

**A study of aggressive interpretative bias in opiate-  
dependent and opiate-abstinent men**

**Joanna Coyle**

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## Overview

The relationship between drug abuse and human aggression is complex and costly. A better understanding of it could inform treatment approaches. This thesis aims to explore the relationship and specifically focuses on the opiate-aggression association. Part 1 of the thesis comprises a literature review of the drug-aggression relationship. It presents an overview of drug use and aggression, outlines a model to understand the association and subsequently looks at the relationship in terms of different drugs of dependence. Finally a summary is given which identifies paucity in the investigation of psychological mechanisms which may underlie the drug-aggression relationship. Part 2 comprises the empirical paper. It reports a novel investigation into the perception of aggressive content in ambiguous information to determine whether increased aggression in dependent drug users may be related to an aggressive interpretative bias. The study compared 21 opiate-dependent, 21 opiate-abstinent and 22 healthy unemployed controls. It found that opiate users showed a bias away from aggressive and towards neutral interpretations. This may mean that opiate users may perceive potentially aggressive information benignly and this could make them more prone to engaging in risk situations and behaviours. Part 3 comprises a critical appraisal of the research and comments on both my experience of conducting the research and on validity issues within the study.

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## **Part 1: Drug use and aggression: A review of the literature**

The relationship between drug abuse and human aggression is complex, costly and indisputable (Hoaken & Stewart, 2003). A better understanding of this relationship could inform treatment approaches and seems crucial given that substance disorders rate among the most prevalent psychiatric disorders for one month, yearly or lifetime diagnosis (Eaton, Kramer, Anthony, Drymon & Locke, 1989). This review begins with an overview of drug use and aggression in naturalistic settings before briefly summarising the research in laboratory contexts. It then considers the complex relationship between drug use and aggression and outlines a model to understand this. Subsequently it considers how various researchers have attempted to measure aggression before looking at the drug-aggression relationship with regard to specific drugs of dependence, with an extended review on opiates.

### **1. Drug use and aggression**

#### **i) Epidemiological studies**

Epidemiological studies reveal a strong relationship between drug use, aggression and criminality. Associations have been examined by studying 1) crime and violence in substance abusing populations, 2) substance abuse in offenders and 3) crime in mentally disordered populations with co-morbid substance abuse.

*i) Crime and violence in substance abusing populations*

Newton-Taylor, Beatty and Chalmers (1998) note that a common theme in the literature is that substance abuse and inter-personal aggression are concurrent problems that generally co-exist within clients (Collins, Kroutil, Roland & Moore-Gurrera, 1997; Levy & Brekka, 1990; Spieker, 1983; Gorney, 1989; Connor & Ackerly 1994; Brown, Caplan, Werk & Searganian 1997; Harner, 1987; Young 1994). The percentages relating substance abuse clients with incidences of aggression vary across studies, probably due to variations in definitions of both substance abuse and aggression.

*Interpersonal aggression:* Domestic violence has been found to be more prevalence among couples in which one or both partners abuse alcohol or other drugs. Murphy and O'Farrell (1994) found the prevalence of male-to-female physical aggression among married or co-habiting men seeking treatment for alcoholism is four to six times higher than demographically matched non-substance abusing individuals. Fals-Stewart, Kashdan, O'Farrell and Birchler (2002) found a similarly high prevalence in co-habiting men seeking treatment for abuse of drugs other than alcohol. In a review of numerous research studies, Collins et al. (1997) found that 25% to 80% of male substance-abuse clients were identified as batterers. Brown et al. (1997) found that 58% of men being treated for substance misuse reported at least one incident of family violence in the past year whilst an overwhelming 100% admitted to psychological abuse. In addition to adult populations, links have been made between drug use and delinquent behaviour in adolescence (Watts & Wright 1990; Fagan 1993; Fagan & Chin, 1990). Kingery, Pruitt and Hurley (1992), for example, found that adolescents reporting more drug use also reported more fighting.

Drug misuse has been related to increased aggression in clinical contexts. Schulte et al. (1998) found that in health programs addressing sexually transmitted diseases, AIDS, HIV and tuberculosis, staff assault was 3.1 times more frequent in alcohol-abusing patients and 1.8 times more common among intoxicated drug users than those not involved in substance misuse.

*Crime:* French et al. (2000) note that numerous studies have established that the use of illicit drugs is strongly related to the commission of criminal acts (e.g., Chaiken & Chaiken, 1990; Dawkins, 1997; Nurco, Ball, Shaffer & Hanlon, 1985). They further note that local and national USA surveys showed that drug users were more likely to be arrested and have a connection with the criminal justice system compared to non-drug users (Anglin & Speckhart, 1998; Inciardi, 1995; Lightfoot & Hodgins, 1998) and that a large percentage of arrestees tested positive for illicit drug use at the time of their arrest (US Department of Justice, 1997).

Nurco (1998) found that 95% of drug addicts had committed a crime. French et al. (2000) reviewed two national US crime surveys and examined the relationship between chronic drug use on two types of crime: predatory crime (defined as using force or aggression with another, e.g. assault, fighting, armed robbery) and property crime (defined as crimes not involving force or aggression with another, e.g. car theft, breaking and entering). They compared frequencies for each across three groups comprising chronic drug users, non-chronic drug users and non-drug users. Their results showed that severity of drug use was significantly related to the probability of committing both property and predatory crimes, with chronic drug

users committing both types of crime more frequently than the other two groups. Chronic drug users were involved in crime 20-30% more often than non-drug users and results were consistent across gender, age and surveys. In addition to studies examining illicit drug use, numerous studies have identified associations between alcohol availability and offending behaviour (Gorman, Speer, Labouvie & Subaiya, 1998; Normström, 1998; Stevenson, Lind & Weatherburn, 1999) and others report a strong relationship of alcoholism with violent crime (Murdoch, Pihl, & Ross, 1990).

*ii) Substance abuse in offender populations*

Studies which have attempted to determine drug use among samples of criminals have tended to focus on arrestees and prison populations.

*Arrestees:* A UK Home Office report published in 2005 concluded that it is not an overstatement to say that drug misuse amongst arrestees is prolific. In urinalysis, over two-thirds tested positive for one or more drugs (excluding alcohol and tobacco), over a quarter tested positive for opiates (including heroin) and about one-fifth tested positive for cocaine. Arrestees who tested positive for three or more drugs reported on average three times as many offences as those with zero positive tests. Those who reported using three or more drug types in the last 12 months reported more offences, more offence types and more arrests than those reporting no drug use.

*Prison populations:* There is a higher prevalence of previous and current drug use in prison populations compared with the general population. In a population of remand prisoners, less than one-fifth of men and one third of women claimed never to have used drugs (Singleton, Meltzer, Gatward, Coid & Deasy, 1998). These percentages

are markedly higher than lifetime prevalence rates in the general population where 45% report never using drugs. In terms of current use, Singleton et al. (1998) found that 50% of sentenced man reported using drugs in prison. Alcohol abuse was reported in 58% of male remand prisoners and in 63% of male sentenced prisoners. Of 277 remand prisoners in Brixton prison, London, 52% were judged to have treatment of substance abuse as an unmet need (Hardie, Bhui, Brown, Watson & Parrot, 1998).

Further to the high prevalence rate of drug misuse in offender populations, abuse of alcohol and drugs has been correlated with a history of greater violence in treatment populations and prison inmates (Heller & Ehrlich, 1984; Langevin, Ben-Aron, Wortzman, Dickie & Handy, 1987; Miller & Potter-Efrom, 1989; Schuckit & Russell, 1984). Specifically, crime studies consistently implicate alcohol intoxication as one of the most significant factors in violent behaviour. In a large scale review of 26 studies involving 11 countries, it was determined that 62% of offenders convicted of violent crime had been consuming alcohol shortly before committing the crime (Murdoch et al., 1990)

### *iii) Co-morbidity, violence and crime*

Pihl and Hoaken (1997) note a high co-morbidity between substance misuse and psychiatric disorders. They note that a diagnosis of substance abuse or co-morbidity yield the highest probability for violent behaviour in a one-year period (over 23 and 24%, respectively), compared to other diagnoses (schizophrenia, 13%; affective disorder 8%, anxiety disorder and no diagnosis 3%). In light of these results, they

suggest that substance misuse might well underlie aggressive behaviours attributed to other psychiatric disorders.

Consistent with their conclusions, numerous studies suggest that substance abuse in the presence of a major mental disorder leads to increased risk of violence. The MacArthur Violence Risk Assessment study (Steadman et al., 1998), for example, compared violence by people discharged from an acute psychiatric inpatient facility with that of people living in the same neighbourhood. No difference was found in the prevalence of violence between patients and community controls. However, substance misuse was associated with increased rates of violence over a 1-year period in both groups and this difference was more pronounced in patients (18% major mental disorder without substance misuse, 31% with substance misuse) than in controls. The highest incidence (43%) was found in those with a combination of substance misuse and conditions such as personality disorder or adjustment disorder. In addition to co-morbid personality disorder or adjustment disorder, co-morbid psychosis has been related to an increased risk of violence. Patients with both psychosis and substance abuse were significantly more likely to report recent aggression (40.7% vs. 9.5%) or a criminal history (74.1% vs. 34.4%) than those with psychosis alone. In addition, key-workers were more likely to report recent aggression among the dually-diagnosed (Scott et al., 1998). These studies suggest an interaction between substance abuse and mental disorder in the causation of violence.

## **ii) Experimental studies**

Experimental studies provide further evidence for the drug-aggression link. A history of drug misuse has been associated with increased aggressive responding in

behavioural laboratory paradigms when compared with samples with no history of drug misuse (Allen, Moeller, Rhoades & Cherek, 1997; Gerra et al., 2004). Allen et al. (1997) compared individuals with a history of drug misuse and Gerra et al. (2004) compared individuals with a history of opiate abuse. In addition, the use of certain drugs has been associated with aggressive responding in behavioural paradigms (Bushman, 1993; Gerra et al., 2001a; Gerra et al., 2001b; Muntaner et al., 1990; Taylor & Chermack, 1993). These studies indicate that those who use drugs may be more likely to engage in aggressive behaviours than those who do not.

In summary, the drug-aggression relationship is one which is consistently reported in the literature in both naturalistic and laboratory contexts. The next section aims to explore this relationship and proposes a model with which it may be understood.

## **2. The drug-aggression relationship**

The relationship between drug use and aggression is multi-faceted and not limited to the direct pharmacological action of the drug (Brain, 1986). Pihl & Hoaken (1997) note that there are several different, but not necessarily mutually exclusive, reasons that the relationship between drugs and aggression exists:

- 1) Violent crimes may be committed to gain access to drugs or resources to purchase drugs. Indeed, studies that examined interviews with drug-using arrestees evidence that arrestees report committing the crime to finance their drug habit (Bennet, 2005). Hoaken and Stewart (2003) note that violence is often a necessary means of resolving disputes in illegal and thus inherently

unregulated and rule-less business. Violence occurs in order to attain drugs and relationship is thus indirect.

- 2) Aggressive behaviour and drug use can be the result of the same intra-personal factors such as high sensation seeking or impulsivity and thus the drug-aggression relationship exists coincidentally.
- 3) Certain drugs can increase the likelihood of aggression because of their direct pharmacological effect on the individual.

The next sections examine the second two factors – the intra-personal factors predisposing to aggression and drug use and the specific impact of drug use on aggression.

#### **i) Pre-existing intra-personal factors**

##### *i) Antisocial personality traits predisposing drug use and aggression*

An argument can be made that aggression is associated with drug use by virtue of an early aggressive personality that was present before drug use began and thus the relationship with drug-use is coincidental. Aggressive behaviour and aggressiveness may exist before substance use (Kelly & Cherek, 1993) and may predispose to drug use.

*Longitudinal studies:* Evidence that aggression is a long-lasting behavioural response pattern related to drug use is provided by studies showing that aggression in children is associated with a higher probability of future drug use. First-grade boys identified by teachers or peers as more aggressive are more likely to use drugs in the future (Kellelem et al., 1989). Moffit (1993) found that early aggressive behaviour in humans

was found to be predictive of later substance abuse. Individuals with childhood conduct disorder, which is included in anti-social personality disorder, are more likely to use drugs in the future (Kellems et al., 1980, 1982, 1983, 1989; Mueser, Drake & Wallach, 1998; Mueser et al., 1999; Ohannessian, Stabeneau & Hesselbrock, 1995). Consistent with these results, Lynam, Leukfeld and Clayton (2003) in a 10-12 year longitudinal study (pre-adolescence through to young adulthood) examined the relationship between personality, antisocial behaviour and drug use/misuse in males and females. Their results showed that low scores on traits of agreeableness and conscientiousness from the five-factor model of personality were most predictive of antisocial behaviour and drug use/misuse. Such studies suggest pre-existing aggression prior to drug use.

*Cross-sectional studies:* Studies looking at personality traits in adult substance-abusing samples report traits of irritability (Tarter, Blackson, Brigham, Moss & Caprara, 1995) and anti-social personality disorder (ASPD) (Kofoid & MacMillan, 1986; Mueser et al., 1998; Mueser, Drake & Wallach, 1999; Stabeneau, 1988). Various studies have found a higher prevalence of anti-social personality disorder in substance-using populations than in non-using populations. Kokkevi, Stefanis, Anastasopolou and Kostogianni (1998) examined personality disorder prevalence in a drug-dependent population (n=226) and found 59.5% met criteria for a personality disorder and ASPD was the most prevalent (33.5%). In line with Kokkevi et al.'s findings, using the Millon Clinical Multiaxial Inventory-III (MCMI-III), Craig (2000) found antisocial personality disorders were among the most prevalent personality disorders in male drug-addicts. Craig (2000) noted that previous studies using different measures (e.g., SCID, SDIP, MCMI-I) reported similar findings in

terms of overall prevalence. Darke, Hall, and Swift (1994) found that in a sample of methadone maintained clients 60.8% qualified for a lifetime diagnosis of ASPD, 25.7% received a current diagnosis of ASPD, and a conduct disorder in childhood was diagnosed for 68.5% of the sample. Several studies relate psychopathy to substance misuse. Smith and Newman (1990) assessed substance use disorder with a structured diagnostic interview in 360 male prison inmates. Correlational and categorical analyses revealed that psychopathy, as measured by the PCL-R, was significantly associated with both alcohol and drug abuse/dependence disorders. In another study PCL/PCL-R scores were significantly correlated with drug abuse dependence diagnoses (Hemphill, Hart & Hare, 1990). Associations of ASPD and psychopathy in drug-abusing populations suggest a lifetime pattern of anti-social and aggressive behaviour in these groups.

*ii) Impulsivity traits predisposing drug use and aggression*

There is a growing body of literature linking impulsivity, aggression and substance misuse (Miller, 1991). As reviewed by Brady, Mirick and McElroy (1998), studies find that impulsive and aggressive individuals have a higher rate of substance abuse than the general population. Some studies find a higher rate of later development of substance abuse among individuals with childhood disorders that are associated with elevated impulsivity (ADHD and conduct disorder), suggesting pre-existing impulsivity as an aetiological factor in drug use. However, other studies argue that the later development of substance misuse is related to conduct disorder alone or to childhood aggressive behaviour (Brook, Whiteman, Cohen & Tanaka, 1992; Reinherz, Giaconia, Hoff, Wasserman & Paradis, 2000). Moeller et al. (2002) provide support for an association between cocaine misuse and impulsivity

independent of ASPD or aggression. They administered the Barratt Impulsiveness Scale (BIS-11), a delayed reward laboratory measure of impulsivity, and the Life History of Aggression Scale to 49 cocaine-dependent individuals and 25 controls. Results showed that cocaine-dependent individuals with ASPD were more impulsive and aggressive than controls, but cocaine-dependent individuals without ASPD were also more impulsive compared to controls. Controlling for aggression history, cocaine dependent subjects without ASPD continued to have elevated impulsivity as measured by the BIS-11.

*iii) Cognitive deficits & neurotransmitter anomalies*

Decreased prefrontal functioning (Miller, 1990, 1991; Pulkkinen & Pitkanen, 1994) and alterations in serotonergic functioning (Brown, Goodwin, Ballenger, Goyer & Major, 1979; Higley & Linnoila, 1997), both of which are associated with impulsivity and aggressiveness, have been suggested to predispose drug-use. However, whether these anomalies are a consequence or antecedent of drug use is still being debated (Moeller & Dougherty, 2002). It is possible, for example, that substance abusers have impaired neuropsychological skills prior to the onset of drug use (Miller, 1990, 1991; Pulkkinen & Pitkanen, 1994) or that impairments may be a consequence of drug use (Volkow, Fowler & Wang, 2003). So too, altered serotonergic functioning may be a consequence of drug use or a predisposing factor. It is notable, for example, that while acute alcohol administration causes release of serotonin, decreased baseline serotonergic activity has been identified in subset of individuals with alcoholism (Higley & Linnoila, 1997). Further to this, individuals with risk factors for the development of drug use/abuse (specifically an aggressive

disposition and impulsivity) have been shown to have depleted markers of serotonin function than those without these traits (Brown et al., 1979).

The 'cause-consequent' debate is next further discussed by reviewing the literature detailing drug-specific effects on cognitive and neurotransmitter functioning.

## **ii) Drug specific effects**

Direct effects of the drug may include 1) direct pharmacological effects (intoxication), 2) neuro-toxic effects (damage caused by prolonged use) or 3) withdrawal effects (abstinence following prolonged use).

### *i) Pharmacological effects on neurotransmitter pathways*

Different drugs of abuse are structurally diverse and produce different behavioural effects in the user. Nevertheless, all share the common feature that they 'hijack' the brain's natural reward system. The dopaminergic system has been mostly closely implicated in reward. All drugs of abuse increase dopamine release in the nucleus accumbens. The extent they do this will vary with several factors, such as dose and route of administration. It will also depend on the particular drug. Tomkins and Sellers (2001) note that drugs of abuse exert influence over the brain's reward pathway either by directly influencing the action of the dopamine within the system, or by altering the activity of other neurotransmitters that exert a modulatory influence over the mesolimbic dopaminergic pathway. Gamma-aminobutyric acid (GABA), opioid, glutamatergic, serotonergic, cholinergic and noradrenergic neurotransmitter pathways have all been shown to interact at various points along the mesolimbic dopaminergic pathway and to modulate its activity.

