In addiction, meditation is helpful when coupled with drug and cognitive therapies

December 19 2013

Using a computational model of addiction, a literature review and an in silico experiment, theoretical computer scientist Yariv Levy provides formal arguments encouraging current rehabilitation therapies to "include meditation-like practices along with pharmaceutical drugs and behavioral counseling." Credit: UMass Amherst

Using a computational model of addiction, a literature review and an *in* *silico* experiment, theoretical computer scientist Yariv Levy and colleagues suggest in a new paper this week that rehabilitation strategies coupling meditation-like practices with drug and behavior therapies are more helpful than drug-plus-talk therapy alone when helping people overcome addiction.

Levy reports results of his survey of animal and human studies and a computational experiment in a special section on addictive disorders in the current issue of the open access journal *Frontiers in Psychiatry*. He conducted this investigation while a doctoral student at the University of Massachusetts Amherst with neuroscience researcher Jerrold Meyer, an expert in the neurochemistry of human psychiatric disorders, and computer scientist Andrew Barto, an expert in mathematical theory of learning and planning.

Levy says the goal is to translate what has been learned from animal and human studies to better understand addiction and explore new approaches to treatment. Another member of the research team was neuroeconomist Dino Levy of Tel Aviv University, an expert in decision-making processes who developed the core of the theoretical model. He is no relation to lead author Yariv Levy.

Levy says, "Our higher-level conclusion is that a treatment based on meditation-like techniques can be helpful as a supplement to help someone get out of addiction. We give scientific and mathematical arguments for this."

His theoretical research approach using virtual subjects is rather unusual, Levy acknowledges, but it's now gaining significant trust because it offers some strengths. In particular, because it relies on the increasing amount of available data and knowledge, in silico research offers quick preliminary tests of "rationally supported speculations," he says, before full-scale experiments are launched with human patients or animals.

"I am a theoretician, so I use other peoples' studies and try to see how they work together and how experiments fit in," Levy points out. "This work follows a knowledge repository (KR) model, where the knowledge comes from other peoples' theories and experiments. By consolidating them, we propose some hypotheses that we hope will subsequently be tested by experts in the field." The KR model used in his current work incorporates pharmacokinetic, pharmacodynamic, neuropsychological, cognitive and behavioral components, the researcher notes.

The researchers explored the allostatic theory of addiction by combining two existing computational models, one pharmacological and the other a more behavioral-cognitive model. The allostatic theory describes changes in the brain's reward and anti-reward systems and reward set points as substance misuse progresses. "Neural adaptations arising from the reward system itself and from the anti-reward system provide the subject with functional stability, while affecting the person's mood. We propose a computational hypothesis describing how a virtual subject's drug consumption, cognitive substrate and mood interface with reward and anti-reward systems," they write.

Put more simply, the allostatic theory says that when someone takes a drug he or she stresses the reward system and it loses its homeostatic or equilibrium state. "We smoke one cigarette and go out, come back in again, and out with another cigarette, always trying to return to equilibrium," Levy says. "The reward system tries to change its structure with neural adaptations to get back to equilibrium. But if I continue to smoke, even with such adaptations, I can't make it back. Equilibrium is broken as long as I continue to smoke."

Here a second mechanism kicks in. "The reward system is so stressed, one can't come back to equilibrium," Levy explains. "So the anti-reward system says, 'I'll try to help.' The person or animal enters an allostatic state." Other brain structures are affected by the addictive substance, impairing the addict's evaluation of drug use compared to other reinforcers, he adds.

To bind the two theories and test how they could work together in silico, the authors follow three virtual case studies, each representing a different trajectory of allostatic state during escalation of cigarette smoking. Case Study 1 shows a virtual subject consuming drugs for the first time, relapsing after a period of abstinence with a concomitant negative shift in mood, a baseline situation with no therapeutic intervention. In Case Study 2, among other variations, the virtual subject uses a nicotine patch for 25 days while the same variables including mood are evaluated as for Case Study 1. In Case Study 3, the virtual subject undergoes treatment intended to emulate healing therapy periods that include meditation.

Among other outcomes, Levy says, "We try to describe what could be the cognitive effect of using a nicotine patch. What does it imply at the cognitive level, when people are willing to use one? Others have showed changes in prefrontal cortex where decisions are made, in executive function, as drug use progresses. Also, we did a small simulation of a couple of weeks with a patch, then tried to simulate the cognitive effect of using meditation for a few weeks."

Overall, "This investigation provides formal arguments encouraging current rehabilitation therapies to include meditation-like practices along with pharmaceutical drugs and behavioral counseling," the authors write.

More information: www.frontiersin.org/Journal/10 … .2013.00167/abstract

Provided by University of Massachusetts Amherst