

Attributions for psychobiological changes in ecstasy/MDMA and other polydrug users

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Abstract

Ecstasy [3,4-methylenedioxymethamphetamine (MDMA)] use has been associated with a number of psychopathological problems. However, research suggests that reported symptoms might be associated more with heavy polydrug use in general rather than ecstasy *per se*. The current study aimed to determine the role of other drug use in reports of long-term effects by some ecstasy-polydrug users. Problematic ecstasy users ($n = 53$), reporting problems which they attributed to ecstasy use, were compared with non-problematic ecstasy users ($n = 62$), polydrug ($n = 62$) and alcohol/nicotine using controls ($n = 111$). Drug use was recorded, and positive and negative life changes were assessed along with which previous drug use, if any, they attributed these changes too. Both ecstasy groups reported higher drug use compared with polydrug controls.

Polydrug and ecstasy users more often reported life changes compared with non-drug users, and ecstasy users appeared to experience more life changes than polydrug users, with problematic ecstasy users experiencing most alterations. Ecstasy users reported changes more to a combination of drugs than to one specific drug, suggesting that polydrug use in these groups has an impact on their life experiences. These findings emphasise that research into the psychological effects of ecstasy should not underestimate the role of other polydrug use.

Key words

attributions; ecstasy/MDMA; polydrug use; problems; psychopathology

Introduction

Recreational ecstasy [3,4-methylenedioxymethamphetamine (MDMA)] use has been associated with a number of psychiatric symptoms and psychobiological problems (Milani, *et al.*, 2000; Soar, *et al.*, 2001; MacInnes, *et al.*, 2001; Parrott, *et al.*, 2001; Verheyden, *et al.*, 2003a,b; Soar, *et al.*, 2006; Rodgers, *et al.*, 2006). A range of measures have been used to record such psychobiological problems, including clinical measures such as the Symptom Checklist-90 (Parrott *et al.*, 2000; Parrott, *et al.*, 2001; Dughiero, *et al.*, 2001; Milani, *et al.*, 2004; Thomasius, *et al.*, 2006), the Symptom Checklist-90-Revised (Daumann, *et al.*, 2001, 2004; Morgan, *et al.*, 2002) and specific measures of depression (MacInnes, *et al.*, 2001; de Win, *et al.*, 2006; Lamers, *et al.*, 2006) and anxiety (Lamers, *et al.*, 2006). These studies have shown that ecstasy users often show higher levels of psychopathology than non-ecstasy user control groups. However, only a limited number of studies have addressed what problems ecstasy users specifically attribute 'off-drug' to their current and previous ecstasy use. Cohen (1995) showed that a number of ecstasy users reported both psychological and physical long-term recurring

effects, which they attributed to their ecstasy use, including depersonalisation, insomnia and depression. Parrott, *et al.* (2002) also reported ecstasy-attributed problems as reported by novice (1–9), moderate (10–99) and heavy (+100) ecstasy users, including depression, memory problems, mood fluctuation, poor concentration, infections, tremors/twitches and weight loss, which were all shown to be significantly associated with the extent of ecstasy use. Rodgers, *et al.* (2006) reported a variety of 'off-drug' problems attributed to ecstasy in 209 ecstasy users, similar to those reported by Parrott, *et al.* (2002), and confirmed the strong association with lifetime ecstasy/MDMA use. Rodgers, *et al.* (2006) also reported that users attributed a number of 'off-drug' perceived positive effects to their ecstasy consumption; including 'a changed outlook on life', 'understanding of self' and improved relationships, sociability, psychological functioning and healthiness. However, none of these studies explored the role of other drugs, combinations of ecstasy with other drugs or related non-drug factors in the attributions made by ecstasy users.

Epidemiological studies show that individuals who regularly take ecstasy are also likely to be polydrug users (Webb, *et al.*, 1996; Pedersen and Skrondal, 1999; Topp, *et al.*, 1999;

Sherlock and Connor, 1999; Winstock, *et al.*, 2001; Strote, *et al.*, 2002; Arria, *et al.*, 2002; Scholey, *et al.*, 2004; Sumnall, *et al.*, 2004; Hopper, *et al.*, 2006). The most commonly reported co-used substances are tobacco, alcohol, cannabis, amphetamine and cocaine (Sherlock and Connor, 1999; Gouzoulis-Mayfrank and Daumann, 2006), although increasing use of ecstasy also appears to be associated with more widespread and heavier use of other stimulants and hallucinogens (Scholey, *et al.*, 2004). These drugs have also been linked with negative psychopathological profiles (Mass, *et al.*, 2001; Lavik and Onstad, 1986). As such, it is clear that polydrug use is an important potential influence for the psychobiological consequences of ecstasy/MDMA consumption (Parrott, 2006). Indeed, Parrott, *et al.* (2001) found that the heavier the polydrug use alongside ecstasy the higher the level of self-reported psychological symptoms. Other studies have also shown that elevated psychopathology in ecstasy users appears to be associated more with polydrug use (Medina and Shear, 2007), and in some cases specifically cannabis rather than ecstasy (Daumann, *et al.*, 2001; Morgan, *et al.*, 2002; Roiser and Sahakian, 2004; Daumann, *et al.*, 2004). A possible combination effect of ecstasy and cannabis use is also supported by recent findings from Milani, *et al.* (2005), who reported that heavy cannabis use appeared to exacerbate psychobiological problems in ecstasy users, and Lamers, *et al.* (2006), who found that individuals who used both ecstasy and cannabis reported more symptoms of anxiety and depression than non-drug users and cannabis-only users. In a review of this topic, Parrott (2006) showed that the deficits of ecstasy/MDMA users generally remained significant after controlling for these other psychoactive drugs, although it was emphasised that these other drugs would also be having important contributory effects.

The present study continues this exploration of chronic 'off-drug' experiences, using a large-scale survey, which sought to determine which drugs were associated with the long-term psychological and physical effects reported by some ecstasy-polydrug users. The volunteers were asked to indicate which drug or drug combinations, if any, they attributed to changes in their life experiences. These 'life experience' items were drawn from previous empirical and subjective literature into ecstasy/MDMA (Liechti, *et al.*, 2000a,b; Gamma, *et al.*, 2000; Cami, *et al.*, 2000; Liechti and Vollenweider, 2001; Cohen, 1995; Parrott, *et al.*, 2002). This novel manipulation then tests the assumption that such changes result from ecstasy use, over and above the effects of other substances, by transposing these positive and negative 'symptoms' into questions and exploring the perceptions and attributions to different drugs amongst polysubstance users themselves.

Another aim was to investigate possible differences in drug-attributions between ecstasy users that did not report problems associated with their ecstasy use (non-problematic users), compared with ecstasy users who did report problems with their ecstasy use (problematic users). Fox, *et al.* (2001) and Soar, *et al.* (2006) have previously compared 'problematic' and 'non-problematic' ecstasy users, and found differences in the perceived psychological problems attributed to their ecstasy

consumption and to a degree such differences have been accounted for by premorbid characteristics and patterns of ecstasy use. However, the role of other polydrug use has not previously been addressed in these two sub-groups.