Research suggests that alterations in neurotransmitters are related to violence. The serotonergic system has a role in impulse control. Alterations in the serotonergic system have unsurprisingly been related to violence. Raised whole blood serotonin and reduced spinal fluid serotonin metabolites have been associated with aggression (Bond, Wingrove & Critchlow, 2001; Moffit et al., 1998). Reduced CSF serotonin in alcohol dependent populations has been shown to correlated with interview-derived lifetime aggression scores (Limson et al., 1991), history of lifetime aggression (Brown et al., 1982) and acting out hostility (Roy, Adinoff & Linnoila, 1998). The actions of the inhibitory neurotransmitter GABA are potentiated by alcohol and benzodiazepines, and this may disinhibit behaviour and thereby increase aggressive responses (Graham et al., 1997). Both dopamine and norepinephrine are involved in behavioural regulation and therefore modulate human aggressive behaviour (Berman & Coccaro, 1997; Fishbein, Lovosky & Jaffe, 1989). Coccaro and Kavoussi (1996), in their hypothetical model of impulsive aggression suggest that, while the threshold to *act* aggressively is modulated by overall serotonergic system function, other neurotransmitter systems (e.g. norepinephrine, dopamine, opioid) may modulate aggression via their role *in perceiving threat* and in activating cognitive systems necessary to mount an aggressive response.

*ii) Pharmacological effects on pre-frontal functioning*

Neurochemical studies have shown that large dopamine release is associated with the reinforcing effects of drugs of abuse, but that after chronic drug abuse and during withdrawal, brain dopamine function is markedly decreased and these decreases are associated with prefrontal cortex (PFC) dysfunction. The changes in dopamine

function are likely to result in decreased sensitivity to natural reinforcers and disruption of frontal functioning, such as inhibitory control. From these findings, Volkow et al. (2003) propose a model that attempts to explain the loss of control and compulsive drug intake that characterises addiction. Specifically, they propose a network of four circuits involved in addiction: reward (nucleus accumbens), motivation (orbitofrontal cortex - OFC), memory (hippocampus & amygdala) and inhibitory control (PFC). During addiction, the enhanced value of the drug in reward, motivation and memory circuits overcomes the inhibitory control exerted by the prefrontal cortex, thereby favouring a positive-feedback loop initiated by the consumption of the drug and perpetuated by the enhanced activation of the motivation and memory circuits. This results in disruption to the control circuit (prefrontal functioning), diminishing inhibitory responses and higher-order functioning. These changes in synaptic connectivity could be involved in the changes in decision-making, judgement and cognitive control that occur during addiction. Such changes thus reinforce further drug use, but decreased cognitive control may also impact upon aggression. Indeed, when faced with threatening (or even ambiguous) situations, individuals with poor executive functioning may select inappropriate response options, have problems inhibiting behaviours once initiated and may not adaptively monitor behaviours to assess their appropriateness.

Various researchers have noted executive functioning deficits in drug users (e.g., Biggins, MacKay, Poole & Fein, 1995; Graham et al., 1997). Others have reported attention and memory deficits as a long-term consequence of drug use (Bruhn, Arlien-Soberg, Glydensted & Christensen, 1981; Grant, Adams, Carlin & Rennik,

1977; Grant & Judd, 1976; Roselli & Ardila, 1996). It has further been suggested that these deficits may not improve with time after drug use ends (Grant & Judd, 1976).

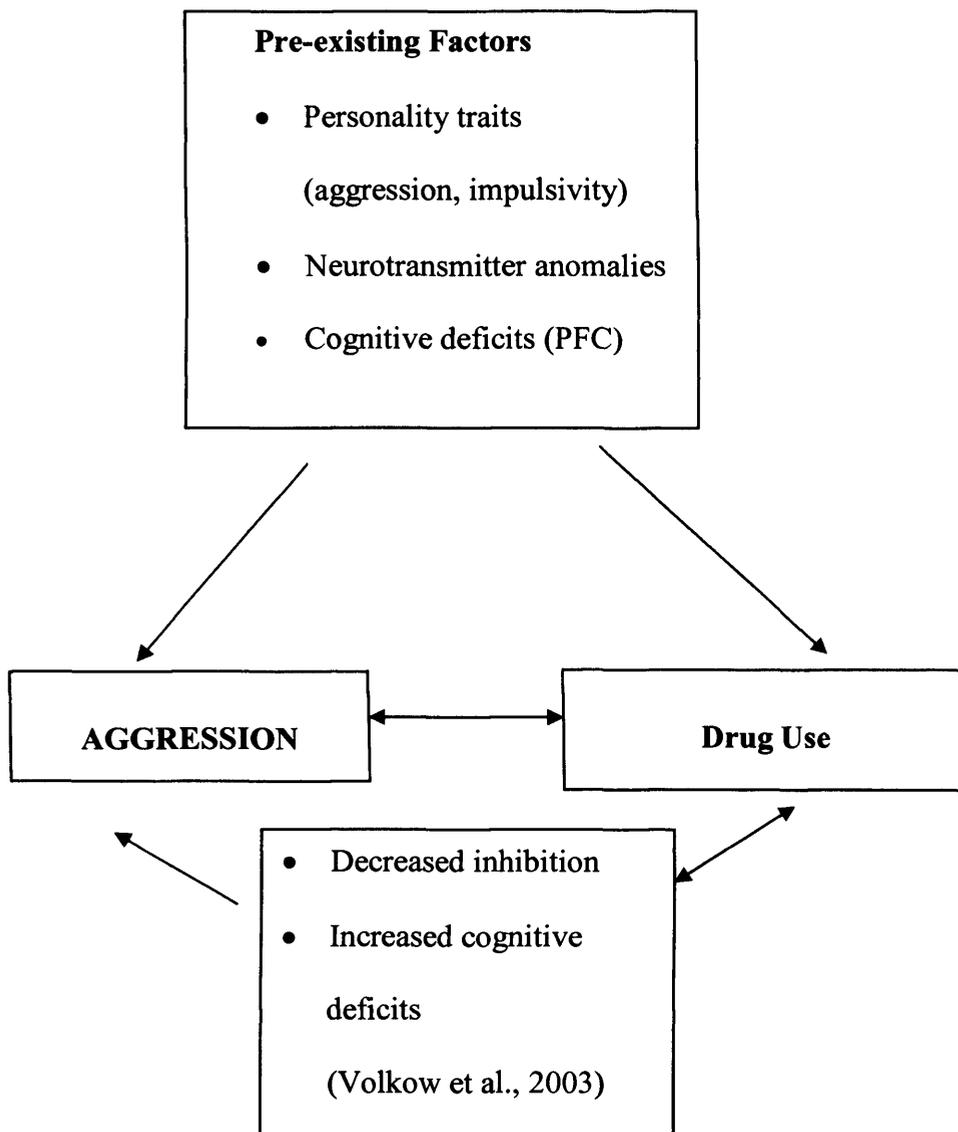
### **iii) Interactional effects**

The above review has outlined pre-existing factors which may influence heightened aggression reported in drug users alongside drug-specific effects which may also influence aggression. In the field of alcohol research, theorists have speculated on an interactional model (Pernanen, 1991). Chermack and Giancola's (1997) review concluded that dispositional aggressiveness is an important moderating variable in the alcohol-aggression relationship, with dispositional aggressiveness increasing aggression during intoxication. In line with this, Moeller, Dougherty, Lane, Steinberg and Chereck (1998) examined the effects of alcohol on a laboratory measure of provoked behavioural aggression in eight individuals with ASPD and 10 controls. Aggressive response following alcohol was greater in individuals with ASPD and the authors postulated a common underlying mechanism involving serotonin. In addition, Pihl, Assaad and Hoaken (2003), in a review of findings from a series of their own laboratory studies conducted on young adults, show that alcohol has its greatest aggression-potentiating effects for persons with low executive cognitive functioning. Studies thus suggest a "pharmacological kindling" (Boles & Miotto, 2003) whereby drug-use augments dispositional aggressiveness and impulsivity.

In line with the literature, and combining the models proposed by Pihl and Hoaken (1997) and Volkow et al. (2003), it seems that the minimum model to understand the drug-aggression relationship is depicted in Figure 1.

The drug-aggression relationship is thus seen as multi-determined and may differ according to the specific drug of abuse. Aggression is a complex concept and its relationship with drug use may differ according to how aggression is measured.

Figure 1. Possible relationship between aggression, pre-existing factors and drug use



Before reviewing the drug-aggression relationship according to specific drugs, the next section first will provide some necessary background by considering the different methods used to measure aggression.

### **3. Measures of aggression**

Aggression is typically been defined as “any form of behaviour directed toward the goal of harming or injuring another living being who is motivated to avoid such treatment” (Baron & Richardson, 1994). Aggression may be viewed as a multidimensional construct consisting of several (interrelated) domains: physiological variables (general sympathetic arousal, hormone/neurotransmitter function), cognitive variables (attentional biases, irrational automatic thoughts), phenomenological variables (subjective awareness and labelling of angry feelings), and behavioural variables (verbal/behavioural expression of anger). Overall, behavioural aggression has been the most widely investigated construct of aggression in studies reporting the drug-aggression relationship.

The ways in which aggression has been measured in studies relating to drug use are diverse and, to some extent, reflect the multidimensional nature of aggression. Measures used include i) epidemiological data of aggressive behaviour and criminality in ‘real-life’ contexts, ii) self-rated aggression via interview or psychometric scales and iii) objective measures of behavioural aggression in laboratory setting, typically using provocation tasks. More recently, two studies have

used an aggressive interpretative bias task to assess cognitive aspects of aggression. Each paradigm is next discussed and critiqued.

### **i) Epidemiological studies**

These have explored the relationship between drug use and aggression by analyses of aggressive behaviour and crimes such as assault and homicide. Although such studies suggest a clear relationship between drug use and aggression, various researchers note that there are a number of methodological issues that need to be considered in evaluating this research (Bushman, 1993; Chermack & Giancola, 1997). Most importantly, they note they provide limited information regarding the drug's role as a causal factor in producing aggressive behaviour; they do not usually allow for controlled drug administration and measurement of destabilisation and, in addition, they typically do not measure risk domains that may account for the relation between drug and aggression (such as personality traits). Chermack and Giancola (1997) note that the majority of these studies have limitations in other areas:

- *the manner in which the influence of the drug was assessed*: In general, non-experimental studies tend to use only one measure of drug use, classing arrestees as either drug using or not. Such an approach provides some information about the percentage of criminals using substances, but does not assess whether the drug had an influential role in the crime.
- *the manner in which aggression was measured*: Studies of crime typically focus on offence type, but lack specific information about the severity. Since many crimes do not result in arrests, official crime records are known to be less sensitive than self-reports in that they underestimate the number of crimes committed.

- *the reliance of self-report and post hoc information about aggressive incidents:*  
Harrell (1985) notes that research on the validity of self-reports indicates that socially unacceptable behaviour is often under-reported by 35-50% and recall problems may compromise accuracy.

## **ii) Self-rating studies**

Some studies have relied on self-reports of aggression either via interview or via the use of self-rating scales. The most widely used self-report measure of trait aggressiveness is the Buss-Durkee Hostility Inventory (BDHI) (Buss & Durkee, 1957). Self-reports are vulnerable to contamination by social desirability and defensiveness (Gur & Sackeim, 1979; Kendall & Korgesky, 1979), not least those concerned with violence and other socially unacceptable behaviour. They may also be contaminated by expectancy effects. Since drug use is associated with aggression, for example, individuals and observer-reports may overrate aggression in this client group. Self-report measures are thus vulnerable to response biases.

## **iii) Objective measures of provoked behavioural aggression**

Experimental methods using objective measures of behavioural aggression allow the control and measurement of factors known to influence aggression (i.e. dose, environment, etc.) and objective measurement may reduce demand characteristics and social-desirability effects. A large number of studies investigating the drug-aggression relationship have used either the Taylor Aggression Paradigm (TAP) (Taylor, 1967) or the 'Point Subtraction Aggression Paradigm' (PSAP) (Cherek, 1981), or modifications thereof. These paradigms provoke participants and measure aggression in different ways (i.e. shock vs. point subtraction).

In the TAP, participants are told that they are competing on a reaction-time task against an opponent in a nearby room. Before each trial, opponents are asked to select one of 10 shock intensities that they wish to administer to their opponent. A reaction time trial then follows. The loser receives the shock selected by the opponent and the winner receives no shock. In most studies the opponent is simulated and thus the rate of wins and losses is predetermined and distributed evenly. The measure of aggression is the intensity of the shocks selected by participants. In the PSAP, participants are seated in front of a response panel containing two buttons. Pressing the first button approximately 100 times earns the person a point, which is worth a specified amount of money. Pressing the second button approximately ten times subtracts one point from the subject's opponent. Points are "taken away" from the subjects by their opponent. The dependent measure of aggression is the number of times participants press the point-subtraction button.

The validity of these paradigms may be limited on the following grounds:

- *Provocation*: Both paradigms provoke aggression. One study showed that while a moderate dose of alcohol increases aggression if participants are provoked, alcohol does not increase aggression if participants are not provoked, suggesting that people act in different ways when they are provoked (Gustafson, 1993). In agreement with criticisms from Tedeschi and Quigley (1996), Giancola and Chermack (1998) concede that these paradigms tell us little about *instigative* aggression.

- *Social desirability*: Given that the task has high face validity in measuring aggression and that participants are generally motivated to present positive identities, participants may not engage in anti-normative aggressive behaviour.
- *Demand characteristics*: The TAP has been criticised in that it only allows participants to make an aggressive response. Gustafson (1993) found that if participants intoxicated with alcohol have access to a non-aggressive response, no increase in aggression was observed.
- *Ecological validity*: Tedeschi and Quigley (1996) argue that these measures are artificial and too far removed from ordinary experience. Overall, however, studies addressing this issue suggest that they have a good degree of external validity. Numerous studies have established the validity of this approach in distinguishing between violent and less violent people. Individuals with records of previous antisocial behaviour (Hartmann, 1969), prison inmates (Wolfe & Baron, 1971) and violent parolees (Cherek, Moeller, Schnapp & Dougherty, 1997) respond more aggressively on these paradigms than controls. In addition, in their review, Craig and Bushman (1997) conclude that responding on these measures correlates well with self-report trait aggression questionnaires and a meta-analytic study found a medium correlation between trait-aggressiveness and laboratory aggression (Anderson & Bushman, 1997).
- *Ethicality*: Task administration involves misinforming participants about their 'opponents' and their use of deception makes them dubious on ethical grounds.

A practical drawback is that such paradigms require complicated equipment and thus makes them impractical to administer in contexts where people use drugs.

#### **iv) Objective measures of aggressive interpretative bias**

More recently, two studies have used a cognitive bias assessment to assess cognitive aspects of aggression (Curran, Rees, Hoare, Hoshi & Bond, 2004; Hoshi, Bond & Curran, *submitted*). These studies used the extended Ambiguous Sentences Task (AST) which is a measure of the perception of aggressive content in ambiguity. The AST was developed from Copello and Tata's (1990) task. Based on Novaco's (1978) cognitive model of anger arousal, which postulates the importance of an individual's cognitive appraisal of a situation in mediating their response to it, Copello and Tata (1990) used an information-processing approach to investigate aggression in violent and non-violent offenders and non-offending controls. They developed a computer task to assess cognitive biases in the interpretation of sentences that were ambiguous for aggressive or neutral meanings (e.g. 'The painter drew the knife') and found that offender groups were more likely to recall ambiguous sentences as hostile (e.g. 'The painter pulled out the knife') whilst non-offenders showed the opposite pattern (e.g. 'The painter sketched the knife'). Further, the tendency to perceive threat correlated with self-rated hostility. The AST was developed to exclude the general anxiety items presented in the original task and focus explicitly on aggressive versus neutral material.

Curran et al. (2004) and Hoshi et al. (*submitted*) used the AST to study sub-acute effects of recreational ecstasy (MDMA) use. Acutely MDMA causes release of serotonin and feelings of empathy. This acute release is followed by depletion of serotonin for a period of days and increased self-ratings of aggression and depression (Verheyden, Hadfield, Calin & Curran, 2002). In a sample of 61 ecstasy users and 32 controls, Curran et al. (2004) found evidence of an aggressive interpretative bias,

with ecstasy use three days previously associated with faster reaction times in responding to aggressive sentences compared to neutral sentences and increased confidence in recognising aggressive compared to neutral sentences. Further, the tendency to infer aggression correlated with self-rated aggression. Hoshi et al. (in press) replicated Curran et al.'s (2004) finding of increased interpretative bias in a sample of 112 participants.

The subtlety of the task may counteract possible social desirability biases in responding which may be apparent on behavioural provocation tasks. Importantly, by looking at aggression from a cognitive perspective, it may tell us about the psychological processes which may *instigate* behavioural aggression, specifically whether cognition is a mediating factor. No study to date has examined aggressive interpretative bias in a population of dependent drug-users.

#### **4. Drug-aggression relationship according to drug class**

This section reviews the drug-aggression relationship for the main drugs of dependency with a focus on the opiate-aggression relationship. For each drug, where available, epidemiological findings are first reported and then, in line with Figure 1, evidence for drug-specific effects and effects of pre-existing intra-personal factors on the relationship. The section ends with an extended review of the opiate-aggression literature.

## **i) Alcohol**

The alcohol-aggression relationship has been extensively studied and alcohol is the substance most frequently cited as being related to aggressive and violent behaviour. Hoaken and Stewart (2003), in their review of alcohol and drug use related to aggression, conclude that alcohol is the drug with the most evidence to support a direct intoxication-aggression relationship.

Research on the epidemiology of violence has consistently linked alcohol intoxication and violence. Murdoch, Pihl & Ross (1990) conducted a large-scale review of 26 studies and determined that 62% of offenders convicted for violent crime had been consuming alcohol shortly before committing the crime. Alcohol was more than twice as likely to contribute to violent than non-violent crimes. Hoaken and Stewart (2003) note the alcohol-aggression relationship has been demonstrated in men and women (Hoaken & Pihl, 2000; Giancola et al., 2002), adolescents (Dembo, Pacheco, Schmeidler, Fischer & Cooper, 1997) and different ethnic groups (Murdoch et al., 1990). It has been associated with a wide range and type of violence, including, but not limited to sexual assault (Testa, 2002), child abuse (Hotaling & Sugarman, 1986), family and marital violence (Caetano, Schafer, Fals-Stewart, O'Farrell, & Miller, 2003), suicide (Brent, Perper & Allam, 1987) and homicide.

### *Drug-specific effects*

Single dose laboratory studies have shown increased aggression in intoxication individuals when compared to placebo. Bushman (1993) conducted a meta-analysis of single dose studies and found moderate effect sizes for alcohol vs. control and for alcohol vs. placebo. At least forty studies using the TAP, its modified versions, and

the PSAP have demonstrated that non-dependent participants who receive alcohol are more aggressive than those who receive a placebo or non-alcoholic beverage (e.g., Cherek, Steinberg, Manno 1985; Giancola & Zeichner, 1995; Weisman & Taylor, 1994). In addition, studies have shown that aggression on these paradigms is positively related, to an extent, to the dose of alcohol administered (Cherek et al., 1985; Taylor & Gammon, 1975). Further, there are several meta-analyses of experimental studies of the alcohol-aggression relationship which all conclude that even moderate doses of alcohol increase a participant's likelihood of responding aggressively (Bushman, 1993, 1996; Bushman & Cooper, 1990; Hull & Bond, 1986; Ito, Miller & Pollock, 1996; Steele & Southwick, 1985).

