The importance of habits and motivation in human drug addiction

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OPINION

Drug addiction is a dysregulated motivation illness characterised by severe drug cravings and obsessive drug-seeking. Behavioural neuroscientists have attempted to determine the neurological foundation for several motivational concepts and describe how they are modified by repeated drug use in the hunt for shared neuronal substrates of addiction to different kinds of drugs. The nigrostriatal system, which is engaged in two types of instrumental learning, is one of three major brain systems that play diverse roles in different conceptual aspects of motivation. A frontal cortical area is that which regulates decision-making and motivational processes and a ventral striatal system that is engaged in Pavlovian incentive motivation and negative reinforcement. Drug addiction can cause a shift in striatal circuits from goal-oriented, incentive-based processes to automatic, habit-based responses. Weak inhibitory control in the cortex is a risk factor for, as well as a result of, persistent drug use. Addiction can emerge without a change to habit-based behaviour, as a result of the overvaluation of drug results and hypersensitivity to motivational features of drug-associated stimuli. Positive reinforcements (or incentives) are highlighted as the first and primary drive for drug use in most motivational models of addiction. To this end, Robinson and Berridge's incentive-sensitization model posits that drug cues can achieve incentive saliency when frequent exposure to drugs and drug-related signals (such as drug paraphernalia) improves recall of the expected reward. In other cases, negative reinforcement becomes important when drug intake is reinforced by avoiding the aversive consequences of drug withdrawal, as described by Solomon and colleagues in the opponent-process theory of motivation, as well as the concept of allostatic load, as described by Koob and colleagues in classical avoidance theories. These motivational addiction models indicate a high level of goal-directedness by including (positive or negative) reinforcement as a major motive for drug misuse. Animal lesion and evaluation experiments, on the other hand, reveal that the reinforcing qualities of medicines lose their value with time, and goal-directedness declines. As goal-directedness reduces over time, so does regard for linked outcomes, and drug use behaviour is more motivated solely by drug-related cues. This stimulus-driven conduct is commonly referred to as habitual behaviour, and it has been defined as behaviour that has become automatized, highly stimuli bound, inflexible, and insensitive to the related results in the setting of a drug-taking habit (positive or negative). This shift from goal-directed to habitual drug use behaviour is described by the habit development model, which is mostly based on rat studies. The concept of reducing the importance of reinforcing effects is not new. Chein and colleagues questioned the idea of addiction as a pure result of rewarding behaviour more than 50 years ago. They discovered that a high majority of healthy people who had tried various substances considered the effects agreeable, but that they did not become drug addicts. They also discovered that a small fraction of people who were addicted found the initial drug experience unpleasant, but went on to become chronic users. As a result, the role of craving in addiction does not appear to have a one-to-one relationship with consumption, as craving can exist without consumption, and, more significantly, consumption can occur without craving. Although craving plays an important part within a larger goal-directed decision-making framework, these motivational theories of addiction do not cover consumption without an internal motivational drive such as craving. To put it another way, the initial relevance of drugs rewarding features, as stressed by various motivational models of addiction, does not necessarily appear to be the primary motivator for continued drug use. As a result, while motivation models are useful in many situations, they do not capture all elements of drug use, particularly when it comes to long-term chronic dependence. A solution could be found by using the habit formation concept, albeit in a more refined version. Although habit formation appears to be an excellent model for covering features of drug addiction that are not covered by motivational models, further research is needed to better the translation of this animal-based model to the human analogue of addictive behaviour. The habit development paradigm is based on research with lever-pressing rats, which appear to be straightforward stimulus-response contingencies. The habit formation model, on the other hand, depicts habitual behaviour as a single construct in contrast to goal-directed behaviour, which is oversimplified for incorporating complex human habitual patterns that are sometimes entangled with motivational motivations. In reality, some recent human neurobiological investigations have found habit formation and the related neuronal shift from the ventral to the dorsolateral striatum in chronic drug users. The challenge is whether simple stimulus-response actions, as outlined in the current habit formation paradigm, can adequately explain complex human behaviour. A future step including a more detailed understanding of habituation could potentially increase the model's ability to translate to human behaviour. During the transition from early to chronic forms of addiction, both motivational and motor types of habituation may play a larger role in regulating drug use. Furthermore, motor habits that are directly caused by environmental stimuli may require a different therapeutic approach than habits that are the product of a response pattern to motivational or emotional states. As a result of these advancements in the study, we anticipate that staging and profiling will become increasingly important in the treatment of addiction in the future. Based on a closer examination of the potential motivational underpinnings associated with habitual, automatic patterns in long-term drug addiction, we recommend the development of a more refined conceptualization and improved measurement of habits in addictive behaviour as the next step in addiction research.

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