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EDITORIAL

Cognitive deficits and cognitive normality in recreational cannabis and Ecstasy/MDMA users

A crucial topic for recreational drug research is the long-term effects of regular usage. With respect to cannabis, Solowij *et al.* (2002) noted: 'One issue remains unresolved: does heavy, frequent or prolonged use of cannabis lead to a deterioration in cognitive function that persists well beyond any period of acute intoxication? Is the functioning of the brain altered in the long-term?'. Many empirical studies have found selective cognitive deficits or altered brain activity in abstinent cannabis users (Loeber *et al.*, 1999; Pope and Yurgelun-Todd, 1996; Solowij, 1998; Solowij *et al.*, 2002), although there are also reports of unimpaired cognition (Lyketsos *et al.*, 1999). This has led to a lively debate on the role of factors such as dosage, duration and intensity of usage, residual effects, pre-drug intellectual ability, and age at which regular usage commenced. Although there is an extensive body of cannabis research, many of the issues surrounding the neurocognitive deficits in recreational users remain unresolved (Pope *et al.*, 1995, 2001a; Solowij *et al.*, 2002).

Ecstasy or MDMA (3,4-methylenedioxymethamphetamine) use has increased considerably in recent years, so that it is now second in popularity to cannabis (Pope *et al.*, 2001b). Despite the comparatively brief history of Ecstasy/MDMA research, there is a now an extensive literature describing selective neurocognitive deficits in abstinent users (Fox *et al.*, 2001, 2002; Gouzoulis-Meyfrank *et al.*, 2000; Morgan, 2000; Parrott, 2000, 2001; Rodgers, 2000). Significant deficits in memory and other cognitive functions have been reported by groups from Australia, Canada, Germany, Italy, the Netherlands, Spain, USA and UK (Table 2 in Parrott, 2001). Indeed every study cited in two recent reviews reported significant deficits on at least one memory task (Morgan, 2000; Parrott, 2001). But does this apparent consistency in the empirical literature mean that the recreational use of Ecstasy invariably leads to cognitive decline, or do some users remain cognitively unaffected? In many studies the lighter Ecstasy users display unimpaired neurocognitive profiles (Fox *et al.*, 2001; Rycroft and Golding, 2002; Turner *et al.*, 1998, 1999), and only a minority of novice users complain of memory problems which they attribute to Ecstasy (Parrott *et al.*, 2002).

Our understanding of the long-term effects of cannabis is based upon an extensive empirical literature, describing a mixture of significant and non-significant findings (Lyketsos *et al.*, 1999; Pope *et al.*, 1995, 2001a; Solowij, 1998; Solowij, *et al.*, 2002). The recreational use of Ecstasy is also associated with a wide range of cognitive and psychobiological problems (Morgan, 2000; Parrott, 2001). The topical question for Ecstasy researchers is not whether these deficits occur, but the conditions under which they develop and endure (Morgan *et al.*, 2002). As noted above, neurocognitive and psychobiological deficits are often evident in the heavier Ecstasy/MDMA users (Fox *et al.*, 2001; Morgan *et al.*, 2002; Parrott *et al.*, 2001, 2002), but there is a need for more empirical data on novice or light users (Rycroft and Golding, 2002). Researchers who find unimpaired performance profiles should be encouraged to submit their findings for publication; although obviously this would be facilitated by the inclusion of a heavy user group as 'verum' or positive internal control. It is crucial to document the conditions under which cognition remains unimpaired, just as it is important to describe the situations where deficits develop.

There are numerous factors which may be important in this regard: gender, dosage, frequency and intensity of use, parallel use of co-drugs (especially other illicit stimulants and hallucinogens; Scholey *et al.*, in press), overcrowding, hyperthermia, the use of putative neuroprotective agents such as fluoxetine, and genetic variations in MDMA metabolism (Tucker *et al.*, 1994: Parrott, 2001). The animal literature

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shows that MDMA is a powerful serotonergic neurotoxin, but this neural damage is strongly influenced by the ambient temperature; thus cold environments are neuroprotective, whereas hot environments increase the neural damage (Malberg and Seiden, 1998). Two Australian studies illustrate the importance of drug usage patterns and related behavioural factors. Topp *et al.* (1999, p. 112) assessed heavy users who generally took Ecstasy at raves, and reported 'an average of eight physical and four psychological side-effects', with the extent of problems significantly related to bingeing. Hansen *et al.* (2001, p. 183) interviewed light/irregular Ecstasy users 'none of whom identified themselves as belonging to the rave/dance music scene'; they described much greater health awareness, self-limitation strategies, and far fewer drug-related problems, despite having used Ecstasy for a similar time period (Hansen's study 3.5 years; Topp's study 3.6 years). In conclusion, the long term effects of recreational Ecstasy/MDMA in humans are probably modulated by a wide range of factors. Future studies will need to systematically investigate them, in order to understand the conditions under which the neurocognitive and psychobiolgical problems develop.

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