Single dose studies with heavy-drinkers, however, suggest that alcohol manipulations have little effect on aggression. (Cherek et al., 1985; Giancola & Zeichner, 1995; Weisman & Taylor, 1994). Rosenhow and Bachorowski (1984), for example, found that actual alcohol consumption did not increase aggression for males and only increased aggression for females at the lower doses. These findings fit with Bushman and Cooper's (1990) meta-analyses of six experiments using a placebo design with male heavy drinkers, from which they conclude that alcohol manipulations have little effect. Bushman and Cooper (1990) conclude that it is possible that drinking habits may moderate alcohol effects. Indeed, Golberg (1943) found that heavy drinkers were more tolerant of acute alcohol effects than either moderate drinkers or abstainers, presumably because they had habituated to the pharmacological properties of the drug.

As identified in Figure 1, Pihl et al. (2003) suggest that alcohol use may impact on aggression through the stimulation of dopamine release, increasing the likelihood of aggression via an increase in sensation-seeking and impulsivity and also via impaired cognitive functioning, most profoundly on cognitive abilities associated with the PFC. Evidence suggests both acute effects and chronic effects of alcohol in impaired PFC functioning (Pihl et al., 2003).

### *Pre-existing factors*

*ASPD & trait aggression:* Moeller and Dougherty (2001) note that within single dose alcohol studies there is high variability. They suggest this variability results from individual personality traits that predispose the person to be aggressive (e.g. ASPD) both in the presence and absence of alcohol. Several laboratory studies have supported the idea that the level of alcohol related aggression is related to whether a person has a history of past aggressive behaviour. For example, Giancola and Zeichner (1995) demonstrated in a study using laboratory measures of aggression that aggressive personality characteristics are associated with alcohol related aggression in a sample of social drinkers. Bailey and Taylor (1991) also demonstrated the interactions between personality traits, alcohol consumption, and aggression. In their study, college students with higher self reported trait hostility demonstrated more rapid increases in aggression in response to provocation after alcohol consumption than did students with lower trait hostility. Dougherty et al. (1999) also found evidence for the influence of individual differences in personality characteristics. Participants with the strongest tendencies for aggression while sober exhibited the greatest increases in aggression after consuming alcohol. Moeller et al. (1998) examined the effects on aggressive responding using the PSAP in eight

individuals with ASPD and 10 controls. Participants each received four drinks (one drink per day) containing varying amounts of alcohol before their level of aggression was assessed. Aggressive response to alcohol was significantly greater in individuals with ASPD.

*Cognitive deficits:* Individual differences in executive functioning have also been demonstrated to mediate the effect of alcohol. As noted earlier, Pihl et al. (2003) conclude from a series of their own laboratory studies that alcohol has its greatest aggression-potentiating effects for persons with low executive cognitive functioning.

A review of the alcohol literature thus identifies both pharmacological effects and pre-existing factors in mediating the alcohol-aggression relationship. Although not the focus for this thesis, others have identified the additional importance of contextual and situational factors.

## **ii) Benzodiazepines (BDZs)**

### *Drug specific effects*

Controlled laboratory experiments demonstrate that BDZs can acutely increase aggression. Bond (1992) reviewed seven single dose studies involving healthy participants using behavioural provocation tasks and found that benzodiazepines caused or increased aggression. Weisman, Berman and Taylor (1998) gave either placebo, 10 mg diazepam, 15 mg chlorazepate, or 50 mg oxazepam orally to 44 healthy controls and measured aggression using the Taylor provocation task. They concluded that diazepam but not all benzodiazepines can elicit aggressive behaviour under controlled laboratory conditions. Cherek, Spiga, Roache and Cowan (1991)

administered placebo and triazolam (0.125, 0.25 and 0.5 mg/70 kg of body weight) to male subjects under double-blind conditions. Using an adapted PSAP, they found that triazolam produced dose-dependent decreases in non-aggressive responding, suggesting aggression to be related to dose. They noted that the effects of triazolam on aggressive responding varied across subjects. The finding of heightened aggression in laboratory experiments is perhaps surprising given that BDZ are used as anti-aggression drugs in clinical contexts. Hoaken and Stewart (2003) note, however, that when BDZ is discussed in the context of aggression-management, higher doses are usually involved (e.g. Salzman et al., 1991). It is thought that the BDZ-aggression relationship is potentially mediated through interference with the anxiety/threat-detection system.

### *Pre-existing factors*

Some studies have sought to investigate the variability in aggressive responding across participants in laboratory studies and, consistent with Figure 1, have demonstrated that individuals with high baseline levels of hostility and/or impulsivity respond most aggressively. Ben-Porath and Taylor (2002), for example, demonstrated that while men administered a 10-mg dose of diazepam responded more aggressively on a laboratory measure of aggression than those given placebo, aggressive responding was greater in men with high pre-existing levels of hostility. Further, Chereck, Steinberg, Kelly, Robinson and Spiga (1990) observed that the aggression heightening effects of diazepam were correlated with verbal hostility, physical assaultiveness and other aggressive behaviours as measured by the BDHI. These findings are consistent with Rothchild's (1992) review of the literature since 1975 which concluded that when aggression follows a typical dose of BZD it is

usually associated with pre-treatment level of hostility. Hoaken and Stewart (2003) note that pre-existing cognitive deficits have been noted to mediate the relationship (French, 1989) (Figure 1) as well as alcohol consumption, which in combination with BDZ has been shown to produce greater aggression than the expected sum of the two drugs (Bond & Silveira, 1993).

A review of the BDZ literature thus suggests the importance of individual differences, dose and co-alcohol use in mediating the BDZ-aggression relationship, with sub-clinical doses being associated with increased aggression.

### **iii) Stimulant drugs (Amphetamine, Cocaine/Crack, MDMA “Ecstasy”)**

#### **Amphetamines**

*Drug specific effects:* Hoaken and Stewart (2003) conclude that the widely held belief that amphetamine leads to heightened aggression is one that is not convincingly supported in the literature. Controlled laboratory studies comparing acute amphetamine with placebo do not report increased aggressive responding (Beezley, Gantner, Bailey & Taylor, 1987; Cherek, Kelly & Steinberg, 1986; Cherek, Steinberg, Kelly & Robinson, 1987). A meta-analysis, however, found medium effects sizes for studies comparing those given amphetamine with those given no drug although the source studies are not cited (Bushman, 1993).

*Pre-existing factors:* It has been suggested that the only individuals likely to act aggressively during intoxication are those with pre-existing problems of impulse control and aggression (Powers & Kutash, 1978), as suggested by Figure 1. In addition, high-dose amphetamine use can result in stimulant-induced psychosis (Kosten & Singha, 1999) and can increase delusions and hallucinations in those with

psychotic disorders. Because psychosis itself may be associated with violence (Hodgins, 1994), high dose amphetamine use in those pre-disposed to psychotic experiences must be considered a greater risk for violence.

The amphetamine literature thus suggests aggression to be mediated by pre-existing aggression. Drug-specific effects remain unclear.

### **Cocaine/Crack**

Epidemiological studies show a cocaine-aggression association. Cocaine use has been related to interpersonal violence (Walton, Chermack & Blow, 2002), male-female marital violence (Fals-Stewart, Golden & Schumacher 2003) and the perpetration of crime and violence (Fishbein & Reuland, 1994; Kosten & Singha, 1999; Miller, Gold & Mahler 1991). Walton et al. (2002) examined the relationship between expressed violence severity and alcohol and cocaine consumption in the 90 days prior to substance abuse treatment. Approximately 85% of clients reported a significant conflict situation and cocaine use was found to be independently associated with violence severity for the most severe violent incidents. Aggression in cocaine using individuals has also been reported in clinical contexts. An observational study conducted by Brody (1990) concluded that patients with acute cocaine-intoxication present with a wide variety of aggressive behaviour patterns. Results are not consistent, however. Dhosshe (1999) conducted a retrospective review of 311 emergency psychiatric admissions, and found that patients with positive toxicology for cocaine were less frequently aggressive than cocaine-negative patients.

One laboratory study demonstrated that cocaine-dependent individuals were more aggressive than matched controls (Moeller, Steinberg, Petty & Fulton, 1994).

*Drug-specific effects:* Only one controlled single dose study has been conducted and suggests increased aggression. Using the TAP, Licata, Taylor, Berman and Cranston, (1993) measured aggression in 30 male undergraduates. Participants received either a placebo or low dose (1 mg/kg) or high dose (2 mg/kg) of orally administered cocaine. Participants in the high-dose cocaine condition reacted more aggressively than those given placebo, irrespective of level of provocation. A self-report study reported a significant positive correlation between the BDHI score and duration and frequency of cocaine use (Murray et al., 2003). Patients with higher levels of aggression and sensation-seeking had used cocaine more frequently and for longer time periods. However, no causal interpretations can be made about the direction of influence, with the possibility of cocaine-use increasing aggression or pre-existing aggression increasing cocaine use. Fals-Stewart et al. (2003) found that same day cocaine use predicted interpersonal aggression when controlling for ASPD.

*Pre-existing factors:* Although Moeller et al. (1994) found increased aggression in cocaine-dependent individuals compared to controls, a more recent study of inpatients admitted for treatment of cocaine-dependence found that a history of aggression best predicted PSAP aggressive responding (Moeller et al., 1997). Amount of cocaine used was a less important predictor and amount of cocaine used, length of time since last usage, cocaine craving and withdrawal symptoms were not predictive. These findings support the belief that a life long history of aggressive behaviour plays a critical role in predicting current aggressive behaviour in cocaine-

dependent samples. In line with this, recent research using the self-report Life History of Aggression Scale demonstrated that cocaine-dependant individuals with ASPD were more aggressive than controls but there were no differences between controls and cocaine-dependant individuals without ASPD (Moeller et al., 2002).

In summary, epidemiological and self-report studies suggest a link between cocaine use and heightened aggression. Findings from one controlled laboratory study, suggests an acute effect of cocaine on aggressive responding but only for a higher dose. Controlled laboratory studies conducted with cocaine-dependent individuals suggest heightened aggression compared to healthy controls, but that the cocaine-aggression relationship is more attributable to pre-existing aggression than drug effects. A review of the literature thus suggests the importance of dose effects in non-dependent samples and pre-existing aggression in dependent samples in mediating the cocaine-aggression relationship.

### **MDMA “ecstasy”**

*Drug specific effects:* Although not associated with drug-dependency, MDMA use has been associated with increased aggression. Gerra et al. (2001b) examined the chronic effects of MDMA use on aggression. They compared participants with a history of MDMA use who were MDMA abstinent for three weeks with MDMA-naïve controls using the PSAP and found heightened aggression in the user group. They found a significant correlation between aggressive responding and MDMA exposure but no correlation with aggressive personality traits, concluding heightened aggression to be more related to drug-specific effects than pre-existing aggression. Curran et al. (2004) and Hoshi et al. (*submitted*) used an aggressive interpretative

bias task to index aggression and showed that three days following ecstasy use, ecstasy-users showed an aggressive interpretative bias which was not apparent in ecstasy-naïve controls. Ecstasy users also self-reported heightened aggression compared to ecstasy-naïve controls. Their findings suggest the rebound effects of ecstasy in heightening aggression. Also using an information-processing approach, Bond, Verheyden, Wingrove and Curran (2004) used a story completion task to assess angry cognitive bias in three groups of participants: ecstasy users who had been abstinent for three weeks, those who had not used the drug for over one year and a control group matched for other drug use. They found that cognitive bias in information-processing was related to trait anger in all participants, suggesting a non-specific effect of ecstasy following abstinence of three weeks. This contrasts with Gerra et al.'s (2001) findings of increased aggression in MDMA-using individuals and the discrepant findings probably reflect the differences in the two paradigms used.

#### **iv) Cannabis**

*Drug-specific effects:* A single-dose study involving 40 male undergraduates on a laboratory measure of aggression, found higher aggression in participants administered a low dose (0.1mg/kg) of THC when compared to participants in either the medium-dose (0.25/mgkg) or high-dose (0.4 mg/kg) conditions (Taylor, 1976), suggesting small doses in non-dependent populations may increase aggression. Heightened aggressive responding during intoxication was also evidenced in a cannabis-dependent sample, where aggressive responding was higher in the first hour after smoking compared to placebo suggesting a heightened effect on aggression of cannabis intoxication in dependent samples (Chereck et al., 1993). Results should be

interpreted with caution, however, due to the small sample size used. Taken together the studies suggest intoxication-effects on aggression which vary with dose. Hoaken and Stewart (2003), in their review of the cannabis-aggression literature, suggest that cannabis and aggression may more reliably co-exist within the still-controversial notion of the cannabis withdrawal syndrome (Kouri & Pope, 2000). One study, using the PSAP, tested users at day zero, one, three, seven and 28 of detoxification. At days three and seven into abstinence, users were significantly more aggressive than at pre-withdrawal levels and at day 28. It is interesting to note that at day zero and day 28 there was no significant differences between cannabis-dependent individuals and healthy controls on aggression, suggesting no group differences in aggression pre- and at four-week withdrawal.

**v) Opiates (heroin, methadone, codeine, morphine): An extended review**

Controlled studies with rats suggest that morphine and other opium derivatives temporarily reduce aggressive behaviour (Espert, Navarro, Salvador & Simon, 1993; Haney & Mizceck, 1989), but that this effect, like many of the effects of opiates diminishes as tolerance develops (Rodriguez-Arias, Minarro & Simon, 2001). There is also evidence from rat studies that opiate withdrawal after tolerance increases aggression (Tidey & Miczek, 1992).

In their review of the human literature, Hoaken & Stewart (2003), however, note that there is considerable confusion regarding the extent to which opiate use is directly linked with aggression and interpersonal violence. They suggest that a complex interplay of pharmacological factors (including withdrawal factors) and interpersonal factors are likely at the root of instances of aggression manifested by opiate users.

*Controlled studies of behavioural aggression:* Two single dose studies conducted with healthy volunteers suggest that opiates increase behavioural aggression. Berman, Taylor and Marged, (1993) gave 28 male undergraduates either 45 mg of immediate-release oral morphine tablets or a placebo and assessed aggression using the Taylor method. Participants in the morphine condition were more willing to initiate attacks against their opponent and reacted more aggressively at all levels of provocation than those given placebo. Spiga, Cherek, Roache and Cowan (1990), using an adapted version of the PSAP, compared aggression in ten healthy males receiving placebo, 25, 50 and 75 mg/70 kg of codeine in a controlled laboratory setting. Aggressive responding was significantly increased at the 50 mg/70 kg dose. They also found that acute administration of codeine increased aggressive responding of all participants who scored below the median on the BDHI. Their findings thus suggest a direct pharmacological effect of codeine in increasing aggression which is affected by dose and pre-existing personality traits. Small participant numbers in the study are a limitation.

While single-dose administration can tell us about the acute drug-effects, chronic administration will produce more complex changes (see Figure 1). Alongside chronic administration, however, there will be intoxication and withdrawal effects between doses which will impact upon functioning and behaviour (e.g. Lyvers & Yakimoff, 2003). Two recent-studies have investigated the impact of opiates in chronic users by comparing opiate-dependent samples with opiate-naïve samples using the PSAP. Gerra et al. (2001a) found higher aggressive responding in heroin-dependent participants compared to healthy controls. A further study (Gerra et al., 2004)

compared 20 opiate-abstinent individuals with 20 healthy controls to examine aggressive behaviour of previously opiate-dependent individuals. They found that participants with a history of opiate use responded more aggressively than those with no history. Their findings provide evidence of a link between chronic-opiate using samples and increased behavioural aggression when compared to healthy controls. Interpretation of these studies is, however, hampered because both studies used the same hospital staff as controls and they differed in other ways apart from drug use from the clinical groups (e.g. they were employed). Hospital staff, for example, are typically selected for pro-social behaviour and screened for a criminal history. A better comparison would compare opiate users with controls matched for employment status. Importantly, both of Gerra et al.'s studies found no correlation between dosage or extent of exposure to opiates and aggressive responding, but a significant correlation with BDHI 'direct' and 'irritability' scores and MMPI II 'psychopathic deviate' scores. Gerra et al. (2001a; 2004) thus concluded that aggression evidenced in chronic opiate-using individuals is probably related to aggressive personality traits pre-existing opiate use rather than drug effects (see Figure 1).

*Self-report studies:* Self-report studies indicate that opiate-using individuals gain high hostility scores on self-report measures (Aharanovich, Nguyen & Nunes, 2001) or significant other-report measures (Babor et al., 1976). Aharanovich et al. (2001) found that anger scores were elevated in opiate-users, as assessed by the State-Trait Anger Expression Inventory. Babor et al. (1976) found high hostility scores using an observer rating interpersonal hostility scale. Further, opiate-dependent individuals score higher than healthy controls in self-reported aggression. Opiate-users have

been found to score higher than controls on the aggression scale of the Personality Assessment Inventory (El-Ksishy, 1996), the 'indirect aggression', 'verbal aggression' and 'inhibited aggression' subscales of the Karolinska Scales of Personality (Stenbacka, Brandt & Lettholm, 2004), the 'direct aggression' subscale of the Buss-Durkee Hostility Inventory (BDHI) and the 'psychopathic deviate' subscale of the MMPI II (Gerra et al., 2001a; Gerra et al., 2004).

One study identified differential hostility as measured by the BDHI in different opiate-user subtypes, defined by age of addiction onset and drugs of choice (Gerra et al., 1995). They identified three groups from 98 heroin-dependent males. 32 (Group A) showed high scores for resentment and guilt on BDHI (hostility-in), had a late-onset dependence and a preference for heroin and alcohol. 29 (Group B) showed high scores on assault and irritability on BDHI (hostility-out), had early-onset and a preference for heroin and cocaine. The other 37 patients (Group C) showed aggression scores in the normal range on BDHI, had late-onset and a preference for heroin only. Their findings thus suggest that elevated hostility-out in opiate-users is associated with early-onset abuse and conjoint use of alcohol and cocaine.

