

Dysexecutive Syndromes

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Editors

Dysexecutive Syndromes

Clinical and Experimental Perspectives

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Introduction

The term “executive function” is relatively new in the cognitive and behavioral neurosciences. Nonetheless, since the nineteenth century, it has been documented that frontal lobe damage can result in a wide range of cognitive and behavioral disturbances. Phineas Gage represents the best-known report of impairments potentially associated with frontal lobe pathology (Harlow, 1868). Toward the end of the nineteenth century, Oppenheim (1890, 1891) associated personality disturbances with orbital and mesial frontal lobe pathology. The “frontal lobe syndrome” was conceptualized during the early twentieth century by Feuchtwanger (1923). He proposed that frontal lobe pathologies were associated with disturbances that were not directly related to memory, language, speech, or sensorimotor deficits. Goldstein (1944) suggested that the capacity of the frontal lobe includes “the abstract attitude”, mental flexibility, and understanding of the contextual situation of behavior. Luria (1969, 1980) referred to three functional units in the brain: (1) arousal-motivation (limbic and reticular systems); (2) receiving, processing, and storing information (postrolandic cortical areas); and (3) programming, controlling, and verifying activity (frontal lobes). Luria suggested that the third unit has an executive role. Lezak (1983) emphasized the fluid nature of executive functioning and observed that both cognitive and emotional aspects were involved.

In recent years, cognitive neuroscience, particularly neuropsychology, has used the term “executive functions” as an umbrella term to describe several interrelated higher cognitive processes such as inhibitory control, working memory, behavioral temporality, cognitive flexibility, planning, self-regulation, monitoring, and similar behavioral and cognitive functions. These functions play a significant role in the successful production of goal-oriented behaviors as well as in the successful performance of daily activities. Executive or cognitive control is a related term that refers to a complex set of cognitive processes working in a top-down functioning mechanism (Diamond, 2013). Cognitive control is an essential life skill that helps in problem-solving, attention holding and control, learning, decision-making, planning, and regulating behaviors (Chung et al. 2014).

Regarding neuroanatomical correlates, the neuropsychological literature has described that executive functions are closely related to frontal lobe activity.

Indeed, the term executive function has been used interchangeably with frontal lobe functioning. With the advent of advanced neuroimaging techniques, it has been found that successful performance of executive abilities is not only dependent on intact frontal lobe structure and functions but is also mediated by dynamic and functional connections between frontal regions, retro-Rolandic, and subcortical areas of the brain (Ardila, Bernal, & Rosselli 2017; Chung et al. 2014; Collette et al. 2006; Bonelli & Cummings 2007; Marvel & Desmond 2010). The smooth and effective behavioral expression of intact executive functions depends on the functional integration and effective connections between cortical and subcortical regions.

During the last decades, a myriad of books dedicated to the analysis of executive functions have been published (e.g., Anderson, Jacobs & Anderson 2010; Eslinger & Flaherty 2018; Miller & Cummings 2017; Rabbitt 2004; Roberts, Robbins & Weiskrantz 1998; Tirapu-Ustárroz, García Molina, Ríos-Lago & Ardila 2012). It is time to publish a book devoted to the analysis of the dysexecutive syndromes or executive dysfunctions. Baddeley (1986) coined the term “dysexecutive syndrome” to refer to the dysregulation of executive functions usually resulting from frontal lobe damage. The syndrome is represented in emotional, motivational, and behavioral problems as well as in cognitive deficiencies related to executive skills such as planning, mental flexibility, inhibition, and working memory. The symptoms of the syndrome can be seen in many clinical conditions, including neurodegenerative diseases such as frontotemporal dementia.

“Executive dysfunction” is described as a disturbance in the efficiency of higher regulatory executive functions (Elliott 2003) which may result in neurocognitive deficits and behavioral symptoms. The terms “executive dysfunction” and “frontal lobe dysfunction” have been some times used interchangeably based on clinical evidence from patients with brain injuries to frontal regions. However, evidence from more recent studies based on imaging techniques, including fMRI and PET scan, has suggested that executive dysfunction is not only associated with frontal lobe abnormalities, but also with the dysfunctional connections between frontal, retro-Rolandic, and subcortical brain regions (Bonelli & Cummings 2007; Chung et al. 2014).