Method

Participants

Participants were recruited through a number of techniques, including recruitment notices throughout the University of East London's e-mail system, posters around the University of East London and various clubs throughout London, and via an advertisement in the 'Big Issue' magazine. The call for participants asked for any ecstasy and/or other drug users (including alcohol and nicotine) interested in contributing to psychological research to contact us or visit our website. The exclusion criteria were: under the age of 18, currently taking any psychotropic medication, epilepsy or any other form of brain injury.

A total of 288 volunteers participated in the study: 111 (37 men, 74 women) participants who reported no previous drug use, other than alcohol and nicotine; 62 (27 men, 35 women) polydrug users who had no history of ecstasy use but otherwise had used other illicit drugs; 62 (33 men, 29 women) 'non-problematic' ecstasy users who reported ecstasy and other drug use but did not report problems from their previous ecstasy use and 53 (25 men, 28 women) 'problematic' ecstasy users who reported ecstasy and other polydrug use and also indicated that they had experienced problems, which they attributed to ecstasy use. All participants were allocated to these groups using a post-hoc method: problematic ecstasy users were distinguished from non-problematic users by answering 'yes' to the question, 'Have you experienced any problems, which you attribute to your ecstasy use?' All participants gave written informed consent and The University of East London ethics committee approved the study.

Assessment measures

Each volunteer completed a questionnaire using either a hard copy ($n = 46$) or one accessed and submitted on-line ($n = 242$) via http://www.homepages.uel.ac.uk/K.Soar/ecstasy_qa.htm (part of the University of East London's web-site).

Health and drug use questionnaire This questionnaire (used previously in Soar, *et al.*, 2006), consisted of questions concerning personal history of participants own, and their immediate family's, psychiatric history. Questions pertaining to previous drug history were those that make up the UEL (University of East London) drug use questionnaire (Parrott, *et al.*, 2000). Ecstasy users were required to provide further information concerning patterns of ecstasy use, including information on the duration of ecstasy use, the last time taken, the average number

of ecstasy tablets consumed in one occasion, the largest number consumed in one occasion and an estimation of their lifetime consumption. This was followed by the question, which allowed post-hoc group allocation to problematic and non-problematic ecstasy groups. Those ecstasy users that indicated they had or did attribute problems to ecstasy use were further asked whether any of these changes had led them to seek help and/or advice from a health professional or organisation, and to indicate which particular service (e.g. GP (General Practitioner), Clinical psychologist, psychiatrist, drugs clinic/services or counselling). Again all these questions have previously been used to ascertain patterns of ecstasy use and indication of problems in ecstasy users (e.g., Soar, *et al.*, 2006).

Life changes questionnaire This questionnaire was designed specifically for this study; it required all participants to indicate whether or not they had experienced a list of 7 positive and 21 negative changes in their life experiences, when *not* under the influence of drugs or alcohol. These life experiences were in fact psychological and physical effects, which have previously been shown to be associated with ecstasy (MDMA). The items were drawn from a review of the empirical and subjective effects associated with ecstasy use (Liechti, *et al.*, 2000a, b; Gamma, *et al.*, 2000; Cami, *et al.*, 2000; Liechti and Vollenweider, 2001; Cohen, 1995; Parrott, *et al.*, 2002). However, wording of the questions did not allude specifically to this connection with ecstasy/MDMA: *Below are a list of positive and negative life experiences, please indicate whether you have experienced any of these (when not under the influence of drugs or alcohol) and what you attribute this change to the most by circling the appropriate statements.* This allowed for the exploration of whether these effects are reported by all participants, regardless of their ecstasy use, and whether these so called 'ecstasy effects' are in fact effects associated or attributed to other, different drugs, amongst those polydrug users. The imbalance in the number of positive and negative items used reflects current bias in the research literature on the investigation into the negative effects of ecstasy/MDMA. Participants were shown a list of the 28 positive and negative (life experience/ecstasy effects) items followed by eight options to circle; 'other non-drug factor', 'ecstasy', 'amphetamine', 'cocaine', 'LSD' (d-lysergic acid), 'cannabis', 'alcohol' or 'no change experienced'. Those specific drug options were chosen because they are the most common drugs used by recreational ecstasy-polydrug users and also in combination with ecstasy (e.g., Scholey, *et al.*, 2004; Gouzoulis-Mayfrank and Daumann, 2006). Cronbach's alpha reliability analyses for the scale (all 28 items) indicates good reliability: $\alpha = 0.90$.

Statistical analysis

Data analysis was conducted using SPSS 10 (Statistical Package for the Social Sciences. Version 10. SPSS Inc., Chicago Illinois US). One-way ANOVAs were performed on the demographic data to assess whether there were any group differences between the alcohol/nicotine group, polydrug controls, non-

problematic and problematic ecstasy users. Where there were violations of homogeneity of variance (e.g., age and rating of health) the Kruskal–Wallis test was used. Post-hoc pair-wise comparisons between groups were conducted using the Tukey's HSD range statistic and Mann–Whitney test for the non-parametric equivalent, with the error rate set at 0.017 to reduce the risk of type 1 errors. Chi-squared tests were used to investigate any significant group differences with questions regarding gender, ethnicity, reported psychiatric history and family psychiatric history.

Drug use data violated the assumption of homogeneity of variance, despite attempts at transforming the data. Therefore, Kruskal–Wallis tests were used. The independent samples *t*-test was used to assess differences in patterns of ecstasy use between the two ecstasy using groups.

Data concerning the positive and negative changes to life experiences and which, if any, drugs they attributed these changes to are reported as percentages. It was deemed inappropriate to conduct detailed inferential analyses on all of this data for a number of reasons. The first was that levels of drug use differed considerably across all four drug-using groups. Second, respondents sometimes indicated more than one drug for each dimension on the questionnaire, yet it was difficult to establish whether they were referring to polydrug use as contributing to this change or whether individual drugs *per se* contributed to this change. Third, not all cells were independent. Finally, if a chi-squared test was conducted, the expected frequency would be less than 5 on more than 20% of cases; therefore, it would not have been statistically viable. However, data concerning the number of respondents, in each of the four groups, who indicated that they had experienced a change were analysed using a 4×2 chi-squared test. Separate 2×2 chi-square tests were used to establish where, between the four groups, any statistically significant differences lay. A significance level of 0.008 was used to limit the possibilities of type 1 errors. For those respondents in the drug-using groups who did indicate a change attributable to drug use, a 3×2 chi-squared test was used to establish whether there were any significant differences between the number of respondents in each group who indicated more than one drug as indicative of positive and negative changes. Separate 2×2 chi-square tests were used to establish which groups differed with the significance level set at 0.02 to reduce possible type 1 errors. The effect size (Cohen's *W*) and post-hoc power calculations of the main group Chi-square analyses (calculated using G*Power 3) are also given in Tables 3 and 4, where appropriate. The standard conventions for *W* are 0.1, 0.3 and 0.5 for small, medium and large effect sizes, respectively (Cohen, 1988).

