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RESEARCH REPORT

Sensation seeking, gambling and gambling addictions

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Abstract

Male off-course bettors were assessed using: the Sensation-Seeking Scale (SSS) Form V, two measures of subjective arousal while betting, and questions concerning chasing, preferences for gambling activities and other aspects of betting behaviour. The SSS was also administered to a random sample of the male general population of Glasgow, together with questions concerning preferences for gambling activities to allow comparison between regular gamblers and the general population. In comparison with the general population and with non-gamblers, off-course bettors scored lower on SSS; gamblers preferring the casino and/or the race-track scored higher on SSS; gamblers betting on many different forms scored higher on SSS. A further analysis produced a cluster of variables among off-course betters associated with impaired control of gambling, among which both SSS scores and chasing were prominent features.

A central feature of all gambling has been observed to be the subjective excitement or arousal it appears to engender (Boyd, 1976). This observation is supported by reports from questionnaires and surveys that excitement is a main reason cited by gamblers as to why they gamble (Anderson & Brown, 1984; Scarne, 1975; Commission on the Review of National Policy Towards Gambling in America, 1976). The existence of increases in arousal while gambling has received much empirical support (Anderson & Brown, 1984; Leary & Dickerson, 1985; Dickerson & Adcock, 1987). Anderson & Brown, for example, found increases in heart-rate of up to 58 beats/minute for frequent gamblers during blackjack play in a casino. The size of the observed increases supports the importance of arousal as a variable in the explanation of gambling behaviour (Brown, 1986). There is also evidence to suggest that higher arousal is associated with greater persistence (Dickerson & Adcock, 1987) and more withdrawal symptoms when trying to abstain (Wray & Dickerson, 1981).

Within a learning theory conceptualization of persistent betting arousal has been hypothesized to act as a reinforcer on a fixed interval schedule (Dickerson, 1977, 1979, 1984; Saunders, 1981) together with the more commonly hypothesized variable schedule of cash won (Skinner, 1953;

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Knapp, 1976). The relationship between arousal and chasing suggests that arousal as a reinforcer may be a more important determinant of loss of control (Dickerson, Hinchy & Fabre, 1987; Blaszczynski, Wilson & McConaghy, 1986). The learning theory conceptualization, however, is unable to account for the fact that only a small percentage of gamblers lose control to the extent to which their gambling becomes problematic (Commission on the Review of National Policy Toward Gambling, 1976; Kallick, Suits, Dielman & Hybels, 1979). Brown (1986) has attempted to integrate the roles of arousal and sensation seeking among many other factors in the development of an individual's gambling frequency from low through regular to excessive gambling, and Blaszczynski & McConaghy (1989) have developed this still further.

Zuckerman's Sensation-Seeking Scale is based on the theory that individual differences exist in the need for optimal levels of stimulation. He postulated sensation seeking to be a biologically based personality dimension with sensation seekers identified as those who seek varied, novel or complex sensations or experiences. High sensation seekers appraise risk as less and anticipate arousal as being more positive than low sensation seekers (i.e. the 'surgery-elation effect', Zuckerman, 1979, 1983).

Alone among theories of individual differences Zuckerman's (1979) account of sensation seeking makes explicit predictions concerning a person's preference for gambling. Studies have shown significant associations between sensation-seeking scores and drug abuse, sex experience, involvement in risky sports and volunteering for sensory deprivation experiments, encounter groups and gambling instruction (Zuckerman, 1983). Zuckerman suggested a relationship between gambling and the trait of sensation seeking in which "individuals entertain the risk of monetary loss for the positive reinforcement produced by states of high arousal during the periods of uncertainty, as well as the positive arousal produced by winning" (Zuckerman, 1979, p. 211). The evidence for Zuckerman's hypothesis is, however, not clear.

Anderson & Brown (1984) found higher SSS scores to correlate positively with greater increases in heart-rate and bet size during blackjack play, although as a group the mean scores of the blackjack players did not differ significantly from a non-gambling control group of students. Kuley & Jacobs (1987) point out that the lack of significant differences between the gamblers and controls in the Anderson & Brown study could be a result of the lack of control for the variable of age. Anderson & Brown reported that their sample of gamblers were between the ages of 20 and 48 years and the controls ranged from 21 to 28 years. The mean age was not reported. As sensation-seeking scores have been found to correlate negatively with age (Zuckerman *et al.*, 1978) then the relationship between sensation seeking and gambling must remain inconclusive from Anderson & Brown's study. However, Leary & Dickerson's finding of significantly greater increases in arousal during poker machine play in high-frequency gamblers as compared with low-frequency gamblers adds extra support for the hypothesis that gambling is positively related to sensation seeking.