Three studies looking in various ways at aggression in opiate-using and opiate-abstinent samples suggest heightened aggression in opiate-using samples. Ladewig and Graw (1988) followed up a sample of opiate addicts over six years and found that people still using opiates reported themselves as more aggressive than those who had become abstinent from opiates on the SCL90-R. Patients in methadone-maintenance were located in between. Goodkin and Wilson (1982) in a discriminant functional analysis, examined factors that significantly differentiated 28 opiate-using

and 24 opiate-abstaining groups. Amongst other factors, abstainers were characterised by fewer aggressive incidents (and previous drug arrests) compared to opiate users. Finally, Babor et al. (1976) used an observer-rated interpersonal hostility scale to study heroin addicts in a rehab setting and found a decline in hostility scores during detoxification. Contrary to the above findings, Roy and Jones (1979), found no difference between outward-directed hostility as assessed by the Hostility and Direction of Hostility Questionnaire (HDHQ) when comparing 14 heroin addicts prior to abstinence again at 48 hours into abstinence. The discrepant findings may be attributable to the different length of abstinence periods between the studies, with 48-hours not being long enough to allow neuronal readjustment. Given that these studies would control for personality traits predisposing opiate use, the overall trend of heightened aggression in opiate-using versus opiate-abstinent groups may reflect a pharmacological impact of opiates in increasing aggression.

*Crime studies:* Not surprisingly, there is a clear relationship between opiate use and crime. Kaye, Darke and Finlay-Jones (1998) reviewed 388 patients in methadone-maintenance treatment and found that only three percent had no history of offending. Ball, Schaffer & Nurco (1983) found that the frequency of crime increases substantially in periods of dependence compared to periods of abstinence.

Studies of interpersonal violence and opiate use, however, provide mixed results. This could be a consequence of the difficulties associated with epidemiological data in measuring aggression and drug use or may actually reflect limited behavioural aggression associated with opiate use in naturalistic contexts. Morentin, Callado and Meana (1998) in a review of the files of 578 recently arrested individuals, concluded

that among those arrestees who were heroin abusers aggression to police authorities and nonfatal violent offences were less frequent (3.7% and 3%, respectively) than among those arrestees for whom there was no drug or psychiatric diagnosis (12% and 13.7%, respectively). Kaye et al. (1998) interviewed 388 methadone-maintained clients and found that although non-violent offences were more commonly reported by the sample (minor theft/possession of stolen property 35%; major theft/break and enter 30%, fraud 22%), a noteworthy proportion had committed violent offences (robbery/armed robbery/robbery with violence 17%; assault using a weapon 17%; cruelly hurt/tortured a person 9%). Clearly there is some inconsistency in the crime literature.

Kaye et al. (1998) further examined the patterns of violent offending in opiate-users and found that violent offences were more prevalent in those who had offended prior to abusing heroin (77%) than those who had used heroin before their first offence (20%). Those who offended before abusing heroin were younger, more likely to be male, to attract a diagnosis of ASPD and to have a history of conduct disorder. A significantly higher proportion of them had committed armed robberies or robberies involving violence. Nearly twice as many had assaulted someone with a weapon or cruelly hurt or tortured a person. Prior to heroin use they had been convicted of non-violent offences such as car theft or shoplifting. This change in non-violent to violent offending may reflect the impact of heroin-dependence. It could, however, simply be an age effect in which more serious and violent offending would have developed even without of drug use. Kaye et al. (1998) conclude that violent offending in opiate-users may be due to a pre-existing criminal disposition that may or may not be exacerbated by heroin-dependence.

One study of interpersonal violence has examined the impact of opiates while controlling for ASPD. Fals-Stewart et al. (2003) looked at the day-to-day conditional relationship between drug use and male-to-female partner physical aggression during a 15-month period. When controlling for ASPD and couple's global relationship of distress, regression analysis revealed that opiate use tended to increase the daily likelihood of physical aggression. However opiate use failed to predict aggression when conjoint alcohol and cocaine use was controlled for.

So, with reference to the drug-aggression model (Figure 1), what do the studies tell us about the opiate-aggression relationship? The literature reveals inconsistencies in the reporting of the opiate-aggression relationship, depending on how aggression has been measured. Studies of violent crime and opiate use provide inconsistent results. Studies using self- and other- reports and controlled behavioural studies of aggression, however, provide broadly consistent evidence relating opiate use to increased aggression.

*Drug-specific effects:* Single dose studies with healthy volunteers indicate a direct pharmacological effect of opiates in heightening behavioural aggression when compared to placebo (Spiga et al., 1990; Berman et al., 1993). In studies with opiate-dependent samples, however, drug-specific effects remain unclear. Some studies suggest heightened aggression in opiate-dependent samples is not related to opiate-specific effects, but is instead associated with conjoint drug use, specifically of cocaine or alcohol (Fals-Stewart et al., 2003; Gerra et al., 1995), and with pre-existing aggression (Gerra et al., 2001a). However, other studies demonstrating

heightened self-reported aggression in opiate-dependent compared to opiate-abstinent individuals (Babor et al., 1976; Goodkin & Wilson, 1982; Ladewig & Graw, 1988) suggest a possible pharmacological impact of opiates in heightening aggression.

*Pre-existing factors:* Studies with opiate-experienced samples, suggest that heightened aggression relates more to aggressive personality traits predisposing opiate use than direct pharmacological effects of opiates. Indeed, studies which demonstrate behavioural aggression in opiate-experienced individuals both in behavioural provocation tasks (Gerra et al., 2001a; 2004) and in crime studies (Kaye et al., 1998) conclude this to be more related aggressive personality traits.

Studies suggesting opiate-specific effects on aggression in opiate-dependent individuals have relied on self- and other- report measures which are susceptible to social desirability and expectancy effects. More convincing evidence of an opiate-specific effect on aggression would derive from an *objective* aggression measure comparing opiate-dependent, opiate-abstinent and unemployed healthy controls within an experimental paradigm to tease apart drug-specific versus pre-existing personality effects on aggression in opiate-dependent populations.

## **5. Summary**

Is there a relationship between drug use and aggression? The answer is an unequivocal “yes”. The nature of the relationship is clearly complex and appears to

vary across the different drug classes. Of the different drugs of dependence, there is most evidence for a direct pharmacological impact of alcohol on aggression. For benzodiazepines, stimulants and opiates personality factors may be as (or more) important than pharmacological ones (Figure 1).

Compared with studies looking at the effects of other drugs on aggression, there is a paucity of literature on the opiate-aggression relationship and conclusions regarding opiate-specific effects on aggression are hampered by the use of self-report measures which are susceptible to response biases. An understanding of the effects of methadone seems important given that it is routinely prescribed to opiate-dependent individuals.

Aggression has been measured in a variety of ways (epidemiological studies of crime and violence, self- and other- report studies and controlled behavioural provocation studies) and research has focused on measuring behavioural aggression. Little research, however, has explored the psychological mechanisms underlying behavioural aggression in drug-users. Impulsivity has been suggested, either as a trait pre-dating drug use (Miller, 1991) or a consequence of drug use (Volkow et al., 2003). Only two studies have looked at the cognitive aspects of aggression by measuring aggressive interpretative bias in recreational ecstasy users (Curran et al., 2004; Hoshi et al., *submitted*). Such investigation may tell us more about the psychological processes which *instigate* behavioural aggression, specifically whether an aggressive interpretative bias is a mediating factor (Dodge & Crick, 1990; Huesmann, 1988, 1998; Novaco, 1978). Based on Novaco's (1978) cognitive model of anger arousal, which postulates the importance of an individual's cognitive

appraisal of a situation in mediating their response to it, increased aggression in drug using populations might relate to an aggressive interpretative bias, whereby ambiguous stimuli or information is perceived as hostile. For example, when given the information “he’s after you”, if one has an aggressive interpretative bias, one might perceive malevolence or aggressive threat in the information (e.g. “he’s going to assault me”) rather than a possible benign scenario (e.g. “I’m ahead of him”). This perceived malevolence may result in anger or humiliation which may then provoke an aggressive retaliatory response by the individual. An investigation into aggressive interpretative bias could inform treatment approaches with drug-dependent individuals. If an aggressive interpretative bias is found in drug-dependent populations, for example, this might suggest the utility of cognitive therapy. No study to date has examined aggressive interpretative bias in a population of dependent drug-users.

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## **Part 2: A study of aggressive interpretative bias in opiate-dependent and opiate-abstinent men**

### **Abstract**

Increased aggression in opiate use has been shown with behavioural provocation methods and self-ratings. No study to date has examined aggression in opiate users from a cognitive theoretical perspective. This study therefore compared 21 opiate-dependent, 21 opiate-abstinent and 22 healthy unemployed controls on a measure of the perception of aggressive content in ambiguity. Both opiate-dependent and opiate-abstinent groups showed a cognitive bias towards neutral interpretations of ambiguous aggressive sentences, while controls showed no bias. The degree of neutral interpretative bias in opiate-dependent clients correlated with dose and years methadone use. Self-rated trait aggression correlated with an aggressive interpretative bias in the control group but not in either opiate group. This neutral interpretative bias contrasts with increased provoked behavioural aggression found previously in these two populations. Implications of these findings are drawn out in terms of a benign interpretative bias making individuals less likely to perceive threat in ambiguous information and thus potentially more vulnerable to engaging in risk situations and behaviours.

### **Introduction**

Methadone maintenance treatment reduces criminal behaviour of opiate-dependent individuals (Gossop, Marsden, Stewart & Rolfe, 2000) but it is not clear whether this

is a direct effect of methadone in reducing aggression or because of less need to fund heroin use. There is a paucity of research on the relationship between opiate use and aggression. While there are some inconsistencies in the reporting of opiate-dependency in the context of violent crime (Kaye, Darke & Finlay-Jones, 1998; Moretin, Callado & Meana, 1998), self- and other- report studies, studies of co-morbidity, and controlled behavioural studies of aggression provide broadly consistent evidence relating opiate use to increased aggression.

Self-report studies indicate that opiate-using individuals gain high hostility scores on self-report measures (Aharanovich, Nguyen & Nunes, 2001) or significant other-report measures (Babor et al., 1976). In addition, opiate-dependent individuals score higher than healthy controls in self-reported aggression. Opiate-users have been found to score higher than non-drug using controls on the aggression scale of the Personality Assessment Inventory (El-Ksishy, 1996), the 'indirect aggression', 'verbal aggression' and 'inhibited aggression' subscales of the Karolinska Scales of Personality (Stenbacka, Brandt & Lettholm, 2004), the 'direct aggression' subscale of the Buss-Durkee Hostility Inventory (BDHI) and the 'psychopathic deviate' subscale of the MMPI II (Gerra et al., 2001; Gerra et al., 2004). An epidemiological study revealed that in a sample of methadone-maintained clients 60.8% qualified for a lifetime diagnosis of ASPD and 25.7% received a current diagnosis of ASPD. The most common symptoms of ASPD were unlawful behaviours, aggressiveness and recklessness (Darke, Hall & Swift, 1994).

Social desirability and expectancy effects may contaminate self- and observer report measures. More convincing evidence would derive from an objective measure of

aggression. Laboratory measures of behavioural aggression also indicate a link between heightened aggression in opiate-experienced individuals when compared to healthy controls. Using the 'Point Subtraction Aggression Paradigm' (PSAP), a behavioural provocation task in which participants are led to believe that they and an apparent competitor can deduct money from each other, Gerra et al. found significantly higher aggressive responses in both methadone-maintained clients (Gerra et al., 2001) and opiate-abstinent clients (Gerra et al., 2004) when compared to healthy controls. Interpretation of these findings is, however, hampered because both studies used the same hospital staff as controls and they differed in other ways apart from drug use from the clinical groups (e.g. they were employed).

The relationship between drug use and aggression is complex. Pihl and Hoaken (1997) note several different, but not necessarily mutually exclusive, reasons why the relationship may exist: 1) an indirect relationship attributable to violence committed to gain access to the drug, 2) individual factors (e.g. impulsivity, poor socialisation) that predispose to both drug use and aggression, or 3) a direct impact of the drug on aggression which may be either acute, chronic or withdrawal effects.

Early aggressive behaviour and childhood conduct disorder have been found to be predictive of later substance misuse (Dawkins, 1997; Kellem et al., 1989; Moffitt, 1993; Murdoch, Pihl & Ross, 1990; Ohannessian, Stabeneau & Hesselbrock, 1995), suggesting pre-existing aggressiveness. Moreover, personality traits of impulsivity (Miller, 1991), irritability (Tarter, Blackson, Brigham, Moss & Caprara, 1995) and anti-social personality disorder (ASPD) (Kofoed & MacMillan, 1986; Stabeneau, 1998) are reported in relationship to substance misuse, suggesting a lifetime pattern

of anti-social and aggressive behaviour. Impaired prefrontal functioning (Miller, 1990, 1991; Pulkkinen & Pitkanen, 1994) and alterations in serotonergic functioning (Brown, Goodwin, Ballenger, Goyer, & Major, 1979; Higley & Linnoila, 1997), both of which are associated with impulsivity and aggressiveness, have been suggested to predispose drug-use. However, whether these anomalies are an antecedent or a consequent of drug use is debated (Moeller & Dougherty, 2002). Studies suggest a possible “pharmacological kindling”, whereby drug-use augments dispositional aggressiveness and impulsivity (Boles & Miotto, 2003; Chermack & Giancola, 1997).

Single dose studies indicate a direct pharmacological effect of opiates in increasing behavioural aggression in laboratory measures. Aggressive responding on an adapted version of the PSAP was significantly increased by codeine when compared to placebo administration in healthy controls (Spiga, Cherek, Roache & Cowan, 1990) and similar effects were found with morphine in another behavioural provocation task (Berman, Taylor & Marged, 1993). Opiate consumption may therefore have a direct impact on aggression.

Studies with opiate-experienced samples, however, suggest that heightened aggression relates more to aggressive personality traits predisposing opiate use than direct pharmacological effects of opiates. Studies finding increased aggressive responding in behavioural provocation tasks in opiate-dependent (Gerra et al., 2001) and opiate abstinent samples (Gerra et al., 2004) found no correlation with current methadone dose or years of opiate use but significant correlations with personality traits of ‘direct aggressiveness’ as assessed by the BDHI and the ‘psychopathic

deviate' subscale of the MMPI-II. In addition, one study of violent offending in opiate users (Kaye et al., 1998) found that offences were more prevalent in those who had offended prior to using heroin, further suggesting aggressive behaviour to be related to pre-existing aggressive personality traits. These findings fit with the broader forensic literature that the best predictor of aggression is past aggression.

One way to explore the drug-specific effects on aggression is to compare currently opiate-dependent with previously opiate-dependent though now opiate-abstinent individuals to better control for predisposing personality traits. Studies comparing these two groups have found heightened self-reported (Ladewig & Graw, 1988) and observer-reported (Babor et al., 1976; Goodkin & Wilson, 1982) aggression in opiate-using individuals compared to opiate-abstinent individuals. However, no study to date has compared opiate dependent and abstinent individuals on any objective measure of aggression.

What psychological mechanisms may account for the increased aggression evidenced in opiate-dependent individuals? Impulsivity has been suggested, either as a trait pre-dating drug use (Miller, 1991) or a consequence of drug use (Volkow, Fowler & Wang, 2003). When faced with threatening or even ambiguous situations, individuals with poor executive functioning may select inappropriate response options and may not adaptively monitor behaviours to assess their appropriateness. No study has yet looked at whether a cognitive interpretative bias may underlie this aggression. This seems important given that information-processing patterns at "higher" levels (such as schemata or scripts) are often proposed as a potential explanation for human aggressive behaviour (Dodge & Crick, 1990; Huesmann, 1988, 1998) and there is

evidence to suggest the interpretation of hostile cues becomes an automatic cognitive process (Berkowitz, 1990; Newman & Wallis, 1993; Winter & Uleman, 1984). Based on Novaco's (1978) cognitive model of anger arousal, which postulates the importance of an individual's cognitive appraisal of a situation in mediating their response to it, increased aggression in this client group might relate to an aggressive interpretative bias, whereby ambiguous stimuli or information is perceived as hostile. For example, when given the information "he's after you", if one has an aggressive interpretative bias, one might perceive malevolence or aggressive threat in the information (e.g. "he's going to assault me") rather than a possible benign scenario (e.g. "I'm ahead of him"). This perceived malevolence may result in anger or humiliation which may then provoke an aggressive retaliatory response by the individual. Previous research has established a link between biased perception of threat by aggressive individuals and its effect on increasing aggressive behaviour (Blackburn & Lee-Evans, 1985).

The Ambiguous Sentences Task (AST) is an unobtrusive measure of the perception of aggressive content in ambiguity. It was developed from Copello and Tata's (1990) original computer task to assess cognitive biases in the interpretation of sentences that were ambiguous for aggressive or neutral meanings (e.g. 'The painter drew the knife'). Copello and Tata (1990) compared three groups: violent offenders, non-violent offenders and non-offending controls and found that both offender groups were more likely to recall ambiguous sentences as hostile (e.g. 'The painter pulled out the knife') whilst non-offenders showed the opposite pattern (e.g. 'The painter sketched the knife'). Further, the tendency to perceive threat correlated with self-rated hostility. The AST was subsequently developed to exclude the general anxiety

items presented in the original task and focus explicitly on aggressive versus neutral material. It has been used in two studies of recreational ecstasy (MDMA) use. Acutely MDMA causes release of serotonin and feelings of empathy. This acute release is followed by depletion of serotonin for a period of days and increased self-ratings of aggression and depression (Verheyden, Hadfield, Calin & Curran, 2002). The AST is shown to be a sensitive measure of rebound effects of ecstasy (Curran, Rees, Hoare, Hoshi & Bond, 2004; Hoshi, Bond & Curran, *submitted*). Both studies found that ecstasy use three days previously was associated with faster reaction times in responding to aggressive sentences compared to neutral sentences and increased confidence in recognising aggressive compared to neutral sentences. Further, task measures correlated with subjective ratings of aggression. No study to date has examined aggressive interpretative bias in a population of dependent drug-users.

This study therefore aimed firstly to determine whether opiate-experienced men have an aggressive interpretative bias. Second, it aimed to differentiate the impact of opiate-specific effects versus pre-existing factors on aggression by comparing opiate-dependent individuals with opiate-abstinent individuals as well as healthy unemployed controls. Based on self-rating and behavioural provocation studies with opiate dependent (Gerra et al., 2001) and opiate-abstinent individuals (Gerra et al., 2004), the central hypothesis was that both opiate-experienced groups would show a bias towards interpreting ambiguous information in an aggressive way compared with controls.

## Method

### *Design and participants*

An independent group design was used to compare opiate dependent clients, opiate abstinent clients and healthy controls. Opiate dependent clients were recruited from a London drug treatment clinic and were receiving daily methadone via methadone-maintenance programs. This group will be termed 'MMT'. Opiate abstinent clients were recruited from two London residential drug rehabilitation clinics and were abstinent of all drugs except tobacco. This group will be termed 'Rehab'. Both MMT and Rehab participants had a self- and key-worker reported history of primary opiate addiction. Controls were recruited via a job-centre in the same London borough as the drug treatment clinic. Controls were either opiate-naïve or had tried the drug once and had no self-reported history of drug or alcohol addiction. Participants were paid a £6 supermarket voucher for completing the study. The research was approved by Camden and Islington NHS ethics committee<sup>1</sup>.

