

Impaired stimulus–outcome but preserved stimulus–response shifting in young substance-dependent individuals

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Substance dependency has been related to an impairment in executive functions and to a dysfunction of the frontal cortex. In this study we developed two experimental tasks, which are physically identical, to analyze whether substance-dependent individuals are impaired in shifting response patterns (stimulus response links) or preferences (stimulus outcome links). To increase the specificity of the dependent variable, we also used two control tasks to analyze for unspecific performance deficits. We included 35 young subjects with polysubstance abuse (International Classification of Diseases, F19.2 ICD 10 diagnosis, mean age of 22 years, maximum age < 27 years) and 18 normal controls, but for a first step focused on only 22 patients and 15 age-matched controls, because we excluded all patients with an IQ below 100. The results show that the substance-dependent individuals are selectively impaired in shifting object preference (stimulus–outcome links) and not in shifting response patterns. They moreover show a higher general impulsivity as reflected in their faster responses than controls on all tasks except the stimulus–outcome task. In a second step we replicated these results by analyzing the original groups of 35 patients and 18 controls. We argue that substance-dependent subjects show an impairment only on specific executive tasks, and these tasks concern stimulus–outcome link shifting, which has been associated with the functioning of the orbitofrontal cortex, not of the lateral prefrontal cortex.

Keywords: Polysubstance dependence; Executive functions; Reversal learning; Stimulus–outcome learning; Impulsivity.

INTRODUCTION

Addiction is a social, psychological, and biological phenomenon, which can be studied on many different levels. On the psychological level it has been associated with cognitive dysfunctions, especially with deficits in executive functions. As summarized by Bechara (2003), three different hypotheses have been proposed for addiction: (a) disinhibition of prepotent motor impulses, which leads to a lack of

control in situations in which strongly preferred stimuli are present; (b) inflexibility in shifting between stimulus–response rules (response inflexibility), which leads to problems in learning new behavior, replacing (over) learned responses; (c) inflexibility in shifting between emotional expectancies, in particular from short-term to long-term reward (reward inflexibility). The first two hypotheses can explain why so many substance-dependent people relapse into addictive behavior when

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