Neurobiological substrates of gambling

Zuckerman (1983) has attempted to elucidate the relationships of serotonin levels, brain monoamine oxidase (MAO) and endorphins to variations in scores on the Sensation-Seeking Scale without reaching striking clarity. In a more recent study in features of the brain chemistry of addicted gamblers, Roy *et al.* (1988) measured levels of noradrenaline, monoamine metabolites and peptides in cerebrospinal fluid, plasma and urine. Based on the hypothesis developed and described in Carlton & Manowitz (1987), they expected to find low levels of serotonin metabolite which would have indicated that addicted gamblers had poor impulse control, but instead they found a pattern of biochemical indicators which pointed towards a significantly different pattern of noradrenaline metabolites, indicating "a functional disturbance of the noradrenergic system" which, they noted, had been postulated to underlie sensation-seeking behaviours.

Roy's study did not include a direct measurement of sensation seeking but extraversion as measured by the EPQ was found in the same sample to be "highly significantly correlated with indexes of adrenergic function" in pathological gamblers, and Roy concluded that this suggested that "the disturbance in the central noradrenergic system in pathological gamblers may be partly reflected in their personality" (Roy, de Jong & Linnoila, 1989, p. 679).

It appears that the early psychological work on the role of arousal in persistent regular gambling has been corrobrated by the psychobiologists (Carlton & Monowitz, 1987; Roy *et al.*, 1988; Roy *et al.*, 1989). Gambling problems are addictions rather than disorders of impulse control and the existence of a role of arousal linked with possible personality features of sensation seeking or extraversion within the development of the addiction has been affirmed.

The relationship between Eysenck's extraversion and psychoticism scales and Zuckerman's sensation seeking is complex. Both sensation seeking and extraversion have been related to the construct of an "optimal level of stimulation" (Eysenck, 1967; Zuckerman, 1969, 1974) but sensation seeking has been found to correlate moderately but highly significantly with both Eysenck's extraversion and his psychoticism superfactors (Eysenck & Zuckerman, 1978). Zuckerman (1979) has interpreted these relationships as indicating that sensation seeking may relate more directly to a rotation of the factors in Eysenck's psychological space and therefore to Gray's separate reward and punishment systems (Gray, 1972) and to his concepts of biological pessimism and optimism (Brown, 1986). More recently (Zuckerman, Kuhlman & Camac, 1988), sensation seeking has come to be seen as closer to Eysenck's psychoticism rather than his extraversion.

Problems in any simple relationship between sensation seeking and gambling

More recent studies suggest that Zuckerman's simple predicted relationship between gambling and sensation seeking cannot have been accurate. Blaszczynski *et al.* (1986) found that a group of male pathological gamblers presenting for treatment had significantly lower than average SSS total scores. Although it can be argued that the questionnaire responses of persons in crisis may differ significantly from their typical responses, Blaszczynski *et al*'s. data matched existent norms with respect to age and extroversion which lends support to the validity of their findings.

Dickerson, Hinchy & Fabre (1987) found lower than average SSS scores in a sample of non-treatment seeking off-course bettors. They suggest that off-course betting is favoured by low sensation seekers as high sensation seekers "might well prefer to choose from a wide range of sporting and social activities rather than bet in an off-course betting agency commonly set in a shopping centre or play poker machines at their local social club" (Dickerson, Hinchy & Fabre, 1987, p. 674). They point out that casino gambling, card clubs, betting at the race track and some illegal forms of gambling may remain exceptions to a general relationship between sensation seeking and gambling diametrically opposed to that proposed by Zuckerman, and confirms the need for researchers not to assume that gambling is an homogeneous activity.

This need is further confirmed by a study in personality differences as measured by the MMPI between gamblers participating in games of luck and those gamblers participating in games of skill, suggesting that different personality types choose different forms of gambling (Adkins, Kreudelbach & Toohig, 1987).

Starr & Potashner (1984) suggest that some forms of gambling activity may be more easily substituted for one another. They found, through cluster analysis of protocols from 197 adult subjects, that adult gambling activities group into four distinct quadrants with the two dimensions being casino vs non-casino and serious vs recreational.

Blaszczynski, Winter & McConaghy (1984) found that specifically horse-race addicts had significantly lower baseline Beta-endorphin levels as compared to poker-machine players and controls. They too concluded that this suggests that distinct subgroups of gamblers exist and raises the possibility that different aetiological factors may characterize each subgroup.