### *Procedure*

MMT and Rehab clients were accessed via liaison with clinic key-workers who identified and approached suitable volunteers. Controls were approached individually at the jobcentre. Volunteers were given an information sheet and asked for written consent prior to participation<sup>2</sup>. On the day of testing volunteers were individually taken to a quiet area. Controls were assessed for suitability using the Cut-down, Annoyed, Guilty, Eye-opener Scale (CAGE: Ewing, 1984) to detect problematic alcohol use and the CAGE-aid (Midanik, Zahnd & Klein, 1998) to detect

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<sup>1</sup> Appendix A

<sup>2</sup> Appendix B

problematic drug use. Control participants were excluded if they scored two or more affirmative responses on either measure. Prior to testing, all participants were screened to exclude acute effects of drugs commonly co-used in opiate-using populations (alcohol, benzodiazepines, and crack). Participants were excluded if they breathalysed positive for alcohol or reported use of benzodiazepine or crack within the period of the drug's reactive half-life (e.g. one month for benzodiazepines; three days for crack).

#### *Measures & materials*

*Demographics:* Age, years of education and employment status were assessed via self-report and pre-morbid IQ estimated via Spot the Word (STW; Baddeley, Emslie, & Nimmo-Smith, 1993). The STW is a lexical decision task designed to estimate pre-morbid verbal ability and hence verbal intelligence. Participants are presented with 60 word-pairs, each comprising one genuine word and one psuedo word designed to be pronounceable and to have a plausible orthographic structure. Participants work at their own rate and tick the item they regard as the genuine word. Performance is scored in terms of the number of correct responses.

*Mood:* Current mood state was assessed using the Depression, Anxiety and Stress Scale-21 item (DASS-21; Lovibond & Lovibond, 1995). The DASS comprises three subscales which independently assess depression (DASS-d), anxiety (DASS-a) and stress (DASS-s).

*Drug use:* Amount and frequency of all psychotropic drugs used in the 30 days prior to testing was recorded, as well as historical drug use (total of years exposure). MMT and Rehab groups were asked to provide a urine sample which was analysed following the testing session for methadone, heroin, benzodiazepine, cocaine (including crack), amphetamine and cannabis. It was not possible to urine screen controls due to environmental constraints (i.e. no client toilet within the job centre).

*Interpretative bias task:* The task, procedure and instructions followed exactly those used by Curran et al. (2004). The extended version of the ambiguous sentences task was used. The stimuli for the first part of the task consisted of 24 ambiguous sentences which could be interpreted as either aggressive or neutral (e.g. “The painter drew the knife.”) interspersed with 36 unambiguous neutral filler sentences (e.g. “She was very surprised to receive the birthday card”). For the subsequent recognition task, 72 sentences were prepared of which 48 were presented to any given participant. For the ambiguous sentences, 24 disambiguated versions were presented in which 12 were consistent with an aggressive interpretation (e.g. “The painter pulled out the knife”) and 12 consistent with a neutral interpretation (e.g. “The painter sketched the knife”). For each previously presented ambiguous sentence, participants received *either* the disambiguated aggressive sentence form *or* the disambiguated neutral sentence form and the task was counterbalanced so that half of the participants were presented with one set of disambiguated sentences (12 aggressive forms and 12 neutral forms) and the other half the opposite set (12 neutral forms, 12 aggressive forms). The remaining 24 sentences consisted of 12 neutral filler sentences with the same meanings as those presented previously, but with

minor word changes (e.g. “She was amazed when she received the birthday card”) and 12 new unambiguous neutral sentences. Items were randomised and the task was presented on a laptop computer.

*Part 1: Sentence processing:* The following instructions were presented on the laptop screen: “A sentences will appear on the screen for a few seconds. The last word will be missing and instead you will see a dotted line. Following this two words will appear: one on the upper part of the screen and one on the lower part. If you think the word on the upper part of the screen best completes the sentence then press the top button. If you think that the word on the lower part of the screen best completes the sentence then press the lower button”. The two buttons were identified on the keyboard by the investigator. Participants were then given three practice items and checked whether they had understood the task. They were then presented with 24 ambiguous and 36 neutral sentences in pseudo-random order. Each sentence was presented with the last word missing for four seconds. Following this two words simultaneously appeared on the screen, only one of which meaningfully completed the sentence. On completion of the sentence, the next sentence appeared. Reaction time was recorded. On completion of part 1 of the task, participants were presented with a filler task in which they were required to read aloud the numbers 100 – 0 as displayed on the screen.

*Part 2: Recognition:* The following instructions were read to participants: “You will now be presented with a series of sentences on the screen. Some of these sentences will have the same meaning as some you saw in the first part of the task. I would like you to read each sentence carefully and decide whether it is similar in meaning to one you previously saw. You need to respond using number keys 1 to 4. Press 1 for “no, definitely not” if you are certain you did not see a sentence of a similar meaning

before. Press 2 for “no, probably not” if you are not certain but think you probably did not see a sentence of a similar meaning before. Press 3 for “yes, probably did” if you are not certain but think you probably did see a sentence with a similar meaning before. Press 4 for “yes, definitely did” if you are certain you did see a sentence with similar meaning before”. The rating scale was displayed on the screen throughout. Forty-eight sentences were presented at the rate of one every 10 seconds. Both reaction time and rating were recorded for each sentence.

*Trait measures:* The Barrett Impulsiveness Scale (BIS-11; Patton, Stanford & Barratt, 1995) was used to index trait impulsivity, the California Psychological Inventory Socialization scale (CPI-So; Gough, 1957) was used to index socialisation and the Aggression Questionnaire (AQ; Buss & Perry, 1992) was used to index trait aggression. Participants were also asked about their previous commission of violent crime to index past aggression.

#### *Statistical analyses*

One-way analyses of variance (ANOVA) were used to compare groups (MMT versus Rehab versus Control) on demographics, current and historical drug use, mood and trait measures. DASS scores were skewed and thus analysed using non-parametric tests (Kruskal-Wallis). Repeated measures ANOVA were used to analyse responses on the AST, with group as a between-participants factor and sentence type (aggressive versus neutral) as a within-participants factor. Reaction time and confidence data were skewed and thus transformed using either square root or logarithmic transformations, as appropriate. For each participant an aggressive interpretative bias (AIB) differential, whereby a positive score indicates an

aggressive interpretative bias, was derived by calculating differences in responses to aggressive and neutral sentences. One sample t-tests were used on the AIB differentials for each group to establish significance of non-zero indices (i.e. no bias) and to follow-up significant group interactions on the AST. Two-tailed Pearson product-moment correlations were carried out for each group on task variables showing significant group interactions to explore relationships between AIB differentials, pre-disposing factors (trait impulsivity, socialisation and trait aggression) and drug use. Only total scores on questionnaires were correlated to reduce multiple correlations and thus Type 1 errors. Preliminary within-group analyses using independent sample t-tests compared perpetrators with non-perpetrators of violent crime on aggression measures. All data were analysed using SPSS for Windows version 11.0.

## **Results**

### *Demographics*

In total there were 64 participants aged 22 - 61 ( $37.86 \pm 7.50$ ) years: 21 methadone maintained clients, 21 rehab clients and 22 healthy controls. The groups were similar on social-demographic factors. There were no group differences in age or pre-morbid IQ, as estimated by STW. All Rehab and control participants were unemployed and 18 of the 21 MMTs were unemployed. The control group had significantly more years of education than the MMT and Rehab groups (Table 1).

Table 1. Group means (SD) for age, years of education, Spot the Word (STW) percentile and Depression Anxiety and Stress Scale (DASS) raw scores.

	MMT	REHAB	CONTROLS	
Age	39.2 (5.9)	38.0 (9.1)	37.9 (7.3)	NS
STW %tle	53.0 (26.3)	47.7 (29.9)	58.9 (22.4)	NS
Education yr	11.6 (2.1)	10.6 (2.6)	14.7 (3.8) <i>a</i>	F(2,63) = 11.20, p < .001
DASS-total	21.7 (15.7)	22.6 (11.7)	8.6 (8.1) <i>a</i>	KW(2) = 17.72, p < .001
DASS-d	5.3 (5.2)	5.5 (4.2)	1.1 (1.8) <i>a</i>	KW(2) = 24.59, p < .001
DASS-a	8.0 (5.9)	7.6 (5.0)	2.9 (2.8) <i>a</i>	KW(2) = 14.00, p < .001
DASS-s	8.3 (5.4)	9.4 (4.0)	4.7 (4.4) <i>a</i>	KW(2) = 10.89, p = .004

N.B. Significant differences using Bonferroni post-hoc analyses ( $\alpha = .05$ ): *a*: controls vs. MMT & Rehab.

*Mood state*: MMT and rehab groups scored significantly higher than controls on anxiety, depression and stress as assessed by the DASS.

*Current drug use (Table 2)*

*Self-reported*: In the 30 days prior to testing participants in the MMT group reported using methadone daily, with a mean dose of 64 ( $\pm$  28.7) ml. Ten reported using heroin a mean of 14.5 ( $\pm$  12.4) days a month. Rehab and control groups reported no opiate use. Other drugs used included alcohol (11 MMT and 20 control), tobacco (19 MMT, 19 Rehab, and seven control), cannabis (13 MMT and nine control), cocaine (two MMT and one control), crack cocaine (eight MMT), benzodiazepines (six MMT participants), and amphetamine (one MMT participant).

Table 2. Current and historical drug use for each group

	MMT	REHAB	CONTROLS	
<b>Current use</b>				
Alcohol frequency/ 30 days	3.8 (5.1)	-	9.9 (9.26)	t(33.1) = -2.70, p = 0.01
Alcohol (units) per session	5.7 (8.7)	-	6.6 (4.55)	t(40) = 5.07, p = 0.03
Cannabis frequency/ 30 days	10.9 (13.2)	-	4.6 (8.91)	[t(34.8) = 1.81, p = .078]
Cannabis (in £) per session	2.7 (3.2)	-	0.4 (0.52)	t(17.7) = 3.10, p = .006
Tobacco (cigarettes) per session	16.2 (12.1)	19.3 (15.5)	3.1 (5.27) <i>a</i>	F(2,63) = 11.63, p < .0001
<b>Historical use</b>				
Methadone use (yrs)	9.1 (8.1)	3.4 (3.34)	-	t(26) = 2.97, p = .006
Heroin use (yrs)	15.3 (8.6)	9.1 (3.42)	-	t(39) = 3.94, p = .011
Crack use (yrs)	5.6 (7.3)	6.6 (6.29)	-	NS
Cocaine use (yrs)	6.0 (8.5)	3.4 (5.05)	3.2 (6.40)	NS
Amphetamine use (yrs)	4.8 (7.7)	4.7 (6.59)	0.8 (1.37) <i>a</i>	F(2,63) = 3.28, p = .044
Alcohol use (yrs)	20.6 (10.1)	18.8 (17.57)	17.6 (6.71)	NS
Cannabis use (yrs)	19.7 (9.7)	15.1 (8.33)	7.3 (9.37) <i>a</i>	F(2,63) = 9.748, p < .0001
Tobacco use (yrs)	24.9 (7.8)	23.3 (9.58)	8.8 (10.73) <i>a</i>	F(2,63) = 18.17, p < .0001

NB: significant group differences using Bonferroni post-hoc analyses ( $\alpha = .05$ ): *a*: controls vs. MMT & Rehab,

*b*: controls vs. Rehab

Controls had drunk more alcohol per session and more frequently than MMT participants. Conversely, they had spent less money on cannabis joints per day than MMT and used for fewer days. Controls had smoked fewer cigarettes per day than both MMT and Rehab participants.

*Urine screens:* All rehab participants screened negative for all substances, except one who screened positive for cannabis. In the MMT group, one man could not provide a sample and another man's screen was not returned from the lab, leaving 19 analysed samples. Of these, all were positive for methadone, six for heroin, three for benzodiazepines and five for crack/cocaine. Of the 19 samples, only nine had been screened for cannabis use. Of these four were positive.

#### *Historical drug use (Table 2)*

Both MMT and Rehab groups had a long and chaotic history of drug use, all with a primary addiction to opiates. This contrasted with the control group who had no history of problematic drug use, except one who reported alcohol as problematic five years previously, another who reported cannabis as previously problematic and seven who defined their tobacco use as problematic. MMT had used methadone and heroin for significantly more years than Rehab participants. Both MMT and Rehab had used amphetamine, cannabis and tobacco for significantly more years than controls. The Rehab group had been drug-abstinent for 6 – 76 ( $23.1 \pm 19.5$ ) weeks.

#### *Self-rating Measures of Aggression, Impulsivity and Socialisation (Table 3)*

The Rehab group scored significantly higher than controls on AQ-total and sub-scales of AQ-physical aggression and AQ-anger. MMT and Rehab groups scored significantly higher than controls on BIS-total and the sub-scale of BIS-cognitive.

MMT scored significantly higher on BIS-non-planning than controls. MMT and Rehab groups scored significantly lower than controls on CPI-So. Eight MMT, 13 Rehab and four controls reported that they had perpetrated violent crime.

Table 3. Group means (SD) for BIS, CPI-So and AQ

	MMT	REHAB	CONTROLS	
<b>BIS-total</b>	75.6 (13.1)	76.2 (10.7)	66.9 (10.1) <i>a</i>	F(2,63) = 4.52, p = .015
<b>BIS-np</b>	32.4 (5.8)	31.9 (5.0)	28.4 (4.6)	F(2,63) = 4.11, p = .021
<b>BIS-m</b>	23.0 (5.4)	23.5 (4.9)	20.7 (3.4)	NS
<b>BIS-cog</b>	20.1 (4.8)	20.8 (3.4)	16.4 (3.8) <i>a</i>	F(2,63) = 7.27, p = .001
<b>CPI-So</b>	24.3 (7.4)	23.0 (6.5)	31.8 (5.8) <i>a</i>	F(2,63) = 11.33, p < .001
<b>AQ-total</b>	80.1 (23.6)	91.7 (20.0) <i>b</i>	70.6 (15.8)	F(2,63) = 6.04, p = .004
<b>AQ-physic</b>	24.2 (9.1)	29.6 (8.4) <i>b</i>	20.1 (4.8)	F(2,63) = 8.54, p = .001
<b>AQ-verbal</b>	15.6 (3.5)	16.2 (4.2)	15.2 (4.3)	NS
<b>AQ-anger</b>	19.2 (6.8)	22.1 (5.2) <i>b</i>	16.2 (5.1)	F(2,63) = 5.66, p = .006
<b>AQ-hostil</b>	21.3 (8.2)	23.8 (7.5)	18.7 (6.5)	[F(2,63)= 2.51, p = .089]

NB: significant differences using Bonferroni post-hoc analyses ( $\alpha = .05$ ): *a*: controls vs. MMT & Rehab, *b*: controls vs. Rehab

*Aggressive Interpretative Bias: Ambiguous sentences task*

Endorsement rates, confidence ratings and reaction times are given in Table 4.

*Part 1: sentence completion:* In the first part of the task in which participants completed sentences, there were significant main effects of group [F (2, 60) = 12.29, p < .0001] and sentence type [F (1, 60) = 178.6, p < .0001] on reaction times (RTs)

Table 4. Endorsement rates, confidence ratings and reaction times to aggressive and neutral sentences by each group

	Aggressive	Neutral
<b>Part 1: median reaction time to completion of sentences</b>		
MMT	1969.5 (494.2)	1597.4 (321.7)
REHAB	1831.0 (512.7)	1541.6 (394.2)
CONTROLS	1452.7 (494.0)	1141.2 (275.4)
TOTAL	1746.4 (539.8)	1426.8 (387.2)
<b>Part 2: total number of sentences endorsed as seen (N=12)</b>		
MMT	5.2 (2.4)	7.0 (1.9)
REHAB	5.5 (2.7)	7.5 (2.4)
CONTROLS	6.1 (2.7)	6.1 (2.7)
TOTAL	5.6 (2.6)	6.8 (2.4)
<b>Part 2: confidence ratings of sentences endorsed as seen</b>		
MMT	3.6 (.5)	3.6 (.5)
REHAB	3.5 (.5)	3.9 (.3)
CONTROLS	3.6 (.5)	3.7 (.5)
TOTAL	3.6 (.5)	3.7 (.4)
<b>Part 2: median RT to sentences endorsed as seen</b>		
MMT	4950.3 (1046.9)	4512.5 (1213.2)
REHAB	4884.8 (962.6)	4222.8 (1010.2)
CONTROLS	4444.8 (1295.7)	4180.1 (1186.9)
TOTAL	4755.0 (1119.7)	4303.2 (1132.6)
<b>Part 2: total number of sentences endorsed as unseen (N=12)</b>		
MMT	6.5 (2.5)	5.0 (1.9)
REHAB	6.3(2.6)	4.4(2.3)
CONTROLS	5.9 (2.7)	5.7 (2.7)
TOTAL	6.2 (2.6)	5.0 (2.4)
<b>Part 2: confidence ratings of sentences endorsed as unseen</b>		
MMT	1.2 (.3)	1.4 (.5)
REHAB	1.2 (.4)	1.5 (.5)
CONTROLS	1.3 (.5)	1.3 (.4)
TOTAL	1.2 (.4)	1.4 (.5)
<b>Part 2: median RT to sentences endorsed as unseen</b>		
MMT	4452.3 (1143.7)	4954.1 (1528.7)
REHAB	4694.5 (1097.4)	4376.9 (1169.7)
CONTROLS	4544.5 (1204.4)	4346.7 (1135.6)
TOTAL	4563.4 (1136.3)	4555.9 (1298.0)

but no group interaction. Controls were faster than MMT and Rehab to complete both sentence types. All groups were faster to complete neutral than aggressive sentences and had a significant *negative* AIB differential (Table 5). As expected, accuracy on this part of the task was at ceiling.

*Part 2: recognition bias:* On the second part of the task, in which participants judged whether a sentence of similar meaning had been presented in part 1 of the task, total number of sentences endorsed as previously seen showed a nearly significant group x sentence interaction [ $F(2,61) = 3.097, p = .052$ ] and a main effect of sentence [ $F(1,61) = 14.02, p < .001$ ]. As seen in Figure 1, MMT and Rehab groups endorsed more neutral than aggressive sentences as previously seen whereas controls endorsed similar numbers of neutral and aggressive sentences. There were significant *negative* AIB differentials for MMT and Rehab groups but not for controls (Table 5).