Executive dysfunctions are also associated with a wide range of psychopathologies, including neurodevelopmental and traumatic brain injuries. The symptoms from neurodevelopmental disorders may include problems with inhibitory control, impulsivity, planning difficulties, working memory deficits, problems with sustained and selective attention, and deficits in mental flexibility. These clinical conditions include autism spectrum disorder, attention deficit hyperactivity disorder, fetal alcohol spectrum disorders, Tourette syndrome, and phenylketonuria (Jurado & Rosselli 2007).

Additionally, executive function deficits are also observed in many psychiatric disorders such as depression and schizophrenia (Johnson 2012). Soraggi-Frez et al. (2017) and Caixeta et al. (2017) provided evidence of executive function deficits, particularly related to working memory, in patients with bipolar disorder. In these psychiatric conditions, executive function deficits are attributed to either frontal lobe

abnormalities or dysfunctional fronto-subcortical networks. Berger et al. (2016) provided evidence for impaired fronto-parietal activation in schizophrenics compared to healthy controls using an electrophysiological pattern of activation. These deficits present a challenge to patients in adapting to the social and workplace requirements and even in adherence to treatment plans. Therefore, there is a need to assess executive function deficits and their link with psychopathology in psychiatric patients for the management of clinical symptoms and social adjustment. Moreover, neurophysiological and cognitive impairments are associated with substance use. Evidence shows that alcohol, opiate, and stimulant abusers show impaired performance on various executive function tasks (Barry & Petry 2008; Verdejo-Garcia et al. 2006).

This book has been divided into six parts. Part I (Theoretical Approaches) represents a theoretical framework for the analysis of the diverse dysexecutive syndromes. Two issues are reviewed: the commonality and diversity of executive disturbances, and the executive function brain organization. Part II (Developmental Executive Dysfunction) consists of two chapters reviewing the most common executive dysfunction syndromes found during childhood development: attention deficit hyperactivity disorder and autism spectrum disorders. One chapter is dedicated to analyzing the impairments that children with attention-deficit hyperactivity disorder have in tasks tapping inhibition, working memory, and sustained attention, and to describe their deficits of self and emotional regulation processes. The subsequent chapter analyzes impairments in planning, cognitive flexibility, and working memory related to the spatial domain in children with autism spectrum disorders. The following part (Acquired Executive Dysfunction) is devoted to executive dysfunctions observed in the cases of neurological conditions such as traumatic head injury, substance abuse, and subcortical diseases. The executive deficits that distinguish normal from abnormal aging are the topic of another chapter in this section, presenting evidence of age-related changes in executive functions and comparing these with the functional decline in the cases of vascular disease and degenerative disorders such as the frontal variant of Alzheimer's disease. Finally, an analysis of the executive function deficits in the use of information technology is included in this section. Individuals of all ages use technology in everyday life; however, for some, it can also be an agent of diverse negative consequences, particularly in the domain of executive function. These consequences are analyzed in this chapter. Part IV (Executive Dysfunction and Personality Disorders) includes the personality disorders associated with executive dysfunction, particularly in convicted individuals who have exhibited extreme violent and criminal behaviors and in others, such as ex-combatants, who have been exposed to violence in war environments for extended periods of time. Some neuropsychiatric disorders are associated with executive dysfunction, such as depressive disorders and HIV infection, and this is the topic of Part V (Executive Dysfunction in Neuropsychiatric Disorder). Interestingly, a biochemical disorder such as depression and an infectious disorder such as HIV have the potential to impair similar brain mechanisms that are also affected in attention deficits and other executive control problems. Part VI (Assessment of Executive Dysfunction)

examines assessment issues in executive dysfunction. In the first chapter, the evaluation procedures and the most common executive function tests are described. The last two chapters of this section are devoted to the assessment of executive dysfunction in bilingual subjects and the corresponding cross-cultural questions. The active use of two languages seems to generate brain changes that are reflected in the performance of neuropsychological tests, particularly in those assessing executive function. An analysis of the complex interaction between bilingualism and executive functions across the lifespan is presented, and its implications for the assessment of bilingual individuals are discussed. In other chapters of this section, differences in executive function test performance are analyzed across individualistic (Western) and collectivistic (Asian) cultures. In addition, the assessment of basic cognitive functions, higher executive functions, and nonverbal abilities is reviewed across cultures and includes the adaptation of new executive function tests for Asian countries.

We are convinced that this book significantly extends the analysis of executive functions and dysfunctions, from a fundamental and clinical perspective.

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Alfredo Ardila
Shameem Fatima
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