Factors reviewed above suggest that it may be useful to distinguish, after Cornish (1978), those determinants of gambling which govern the choice of type or form of gambling from those governing the way in which a particular form is 'used' by the individual.

Kuley & Jacobs (1987) found that problem gamblers scored significantly higher than social gamblers on the Sensation Seeking total score and on the Disinhibition, Experience Seeking and Boredom Susceptibility subscales. There was no control for the type or form of gambling participated in and it is possible that the results relate sensation seeking to a wide range of differences in the choice of form among their sample rather than to the way in which all forms were

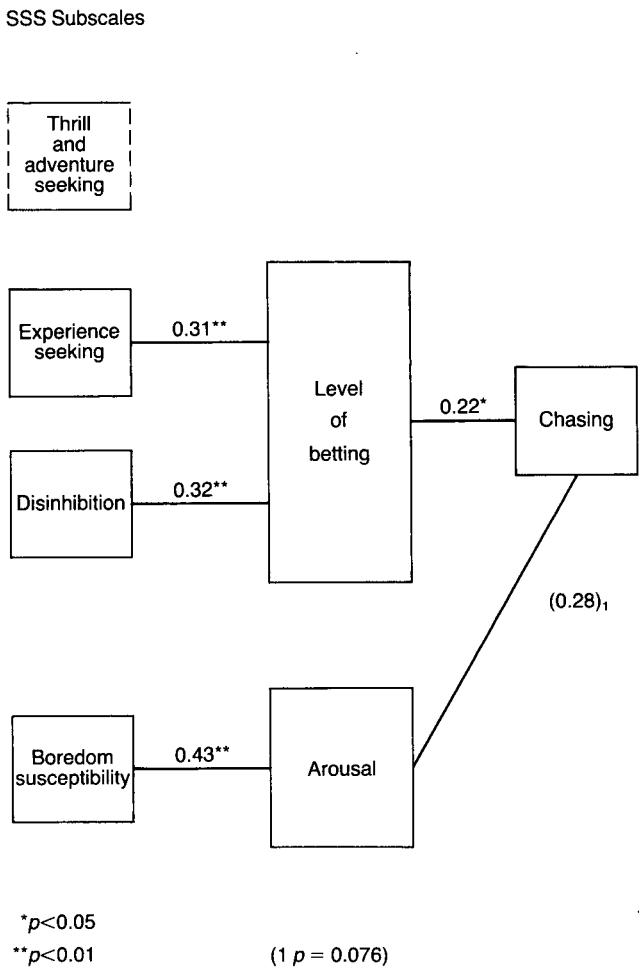

Figure 1. *Schema of variables that may contribute to loss of control of betting (From: Dickerson, Hinchy & Fabre, 1987).*

used. Dickerson, Hinchy & Fabre (1987) found that total SSS scores and subscale scores on Experience Seeking and Disinhibition were associated with greater expenditures of time and money and other general measures of level of involvement in betting. Boredom Susceptibility subscale scores were also found to be linked to subjective reports of arousal while betting. They speculate that these sensation seeking characteristics in off-course gamblers may be a "possible predisposing route to loss of control of betting and eventual problematic or pathological gambling." These possible predisposing factors in the sensation seeking of off-course bettors which may lead them to loss of control and gambling to excess were summarized by Dickerson, Hinchy & Fabre in Fig. 1.

The present study is in part a near replication of the Dickerson, Hinchy & Fabre's work examining chasing, arousal and sensation seeking in off-course gamblers, but in addition an attempt is made to examine the relationship between sensation seeking and preference for gambling activities in a sample of the general population.

Past studies investigating the relationship between gambling and sensation seeking have compared the scores of gamblers to those of the general population. But Downes *et al.* (1976) estimated that 27% of men and 7% of women in the UK bet at least occasionally in betting

offices, and that 17% of men and 2% of women bet there regularly (not to mention the people gambling on other forms). Hence gamblers have in the past been compared to a general population sample containing a significant proportion of gamblers plus the non-gamblers that they are being compared with. Attempts were also made to control for another possible confounding factor in the Dickerson, Hinchy & Fabre study, the lack of control for other possible forms of gambling that the off-course bettors may have participated in.