Figure 1. Mean total number of aggressive and neutral sentences endorsed as previously seen by each group

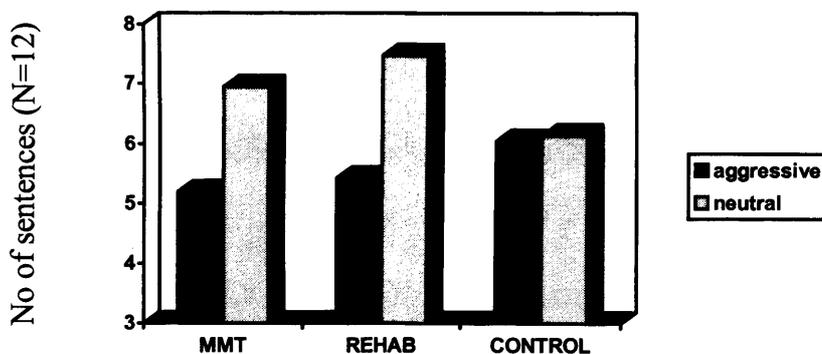


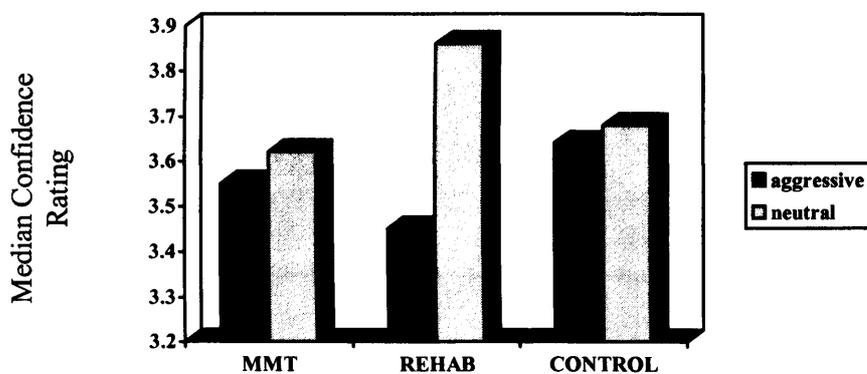
Table 5. AIB differentials for each AST measure for each group and test of difference from zero bias

	MMT		REHAB		CONTROLS	
	M (Sd)	t, p-value	M (Sd)	t, p-value	M (Sd)	t, p-value
<b>RT Sentence Compl</b>	-372.1 (231.2)	-9.73, <b>p &lt; .001</b>	-289.3 (208.7)	-7.43, <b>p &lt; .001</b>	-247.6 (211.8)	-6.66, <b>p &lt; .001</b>
<b>Endorsed as seen</b>						
<i>No of Sentences*</i>	-1.8 (2.4)	-3.42, <b>p = .003</b>	-2.1 (3.0)	-3.16, <b>p = .005</b>	-.09 (2.9)	-0.15, p = .886
<i>Confidence rating*</i>	-0.1 (0.6)	0.77, p = .45	-0.4 (0.54)	-3.45, <b>p = .003</b>	-.05 (0.4)	0.31, p = .765
RT	-437.8(1035.9)	-2.09, <b>p = .05</b>	-662.0 (766.0)	-3.95, <b>p = .001</b>	-264.7 (772.8)	-1.53, p = .142
<b>Endorsed as unseen</b>						
No of sentences <sup>^</sup>	-1.5 (2.3)	-3.07, <b>p = .006</b>	-2.0 (2.9)	-2.96, <b>p = .006</b>	-.14 (2.9)	-0.22, p = .829
Confidence rating	-0.2 (0.6)	-1.56, p = .134	-0.3 (0.5)	-2.82, <b>p = .010</b>	-.02 (0.3)	-0.37, p = .747
RT*	501.9 (766.0)	2.57, <b>p = .018</b>	-317.6 (1031.9)	-1.58, p = .129	-197.7 (1331.2)	-0.73, p = .476

NB:\* significant group interaction p < .05, ^ significant group interaction at p < .1

Confidence ratings (how sure they were that they had previously seen the sentence) showed a significant group x sentence interaction [ $F(2,61) = 3.25, p = .045$ ] and a significant main effect of sentence type [ $F(1,61) = 7.54, p = .008$ ]. As seen in Figure 2, the Rehab group were more confident in endorsing neutral than aggressive sentences as previously seen, whereas the other two groups showed little difference in confidence ratings for aggressive and neutral sentences. There was a significant *negative* AIB differential for Rehab but not for MMT and controls (Table 5).

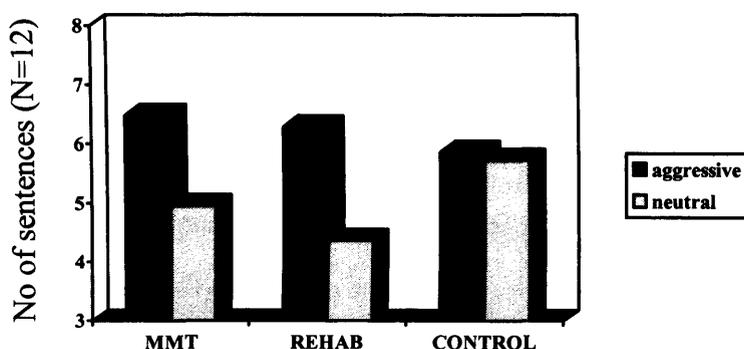
Figure 2. Group median confidence ratings to aggressive and neutral sentences endorsed as previously seen



RTs to sentences which participants endorsed as previously seen showed only a significant main effect of sentence type [ $F(1, 61) = 17.66, p < .0001$ ]. All groups had slower RTs to aggressive than neutral sentences. There was a significant *negative* AIB differential for MMT and Rehab but not for controls (Table 5).

Total number of sentences endorsed as previously *unseen* showed a main effect of sentence type [ $F(1,61) = 12.09, p = .001$ ] but not of group. There was a trend towards a group x sentence interaction [ $F(2,61) = 2.66, p = .078$ ] in which MMT and Rehab groups tended to endorse more aggressive than neutral sentences as unseen, whereas controls endorsed similar numbers of aggressive and neutral sentences as unseen (Figure 3). There was a significant *negative* AIB differential only for MMT and Rehab groups (Table 5). Confidence ratings showed only a significant main effect of sentence type [ $F(1,61) = 8.40, p = .005$ ]. All groups were more confident in endorsing aggressive than neutral sentences as previously unseen. There was a significant *negative* AIB differential for Rehab but not for MMT and controls (Table 5).

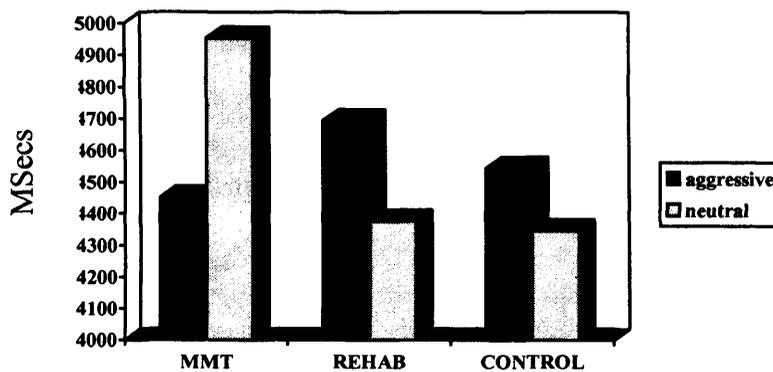
Figure 3. Mean total number of aggressive and neutral sentences endorsed as previously unseen by each group



RTs to sentences which participants endorsed as previously unseen showed a significant group x sentence interaction [ $F(2, 61) = 3.16, p = .05$ ]. As seen in Figure 4, MMT participants were faster to endorse aggressive than neutral sentences as

unseen. Rehab and control participants showed the opposite pattern and were faster to endorse neutral than aggressive sentences as unseen. There was a significant *positive* AIB differential for MMT but not for Rehab or controls (Table 5).

Figure 4. Median reaction time of each group to endorse aggressive and neutral sentences as previously unseen



### *Correlations*

#### MMT

The difference between the number of aggressive and neutral sentences endorsed as recognised correlated negatively with methadone dose ( $r = -.48$ ,  $n = 21$ ,  $p = .032$ ).

The difference between the number of neutral and aggressive sentences endorsed as unrecognised also correlated negatively with methadone dose ( $r = -.46$ ,  $n = 21$ ,  $p = .04$ ). The difference in confidence ratings for recognising aggressive and neutral sentences correlated negatively with years of methadone use ( $r = -.59$ ,  $n = 21$ ,  $p = .006$ ). No significant correlations were found between AST measures and questionnaire measures (AQ-total, BIS-total, CPI-So). Correlations of drug use and

questionnaire measures showed that years of heroin use correlated negatively with CPI-So ( $\rho = -.58$ ,  $n = 21$ ,  $p = .006$ ). Correlations of questionnaire measures showed that AQ-total positively correlated with BIS-total ( $r = .64$ ,  $n = 21$ ,  $p = .002$ ) and negatively with CPI-So ( $r = -.69$ ,  $n = 21$ ,  $p = .001$ ).

### Rehab

The difference in confidence ratings for recognising aggressive and neutral sentences correlated negatively with years of cannabis use ( $r = -.57$ ,  $n = 19$ ,  $p = .009$ ). No significant correlations were found between AST measures and questionnaire measures (AQ-total, BIS-total, CPI-So). Further, there were no significant correlations between drug use and questionnaire measures. Correlations of questionnaire measures showed that AQ-total correlated positively with BIS-total ( $r = .53$ ,  $n = 20$ ,  $p = 0.012$ ) and negatively with CPI-So ( $r = -.51$ ,  $n = 20$ ,  $p = 0.018$ ).

### Control

The difference in confidence ratings for recognising aggressive and neutral sentences correlated positively with number of units of alcohol consumed per day in the 30 days prior to testing ( $r = .45$ ,  $n = 20$ ,  $p = 0.04$ ). There were significant correlations between AST measures and AQ-total but not BIS-total and CPI-So. AQ-total correlated with the difference in number of aggressive and neutral sentences endorsed as recognised ( $r = .45$ ,  $n = 22$ ,  $p = .035$ ) and the difference between the number of neutral and aggressive sentences endorsed as unrecognised ( $r = .43$ ,  $n = 22$ ,  $p = .046$ ). AQ-anger also correlated with these two differentials ( $r = .47$ ,  $n = 22$ ,  $p = .027$ ;  $r = .46$ ,  $n = 22$ ,  $p = .030$ , respectively). There were no significant correlations

between drug use and questionnaire measures (AQ-total, BIS-total, CPI-So). Further, there were no significant correlations between questionnaire measures.

### *Exploratory within-group analyses*

#### MMT

Perpetrators of crime ( $n = 8$ ) were more confident in endorsing aggressive than neutral sentences as previously unseen ( $M = -0.50 \pm 0.54$ ), whereas non-perpetrators ( $n = 13$ ) showed no difference in confidence ratings between the sentence types ( $M = .00 \pm .50$ ),  $t(19) = 2.17$ ,  $p = .04$ ). Perpetrators scored significantly higher than non-perpetrators on the AQ-total ( $100.4 \pm 20.4$  vs.  $67.5 \pm 15.5$ ,  $t(19) = 4.17$ ,  $p = .001$ ), BIS-total ( $83.8 \pm 15.2$  vs.  $70.5 \pm 9.0$ ,  $t(10) = 2.22$ ,  $p = .05$ ) and significantly lower than non-perpetrators on the CPI-So ( $17.7 \pm 4.2$  vs.  $28.4 \pm 5.9$ ,  $t(19) = -4.45$ ,  $p < .001$ ).

#### Rehab

Perpetrators ( $n = 13$ ) tended to score higher than non-perpetrators ( $n = 7$ ) on AQ-total ( $97.9 \pm 20.1$  vs.  $80.1 \pm 16.7$ ,  $t(18) = 1.99$ ,  $p = .062$ ) and BIS-total ( $80.1 \pm 8.8$  vs.  $72.3 \pm 9.8$ ,  $t(18) = 1.81$ ,  $p = .086$ ).

## **Discussion**

As far as we are aware, this is the first study to use an objective measure of aggression to directly compare an opiate-dependent with an opiate-abstinent population and hence aim to control for pre-disposing factors of drug use and aggression. Further, unlike previous studies (e.g. Gerra et al., 2001; 2004), it

compared clinical groups with a control group who were similar in age, estimated IQ and employment status. Opiate-dependent and opiate-abstinent groups did not differ on trait aggression, trait impulsivity or socialisation. In addition, negative urine screens in the opiate-abstinent group objectively confirmed their drug-abstinent status whereas positive screens for methadone in the opiate-dependent group confirmed their adherence to methadone treatment.

The opiate-dependent group had used methadone for approximately nine years and heroin for 15 years. The opiate-abstinent group had used methadone for approximately three-and-a-half years and heroin for nine years. All lived in the same London borough and all were unemployed, except three opiate-dependent individuals. Self-report measures showed that both clinical groups were broadly more aggressive, more impulsive and less socialised than controls.

In line with information-processing theories of aggression (Dodge & Crick, 1990; Huesmann, 1988, 1998) and Novaco's (1978) theory of anger arousal together with previous findings of increased self-rated and behaviourally provoked aggression, we had predicted that opiate-experienced clients would show a bias to interpreting ambiguous information in a more aggressive way than controls. In line with previous research, self-reported aggression (AQ and violent crime commission) was higher for our clinical groups than the control group. However, our prediction of increased aggressive interpretative bias was not confirmed. On the contrary, both opiate-dependent and opiate-abstinent groups showed a negative interpretative bias away from aggressive interpretations and towards neutral interpretations. Specifically, opiate-dependent and opiate-abstinent groups recognised more sentences when they

were re-presented in a neutral than an aggressive form, whilst the controls showed no bias. Further the opiate-experienced groups tended to endorse as previously *unseen* more sentences when they were re-presented in an aggressive than a neutral form, whilst again controls showed no bias. A bias away from aggressive interpretations was again seen in confidence ratings, whereby opiate-abstinent individuals were more confident in recognising sentences that were re-presented as neutral than those re-presented as aggressive. This pattern of findings thus suggests that, contrary to predictions, opiate-dependent and opiate-abstinent were cognitively biased towards *neutral* interpretations (or away from aggressive interpretations).

In terms of speed of recognition, opiate-dependent and opiate-abstinent individuals again showed evidence of a neutral interpretative bias in that they were faster to recognise neutral than aggressive interpretations. Opiate-dependent individuals showed a distinctly different pattern of performance to opiate-abstinent and controls in the speed of rejection of aggressive and neutral sentences. The opiate-dependent group were faster to reject sentences that were re-presented in an aggressive than a neutral form. It is difficult to interpret what faster RT to rejecting an aggressive interpretation actually suggests, however, because no studies relating task performance to aggressive traits have found a significant difference in RT between aggressive and non-aggressive groups. Copello and Tata (1990) did not find significant differences in RTs for aggressive and neutral sentences between offenders and non-offenders and no significant group differences on this dimension of the AST were found in Bond and Wingrove's (*submitted*) study comparing high and low trait aggression individuals. Previous studies finding this interaction (Curran et al., 2004; Hoshi et al., *submitted*) with ecstasy users have interpreted faster RT to aggressive

stimuli as evidence for an aggressive interpretative bias, suggesting faster response time reflects the greater saliency of aggressive cognitions. However, unlike our study, their studies also found faster RTs towards aggressive sentences on part 1 of the task and in endorsing aggressive sentences as previously seen, reflecting a global trend in faster RT to aggressive versus neutral stimuli. Given that RT is usually construed as the amount of processing needed to perform a particular task, however, it could be interpreted that a faster rejection of aggressive sentences is indicative of a neutral interpretative bias. Indeed, a faster RT suggests that less processing was required to reject aggressive sentences and this would follow if aggressive interpretations were not cognitively salient.

In the opiate-dependent group, there was an association between dose and years of methadone use and task performance, with larger methadone dose relating to a decreased aggressive interpretative bias in recognition and years of methadone exposure relating to a decreased aggressive interpretative bias in confidence. No significant correlations emerged between interpretative bias and trait personality measures. Although no causative link can be inferred, these findings suggest that greater opiate use is associated with increased neutral interpretative bias. In the opiate-abstinent group aggressive interpretative bias in confidence correlated negatively with years of cannabis use. Interestingly in controls, the amount of alcohol consumed per session in the previous month correlated positively with an aggressive interpretative bias in confidence suggesting an association between alcohol intake and aggressive interpretative bias. This finding is reminiscent of the known link between alcohol use and other measures of aggression (e.g. Bushman & Cooper, 1990; Chermack & Giancola, 1997). Trait aggression, as assessed by AQ,

was not related to interpretative bias for opiate-dependent and opiate-abstinent participants but was significantly related to aggressive interpretations of ambiguous aggressive sentences for control participants.

Our findings are not in line with Gerra et al.'s findings of increased aggression in methadone-maintained (Gerra et al., 2001) and opiate-abstinent (Gerra et al., 2004) individuals when compared to healthy controls on a behavioural provocation task. In addition our findings of no association between an aggressive interpretative bias and trait aggression in opiate-experienced groups contrasts with i) the positive association found in our control group, ii) Copello and Tata's (1990) finding of an association with trait hostility and iii) Bond and Wingrove's (*submitted*) finding that healthy controls with high trait hostility recognised more aggressive than neutral sentences than those with low trait hostility. Other studies, however, have also failed to find an association (e.g. Curran et al., 2004; Hoshi et al., *submitted*), but unlike our findings, the lack of association was across both drug (ecstasy) using *and* control groups.

In line with Hoshi et al. (*submitted*) it might be argued that since aggression is a multi-dimensional construct, we might not necessarily expect behavioural aggression and an aggressive interpretational bias to correlate and this could account for why our findings do not accord with Gerra et al.'s (2001; 2004). That said, however, it seems that individuals with a history of chronic drug-use have distinctly different patterns of performance to those with no defined history (e.g. our control group; Bond & Wingrove, *submitted*; Copello & Tata, 1990), whereby an aggressive interpretative bias is not related to trait aggression or aggressive behaviour. In fact,

our findings directly contrast with Copello and Tata's (1990) which showed increased aggressive interpretative bias in offenders compared to non-offenders in sentence recognition. Conversely, we found that perpetrators of violent crime in the opiate-dependent sample had a neutral interpretative bias, with perpetrators more confident than non-perpetrators in rejecting aggressive interpretations. Before considering possible explanations for the pattern of results, let us first consider the implications of a neutral interpretative bias.

A neutral interpretative bias indicates a tendency to draw benign interpretations from potentially threatening information. In terms of evolution, rapid detection of threat is critical for species survival (Green & Philips, 2004) and threat-detection functions to protect the individual from danger and minimise subsequent harm in the event of some damage occurring (Gilbert, 2001). A possible implication of a benign interpretative bias, therefore, is that it may make an individual more vulnerable to engaging in potentially hostile or risky situations. By extension, this may increase levels of aggressive behaviour, for example, by provoking retaliatory aggression.

