some of the most commonly used tests of executive function. The principal aim is to outline the philosophy of the assessment procedure, so that the reader can know what to look for, decide which tests to use, and understand the issues surrounding the possible choices of assessment procedure.

Contributions of Mesocorticolimbic Dopamine to Cognition and Executive Function
Stan B. Floresco

in Dopamine Handbook

This chapter presents a summary of studies that have investigated the contribution of prefrontal cortex (PFC) dopamine (DA) transmission to higher-order cognition, and compares and contrasts the specific DA receptor mechanisms that regulate different types of executive function. Viewed collectively, the findings reviewed suggest that dopaminergic
input to the forebrain, including the frontal lobes and the dorsal and ventral striatum, forms an essential component of the neural circuits that mediate a variety of cognitive and executive functions, including working memory and different forms of behavioral flexibility. Both of these executive functions engage distinct types of cognitive operations and functional neural circuits. Therefore, it is not surprising that the receptor mechanisms by which DA exerts its effects are not unitary across these functions; instead, each type of process relies on different patterns of activation of DA receptors in the PFC and the striatum.

Mental Disorders Across the Life Span and the Role of Executive Function Networks

Michelle C. Carlson, Dana Eldreth, Yi-Fang Chuang, and William W. Eaton

in Public Mental Health

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Item type: chapter

This chapter considers the relationship of disorders to brain function. It begins by defining executive functions and their importance to prosocial behavior and independent functioning. It then describes how these functions develop concomitantly with prefrontal brain growth through childhood and adolescence and decline in late life. Next it reviews specific mental disorders that arise during these developmental windows and the executive dysfunctions common to those disorders. The disorders considered include attention deficit hyperactivity disorder, schizophrenia, depression, generalized anxiety disorder, Huntington's disease, Parkinson's disease, and possibly Alzheimer's disease. The chapter concludes by highlighting the importance of imaging and biomarkers, methods that will continue to elucidate brain-behavior relationships and so aid early detection, prognosis, and treatment.

Vygotsky, Luria, and the Social Brain

Charles Fernyhough

in Self- and Social-Regulation: Exploring the Relations Between Social Interaction, Social Understanding, and the Development of Executive Functions

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Item type: chapter
This chapter considers the potential value of Vygotsky's and Luria's functional systems approach for our understanding of the developmental linkages between executive functioning and social understanding. It proposes that such linkages are best explained through taking an interfunctional approach to both classes of psychological process, according to which both executive functioning and social understanding are constituted of functional systems developmentally structured by social experience, and shaped by a general transition towards semiotic mediation of cognition and behavior in the preschool years. In addressing the significance of this view for the developing neuroanatomical localization of such functions, this chapter considers these relations in light of Luria's co-constructivist approach to neurodevelopment which allowed for bidirectional causal influences between biology and social environment.

A Systems Approach to the Aging Brain: Neuroanatomic Changes, Their Modifiers, and Cognitive Correlates

Naftali Raz and Kristen M. Kennedy

in Imaging the Aging Brain

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Item type: chapter

Success in diagnosing and treating age-related brain disease depends on understanding normative and optimal aging of the brain. Neuroimaging studies of healthy adults reveal differential brain shrinkage. Prefrontal cortices evidence the largest age-related differences, whereas tertiary association cortices, the neostriatum, and the cerebellum show the greatest rate of shrinkage. Reduced regional brain volumes and steeper longitudinal declines are usually associated with lower cognitive performance. Trajectories of differential brain aging are modified by multiple negative and positive factors. Vascular risk factors affect the regions deemed most vulnerable to aging. However, the positive modifying influence of aerobic fitness is clearest in the same age-sensitive areas. Genetic variation may have a significant impact on age-related changes in brain and cognition. In addition to (and in conjunction with) improved aerobic fitness, antihypertensive treatment and hormone replacement therapy may alleviate negative effects of aging on the brain structure.
Clarifying the Relation between Executive Function and Children’s Theories of Mind

Louis J. Moses and Deniz Tahiroglu

In Self- and Social-Regulation: Exploring the Relations Between Social Interaction, Social Understanding, and the Development of Executive Functions

In this chapter, we explore the relation between executive functioning (EF) and theory of mind (ToM), examining (a) what aspects of EF and what aspects of ToM are implicated, (b) whether the relation is merely a product of task-specific performance factors or whether it reflects more fundamental processes in conceptual development, and (c) whether the causal relation runs from EF to ToM or vice versa. We review data from experimental, training, correlational, and cross-cultural studies to clarify these issues. We conclude that the evidence best supports the view that EF is causally implicated in ToM development and that advances in EF are necessary (but not sufficient) for the emergence, as opposed to their expression, of ToM concepts.