Method

There were two groups of subjects: a group of gamblers ($n = 79$) from off-course betting offices and a sample of the general population of the city of Glasgow ($n = 96$). All subjects were male. Female subjects were excluded from the study as the vast majority of gamblers that gamble in the off-course betting office are male (Downes *et al.*, 1976) and also because women are lower sensation seekers than men, and it was thought that a small number of women in the sample may unnecessarily complicate the analysis.

A six page battery of questionnaires was used comprising:

(a) The Sensation-Seeking Scale (SSS) Form V (Zuckerman, 1979).
(b) Questions concerning frequency of gambling behaviour and the number of different forms of gambling participated in.
(c) Demographic data on sex, marital status, age and employment.
(d) A 4-item subscale of the State portion of the State-Trait Anxiety Inventory (Spielberger *et al.*, 1970), used previously by Dickerson *et al.* (Leary & Dickerson, 1985; Dickerson & Adcock, 1987) and especially by Dickerson, Hinchy & Fabre (1987) as a measure of subjective arousal. Subjects were asked to answer about how they usually felt when waiting for the result of a race on which they had bet to be announced.
(e) A version of the Awareness of Autonomic Activity (AAA) scale. This is an 11-item scale developed by Mandler *et al.* (Mandler, Mandler & Uviller, 1958; Mandler, Mandler, Kremen & Sholiton, 1961; Mandler & Kremen, 1958) and adapted by Kissen, Brown & Kissen (1969). The inclusion of the scale was validated on two counts. Firstly, because it is extremely easy to complete, it was hoped that there would be few blank returns (only 50% of off-course bettors who returned questionnaires in the Dickerson, Hinchy & Fabre study completed the 4-item Spielberger subscale). Secondly, the inclusion of two measures of subjective arousal enabled an examination of the relationship between the two.
(f) A question concerning chasing, "When you are behind or losing, how often do you chase your losses? In order words, how often do you start placing more bets once you've had a few losers? Never, occasionally, usually, nearly always?"
(g) Questions concerning betting behaviour which have been associated with loss of control. These included items which have been used and associated with out of control betting behaviour previously (Dickerson, 1977, 1979, 1984; Dickerson, Hinchy & Fabre, 1987; Kuley & Jacobs, 1987; Custer, Meeland & Krug, 1984).
(h) Questions relating to cash involvement in betting, including bet size and amount of expenditure on one day on gambling.

Procedure: off-course bettors sample

The sample of off-course bettors came from eight off-course betting agencies in the Glasgow area, selected to cover different types of location (city centre, shopping centre and industrial), to ensure a wide selection of bettors from different areas of Glasgow and included both large chain and private offices. All agencies were approached beforehand and the co-operation of staff secured, with the exception of one agency which refused to allow the study to take place. This agency was replaced with one which was similarly situated. Times of the day and days of the week were systematically chosen to ensure that lunchtime, afternoon and weekend customers were sampled.

Bettors were selected as those people who entered the office after the data collector, or people who were already in the office if the number was small enough to avoid experimeter bias. They were never approached during the races themselves (i.e. during the race commentary) or while placing bets as it would be more of

an invasion of privacy as these stages have been seen as central in the betting process (Dickerson, 1977, 1979, 1984), but instead when leaving the office or between races.

If the subject agreed to take a questionnaire he was instructed to return it to the data collector or to hand it in behind the counter in that particular office next time he was in. The data collectors consisted of one psychology student and three regular gamblers well acquainted with the agencies in question. The staff behind the counter in each office were all aware of the methods of data collection, and helped to encourage high return rates from the bettors they were acquainted with.

Procedure: sample of the general population

A random sample of 200 males from the general population of Glasgow was selected from the Glasgow Electoral Voters' Register by selecting every 2437th name ensuring representatives from all 66 electoral wards (i.e. voting areas), the number from each ward varying depending on the size of the ward. If the name at the number reached was female, the male name nearest to that position in the role was selected.

Although it has been estimated that over 80% of the population are reachable by telephone (Belson, 1986) the possibility of selecting names from the telephone directory and phoning a random sample was ruled out due to possible confounding variables (such as experimenter bias manifested in alterations in pitch of voice, etc.), unnecessary expense (it was estimated that each call would last 20 minutes) and for the simple reason that the number of registered voters is greater than the number of people who have telephones.

Once the names were selected questionnaires were posted out to each subject with a stamped-addressed envelope for return. Each of the addressed envelopes were secretly encoded inside in order that the sample could be examined to see if it was a representative sample of the Glasgow population with respect to wards covered and to allow the analysis of social class factors. For ethical reasons the original names chosen from the electoral role were left out, and only the ward areas were recorded by code.

