

Heroin-related attentional bias and monthly frequency of heroin use are positively associated in attenders of a harm reduction service

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Abstract

The relationship between heroin-related attentional bias (AB) and a proxy for dependence severity (monthly frequency of heroin use-injecting or inhaling) was measured in individuals attending a heroin harm reduction service. A flicker change blindness paradigm was employed in which change detection latencies were measured to either a heroin-related or to a neutral change made to a stimulus array containing an equal number of heroin-related and neutral words. Individuals given the heroin-related change to detect showed a positive relationship between heroin-related AB and the proxy for dependence severity; those given the neutral change showed a negative relationship. Both findings complement each other — and are consistent with the sending of more attention to heroin-related stimuli than neutral, the more severe is the dependence.

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As a survival adaptation delivered through natural selection, (*selective*) *attention* helps reduce information processing from maximal towards only what is currently most appropriate. Although it has survival benefit, its operation can backfire and cause harm (Bruce & Jones, 2006). Such a case is substance-related *attentional bias* (AB): a processing bias for substance-related paraphernalia, found in those depending on the addictive substance. In such individuals, information representing endogenous or exogenous substance-related stimuli appears to be processed more readily than information representing other stimuli (e.g. alcohol Sharma, Albery & Cook, 2001; nicotine Gross, Jarvik, & Rosenblatt, 1993; cannabis Field, Mogg & Bradley, 2004; heroin Franken, Hendriks, Stam & Van den Brink, 2004; cocaine Franken, Kroon & Hendriks, 2000). AB partly explains two anomalous features of dependence. First, its

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persistence in the face of escalating problems that should normally cause it to reduce or stop. Second, after apparently successful formal or informal interventions, its return to pre-intervention levels more frequently than might otherwise be expected. Increases in cravings, urges and strong desires caused or accentuated by the development of AB are thought to help explain these behavioural anomalies (e.g. Cox, Fadardi & Pothos, 2006; Franken, 2003; Lubman, Peters, Mogg, Bradley & Deakin, 2000; Lusher, Chandler & Ball, 2004; Ryan, 2002) — to the extent that there are emerging interventions designed to reduce AB and, thereby, subsequent substance involvement (e.g. Field & Eastwood, 2005).

AB is usually set in a cognitive neuroscience framework — in particular, Incentive-Sensitisation theory (Robinson & Berridge, 2000). It is posited that with prolonged exposure to a potentially addictive substance, neural sensitisation and associative learning make stimuli that were present during substance consumption “powerful incentives” promoting consumption. Neither process is thought to be all-or-none — implying that dependence also is not all-or-nothing. Mogg, Field and Bradley (2005, page 333), for example, observe with respect to Incentive-Sensitisation theory “... markers of *attentional* and approach biases for drug-related cues, should provide a cognitive index of the *severity* of drug dependence ...” (our italics). Consequently, just as there has been traditionally sought an AB in those who were dependent on a substance as compared with those who were not, so might there also be sought a *differential* AB between individuals with *different levels* of dependence (see Bruce & Jones, 2006).

Limited support for this hypothesis has been reported from alcohol treatment programmes. Although, using a modified Stroop paradigm, Lusher et al. (2004) found no *difference* in AB between two levels of severity generated by manipulating SADQ scores through a median split technique and analysing the data with an ANOVA, Ryan (2002) using the same paradigm has tested the *relationship* between AB and severity continuously represented by SADQ scores using regression analysis and found a significant positive relationship. Jones, Bruce, Livingstone and Reed (in press) using the flicker paradigm for induced change blindness (Rensink, O'Regan, & Clark, 1997; Simon & Rensink, 2005) also used a relational test of AB between continuously differing levels of problem severity of drinkers in treatment, and showed that increases in problem severity represented by the number of times previously in treatment was associated with increases in AB. We extend a test of this AB continuity hypothesis from alcohol to heroin dependence, reporting on the relationship between heroin-related AB measured by the flicker paradigm and continuously differing levels of severity in heroin addicts engaging with harm reduction services.

Mogg et al. (2005) raise the possibility, however, that the positive relationship predicted by Incentive-Sensitisation theory between AB and severity of dependence is not the only prediction that can be made. In Di Chiara's (2000) model of nicotine dependence, such a relationship might be evident in the early stages of nicotine dependence but might give way to a negative relationship as dependence increases — at which time responding might be driven less by *incentive sensitisation* and more by automated and unconscious *habit* (see Everitt, Dickenson & Robbins, 2001; Tiffany, 1990). Mogg et al. (2005) review several dot-probe studies that find such a negative relationship supporting Di Chiara's model (e.g. Hogarth, Mogg, Bradley, Duka & Dickenson, 2003), but they also review others that do not (e.g. Mogg & Bradley, 2002). They also review several Stroop studies that find a positive relationship between smoking dependence and AB supporting Robinson and Berridge (e.g. Zack, Belsito, Scher, Eissenberg & Corrigan, 2001), but several others that do not (e.g. Waters and Feyerabend, 2000). Somewhat critical of the “snap shot” nature of AB measures traditionally delivered through these two brief exposure paradigms; and on the back of their suggestion that more sensitive and ecologically valid measures could be used to help resolve the issue of which theory is the most defensible, Mogg et al. have measured gaze within the

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