

Ceasing the use of narcotics without treatments in the context of a multiscale computational model of addiction.

Yariv Z. Levy¹, Dino Levy², Jerrold S. Meyer³, Hava T. Siegelmann¹

¹ *Department of Computer Science, University of Massachusetts Amherst, USA*

² *Center for Neural Science, New York University, USA*

³ *Department of Psychology, University of Massachusetts Amherst, USA*

Drug addiction is recognized as a disease which affects a significant number of human beings. The United Nations Office on Drugs and Crime estimates that between 15 and 21 million people used opiates at least once in 2007.

A novel computational model of drug addiction, which considers the addictive process as non-monotonic and thereby enables the possibility to recover from this condition, was recently proposed [1]. This model integrates diverse aspects from three scales of observations of the addictive process: neuropsychology, cognition, and behavior. The simulated output predicts the likelihood of drug-seeking behavior of a virtual patient.

In the present study, two expansions of the addiction model were developed to further explore the plausibility of the recovery process. On the one hand, time dependency is included to the inhibition and the compulsion processes, and on the other hand, the probability that enables the recovery process to activate is explicitly inferred from previously presented socio-psychological observations known in the literature as "natural recoveries". In this way, the addictive model is able to describe the theoretical dynamics of the multiscale set of processes occurring during the course of actions of people who recover from narcotics addiction without the use of any behavioral or chemical treatments. Noteworthy dynamics of virtual subjects are presented and the correlation with experimental data is further discussed. This development is illustrated for natural recoveries related to dependencies on opium derivatives (such as heroin) and on synthetic opiates.

Reference:

[1] Hava T. Siegelmann, Dino Levy, Yariv Z. Levy (2009). Addiction as a non-monotonic computational process: toward in silico rehabilitation. *Submitted*.