Further to this, hostile attributions function to enable the individual to pre-empt or deal assertively with injustices. Assertiveness or 'defensive aggression', as it is known in the primate literature, is viewed as necessary for a good position in the social hierarchy. A further implication of a benign interpretative bias may therefore be that it results in defencelessness of the individual. Such defenceless may be dealt with via a range of defensive behaviours, which could include passive-avoidance, submitting, cutting off, demobilisation (depression) but also behavioural aggression (defensive fight) in an attempt to gain or maintain social rank and status (Gilbert,

2001; Gilbert & McGuire, 1998). Interestingly, Linquist, Lindsay & White (1979) found heroin-addicted individuals to be less socially assertive than healthy controls. Furthermore they found assertiveness and aggression to correlate in heroin-addicted but not control individuals, suggesting that opiate-dependent individuals may be more likely to use aggression than healthy individuals when asserting themselves.

Given the feature that differentiates opiate-dependent and opiate-abstinent individuals from controls is a history of drug dependency, this suggests a neutral interpretative bias may be a feature of populations who abuse opiates. It is possible that neutral interpretative bias could be a factor which pre-dates opiate-dependency or it could be related to chronic effects of drug use, whereby drug use alters threat-perception through changes in neuronal pathways (Coccaro & Kavoussi, 1996). Following abstinence from chronic drug use, there is a prolonged period of neuronal adaptation (Volkow et al., 2003). For the opiate-abstinent group it is highly likely that this adaptational process was still ongoing. Whether with prolonged abstinence this interpretational bias eventually changes will require a long-term follow-up study.

In addition to neurological factors, a neutral interpretative bias may relate to psychological factors either pre-dating or as a consequence of drug use. An avoidant coping style may be one such factor. 'Vigilance-avoidance' of threatening stimuli on information-processing tasks has been found in other populations and has been formulated as an attempt to reduce anxiety (Dixon, 1981; Green & Philips, 2004). Dixon (1981) theorised that aversive stimuli may not be encoded or remembered due to a form of 'perceptual defence'. Drug use is widely conceptualised as an avoidant

coping strategy to deal with external stressors and eliminate aversive internal states (Alexander & Hadaway, 1982; Khantzian, Mack & Schatzberg, 1974; Wills & Shiffman, 1985) and, interestingly, aggression in drug-users has been related to escape-avoidance coping (McCormick & Smith, 1995). Drawing together these two literatures, a neutral interpretative bias in the opiate-experienced groups could be conceptualised as resulting from an avoidant cognitive coping style, whereby aversive stimuli is either not encoded or retrieved. The idea that drug users are particularly avoidant may explain why their pattern of recognition of threatening stimuli may be different to other aggressive but non-drug using populations, such as the offender populations studied by Copello and Tata (1990). The idea of a neutral interpretative bias relating to an avoidant coping strategy remains speculative with future research required to explore this link.

So, what factors are suggested contribute to the heightened aggression found in the opiate-experienced groups? The opiate-experienced groups reported lower socialisation and higher impulsivity than controls. Both low socialisation and high impulsivity were associated with trait aggression in the opiate-experienced groups but not in controls. Further, opiate-dependent perpetrators of violent crime had lower socialisation than non-perpetrators and perpetrators in both opiate-experienced groups had higher impulsivity than non-perpetrators. This pattern of results thus suggests that low socialisation and impulsivity may underlie the heightened aggression in the opiate-experienced groups. Poor socialisation is linked to aggressive behaviour (Gough, 1994). Low socialisation indicates that the individual has a limited internalisation of the values of society (Gudjonsson, Sigurdsson, Bragason, Einarsson & Valdimarsdottir, 2004). It follows, therefore, that low

socialisation may make opiate-experienced individuals more likely to engage or respond in behaviours that run counter to prevailing norms, one of which maybe aggressive behaviour. Impulsivity is also related to aggressive behaviour (Lee & Coccaro, 2000). When faced with threatening or even ambiguous situations, impulsive individuals may select inappropriate response options, such as aggression, have problems inhibiting behaviours once initiated and may not adaptively monitor behaviours to assess their appropriateness. Heightened impulsivity in these groups may pre-date their drug use (Miller, 1991), be a consequence (Volkow et al., 2003), or indeed be a combination of the two.

#### *Clinical implications*

The finding of a neutral interpretative bias in opiate-dependent and opiate-abstinent groups may shed light on why opiate-using clients find themselves in risky situations and engage in risk behaviours, other than factors related to poor socialisation and heightened impulsivity. Staff need to be aware that opiate-experienced clients may only recall benign interpretations from ambiguously aggressive situations and that this may explain why they have repeated patterns of risk behaviour. One possible intervention may be to help clients think through the full range of possible meanings of their experiences so that they can avoid further risk situations. This seems of clinical use if a neutral interpretative bias is attributable to neurological or pharmacological factors. However, if found to relate to an avoidant coping style, as has been speculated, it seems this surface intervention may have limited utility in the absence of dealing with the deeper problem of the avoidance of aversive internal states.

### *Methodological limitations*

The AST does not require a personal interpretation and does not comprise a personal threat. Given this, task responding may tell us little about how people interpret personally meaningful information in the 'real world'. Further research could seek to replicate findings using more personally meaningful stimuli, such as vignettes involving an ambiguously aggressive act towards the participant. Polysubstance use in the drug-using groups limits conclusions about opiate-specific effects on interpretative bias. However, given that polysubstance misuse is an increasingly common characteristic of this client group (Darke & Ross, 1997), our sample therefore increases the ecological validity of the findings. There were some dissimilarities between the groups. Firstly, the control groups had more years of education than both clinical groups and so groups differed. However, this is unlikely to differentially effect responses to aggressive versus neutral sentences. Second, the opiate-dependent group had a longer history of both methadone and heroin use than the opiate-abstinent group. It is difficult to match clinical groups for previous drug use. Essentially, when matched for age, those remaining in methadone-maintenance treatment, are, by virtue of their treatment, likely to have longer methadone histories than those in rehab. Despite these limitations, this study has several strengths. Unlike previous studies, all groups were similar in employment status, pre-morbid IQ and age, thus allowing carefully controlled group comparison. In addition, we gained objective verification of drug-using status of our opiate-using group and drug-free status of our opiate-abstinent group. A longitudinal study would redress difficulties in matching groups. Clients could be tracked from treatment to rehab and beyond to look at changes in cognitive bias as well as behavioural markers of aggression. Our preliminary analysis could be extended to look at greater numbers of perpetrators and

non-perpetrators, to permit firmer conclusions regarding drug-specific effects versus pre-disposing factors. That said, however, the chaotic presentation of drug using populations impedes longitudinal investigation.

### *Summary*

In summary, this study showed that opiate-dependent and opiate-abstinent individuals were cognitively biased towards recognising neutral interpretations of ambiguous sentences, whereas controls showed no bias. The degree of neutral interpretative bias in opiate-dependent clients correlated with dose and years methadone use. Trait aggression did not correlate with an aggressive interpretative bias in clinical groups but correlated in the control group. This neutral interpretative bias contrasts with increased provoked behavioural aggression found previously in these two populations. Taken together, these findings thus capture two polaric aspects of aggression in substance-abusing populations, with high behavioural aggression being the opposite of a cognitive bias towards neutrality (away from aggression).

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## **Part 3: Critical appraisal**

### **1. Reflections on “the journey”**

At the start research intentions were clear. Compare a methadone-using group with a methadone-abstinent group on an aggression measure to examine the effect of methadone on aggression while controlling for individual factors pre-disposing drug addiction and aggression. I was to share data collection with a fellow trainee, with each of us running each other’s tasks. We developed our protocol very early on in the research process and estimated each testing session would take an hour. With 60 participants, this meant 30-hours of testing, with five participants a day. Great, between us we could finish data collection in six days!

What seemed theoretically and logically coherent, however, did not translate into practical reality. We began recruitment in March 2004 at a large London drug treatment centre with over 300 methadone-maintained clients. As we approached key-workers with exclusion criteria it became obvious that examining methadone-specific effects would not be possible or of much clinical utility. Polysubstance use, specifically conjoint use of heroin, alcohol, crack and benzodiazepines (BDZ), typified the client group. With this in mind, we broadened our criteria to include infrequent use (no more than twice-weekly) of crack and BDZ and non-dependent alcohol use. Recruitment still remained slow, with key-workers only able to identify one or two clients from their caseload. Data collection was further hampered by a high rate of DNAs. Many clients lead a transient, chaotic lifestyle with their

appointment at the drug clinic maybe being the only appointments they have in life. The DNA rate within the clinic is approximately 50%, even though appointments invariably involve clients receiving their much-needed prescription for methadone. Juxtaposed on this, it seemed unsurprising that clients did not attend to participate in a research project. In addition our payment seemed not to provide an incentive for participation. One key-worker told me that one of his clients earns £80 per hour from begging, so would be unlikely to be enticed by our £6 supermarket voucher.

I came to realise my calculated two days recruitment for the methadone-maintained group was vastly underestimated. Altogether testing this sample took two of us from July 2004 until Jan 2005, two days a week, totalling approximately 50 days each. This discrepancy highlighted how little I knew about this client group and drug treatment services at the start of the research.

The testing process provided me with a window into the complex issues in drug-dependent individuals. Some used the session as an opportunity for them to reflect on their drug use and 'tell their story'. I was struck by the theme of powerlessness in this client group. Their stories often described guilt and wasted time and the desire but ultimate failure to be free from the enslavement of drug use. I also became aware of their powerlessness in society. Issues of homelessness and themes of societal marginalisation were evident. One client told me, for example, that he felt he is housed in poor accommodation because of his drug use and talked of living in a rodent-infested, damp flat in a noisy, dangerous neighbourhood. Some wanted to do something good to help others and this had prompted them to take part in the

research. This gave me some encouragement that, despite their devalued societal status, they felt could make a positive contribution.

As well as hearing participants 'stories', spending so much time in the clinic gave me a sense of what it may feel like to be a user, with all that this entails for one's self-concept and social value. There is a hostile response to the clinic from the local neighbourhood. The clinic is a large, intimidating building in an inner-city area, closed in with six-metre high iron gates. On approaching the building one may pass groups of clients drinking strong lager and clients' dogs tied up outside. The building has surveillance and security guards. Clients need to be cleared for entry and can only pass through the building when accompanied by a staff member through swipe-entry doors. Due to security, clients are not allowed to come accompanied to the clinic or to use their mobile phones whilst inside. Although the staff are friendly, I found the clinic to be a hostile, demoralising environment, with restricted access, barred windows, a large, impersonal waiting area, the sound of dogs barking outside and a pervasive smell of rotting.

The research progressed with me testing the healthy volunteers in a busy, local jobcentre and my colleague recruiting rehab participants of whom I tested two participants. Each group took approximately five whole days to test, with the rehabs taking a little longer than controls. Testing with the controls was a very different experience. The jobcentre did not feel as hostile as the clinic. Although there were security staff, clients and reception staff talked face to face as opposed to through a hatch window, there was no restricted access and the environment was airier. Control participants were invariably keen to take part, citing both personal interest and

payment as incentives. The biggest differences I noticed between the groups was that control participants were more enquiring about the research and the measures, while the methadone-maintained group were more passive.

The rehab centre was based in an airy yet intimate Edwardian building in a leafy London suburb and seemed a different world from the drugs clinic. This experience was very important for me in that it gave me hope that there was “light at the other side”. Having seen the entrenched difficulties in the methadone clients, it made me feel less despondent about the apparent powerlessness of people caught in the cycle of serious drug abuse. Rehab involves intensive therapeutic input requiring the confrontation of long-avoided issues, experiences and aspects of self. The theme of precariousness struck me in my testing of the rehab group, both through the comments of a participant who detailed several previous rehab admissions and told me how he really did not “want to screw up this time”, but also in the sense that the rehab seemed to provide a safe ‘bubble’ from the real world. I was left with the feeling that people leaving would have to work extremely hard to sustain their abstinence in the outside world.

My learning from the journey can be categorised into 1) factors associated with the client group and 2) factors associated with the research process itself.

#### *The client group*

My personal experiences of hearing participants’ ‘stories’ and witnessing the particularly hostile environment of the drug clinic made me curious about the impact of contextual factors upon aggression in those with a history of opiate-dependence.

Specifically, the restriction of liberties imposed upon this client group, their sense of social ostracisation, their powerlessness regarding their drug use and their lack of curiosity regarding the research, made me question of the impact of both a devalued status and social powerlessness on aggression.

Literature suggests social context has an impact upon aggression. Good relationships and support are known to buffer aggression (Howells, 1998). McCormick and Smith (1995) identified that social rejection is one of the factors most associated with aggression and hostility amongst substance abusers, alongside negative internal states and situations involving conflict with family and friends. Given the hostile environment and the apparent absence of social support for drug-using individuals it seems likely that social context may be an important factor impacting upon aggression in this client group. Also poignant was the restriction on liberties that I observed at the clinic. Given that some theorists have speculated about the role of frustration (Berkowitz, 1989) and humiliation (Gilbert, 1998) in aggressive behaviour, I wonder too that these contextual factors may impact on aggression. With regard to social powerlessness, I was reminded of Gilbert and McGuire's (1998) theory of 'social attention holding power' (SAHP), which postulates that social rank is elicited or maintained either via affiliation, whereby one demonstrates skills and attributes to attract and inspire others, or via aggression to inhibit others and stimulate fear. It seems possible that, due to their societal marginalisation, drug-users may be less able to gain SAHP via affiliation and may therefore need to assert themselves via aggressive behaviour. Irrespective of the mechanisms that may increase aggression (i.e. frustration, humiliation, attempts to attain social rank) it seems plausible that a comparatively hostile social context may be an additional risk

factor for aggression in this client group. This is something I had not considered prior to my experience at the clinic. Experience with this client group thus enabled a broadening of my theoretical perspective from one focused solely on pharmacological and intra-personal influences on aggression in this client group to one that includes social context.

### *The research process*

Upon reflecting on my own personal experience of my 'research journey' I would characterise as moving from 'optimism/naivety', to 'overwhelmed/uncertainty' to 'containment'. Following the initial 'naivety' regarding recruitment, there followed a period of uncertainty regarding the broadening of the inclusion criteria and anxiety as to whether it would be possible to recruit enough participants given the time constraints. Alongside data collection, time was spent researching the literature. I noticed that both experience at the 'coal face' alongside a growing knowledge of the literature gave me a growing appreciation of the complexity of the topic. This awareness made me feel overwhelmed at times and led me to question my research choices, placing me in a position of 'uncertainty' about my study. My research journey ended with the analysis of the results and writing of the empirical paper. Although anxiety-provoking, I ultimately found the writing of the paper to be a grounding experience which required me again to re-focus on the research question and culminated in my results and the literature to be pulled together into a coherent and meaningful way.

I observed a similar 'research journey' in my colleagues and have come to understand it as a natural process in research. This learning has been very important

for me. Many research projects begin and are not completed, maybe as a consequence of this move from the 'optimism/naivety' to the 'overwhelmed/uncertainty' stage. I hope my personal experience of moving through these stages to a 'containment' stage will help me to maintain determination and confidence in future research. In addition, from this process I have learnt the value of familiarising oneself with the client group while generating inclusion and exclusion criteria to enable a more realistic and clinically useful generation of research goals. I have also gained insight into the importance of good supervision to keep me focused and optimistic in the difficult 'uncertainty' stage. Crucially, I have learnt the value of being personally involved in data collection in that it enables the broadening of one's theoretical perspective and promotes interpretation of results within an ecologically-valid contextual framework.

## **2. Critical appraisal of research**

The main finding of the study was that both opiate-dependent and opiate-abstinent individuals had a neutral interpretative bias in their recognition of ambiguously aggressive sentences. This was an unexpected finding given information-processing theories of aggression (e.g., Dodge & Crick, 1990; Huesmann 1988, 1999; Novaco, 1978) alongside the dearth of research which relates drug-use with aggressive behaviour and cognitive hostility. Given that no research has been conducted with any drug-using populations on threat-perception with other cognitive tasks, it felt difficult to draw the data together in a meaningful way. A neutral interpretative bias was discussed in terms of a pharmaco-neurological impact of chronic drug use on

threat-perception and also as related to factors pre-dating or even predisposing drug-use, such as a neuronal abnormality in threat-perception or an avoidant coping style.

While correlational analysis relates opiate use (dose and years of exposure) to a neutral interpretative bias in the opiate-dependent group, it was difficult to draw any conclusions regarding the *causal* role of opiates on a neutral interpretative bias. The only group differences between opiate-dependent and opiate using groups was in their reaction time to rejecting aggressive interpretations, with opiate-dependent faster than opiate-abstinent individuals. As discussed in the empirical paper, interpretations of what this difference actually means are hampered, however, because no studies relating task performance to aggressive traits have found a significant difference in RT between aggressive and non-aggressive groups (Copello & Tata, 1990; Bond & Wingrove, *submitted*).

Group differences between opiate-dependent and opiate-abstinent groups on RT to rejecting aggressive sentences thus suggest some pharmacological impact on threat-perception. This finding is in line with Coccaro and Kavoussi's (1996) hypothetical model of impulsive aggression in which they propose that the opiate system may mediate threat perception. It could be interpreted that this RT differential in isolation alongside the negative correlation between an aggressive interpretative bias and methadone seems to suggest the role of methadone in inducing a cognitive interpretational bias towards neutrality. However, replication of this RT differential between the two groups is required with a more established information-processing task, such as the dot-probe task, to enable more confident conclusions regarding the causal role of methadone use in a bias towards neutral interpretations.

I speculated about the evolutionary advantage of threat perception and the possible implications of such a bias in that it may make the individual defenceless and place the individual at more risk of entering risky situations. In line with the literature, I proposed that this defenceless may be dealt with via a range of defensive behaviours, which could include passive-avoidance, submitting, cutting off, demobilisation (depression) but also behavioural aggression (defensive fight) in an attempt to gain or maintain social rank and status (Gilbert, 2001; Gilbert & McGuire, 1998). Replication of this study is now needed with more personally relevant stimuli to tell us about how this bias could impact in real life scenarios.

In terms of clinical practice, these findings may shed light on why these client groups often find themselves in risky situations and engage in risk behaviours, other than factors solely related to poor socialisation and heightened impulsivity. As discussed in the empirical paper, staff need to be aware that clients may only recall benign interpretations from ambiguously aggressive situations and that this may explain why they have repeated patterns of risk behaviour. One of the clinical implications of these findings may be to help clients think through the full range of possible meanings of their experiences so that they can avoid further risk situations. As discussed, this seems of clinical use if a neutral interpretative bias is attributable to pharmacological factors of drug use. However, if found to relate to an avoidant coping style, as I have speculated, it seems that this surface intervention would have little utility in the absence of dealing with deeper problem of the avoidance of aversive internal states.