Results

Group characteristics and drug data

Table 1 shows the demographic data for the participants and patterns of drug use and Table 2 indicates the number of

Table 1 Group demographics, drug use data and patterns of ecstasy use in drug-naïve, polydrug users, non-problematic and problematic ecstasy users

	Drug naïve (N)	Polydrug users (C)	Non-problematic ecstasy users (E)	Problematic ecstasy users (P)	Group effect	Post-hoc comparisons
Gender	37 M/74 F	27 M/35 F	33 M/29 F	25 M/28 F	0.065	
Age	23.72 ± 6.79	25.55 ± 7.02	25.24 ± 4.22	25.74 ± 5.14	< 0.001	N < E
Current rating of health	3.34 ± 0.80	3.16 ± 0.96	3.15 ± 0.70	3.13 ± 0.79	0.269	
Patterns of ecstasy use						
Average dose	—	—	1.82 ± 1.07	2.89 ± 2.25	0.003	E < P
Maximum dosage	—	—	4.19 ± 3.08	6.56 ± 5.38	0.005	E < P
Total consumption	—	—	117.27 ± 273.48	404.61 ± 871.36	0.025	E < P
Duration of ecstasy use (months)	—	—	59.30 ± 42.34	75.02 ± 47.55	0.075	
Months since last used	—	—	13.94 ± 20.40	17.22 ± 28.91	0.493	
Other drug use						
Amphetamine	0	2.06 ± 5.69	26.58 ± 36.35	73.45 ± 154.39	< 0.001	C < E, P
Cocaine	0	3.50 ± 13.64	24.48 ± 39.85	74.13 ± 273.74	< 0.001	C < E, P
Crack	0	0	0.11 ± 0.45	2.23 ± 13.76	0.001	C < P
Opiates	0	0.10 ± 0.53	0.23 ± 0.58	1.17 ± 4.07	0.058	
Benzodiazepines	0	0.85 ± 3.84	2.11 ± 7.40	3.68 ± 8.43	0.005	
LSD	0	0.27 ± 1.33	8.11 ± 13.99	70.84 ± 278.80	< 0.001	C < E, P: E < P
Magic Mushrooms	0	1.08 ± 4.41	15.18 ± 67.74	179.04 ± 733.17	< 0.001	C < E, P: E < P
Solvents	0	0.15 ± 0.81	0.68 ± 3.86	10.00 ± 43.47	0.004	
Poppers	0	1.02 ± 2.83	28.85 ± 126.95	14.17 ± 19.16	< 0.001	C < E, P
Ketamine	0	0	2.13 ± 10.23	5.66 ± 16.33	< 0.001	C < E, P
Prozac	0	0.10 ± 0.56	0.18 ± 0.78	0.25 ± 1.65	0.662	
GHB	0	0	0.18 ± 0.92	3.06 ± 20.60	0.053	
Others	0	0.19 ± 0.94	0.18 ± 1.09	0	0.292	
Tobacco (per day)	0.80 ± 3.67	3.55 ± 5.76	6.84 ± 7.95	6.53 ± 7.18	< 0.001	N < C, E, P: C < E, P
Alcohol (units per week)	4.16 ± 7.83	9.00 ± 10.99	15.02 ± 9.56	13.23 ± 14.45	< 0.001	N < C, E, P: C < E
Current cannabis use (no. per month × no. years)	0	564.97 ± 2349.78	990.19 ± 1639.99	1092.91 ± 1709.50	0.003	C < E, P

participants, by group, who indicated previous individual and family psychiatric problems (data previously reported for these participants in Soar, *et al.*, 2006). There were no significant group differences for gender or health. However, there was a significant group effect of age [$\chi^2(3) = 19.51$, $P < 0.001$], as non-problematic ecstasy users were significantly older than alcohol/nicotine group ($P \leq 0.001$). There was a significant difference in reported psychiatric history ($\chi^2(3) = 30.71$, $P < 0.001$) and family psychiatric history ($\chi^2(3) = 18.84$, $P < 0.001$), with a greater number of problematic ecstasy users reporting a psychiatric history compared with controls and ecstasy users. There was also a significant difference in ethnicity between groups ($\chi^2(12) = 45.78$, $P < 0.001$), with alcohol/nicotine participants showing greater ethnic diversity than non-problematic ecstasy and problematic ecstasy users.

There were significant group differences on most levels of reported illegal drug consumption: amphetamine, cocaine, crack, LSD, magic mushrooms, poppers, ketamine and current cannabis use. Specifically, polydrug controls reported using significantly less amphetamine, cocaine, LSD, magic mushrooms,

poppers, ketamine and current cannabis use, compared with non-problematic ecstasy and problematic ecstasy users; and significantly less crack use compared with problematic ecstasy users. Given that this group of users reported low use of drugs with the exception of cannabis, it was deemed appropriate to refer to this group as cannabis using controls rather than polydrug controls from here on. Non-problematic ecstasy and problematic ecstasy users reported similar consumption of illegal drugs, with the exception of LSD and magic mushrooms, where the problematic ecstasy group reported a significantly greater consumption of both drugs.

The alcohol/nicotine group reported significantly less tobacco and alcohol use compared with cannabis, non-problematic ecstasy and problematic ecstasy users. Cannabis controls also reported significantly less tobacco use compared with non-problematic ecstasy and problematic ecstasy users, as well as significantly less alcohol use compared with non-problematic ecstasy users.

Patterns of ecstasy use differed between the two ecstasy using groups. Problematic ecstasy users reported significantly

Table 2 Reported psychiatric and family psychiatric histories for drug-naïve, polydrug users, non-problematic and problematic ecstasy users

	Participants				Immediate family			
	Drug naïve	Polydrug users	Ecstasy users	Problem users	Drug naïve	Polydrug users	Ecstasy users	Problem users
Anxiety	3	4	6	14	5	12	5	19
Depression	9	9	14	22	31	22	22	32
Obsessive-compulsive disorder	0	1	0	1	0	2	2	2
Schizophrenia	0	0	0	1	1	2	4	5
Phobia	2	0	3	4	3	2	0	2
Panic attacks	1	2	3	16	6	7	6	14
Eating disorder	6	4	1	6	5	5	4	8
Alcohol and/or drug dependency	1	0	3	3	10	7	6	11

higher lifetime consumption levels of ecstasy [$t(113) = -2.31$, $P = 0.025$], average dosage levels [$t(109) = -3.09$, $P = 0.003$] and maximum dosage levels [$t(109) = -2.90$, $P = 0.005$] compared with non-problematic ecstasy users. However, there were no significant differences in duration of ecstasy use and length of abstinence periods from ecstasy use between the two ecstasy using groups.