Results

Of the 143 male off-course bettors approached, 10 refused, and 79 (55%) returned a questionnaire. The mean age was 40.7 years (SD 17.3, range 19–74). Ninety-four per cent reported betting once a week or more often.

Of the bettors samples, 34% reported themselves as never chasing; 26% as occasionally; 17% as usually; and 23% as nearly always. Table 1 illustrates the relationship between chasing and questions relating to loss of control of gambling and gambling expenditure.

The short form of the State portion of the State-Trait Anxiety Questionnaire was completed fully by only 56 subjects. The remainder checked only one or two of the subscales, and their records were excluded on this component. The mean score of those completing the scale was 8.61 (SD 3.89, range 4–16) which is similar to that reported by poker machine players while betting (Dickerson & Adcock, 1987) and off-course bettors from Australia while betting (Dickerson, Hinchy & Fabre, 1987).

The other measure of subjective arousal used, the Awareness of Autonomic Activity scale was fully completed by 73 subjects. The remainder left several of the items blank, and their records were excluded on this component. The mean score was 15.6 (SD 6.14, range 11–38).

The Pearson Product-Moment correlation between the AAA scale and the Spielberger subscale was 0.485 ($p < 0.001$ two-tailed).

All 79 of the off-course bettors completed Zuckerman's Sensation-Seeking Scale. The mean total score was 16.86 (SD 7.38, range 2–39, with mean subscale scores of 4.25 for TAS (SD 2.74, range 0—10), 4.10 for ES (SD 2.04, range 1–9). 4.59 for Dis (SD 2.91, range 0–10) and 3.91 for BS (SD 2.24, range 0–10). Significant negative correlations of the SSS total and subscale scores with age were found, with the strongest relationship for the total scale score ($r = -0.675$, $p < 0.001$) and the Dis subscale ($r = -0.6742$, $p < 0.001$). Correlations for the ES and BS subscales were $r = 0.421$ ($p < 0.001$) and $r - 0.250$ ($p < 0.05$) and the correlation for the TAS subscale was $r = -0.61$ ($p < 0.001$).

The relationship between sensation seeking and other variables of interest central to the study is illustrated in Table 2. A measure of 'frequency of betting' was derived by multiplying the reported frequency of betting each week with the total time spent during each episode of betting. 'Loss of control' refers to a score which

Table 1. *Pearson product-moment correlations between chasing and items related to loss of control (two-tailed significance)*

Questionnaire items		Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
Q7	Chasing	1.00	0.53***	0.63***	0.54***	0.48***	0.37***	0.37***	0.55***	0.52***
Q8	Gambling longer than planned		1.00	0.60***	0.78***	0.31**	0.17	0.49***	0.35***	0.48***
Q9	Gamble until all spare cash gone			1.00	0.65***	0.31**	0.34**	0.40***	0.54***	0.60***
Q10	Spend more than intended				1.00	0.47***	0.32**	0.42***	0.43***	0.59***
Q11	Do you have a problem controlling level of gambling					1.00	0.51***	0.58***	0.47***	0.44***
Q12	Previously tried stopping						1.00	0.58***	0.41***	0.35***
Q13	Like to reduce amount you spend							1.00	0.52***	0.45***
Q14	Must return after losing								1.00	0.55***
Q15	Must return to win more after winning									1.00

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 2. *Pearson product-moment correlations between sensation seeking, chasing, arousal, frequency of betting, age, bet size, expenditure on betting, loss of control, and number of other gambling forms participated in (two-tailed significance)*

Variable	TAS	ES	Dis.	BS	Total	Chasing	Spiel.	AAA	Age	Bet size	Expenditure	Loss of control	No other forms	Frequency betting
SSS TAS	1.00	0.42***	0.56***	0.19	0.74***	0.19	0.18	0.22*	−0.61***	0.23*	0.26*	0.19	0.17	−0.18
ES		1.00	0.59***	0.25*	0.74***	0.09	0.05	0.32**	−0.42***	0.27*	0.28*	0.16	0.23*	−0.13
Dis			1.00	0.43***	0.87***	0.29**	0.15	0.32**	−0.67***	0.53***	0.61***	0.36***	0.35**	−0.14
BS				1.00	0.62***	0.22*	0.05	0.28*	−0.25*	0.26*	0.34**	0.40***	0.36***	0.23*
Total					1.00	0.26*	0.15	0.38***	−0.67***	0.43***	0.49***	0.37***	0.36***	−0.09
Chasing						1.00	0.20	0.45***	−0.43***	0.46***	0.41***	0.65***	0.44***	0.14
Arousal (Spiel.)							1.00	0.49***	−0.30**	0.19	0.17	0.38***	0.13	0.02
Arousal (AAA)								1.00	−0.36***	0.51***	0.47***	0.57***	0.41***	0.11
Age									1.00	−0.40***	−0.44***	−0.33**	−0.37***	0.16
Bet size										1.00	0.88***	0.51***	0.39***	0.09
Expenditure											1.00	0.48***	0.42***	0.08
Loss of control												1.00	0.49***	0.28*
No other forms													1.00	0.19
Frequency of betting														1.00