Atypical Attention: Attention Deficit/Hyperactivity Disorder (ADHD)

Kim Cornish and John Wilding

In Attention, Genes, and Developmental Disorders

Chapter 8 focuses exclusively on ADHD, a complex disorder with a broad spectrum of involvement. It is also one of the most widely researched of neurodevelopmental disorders; yet pinpointing its causal mechanisms and attention pathways has not proved as straightforward as at first it appears. Core issues of concern centre on the disorders heterogeneity, the presence of co-morbid disorders (e.g. anxiety, learning disabilities, conduct disorder), and cognitive variability across development. Recent findings clearly support the hypothesis that ADHD should be viewed as a continuum of impairment rather than a discrete clinical disorder. The chapter concludes that weakness in EF processes, particularly planning, inhibition and maintenance of focus, are the key to ADHD, but notes that
no convincing explanation is apparent for the frequent co-occurrence of inattentive and hyperactive behaviors.

A Bidirectional View of Executive Function and Social Interaction

Suzanne Hala, Penny Pexman, Emma Climie, Kristin Rostad, and Melanie Glenwright

in Self- and Social-Regulation: Exploring the Relations Between Social Interaction, Social Understanding, and the Development of Executive Functions

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Item type: chapter

In this chapter, we explore the idea that the relation between social interaction and executive functions might be best characterized as bidirectional. That is, that while developing executive function abilities almost definitely have considerable impact on emerging social understanding in young children, social interactions may also provide significant impetus for executive development. Working from a broadly Piagetian framework we include two avenues of exploration to illustrate. The first is that social collaboration on a problem might facilitate executive processes. Here we use the example of a collaboration on a strategic deception task. The second is that exposure to the ambiguous nature of social interactions may force the child to exercise more executive control, resulting in advances in various aspects of executive function. For examples, we draw from two research literatures—children's understanding of sarcasm and children's ability to grapple with acquiring more than one language.

Early Social and Cognitive Precursors and Parental Support for Self-Regulation and Executive Function: Relations from Early Childhood into Adolescence

Susan H. Landry and Karen E. Smith

in Self- and Social-Regulation: Exploring the Relations Between Social Interaction, Social Understanding, and the Development of Executive Functions

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Item type: chapter

Development of executive functions and self-regulation, two important goals for school age children, are described in this chapter. To better
understand their development, we examine the evidence for several early skills as precursors, including social communication, language, and pretend play. The potential for the quality of caregivers' early verbal input to also support these skills is described, particularly as this input occurs during early childhood. Finally, evidence is provided for the links between early precursor skills and caregiver input with school age executive functions and adolescent social competence. Evidence for these relations comes from a unique longitudinal study of 360 children and their caregivers examined in home settings from 6 months to 13 years of age. Findings highlight how skills developing in infancy and early childhood provide a foundation for executive functions and self regulation in middle childhood and early adolescence and the importance of the child's social context.

Neuroscience of Rule-Guided Behavior

Silvia A. Bunge and Jonathan D. Wallis (eds)

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A fundamental question facing neuroscience is how complex behavior is controlled. This book brings together a number of leading cognitive and systems neuroscientists focusing on this question. Presenting a wide range of methods and approaches, these researchers provide novel insights into the neuronal mechanisms that support rule-guided behavior.

The Neuropsychology of Epilepsy: An Application of Luria’s Concepts

William B. Barr and Luba Nakhutina

in Luria's Legacy in the 21st Century

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Item type: chapter

This chapter demonstrates that many of the central concepts from Luria's theories continue to be relevant to the contemporary neuropsychological study of epilepsy. It begins with a review on the treatment of epilepsy in Russia during the most productive years of his investigations. While Luria had not provided any extensive written discussion on epilepsy, he and his colleagues were very familiar with the works of Penfield, Milner, and other Westerner investigators, making it clear there were limitations to their approaches to higher cortical functions. This chapter demonstrates
that a neuropsychological approach to memory and executive function deficits, based on Luria's concept of functional systems, has the potential to extend our knowledge and practice in the field of epilepsy well beyond the constraints inherent to a simple quadrant-based approach to the brain.