Problematic ecstasy users were also asked to indicate whether they had sought some form of help for their attributed problems. 32.1% ($n = 17$) reported that the most common help they had was sought from a GP (26.4%). 11.3% sought help from a psychiatrist and 9.4% sought help from a clinical psychologist or drugs service. The final 11.3% sought help from a variety of other organisations, which included counselling services.

Changes in life experiences questionnaire

Table 3 shows the number and percentage of alcohol/nicotine users, cannabis controls, non-problematic and problematic ecstasy users who reported that they had experienced positive and negative life changes. There were highly significant differences between groups for all life changes. Post-hoc comparisons are also indicated (Table 3), with a significantly lower number of people in the alcohol/nicotine group reporting experiencing a majority of the positive and negative changes compared with cannabis controls, non-problematic and problematic ecstasy user groups. Cannabis users reported significantly less life experience changes compared with non-problematic and/or problematic ecstasy users in areas of spiritual enlightenment, enhanced sensations, obsessive thoughts, mood swings, depression, anxiety, paranoia, hallucinations, panic attacks, weight loss, sleep disruptions, but a greater number of cannabis using controls reported memory problems compared with both non-problematic and problematic ecstasy users. A significantly greater number of problematic ecstasy users reported changes in panic attacks, depression, paranoia and general illness, compared with non-problematic ecstasy users.

Changes in life experiences attributed to single versus multiple drug types

Chi-squared results indicate that there were significant group differences in the number of people who reported attributing life changes to more than one drug on a majority of life changes (Table 4). Of those cannabis-using controls who did indicate life changes attributable to drugs, they were significantly more likely to attribute these changes to just one drug rather than a combination of drugs, compared with the non-problematic and problematic ecstasy users. This finding was relatively consistent across positive and negative life changes, except for spiritual enlightenment, confidence loss, backache and sexual problems. In addition, compared with non-problematic ecstasy users, a significantly higher number of problematic ecstasy users attributed more than one drug to increased empathy, decreased fear, obsessive thoughts, aggression, anxiety, paranoia, hallucinations, sexual problems, general illness, loss of organisational skills, memory loss and concentration loss.

Specific drugs and attributions to positive life experience changes

In attempting to establish which, if any, specific drugs were more likely to be associated by participants as being linked to or causing specific changes in behaviour/life experience, inferences could only be made by comparing percentages, for reasons stated earlier (Tables 5–8). Improved social/interpersonal functioning was relatively strongly attributed to alcohol compared with any other drug across all four groups, with 18% of alcohol/nicotine users, 45.2% cannabis controls, 43.5% non-problematic ecstasy users and 28.3% problematic ecstasy users attributing this change to alcohol. However, amongst non-problematic ecstasy users, ecstasy (35.5%) and cocaine (33.9%) was also reported as having played a strong part, whereas amongst problematic ecstasy users this life change was more often attributed to ecstasy than alcohol (45.3% vs 28.3%, respectively). A decrease in fear was also attributed mostly to alcohol compared with any other drug, amongst

Table 3 Number and percentage of drug-naïve, polydrug controls, non-problematic and problematic ecstasy users that reported that they had experienced positive and negative life changes

	Drug-naïve (N)		Polydrug Users (C)		Non-problematic Ecstasy Users (E)		Problematic Ecstasy Users (P)		Chi square <i>P</i>	Effect size*	Post-hoc comparisons (<i>P</i> < 0.008)
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%			
Positive life changes											
Increased empathy	28	25	32	52	44	71	35	66	< 0.001	0.39	N < C,E,P
Decrease in defensiveness	20	18	32	52	32	53	36	68	< 0.001	0.40	N < C,E,P
Improved social/ interpersonal functioning	47	42	49	79	53	83	44	83	< 0.001	0.41	N < C,E,P
Increased feelings of well being	40	36	47	76	44	36	38	72	< 0.001	0.37	N < C,E,P
Decrease in fear	37	33	38	61	33	53	28	53	0.002	0.23	
Spiritual enlightenment	21	19	21	34	30	48	33	62	< 0.001	0.34	C < E,P
Enhanced sensations	30	27	26	42	40	65	40	76	< 0.001	0.39	C < E,P
Negative life changes											
Obsessive thoughts	22	20	25	40	35	57	36	68	< 0.001	0.38	N < C,E,P; C<E,P
Aggression	33	30	31	50	29	47	29	55	0.006	0.21	N < C,E,P
Mood swings	37	33	37	60	42	68	45	66	< 0.001	0.39	N < C,E,P; C < E,P
Less sociable	31	28	32	52	36	58	34	64	< 0.001	0.30	N < C,E,P
Confidence loss	41	37	29	47	30	48	33	62	0.024	0.18	
Depression	35	32	29	45	33	53	44	83	< 0.001	0.36	C < E,P; E < P
Anxiety	21	19	29	47	40	65	39	74	< 0.001	0.45	N < C,E,P; C < E,P
Paranoia	13	12	21	34	34	55	42	79	< 0.001	0.51	N < C,E,P; C < E,P; E < P
Hallucinations	5	5	8	13	21	34	25	47	< 0.001	0.41	C < E,P
Panic attacks	4	4	13	21	14	23	28	53	< 0.001	0.43	N < C,E,P; C < E,P; E < P
Phobias	10	9	6	10	7	11	13	25	0.032	0.17	
Breathlessness	16	34	25	40	21	34	25	47	< 0.001	0.29	N < C,E,P
Backache	32	29	21	34	18	29	28	53	0.016	0.19	
Sex problems	12	11	13	21	17	28	21	40	< 0.001	0.26	
General illness	32	41	27	44	16	26	30	57	0.001	0.24	E < P
Weight loss	27	24	18	29	31	50	38	72	< 0.001	0.37	C < E,P
Sleep problems	35	32	28	45	37	60	38	72	< 0.001	0.31	N < C,E,P; C < E,P
Loss of organisational skills	19	17	27	44	27	44	31	59	< 0.001	0.33	N < C,E,P
Motivational problems	32	29	33	53	36	58	37	70	< 0.001	0.32	N < C,E,P
Memory loss	16	14	60	97	37	60	40	76	< 0.001	0.66	N < C,E,P; E,P < C
Concentration loss	34	31	36	59	38	61	54	86	< 0.001	0.42	N < C,E,P

* Post-hoc power calculations exceeded 0.9 in all cases except for aggression (0.86), confidence loss (0.73), phobias (0.67) and backache (0.78).

drug naïve (12.6%), cannabis controls (32.3%) and non-problematic ecstasy user (32.3%) groups.

Increased feelings of well being were attributed not only to alcohol amongst polydrug controls (21%) and non-problematic ecstasy users (25.8%) but also to cannabis (24.2%) in the cannabis using controls, whereas amongst non-problematic ecstasy users, ecstasy (25.8%) and cocaine (27.4%) were strongly implicated. Ecstasy was the strongest drug implicated (35.8%) in feelings of well being with problematic ecstasy users.