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 3. *Gambling in the general population, and the relationship to sensation seeking*

	Non-gamblers ($n = 51$)	Off-course betting (no other forms) ($n = 15$)	Participation in two forms ($n = 10$)	Casino among gambling activities ($n = 7$)
SSS total	16.4	14.1	18.4	22.0
TAS	5.3	3.5	6.3	7.2
ES	3.9	3.8	4.4	5.4
Dis	4.1	3.8	5.1	6.2
BS	3.1	3.0	2.6	3.2

resulted from the summation of questions relating to loss of control.

From the random sample of the male population of Glasgow, 52% of the questionnaires which reached the subjects who had not moved house or could be located by the Post Office were returned. The return rate did not differ from ward to ward. The mean age of the subjects who returned questionnaires was 38.82 years (SD 17.46, range 18–76). No significant differences in social class were apparent when comparing data from the sample to figures for the whole of the Glasgow population as given in the ward profiles introduction to the electoral register.

All of the 96 males who returned questionnaires completed the Sensation-Seeking Scale. The mean total SSS score was 17.53 (SD 7.96, range 2–37), with mean subscale scores of 5.23 for TAS (SD 7.96, range 0–10), 4.26 for ES (SD 1.96, range 0–9), 4.64 for Dis (SD 2.73, range 0–10) and 3.48 for BS (SD 2.24, range 0–10). A greater decline in age was observed for TAS and Dis than for ES and BS. This is in accordance with previous results (Zuckerman *et al.*, 1978; Zuckerman, 1979, 1983).

The sample of the Glaswegian off-course bettors were compared to the sample of the Glaswegian population on the sensation-seeking dimension. The off-course bettors scored significantly lower than the general population on the TAS ($t = 2.118$, $p < 0.05$). The gamblers (i.e. off-course bettors) also scored lower on the total SSS and on the Dis and ES subscales (although this trend did not reach significance). The off-course bettors scored higher than the general population on the BS subscale (but not significantly).

Since the mean age of the sample of off-course bettors (40.7) did not differ significantly from the mean age of the general population (38.8) and the profiles of changes in SSS with age was so similar for both samples, it was not judged necessary to perform and analysis of covariance to demonstrate the independence of differences in sensation seeking between the two samples from age effects.

Of the general population sample, 47% reported gambling on one form or more. Thirty-two subjects reported gambling on one form; 10 subjects reported gambling on two forms; and 3-subjects reported gambling on more than two forms. The relationship between sensation seeking, number of gambling activities participated in, and type of gambling in those who gamble in the general population is illustrated in Table 3. There is a trend (not reaching significance) with non-gamblers scoring higher on the SSS total and on all the subscales than those who gamble in the off-course betting office. Gamblers who gamble on two forms of gambling are similarly higher scorers on the SSS total and subscales than non-gamblers (with the exception of the ES subscale), but this trend does not reach levels of significance. Those who gamble in the casino scored higher than any of the other groups mentioned on all the SSS subscales and on the total SSS (although, once again not to a significant level).

An analysis of the off-course bettors sample with respect to other forms of gambling participated in and sensation seeking is shown in Table 4. Similar results were found to those for the general population, with those participating in off-course betting and nothing else scoring lower than the general population on the total SSS and all the subscales. Off-course bettors who gamble on three or more additional forms of gambling in the casino or at the race-track were found to be higher scorers than the general population on the total SSS and on all the subscales.