Specific aspects of the measures and methodology are next discussed. Thoughts are given as to how the research may be limited and how future investigations may address these limitations.

*Ambiguous Sentences Task: validity & utility*

*Ecological validity:* The Ambiguous Sentences Task (AST; Bond & Wingrove, *submitted*) has established convergent validity with biased recognition of aggressive sentences in the original version of the task being found in offenders when compared to non-offenders (Copello & Tata, 1990) and in healthy controls with high hostility compared to those with low hostility (Bond & Wingrove, *submitted*). However, the AST does not require a personal interpretation and does not comprise a personal threat. Given this, task responding may tell us little about how people interpret personally significant information in the 'real world'. Indeed, Dodge and Frame (1982) found hostile attributional bias in behaviourally aggressive boys to be restricted to a peer member's behaviour towards the self and not another peer. Their findings thus suggest that interpretational biases may be influenced by whether content is personally relevant. Further research could thus seek to replicate findings using more personally meaningful stimuli, such as vignettes involving an ambiguously aggressive act towards the participant.

*Utility:* As previously discussed, the lack of validation of the RT measure in the AST makes interpretation of this dimension difficult. In addition, from the results, the locus of the neutral interpretative bias remains unclear, particularly because there were no group differences in RT in processing of aggressive and neutral sentences (phase 1). Clinical groups may favour neutral interpretations at encoding and through

to recognition, as suggested by the 'single access model' of resolution of ambiguity (Foss & Jenkins, 1973). Alternatively, both neutral and aggressive meanings may be activated at encoding as suggested by the 'exhaustive access model' (Simpson, 1984) but subsequently many of the threat interpretations fail to reach recognition. The former might imply more a threat-perception deficit, whereas the later may be more suggestive of a defensive procedure in response to aversive stimuli (Dixon, 1981).

Further research is therefore needed to replicate findings of a bias towards neutrality using other established and more validated information-processing tasks, such as the dot-probe task. Given that the dot-probe task indexes mainly attentional processes, it may also shed light on the possible location of the neutral interpretative bias. If an attentional bias is found on the dot-probe, for example, this may suggest that biasing could occur at the encoding phase. Finally, measures from the psychoanalytic tradition, such as the Rorschach, may be considered, particularly given that they may assess both threat-perception and defensive procedures, the latter of which has been speculated to operate within drug-using client groups.

#### *Groups: internal and external validity issues*

Polysubstance use in the opiate-experienced groups limits the conclusions about opiate-specific effects on interpretative bias. However, given that polysubstance misuse is an increasingly common characteristic of this client group (Darke & Ross, 1997), the clinical utility of such findings would be limited as this population is so rarely seen in real-life settings. A considerable strength of the study is therefore the degree of ecological validity it attains due to the samples used. This said, research participation requires both motivational and organisational abilities to attend a testing session and in this sense the methadone-maintained sample might represent the more

stable end of the opiate-using population seen for treatment. A more representative sample, however, is unlikely to volunteer for research or attend a testing session.

Dissimilarities between the groups have already been discussed in the empirical paper. The control individuals had more years of education than clinical individuals and the opiate-dependent individuals had a longer history of both methadone and heroin use than our opiate-abstinent individuals. It is difficult to match clinical groups for previous drug use. Essentially, when matched for age, those remaining in methadone-maintenance treatment are, by virtue of their treatment, likely to have longer methadone histories than those in rehab. Despite some differences, however, the groups were comparable on many domains and this adds to validity of the conclusions drawn about drug using versus non-drug using populations. All groups were similar in pre-morbid IQ and age. In addition participants were broadly similar in social-economic statuses, with all living in a similar London borough and all unemployed, except for three of the methadone-maintained clients. This allowed carefully controlled comparison between clinical and control groups while limiting the impact of extraneous social factors on aggression. This seems to be a considerable strength of the study given that social stressors such as poor living conditions, financial problems and unemployment have been related to aggressive behaviour (Howells, 1998). Barefoot, Peterson, Dahlstrom and Siegler (1991), for example, found that hostility associated strongly with income and occupation.

The use of an all male sample was important for several reasons. Firstly, gender differences have been shown in aggression. Men are more likely to use direct aggression and women indirect (Bjorkqvist, 1994). In addition, there is evidence of

gender differences in responses to anger. Males tend to react with ‘anger-out’ or more aggressive responses, whereas women tend to have an ‘anger-in’ reaction (Nunn & Thomas, 1999; Newman, Gray & Fuqua, 1999). Secondly, research indicates that men and women with substance-misuse problems may enter treatment with different problems. Women and men in treatment have been found to differ in their use of substances other than heroin, interpersonal relationships, drug dealing, employment and criminal behaviours (Anglin & Hser, 1987). The use of a purely male sample thus reduced sample variability in aggression, allowing a more controlled examination of the drug-aggression relationship.

#### *Validity of self-reports of drug use and aggression*

Via urine analysis, we gained objective verification of drug-using status of our opiate-using individuals and drug-free status of our opiate-abstinent individuals. In addition to this, we used self-report data to index drug use as well as aggression and violent offending. Research suggests that within clinical groups self-reported drug use and criminal history is reliable and valid, allowing us confidence in the validity of the self-report measures. Darke (1997), in his meta-analytic review, for example, found sufficiently reliable and valid self-reports by drug-users of their drug-use, drug-related problems and history of drug use. In addition he found respectable reliability and validity of self-reported aggressive behaviours when compared to criminal records and collateral interviews. In contrast, we know little of the validity and reliability of non-clinical individuals’ self-reports of drug use and aggression and so the validity of these measures with control individuals is less certain. In an attempt to minimise socially desirable responding all participants were ensured of the confidentiality and anonymity of their reports. Validity would be improved by urine

screening unemployed individuals to verify drug use status. This was not possible, however, as there were no client toilets at the jobcentre.

### *Payment*

Consideration was given to the ethical dilemma of offering payment. As all populations were in receipt of little income, there was a question as to whether participants would take part irrespective of whether they wished to, in order to receive payment. In order to maximise informed consent, participants were given the time to consider the study which was then fully explained. I was also aware of the possibility that within the drug-using groups, payment could be used in exchange for drugs. To minimise this, payment was given in the form of a supermarket voucher to encourage the purchase of non-drug items.

### **3. Future directions**

Having experienced a sense of achievement in finding some clinically useful results, I hope to remain research active in my work as a clinical psychologist. Having learned of the time demands of research, however, I am not sure that research conducted alongside clinical work is a reality. My research experience has made me aware that good knowledge of the client group and good networking with services can help with the arduous recruitment process. This is an under-researched client group, no doubt in part because of some the difficulties I have described and also the complex presentations of this client group (i.e. polysubstance abuse, dual diagnosis) making homogeneity of groups a difficult issue. This research has fuelled my interest

in further research and working clinically with this client group. My experience of research with this client group has given me a better grasp of the potential difficulties involved in conducting research and how to avoid pitfalls. One area of interest that has arisen for me, and for which there is very little empirical literature with this client group, is the issue of coping. I have become interested in how coping style impacts upon behavioural and interpretational processes, and, more specifically, whether an avoidant coping style in this client group relates to an interpretational bias towards neutrality (and away from threat).

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**Appendix A: Letter of ethical approval**

**Camden & Islington Community Health Services Local Research Ethics Committee**

Room 3/14  
3<sup>rd</sup> Floor West Wing  
St Pancras Hospital  
4 St Pancras Way  
London  
NW1 0PE

**PRIVATE AND CONFIDENTIAL**

Professor V Curran  
Sub-Department of Clinical Health Psychology  
University College London  
1-19 Torrington Place  
London

30 March 2004

Dear Professor Curran

**Title: Methadone maintenance and the interpretation of sentences and emotions.**

Thank you for your email of 26<sup>th</sup> March 2004, which addressed the points raised by the Ethics Committee at their meeting on 23<sup>rd</sup> February 2004. I am pleased to inform you that after careful consideration the Local Research Ethics Committee has no ethical objections to your project proceeding. This opinion has also been communicated to the North Central London Community Research Consortium.

**PLEASE NOTE THAT THIS OPINION ALONE DOES NOT ENTITLE YOU TO BEGIN RESEARCH, YOU MUST RECEIVE AN APPROVAL FROM EACH NHS TRUST HOSTING YOUR RESEARCH.**

Camden and Islington Community Health Service LREC considers the ethics of proposed research projects and provides advice to NHS bodies under the auspices of which the research is intended to take place. It is that NHS body which has the responsibility to decide whether or not the project should go ahead, taking into account the ethical advice of the LREC<sup>1</sup>. Where these procedures take place on NHS premises or using NHS patients, the researcher must obtain the agreement of local NHS management, who will need to be assured that the researcher holds an appropriate NHS contract, and that indemnity issues have been adequately addressed.

**N.B.** Camden and Islington Community Health Service LREC is an independent body providing advice to the North Central London Community Research Consortium. A favourable opinion from the LREC and approval from the Trust to commence research on Trust premises or patients are NOT one and the same. Trust approval is notified through the Research & Development Unit (please see attached flow chart).

**The following conditions apply to this project:**

- ♦ You must write and inform the Committee of the start date of your project. The Committee (via the Local Research Ethics Committee Administrator or the Chair at the above address) must also receive notification:
  - a) when the study commences;
  - b) when the study is complete;
  - c) if it fails to start or is abandoned;

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<sup>1</sup> Governance Arrangements for NHS Research Ethics Committees, July 2001 (known as GAFREC)  
An advisory committee to North Central London Strategic Health Authority

- d) if the investigator/s change and
- e) if any amendments to the study are made.

- ♦ The Committee must receive immediate notification of any adverse or unforeseen circumstances arising out of the project.
- ♦ It is the responsibility of the investigators to ensure that all associated staff, including nursing staff, are informed of research projects and are told that they have the approval of the Ethics Committee and management approval from the body hosting the research.
- ♦ The Committee will require a copy of the report on completion of the project and may request details of the progress of the research project periodically (i.e. annually for longer projects).
- ♦ If data is to be stored on a computer in such a way as to make it possible to identify individuals, then the project must be registered under the Data Protection Act 1998. Please consult your department data protection officer for advice.
- ♦ Failure to adhere to these conditions set out above will result in the invalidation of this letter of no objection.

**Please forward any additional information/amendments regarding your study to the Local Research Ethics Committee Administrator or the Chair at the above address.**

Yours sincerely

**Stephanie Ellis**  
**LREC Chair**

Email: [Kathryn.Atkinson@Camdenpct.nhs.uk](mailto:Kathryn.Atkinson@Camdenpct.nhs.uk) (administrator)

Enc/s:

Copy to:

**Appendix B: Participant information and consent sheets**

## **Participant information sheet**

### **Research Study: Methadone and the interpretation of sentences and emotions**

**Researchers:** Louise Martin and Jo Coyle (Trainee Clinical Psychologists)

You are invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please read the following information. Please ask us if there is anything that is unclear or if you would like more information. Take time to decide whether you wish to take part.

#### **What is the purpose of the research project?**

To understand what effect methadone has on the way people understand sentences and facial expressions. Research has shown that different drugs affect these two things. In this study we are looking at 1) people who use methadone at the moment, 2) people who no longer use methadone or heroin, and 3) people who have never used methadone.

#### **Why have I been chosen?**

We have asked you to take part in the study because you are using methadone at the moment. We will also be approaching around 30 other people who currently use methadone.

#### **Do I have to take part?**

You do not have to take part in this study if you do not wish to. Your decision to take part will not affect your care management in any way. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you do decide to take part, you can withdraw at any time without having to give a reason.

#### **What will happen if I take part?**

We will arrange to meet you once for about 1-hour at the Margarete Centre, after you have taken your methadone. First we will ask you a little about your drug use. You will then be shown some sentences and faces on a computer and asked to make some decisions about them. We will also ask you to complete some questionnaires and provide a urine sample. When this is completed, we will give you a voucher worth £6. All information collected about you during the study is strictly confidential and will be coded by number. Your name will not appear on any forms.

#### **What are the advantages and disadvantages of taking part?**

We do not foresee that taking part will cause you distress. We hope that the information we collect from this study will improve our understanding of the effects of methadone, and so help to improve services to methadone clients.

#### **What will happen to the results of the study?**

The results will be written up as part of a thesis, which we hope will be published in a scientific journal. A summary of the findings will be available to all who took part.

#### **Who is organising and funding the study?**

The study is organised and funded by Camden and Islington NHS Trust and University College London.

#### **Contact for further information:**

If you would like further information or have any questions, then please leave a message for us at the Margarete Centre.

**Thank you for taking time to read this.**

Date: 14<sup>th</sup> July 2004

All proposals for research using human subjects are reviewed by an ethics committee before they can proceed. This proposal was reviewed by Camden and Islington Health Services NHS Trust Ethics Committee.

**Participant information sheet (opiate abstinent clients)**  
(CORE Trust)

**Research Study: Methadone maintenance and the interpretation of sentences and emotions**

**Researchers: Louise Martin and Joanna Coyle**

You are invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please read the following information. Please ask us if there is anything that is unclear or if you would like more information. Take time to decide whether you wish to take part.

**What is the purpose of the research project?**

To understand what effect using methadone has on the way people interpret sentences and facial expressions. Research has shown that different drugs affect these two functions. In this study, we are looking at 1) people who are using methadone at the moment, 2) people who no longer use methadone or heroin, and 3) people who have never used.

**Why have I been chosen?**

We have asked you to take part in the study because you are no longer using methadone or heroin. We will also be approaching around 20 other people who are currently abstinent.

**Do I have to take part?**

You do not have to take part in this study if you do not wish to. Your decision to take part will not affect your healthcare or management in any way. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you do decide to take part, you can withdraw at any time without having to give a reason.

**What will happen if I take part?**

We will arrange to meet you once for around 1 hour at the CORE Trust. First we will ask you a little about yourself and your drug use. Then we will ask you to complete some questionnaires. After this you will spend around half an hour doing some tasks on a computer. These will include making decisions about sentences and faces that you are shown. When this is completed, we will give you a voucher worth £6. We would like to take a urine sample, just to confirm that you are not using drugs. The results of this would be confidential and not fed back to the CORE Trust. All information collected about you during the study is strictly confidential and will be coded by number. Your name will not appear on any forms.

**What are the advantages and disadvantages of taking part?**

We do not foresee that taking part will cause you distress. We hope that the information we collect from this study will improve our understanding of the effects of methadone, and have implications for improving services to clients.

**What will happen to the results of the study?**

The results will be written up as part of a thesis, which we hope will be published in a scientific journal. A summary of the findings will be available to all who took part.

**Who is organising and funding the study?**

The study is organised and funded by Camden and Islington NHS Trust and University College London.

**Contact for further information:**

If you would like further information or have any questions, you can contact us at the Margarete Centre on 020 75303086.

**Thank you for taking time to read this.**

Date: 15.12.04

All proposals for research using human subjects are reviewed by an ethics committee before they can proceed. This proposal was reviewed by Camden and Islington Health Services NHS Trust Ethics Committee.

Participant identification code:

## Consent Form (Methadone maintained and opiate abstinent clients)

### Confidential

**Research Study:** Methadone maintenance and the interpretation of sentences and emotions

**Name of researchers:** Louise Martin and Joanna Coyle

1. I confirm that I have read and that I understand the information sheet dated \_\_\_\_\_ for the above study.

YES/NO

2. I have had an opportunity to ask questions and discuss this study.

YES/NO

3. I understand that I am free to withdraw from this study:

- at any time
- without reason
- without affecting my healthcare and management at the Margarete Centre.

YES/NO

4. I agree to take part in the above study.

YES/NO

\_\_\_\_\_  
Name of participant

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of participant

\_\_\_\_\_  
Researcher

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of researcher

## **Participant information sheet**

### **Research Study: Methadone and the interpretation of sentences and emotions**

**Researchers:** Louise Martin and Jo Coyle (Trainee Clinical Psychologists)

You are invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please read the following information. Please ask us if there is anything that is unclear or if you would like more information. Take time to decide whether you wish to take part.

#### **What is the purpose of the research project?**

To understand what effect drugs have on the way people understand sentences and emotions. Research has shown that different drugs affect these two things. In this study we are looking at 1) people who use methadone at the moment, 2) people who no longer use methadone or heroin, and 3) people who have never used methadone.

#### **Why have I been chosen?**

We have asked you to take part in the study because you do not and have never used methadone. We will be approaching 30 other people from the Jobcentre.

#### **Do I have to take part?**

You do not have to take part in this study if you do not wish to. The decision is up to you. It is completely independent of the Jobcentre and will not affect your benefit rights or management of your case with the Jobcentre or Benefits Agency. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. You can withdraw at any time without having to give a reason.

#### **What will happen if I decide to take part?**

We will arrange to meet you for about 1-hour at the Jobcentre. As we are looking to hear from people who do not use opiates, you will first be asked a few questions about your drug use. You will then be shown some sentences and faces on a computer and asked to make some decisions about them. We will also ask you to complete some questionnaires. We will give you a voucher worth £6 as a thank you for taking part. All information collected about you during the study is strictly confidential and will be coded by number. Your name will not appear on any forms.

#### **What are the advantages and disadvantages of taking part?**

We do not foresee that taking part will cause you distress. We hope that the information we collect from this study will improve our understanding of the effects of drugs, and so help to improve drug treatment services.

#### **What will happen to the results of the study?**

The results will be written up as part of a thesis, which we hope will be published in a scientific journal. A summary of the findings will be available to all who took part.

#### **Who is organising and funding the study?**

The study is organised and funded by Camden and Islington NHS Trust and University College London.

#### **Contact for further information:**

If you would like further information or have any questions, then please leave a message for us on 07906 714424.

**Thank you for taking time to read this.**

Date: 14<sup>th</sup> July 2004

All proposals for research using human subjects are reviewed by an ethics committee before they can proceed. This proposal was reviewed by Camden and Islington Health Services NHS Trust Ethics Committee.

Participant identification code:

**Consent Form**  
(Employment Centre)

**Confidential**

**Research Study:** Methadone use and the understanding of written information and emotions

**Name of researchers:** Louise Martin and Joanna Coyle

1. I confirm that I have read and that I understand the information sheet dated \_\_\_\_\_ for the above study.  

**YES/NO**
2. I have had an opportunity to ask questions and discuss this study.  

**YES/NO**
3. I understand that I am free to withdraw from this study:
  - at any time
  - without reason
  - without affecting my management at the Employment Centre.

**YES/NO**
4. I agree to take part in the above study.  

**YES/NO**

\_\_\_\_\_  
Name of participant

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of participant

\_\_\_\_\_  
Researcher

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of researcher