Cannabis was reported as the reason behind enhanced sensations, by 22.6% of cannabis using controls, yet ecstasy appeared to be the drug that non-problematic (54.8%) and

problematic ecstasy users (56.6%) attributed this change to the most, with LSD, cocaine and cannabis also being implicated in these two ecstasy using groups. Ecstasy use was also commonly linked to changes in spiritual enlightenment in both of these groups (27.4% of non-problematic and 30.2% problematic ecstasy users), although non-problematic ecstasy users reported LSD to have contributed equally to this change. As expected, increased empathy was attributed to ecstasy more than any other drug amongst non-problematic and problematic ecstasy users (45.2% and 45.3%, respectively), as was a decrease in defensiveness amongst problematic ecstasy users (35.8%).

Table 4 Number of polydrug, non-problematic and problematic ecstasy users who attributed life changes to more than one drug

	Polydrug users (C)		Non-problematic ecstasy users (E)		Problematic ecstasy users (P)		Chi square	Effect size	Power	Post-hoc (<i>P</i> < 0.02)
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%				
Positive life changes										
Increased empathy	5	23	11	34	21	68	12.36 ^a	0.38	0.92	C < E,P; E < P
Decrease in defensiveness	4	18	12	46	18	62	9.84 ^a	0.36	0.84	C < E,P
Improved social/interpersonal functioning	10	28	28	65	19	59	12.09 ^a	0.33	0.91	C < E,P
Increased feelings of well being	5	18	18	60	16	62	13.79 ^b	0.41	0.95	C < E,P
Decrease in fear	5	20	11	41	15	79	15.40 ^b	0.47	0.97	C < E,P; E < P
Spiritual enlightenment	2	22	15	65	15	54	4.81	0.28	0.49	
Enhanced sensations	6	30	23	59	23	62	6.02 ^c	0.25	0.60	C < E,P
Negative life changes										
Obsessive thoughts	2	17	8	27	21	60	9.91 ^a	0.36	0.83	C < E,P;E < P
Aggression	3	19	6	23	13	57	8.26 ^a	0.36	0.77	C < E,P; E < P
Mood swings	3	18	17	52	28	63	10.09 ^a	0.33	0.84	C < E,P
Less sociable	1	6	9	46	11	36	8.69 ^a	0.31	0.77	C < E,P
Confidence loss	1	11	4	20	14	52	7.69 ^c	0.37	0.72	
Depression	3	25	11	44	20	49	2.14	0.17	0.24	
Anxiety	2	14	8	25	22	65	15.50 ^b	0.44	0.97	C < E,P; E < P
Paranoia	2	13	9	27	24	60	13.36 ^b	0.39	0.94	C < E,P; E < P
Hallucinations	0	0	4	20	13	54	7.96 ^a	0.41	0.72	C < E,P; E < P
Panic attacks	1	20	2	25	13	54	3.35	0.30	0.35	
Phobias	0	0	1	50	5	63	0.10	0.10	0.06	
Breathlessness	0	0	2	13	7	33	4.67	0.33	0.49	
Backache	0	0	0	0	8	40	4.48 ^c	0.40	0.46	
Sex problems	1	20	1	7	9	64	10.76 ^a	0.57	0.84	E < P
General illness	3	43	1	7	14	54	9.13 ^a	0.44	0.78	C < E,P; E < P
Weight loss	0	0	8	29	17	50	6.23 ^c	0.09	0.09	C < E,P
Sleep problems	1	13	14	42	18	50	Ns	0.22	0.39	
Loss of organisational skills	4	29	6	26	19	63	8.92 ^a	0.36	0.75	C < E,P; E < P
Motivational problems	5	33	8	26	12	35	Ns	0.09	0.10	
Memory loss	2	12	9	25	24	63	17.67 ^b	0.44	0.97	C < E,P; E < P
Concentration loss	7	32	11	32	29	73	15.21 ^b	0.40	0.95	C < E,P; E < P

^a $P < 0.01$; ^b $P < 0.001$; ^c $P < 0.05$.

Specific drugs and attributions to negative life experience changes

Aggression appeared to be strongly associated with alcohol compared with any other drug and across all groups, with 24.2% of cannabis controls, 32.3% ecstasy users and 26.4% problematic users attributing this change to alcohol. Paranoia was most strongly associated with cannabis, compared with other drugs and across groups, with 21% of cannabis controls, 25.8% ecstasy users and 49.1% problematic ecstasy users implicating cannabis in this change. However, problematic ecstasy users also attributed paranoia quite highly to ecstasy (34%) and amphetamine (30.2%) use.

Cannabis use also appeared to be a strong factor compared with any other drug for motivational problems and loss of sociability in both non-problematic ecstasy (30.6% and 22.6%, respectively) and problematic ecstasy users (32.1% and 39.6%,

respectively). Cannabis was also implicated in perceptions of concentration loss amongst problematic ecstasy users (24.5%) and also with memory loss amongst non-problematic ecstasy users (27.4%) compared with a low implication of ecstasy attributed to memory loss in this non-problematic and problematic ecstasy users (only 4.8% and 13.2%, respectively).

Hallucinations were mainly reported by problematic ecstasy users but were equally attributed to ecstasy and LSD use (24.5%). This is probably because this group reported significantly greater consumption levels of both ecstasy and LSD compared with the other drug using groups.

Ecstasy was a very strong attributional factor linked to negatively perceived changes in depression (62.3%), anxiety (37.7%), panic attacks (34%), general illness (39.6%) and weight loss (49.1%) amongst problematic ecstasy users. Amongst this group, ecstasy was also implicated in obsessive thoughts, alongside cannabis use (30.2%). Although in the

Table 5 Percentages of reported positive and negative life changes in alcohol/nicotine (non-polydrug) controls and whether they attributed this change to alcohol or other factors

N = 111	Other non-drug factor	Alcohol	No change experienced
Positive life changes			
Increased empathy	19.8	5.4	74.8
Decrease in defensiveness	11.7	6.3	82
Improved social/interpersonal functioning	24.3	18	57.7
Increased feelings of well being	26.1	9.9	64
Decrease in fear	20.7	12.6	66.7
Spiritual enlightenment	18	0.9	81.1
Enhanced sensations	18	9	73
Negative life changes			
Obsessive thoughts	15.3	4.5	80.2
Aggression	20.7	9	70.3
Mood swings	28.8	4.5	66.7
Less sociable	25.2	2.7	72.1
Confidence loss	35.1	1.8	63.1
Depression	25.2	6.3	68.5
Anxiety	17.1	1.8	81.1
Paranoia	9	9	88.3
Hallucinations	4.5	0	95.5
Panic attacks	2.7	0.9	96.4
Phobias	9	0	91
Breathlessness	12.6	1.8	85.6
Backache	28.8	0	71.2
Sex problems	10.8	0	89.2
General illness	27	1.8	71.2
Weight loss	23.4	0.9	75.7
Sleep problems	25.2	6.3	68.5
Loss of organisational skills	12.6	4.5	82.9
Motivational problems	23.4	5.4	71.2
Memory loss	9	5.4	85.6
Concentration loss	21.6	9	69.4

non-problematic user group, far fewer participants linked their ecstasy use to these negative symptoms. Mood swings were also strongly attributed to ecstasy amongst non-problematic and problematic ecstasy users (25.8% and 54.7%, respectively), but so too were the stimulants, cocaine and amphetamine. Similarly, both ecstasy-using groups reported similar drug attributions with sleep problems.