A principal components varimax factor analysis with orthogonal rotation was carried out on the variables involved in the off-course betting

Table 4. *Off-course bettors, other forms of gambling participated in and sensation seeking*

	Off-course betting (no other forms) ($n = 9$)	Off-course betting and one other form ($n = 44$)	Off-course betting and two other forms ($n = 18$)	Off-course betting and three other forms ($n = 6$)	Casino among activities ($n = 21$)	Race-track among activities ($n = 22$)
SSS total	10.9	16.0	19.1	24.0	20.2	21.8
TAS	2.0	4.2	5.1	4.3	4.7	5.1
ES	3.6	4.0	4.3	5.7	5.2	4.9
Dis	2.8	4.2	4.8	8.0	6.3	5.9
BS	2.7	3.4	4.9	6.0	3.9	5.9

Table 5. *Results of factor analysis performed on all variables monitored in off-course bettors' sample*

Factor	Eigenvalue	Percentage of variance	Loading of variables on factor 1 (varimax rotation)*	
1	8.97960	32.1	Size of bet	0.86
2	2.54407	9.1	Spending more than intended	0.84
3	2.12178	7.6	Expenditure on gambling	0.79
4	1.79889	6.2	Acknowledge problems controlling levels of gambling	0.62
5	1.56022	5.6	Spending all spare cash	0.56
6	1.36955	4.9	Subjective arousal while betting	0.56
7	1.18495	4.2	Spending longer than planned in the office	0.56
8	1.06104	3.8	After winning, want to return to win more	0.56
9	0.97599	3.5	Amount of time per day spent gambling	0.51
10	0.86242	3.1	Number of days a week spent gambling	0.47
			SSS total	0.40
			Chasing	0.36

*Only loadings over 0.3 are reported.

office (i.e. hence the off-course bettors sample was used). The results are displayed in Table 5 with the factor loadings of variables on factor one.

Discussion

The sample, and therefore the findings from it, appear to be broadly representative of the male populations of off-course bettors and non-gamblers in the city of Glasgow. There were very few refusers among the off-course bettors; over half of the questionnaires that reached the general population were returned. Strong relationships of total and subscale scores of the Sensation Seeking Scale to age were found, but with the Boredom Susceptibility Scale showing the weakest effect, which is a typical finding in earlier studies (Zuckerman *et al.*, 1978; Zuckerman, 1979; Zuckerman & Neeb, 1980; Blaszczynski *et al.*, 1986; Dickerson *et al.*, 1987). The correlations within the the SSS are typical of previous reports. Comparison between returners and non-returners from the general population showed no significant differences in social class, occupation and areas of return and the SSS scores of the male general population show the same relationships to age and among the subscales as provide evidence of concurrent validity for the bettors sample.

The results of the general population sample probably generalize quite well to the population of the UK as a whole. Scottish norms for the SSS have hitherto been drawn from undergraduate populations. This sample covers all age groups randomly, and when compared to existing English norms (Zuckerman, Eysenck & Eysenck, 1978) looks very similar indeed. Since there is no known reason to suspect that Glaswegian off-course bettors are in any way different from those of the remainder of the UK, it is likely that the present findings are broadly representative of the UK as a whole.

The comparison of the SSS scores between the gamblers sample and the general population shows consistent differences in the direction of lower sensation seeking among the off-course bettors, although the only statistically significant difference is on the TAS subscale. These findings concur with the previous findings of Blaszczynski *et al.* (1986) and Dickerson *et al.* (1987). Closer scrutiny of the data, separating the general population out into different groups (including a group of non-gamblers) and separating the off-course bettors into different groups (with reference to the number of other activities participated in, and the nature of those gambling activities) reveals important relationships in sensation seeking between types of gambling participated in and the number of forms of gambling participated in. As Dickerson, Hinchy & Fabre (1987) suggested, off-course bettors as a group are lower sensation seekers than the general population. In contrast, casino gamblers and gamblers who go to the race-track are higher sensation seekers than the general population. The number of gambling forms participated in is also an important factor. Involvement in many different forms of gambling is associated with high SSS.

The relationships depicted bear a close

resemblance to predictions from previous research. The preference of high sensation seekers for casino and race-track gambling fits the general picture of the high sensation seeker. It also fits the general picture of the high sensation seeker that he should be more likely to participate in a number of different forms of gambling rather than just one form, as sensation seeking is defined by the "need for varied, novel and complex sensations and experiences" (Zuckerman, 1979). The finding that the only statistically significant difference between off-course bettors and the general population was in the TAS subscale might suggest that low sensation seekers, especially, would shun the more dramatic and extravert form of sensation seeking and be more likely to pick off-course betting in a safe, well-controlled environment close to home. Indeed, it is likely that gamblers as a whole, even those with the highest SSS scores, become specialists in their sensation-seeking outlets, concentrating all their sensation-seeking in just one channel, gambling, and so fail to register the true extent of their commitment to sensation-seeking on a scale which simply sums the commitment to a variety of sensation-seeking activities without weighting the extent of commitment to any one single form.