Discussion

Parrott, *et al.* (2001) and Milani, *et al.* (2005) showed that psychiatric symptoms and psychobiological problems were associated not only with ecstasy/MDMA use but also with recreational polydrug use. The current exploratory survey investigated the issue of polydrug use with regard to long-term 'off-drug' psychological and physical effects reported by recreational drug users. It sought to determine which drugs, if any, were associated with the long-term effects reported by some ecstasy-polydrug users and whether problematic and

non-problematic ecstasy users differed with respect to what problems they attributed to particular drugs or drug combinations.

The study showed that polydrug use does play a role in the effects commonly associated with ecstasy use, referred to here as positive and negative life changes. A significantly greater number of cannabis controls and ecstasy users reported life changes compared with non-drug users in a number of positive and negative areas, and further still attributing these more to drug use than 'other factors', suggesting that polydrug use certainly plays a role in attributions related to changes in life experiences. Amongst the drug using groups (cannabis and ecstasy user groups), the ecstasy users reported the greatest number of changes and in some areas, that is, panic attacks, depression, paranoia and general illness, problematic ecstasy users reported more changes compared with non-problematic ecstasy users. The fact that fewer cannabis using controls reported changes compared with ecstasy users could reflect that ecstasy rather than polydrug use is more associated with these effects; however, levels of polydrug use are significantly

Table 6 Percentages of reported positive and negative life changes in polydrug controls and which, if any drug(s), they attributed this change to

<i>N</i> = 62	Other non-drug factor	Amphetamine	Cocaine	LSD	Cannabis	Alcohol	No change experienced
Positive life changes							
Increased empathy	24.2	0	3.2	0	17.7	11.3	48.4
Decrease in defensiveness	16.1	0		0	21.0	17.7	48.4
Improved social/interpersonal functioning	21	1.6	4.8	0	19.4	45.2	21
Increased feelings of well being	30.6	4.8	3.2	0	24.2	21.0	24.2
Decrease in fear	21	1.6	1.6	0	9.7	32.3	38.7
Spiritual enlightenment	19.4	0	0	1.6	12.9	0	66.1
Enhanced sensations	9.7	1.6	3.2	1.6	22.6	9.7	58.1
Negative life changes							
Obsessive thoughts	21	0	3.2	0	12.9	6.5	59.7
Aggression	24.2	0	3.2	0	14.5	24.2	50
Mood swings	32.3	1.6	3.2	0	8.1	16.1	40.3
Less sociable	24.2	0	1.6	0	12.9	14.5	48.4
Confidence loss	32.3	0	1.6	0	8.1	6.5	53.2
Depression	27.4	1.6	1.6	0	9.7	11.3	53.2
Anxiety	24.2	0	1.6	0	14.5	9.7	53.2
Paranoia	9.7	0	1.6	0	21.0	4.8	66.1
Hallucinations	6.5	1.6	0	1.6	3.2	3.2	87.1
Panic attacks	12.9	0	0	0	8.1	1.6	79
Phobias	9.7	0	0	0	0	0	90.3
Breathlessness	27.4	0	0	0	12.9	0	59.7
Backache	33.9	0	0	0	0	0	66.1
Sex problems	12.9	0	0	0	1.6	4.8	79
General illness	32.3	0	1.6	0	3.2	9.7	56.5
Weight loss	21	1.6	0	0	6.5	0	71
Sleep problems	32.3	1.6	1.6	0	8.1	3.2	54.8
Loss of organisational skills	21	1.6	1.6	0	12.9	4.8	56.5
Motivational problems	29	1.6	0	0	17.7	12.9	46.8
Memory loss	14.5	1.6	0	0	16.2	12.9	3.2
Concentration loss	22.6	3.2	0	0	24.2	19.4	41.9

higher in both ecstasy using groups compared with the cannabis controls. This strongly supports previous studies suggesting that the heavier the ecstasy use, the heavier the polydrug use (Scholey, *et al.*, 2004), and as such these effects cannot solely be attributed to ecstasy, based on these group differences in life changes.

Whether drug user's attributed changes to a single drug or a number of drugs was also explored. Cannabis using controls who reported changes, and attributed these to drug use, tended to attribute the change to just the one drug, which tended to be cannabis or alcohol, rather than both. This is not surprising given the limited use of other drugs in this group (see Table 1). In comparison, the ecstasy using groups tended to report a combination of drugs as influencing the reported changes (both positive and negative), more so for the problematic ecstasy users. Of the drugs reported, ecstasy did appear to play a strong attributional role, especially for problematic ecstasy users with regard to depression, anxiety, panic attacks, general illness and mood swings. However, this could simply be

due to the nature of the study, and potential priming in these participants from completion of earlier questions on the patterns of ecstasy use and whether they indicated problems associated with their previous use, specifically for problematic ecstasy users. Although this is a possibility to some extent, the strong attributional role of ecstasy, particularly in these areas, is consistent to previous research (Parrott, *et al.*, 2002; Rodgers, *et al.*, 2006). Although ecstasy is a strong attributional role for a lot of the changes reported by the ecstasy users, what is interesting is that when investigated further, especially amongst the problematic ecstasy users, it is not the only drug which plays a role in reported problems, rather a range of drugs are strongly implicated. These other drugs include alcohol, amphetamine and cocaine and especially cannabis, which participants associated with negative changes such as paranoia, memory loss, concentration loss, motivational problems and obsessive thoughts. The role of these and other drugs in ecstasy-attributed effects was not covered by Parrott, *et al.* (2002) or Rodgers, *et al.* (2006), but is consistent with the

Table 7 Percentages of reported positive and negative life changes in non-problematic ecstasy users which, if any drug(s), they attributed this change to

N = 62	Other non-drug factor	Ecstasy	Amphetamine	Cocaine	LSD	Cannabis	Alcohol	No change experienced
Positive life changes								
Increased empathy	19.4	45.2	6.5	9.7	16.1	21.0	12.9	29
Decrease in defensiveness	12.9	17.7	8.1	6.5	11.3	21.0	22.6	45.2
Improved social/interpersonal functioning	12.9	35.5	17.7	33.9	6.5	19.4	43.5	17.7
Increased feelings of well being	22.6	33.9	9.7	27.4	8.1	17.7	25.8	29
Decrease in fear	9.7	16.1	4.8	21.0	4.8	6.5	32.3	46.8
Spiritual enlightenment	11.3	27.4	3.2	3.2	27.4	22.6	8.1	51.6
Enhanced sensations	1.6	54.8	12.9	25.8	24.2	22.6	11.3	35.5
Negative life changes								
Obsessive thoughts	11.3	3.2	8.1	16.1	8.1	21.0	8.1	43.5
Aggression	4.8	4.8	4.8	11.3	0	0	32.3	53.2
Mood swings	14.5	25.8	19.4	21.0	9.7	12.9	25.8	32.3
Less sociable	8.1	9.7	8.1	8.1	4.8	22.6	16.1	41.9
Confidence loss	16.1	4.8	4.8	4.8	3.2	12.9	9.7	51.6
Depression	12.9	16.1	11.3	6.5	4.8	9.7	16.1	46.8
Anxiety	12.9	14.5	8.1	11.3	6.5	22.6	1.6	35.5
Paranoia	1.6	11.3	9.7	8.1	11.3	25.8	3.2	45.2
Hallucinations	1.6	9.7	1.6	0	21.0	4.8	1.6	66.1
Panic attacks	9.7	9.7	4.8	3.2	4.8	8.1	1.6	77.4
Phobias	8.1	0	0	0	0	0	1.6	88.7
Breathlessness	9.7	3.2	8.1	3.2	0	11.3	1.6	66.1
Backache	16.1	9.7	3.2	1.6	0	0	3.2	71
Sex problems	8.1	6.5	6.5	3.2	0	0	14.5	69.4
General illness	1.6	9.7	1.6	4.8	0	0	9.7	74.2
Weight loss	4.8	19.4	22.6	6.5	0	1.6	0	50
Sleep problems	6.5	14.5	22.6	19.4	4.8	12.9	3.2	40.3
Loss of organisational skills	6.5	1.6	1.6	0	0	16.1	11.3	56.5
Motivational problems	8.1	1.6	1.6	0	0	30.6	6.5	41.9
Memory loss	1.6	4.8	0	0	0	27.4	11.3	40.3
Concentration loss	6.5	3.2	3.2	0	0	19.4	17.7	38.7

findings that elevated psychopathology in ecstasy users, is associated more with polydrug use (Medina and Shear, 2007), and in some cases specifically cannabis (Daumann, *et al.*, 2001; Morgan, *et al.*, 2002; Roiser and Sahakian, 2004; Daumann, *et al.*, 2004). Thus, data from the current study, taken together with these previous reports, highlight the important possible confounding effects of polydrug use in research attempting to explore and characterise the extent and nature of MDMA/ecstasy-related effects.

As previously discussed, there were differences in drug attributions between the ecstasy using groups (non-problematic and problematic). The fact that problematic ecstasy users reported more changes and attributed these more to ecstasy than other drugs, over and above non-problematic ecstasy users, is not surprising given that these ecstasy users identify themselves as 'having psychological problems', which they attribute to previous ecstasy use. It is possible that these problematic ecstasy users were experiencing these problems before their ecstasy use given that a greater number of problematic ecstasy users

reported psychiatric histories compared with non-problematic ecstasy users; an account previously acknowledged by the authors (Soar and Parrott, 2002; Soar, *et al.*, 2006). Suggesting that pre-existing problems could be the cause of the drug use rather than the consequence; this has previously been shown by Lieb, *et al.* (2002), who reported that in a majority of cases ecstasy and other drug use was actually secondary to the onset of psychological problems. However, more recently Alati, *et al.* (2008) have prospectively shown that the psychopathology, such as anxiety and depression, did not precede ecstasy use. Whether the problems reported by problematic ecstasy users within this current study preceded or followed ecstasy user is impossible to conclude based on the retrospective nature of the current study.

It is possible that the reported differences between problematic and non-problematic ecstasy users could be accounted for by an attribution bias, and this could further explain why some ecstasy users do not report problems despite showing evidence that their psychological performance is impaired (Fox, *et al.*,

Table 8 Percentages of reported positive and negative life changes in problematic ecstasy users which, if any drug(s), they attributed this change to

N = 53	Other non-drug factor	Ecstasy	Amphetamine	Cocaine	LSD	Cannabis	Alcohol	No change experienced
Positive life changes								
Increased empathy	7.5	45.3	7.5	15.1	17.0	26.4	13.2	34
Decrease in defensiveness	13.2	35.8	9.4	9.4	13.2	20.8	13.2	32.1
Improved social/interpersonal functioning	22.6	45.3	11.3	18.9	3.8	17.0	28.3	17.0
Increased feelings of well being	22.6	35.8	11.3	15.1	9.4	15.1	20.8	28.3
Decrease in fear	17	20.8	1.9	17.0	7.5	7.5	17.0	47.2
Spiritual enlightenment	9.4	30.2	3.8	3.8	18.9	24.5	1.9	37.7
Enhanced sensations	5.7	56.6	20.8	18.9	20.8	26.4	11.3	24.5
Negative life changes								
Obsessive thoughts	1.9	37.7	18.9	18.9	20.8	30.2	13.2	32.1
Aggression	11.3	11.3	18.9	17.0	3.8	3.8	26.4	45.3
Mood swings	7.5	54.7	28.3	28.3	9.4	24.5	24.5	15.1
Less sociable	5.7	17.0	13.2	9.4	5.7	39.6	9.4	35.8
Confidence loss	11.3	22.6	24.5	15.1	5.7	24.5	9.4	37.7
Depression	5.7	62.3	28.3	18.9	7.5	17.0	22.6	17.0
Anxiety	9.4	37.7	24.5	22.6	9.4	24.5	9.4	26.4
Paranoia	3.8	34.0	30.2	20.8	17.0	49.1	9.4	20.8
Hallucinations	1.9	24.5	3.8	3.8	24.5	3.8	3.8	52.8
Panic attacks	7.5	34.0	17.0	11.3	5.7	17.0	5.7	47.2
Phobias	9.4	9.4	3.8	3.8	3.8	3.8	3.8	75.5
Breathlessness	7.5	17.0	17.0	7.5	1.9	11.3	0	52.8
Backache	15.1	28.3	15.1	1.9	0	0	1.9	47.2
Sex problems	13.2	13.2	3.8	11.3	1.9	5.7	5.7	60.4
General illness	7.5	39.6	20.8	15.1	9.4	22.6	3.8	43.4
Weight loss	7.5	49.1	32.1	15.1	1.9	5.7	1.9	28.3
Sleep problems	3.8	35.8	35.8	20.8	9.4	20.8	15.1	28.3
Loss of organisational skills	1.9	18.9	5.7	1.9	0	13.2	5.7	41.5
Motivational problems	5.7	13.2	11.3	3.8	0	32.1	5.7	30.2
Memory loss	3.8	13.2	3.8	1.9	0	7.5	1.9	24.5
Concentration loss	7.5	17.0	9.4	3.8	1.9	24.5	3.8	17.0

2001). Attributional style itself can be influenced by medical and psychiatric history (Robbins and Kirmayer, 1991), and indeed individual psychological health at the time of reporting of symptoms/changes in experiences could influence questionnaire responses, especially if those problematic ecstasy users are still experiencing their reported problems. There is some indication of this from the psychopathological profiles of these problematic ecstasy users (reported in a previous article, Soar, *et al.*, 2006), which indicated that scores on the Brief Symptom Inventory (BSI; Derogatis and Melisaratos, 1983) for these participants were significantly higher compared with the non-problematic ecstasy users, specifically on the somatisation, depression and anxiety subscales.