One way of conceiving of the distribution of sensation seekers within gambling forms might be to combine the relationships depicted with the dichotomy made between skill and luck games (Adkins, Kreudelbach & Toohig, 1987), or with the serious-recreational casino-non-casino distinctions made by Starr & Potashner (1984). Off-course bettors are different and, from the characteristics of slot machine players depicted by Adkins, Kreudelbach & Toohig (1987), slots players can be predicted to be lower sensation seekers also, possibly the lowest of all. Other typologies and subgroups of gamblers are currently being identified (Griffiths, 1991; Fisher, 1993). Certainly the relationship of sensation-seeking to preference for form of gambling activities is more complex than Zuckerman's original prediction suggests and it now seems an essential requirement of future research methodology in gambling that it should control for the likely differences between forms.

Focusing now on the sample of off-course bettors and the interrelationships between variables involved, the comparison of measures of arousal used showed that the correlation between the AAA scale and the Spielberger was highly significant, but it is suggested that the AAA is a better measure, both because it is earlier to complete (73 subjects completed it as opposed to 56), and because it has a greater ability to detect significant differences in arousal than the subscale of the STAI (possibly due to the higher completion rate). This can be readily observed from Table 2 above.

The validity of the long entertained assumption that chasing is a central variable of interest in the generation of problematic levels of gambling is supported by the relationships between chasing and aspects of control (Table 1 above) such as spending more than planned, gambling longer than planned, and attempting to stop, as well as with more direct admissions to having problems controlling levels of gambling. Chasing therefore may be a central characteristic of a complex of experiences which are concerned with the subjective control of gambling behaviour (these results concur with those of Dickerson, Hinchy & Fabre, 1987). However, in the present sample 66% of off-course bettors reported chasing at least occasionally. It is therefore unlikely that chasing *per se* leads to problematic levels of gambling. Lesieur (1979) suggested that an additional change in associated cognitions is required so that the gambler comes to believe that chasing is rational before it may become the central feature of a major addiction.

Once inside the off-course betting office, the total SSS is related significantly and positively to subjective awareness of arousal (measured by the the AAA), bet size, expenditure on betting, loss of control, and number of other forms participated in. Sensation seeking therefore seems an important variable involved in high levels of gambling. All the subscales of the SSS relate to arousal (as measured by the AAA), and to bet size and expenditure. No significant relationship was found between the subscale scores of the Spielberger and any sensation-seeking score (total or subscales).

Only the first factor emerging from the factor analysis is discussed because, as can be seen from Table 6, it accounts for more than three times the percentage of the total variance than any other factor. The loadings on this factor (illustrated in Table 6) include variables associated with loss of control of gambling and frequency of gambling, as well as variables related to expenditure on gambling. This factor

might therefore be interpreted as representing a cluster of variables associated with problematic levels of gambling. If this is the case, then this is further evidence for the importance of the variables of chasing and sensation-seeking, as they load on this factor.

The results of this study give rise to some problems surrounding Dickerson *et al*'s (1987) 'Schema of variables which may contribute to loss of control of betting', mainly because of validation problems with the STAI subscale as a measure of subjective awareness of arousal. Because of this it may still be too early to speculate about variables involved in the route to loss of control of betting. If the AAA does prove to be an effective measure, then the sensation-seeking subscales and total may well, nevertheless, through their relationships to arousal and level of betting, eventually point to a predisposition to chasing and loss of control. The correlations among variables (see Table 2) lend some support to this.

Scrutiny of the evidence from this study suggest that sensation- seeking is an important variable in both choice of form of gambling and in the way in which gambling develops. This is confirmed by the psychophysiological and the psychobiological evidence about the neural substrates of both sensation seeking and gambling. But the optimal level of arousal/optimal level of stimulation model for understanding the relationship between sensation seeking and gambling, both 'normal' and addictive, may be conceptually too simple. A reversal theory framework explaining the gambler's behaviour in terms of the paradoxes of felt arousal as put forward by Apter (1989) may make more sophisticated research and explanation possible. The application of reversal theory to gambling and other addictions leaves open the possibility of subsuming sensation-seeking within a reversal theory framework, or vice versa (Anderson & Brown, 1987; Brown, 1988). Nevertheless, the present study has shown the need for continued interest in sensation-seeking with respect to explanations of gambling and excessive gambling behaviour.

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