The current study has shown that other drug use is often attributed as being responsible for effects, which have previously been described in many reports as being due to ecstasy/MDMA. This adds to the view that isolating the specific effects of ecstasy in recreational drug users is difficult, if not impossible. To complicate the issue further different patterns of polydrug use,

consumed in combination with or directly following and/or preceding ecstasy use could influence the reporting of specific ecstasy-related effects and potential problems. Sumnall, *et al.* (2004) reported that 68% of the clubbers they interviewed regularly mixed a variety of drugs; the most popular combinations being cannabis, alcohol, ecstasy and amphetamines. Therefore, the complex interactions between drugs need to be considered, as well as their possible additive effects (Parrott, 2006; Gouzoulis-Mayfrank and Daumann, 2006; Parrott, *et al.*, 2007). At present, little is known of the psychopharmacological effects of combining drugs. Hernandez-Lopez, *et al.* (2002) reported that MDMA used in combination with alcohol-induced longer lasting euphoria and well being than MDMA or alcohol alone, whereas MDMA actually reversed the subjective sedation induced by alcohol and Verheyden, *et al.* (2003a) reported that participants who took cannabis, alcohol and cocaine in conjunction with ecstasy reported higher scores for acute positive effects of the drug, suggesting that the subjective pleasurable effects of these drugs are additive. Furthermore, they showed that users who

had used cocaine in conjunction with their ecstasy use scored higher on the acute negative and positive effects compared with ecstasy users who had not used cocaine, whereas those who had used amphetamine and ecstasy together reported higher physical effects than those who had not. These findings may be of possible significance within the current study, and may explain why the ecstasy using groups within the current study reported ecstasy-related effects more to a combination of drugs than to single drug use.

As with the majority of research assessing the effects of recreational ecstasy-polydrug use, there are a number of methodological limitations that need to be acknowledged (for a detailed discussion see Curran, 2000). Profiles of individual's ecstasy and other drug use were based solely on self-report data with no biological assays to verify this data. Self-report data is not always reliable. These reports are unlikely to be wholly accurate and may often underestimate or overestimate drug consumption. They may also under- or overestimate their usage either because of fears about confidentiality or to heighten their 'street credibility'. Furthermore, only lifetime estimations of other drug use were reported and similar questions akin to those asked of ecstasy users (e.g., average consumption and maximum consumption on each occasion and duration of usage) also need to be asked pertaining to patterns of other drug use, to establish specifically the contributing role, if any, of other drug use.

In this study, there was also no objective assessment to show that participants were 'drug-free' at the time of completing the questionnaires. Even if they were drug free at the time of completion, there is the potential that rather than just reflecting on the long-term 'off-drug' effects, responses may have been affected by residual and sub-acute drug effects (Verheyden, *et al.*, 2003a; Curran, *et al.*, 2004).

The Life Experiences Questionnaire was developed from identifying the common psychological and physical effects associated with ecstasy use, from a review of the empirical and subjective reports on ecstasy users (Liechti, *et al.*, 2000a,b; Gamma, *et al.*, 2000; Cami, *et al.*, 2000; Liechti and Vollenweider, 2001; Cohen, 1995; Parrott, *et al.*, 2002). Labelling the questionnaire as 'Life Experiences', without reference to the identified items being known effects of ecstasy, allowed these effects to be explored in relation to other drug use, as well as ecstasy, thus exploring the perceptions and attributions to different drugs amongst polysubstance users themselves. Given that the Life Experiences questionnaire was devised specifically for this exploratory study, its validity and reliability needs to be fully determined in other samples of polysubstance users. However, support that this questionnaire does reliably detect life changes in ecstasy users and the distinction between problematic and non-problematic ecstasy users, comes from data on the psychopathological profiles of these users, reported in Soar, *et al.* (2006). However, the forced choice nature of the questionnaire limits participant responses and participant's interpretations of these questions could have also differed to that intended by the researchers. A semi-structured questionnaire or follow-up interviews could provide more detailed information, and also explore other effects attributed to drug use rather just

the psychological and physical effects of these substances, for example, social aspects and lifestyle issues surrounding drug use, which too could influence the reporting of problems or changes in individuals lives.

The current study allocated ecstasy users to one of two groups (problematic and non-problematic ecstasy user) based on the response to a single question, 'Have you experienced any problems, which you attribute to your ecstasy use?' As pointed out by one of the reviewers, this question could be interpreted in a number of ways with participants attributing a wide range of problems including psychological, physical, social, economic, etc. to their use of ecstasy. Although it is acknowledged by the authors that this is somewhat of a crude classification system, it replicates the method used by Fox, *et al.* (2001), who also asked participants to give some qualitative information on their problems. The common problems reported related predominantly to the psychological effects associated with the drug, such as low mood, depression and anxiety and cognitive difficulties. Additional evidence to suggest this single question has some validity, which also comes from the psychopathological profiles of these problematic ecstasy users compared with non-problematic ecstasy users, as measured by a standardised and validated measure – the BSI (Soar, *et al.*, 2006), suggesting that the problematic ecstasy users within this study were showing signs of psychological problems over and above the non-problematic ecstasy and cannabis using controls. However, this still does not provide objective confirmation that the life changes reported by the drug users within this study have actually occurred. The significance of this objective confirmation of problems is somewhat trivial considering that individuals actually perceive themselves to have experienced certain changes, and in some these changes are perceived to be problematic to the extent that some of them are seeking help and advice from professional organisations. Taken together, this highlights that the individual's perception of their experiences and problems are important when addressing drug-attributed effects. However, there may also be some individuals who are displaying problems and through poor self-awareness and/or the lack of recognition and perception of these problems (Parrott, *et al.*, 2002; Sumnall, *et al.*, 2004), may not be reporting them or more importantly seeking help for them.

Overall, whether one can objectively confirm the effects related to drug use or not, the current study reported that both ecstasy using groups reported greater polydrug use than cannabis using controls and that they also attributed more life changes, both positive and negative to a range of drugs rather than specifically just ecstasy. This data supports the important role of polydrug use and attributions in ecstasy-related effects and as such future research into the psychological effects of ecstasy clearly should not underestimate the contribution of other drug use/polydrug use.

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