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Mood state and gambling: Using mobile telephones to track emotions

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Mobile telephones were used to collect data on the relationship between gambling and mood state from gamblers in the field. Seventeen gamblers called an interactive voice response system running on a computer before, during and after a gambling episode. Measures taken in this way included self-reports of anxiety/arousal, the amount of money gambled, whether the result was a win or loss, the amount won or lost, and the type of gambling engaged in. Other measures were taken during an initial briefing session using conventional questionnaires that included self-reports of anxiety/arousal taken in a non-gambling situation, dissociation during gambling, and a measure of degree of impairment of control. The results showed that subjective anxiety/arousal levels were significantly higher during and after gambling than during the urge to gamble or at baselines. Losing was associated with increased subjective anxiety/arousal after play, and winning was associated with a decrease in subjective anxiety/arousal. This suggests that gambling may be a cause of increased subjective anxiety/arousal, rather than functioning to relieve it. A cluster of variables associated with impaired control and subjective anxiety/arousal levels was also identified. The method of collecting data using mobile telephones appears to be a valuable development.

Several studies have reported a link between problem gambling and mood disorders (see Crockford & El-Guebaly, 1998, for a review), and there is much evidence to suggest a link between pathological gambling and depression (Blaszczynski & McConaghy, 1988, 1989; Graham & Lowenfeld, 1986; Griffiths, 1995). Indeed, Griffiths (1995) suggested that depression might act as a negative reinforcer in the maintenance of gambling.

However, as Hills, Hill, Mamone, and Dickerson (2001) point out, the demonstration of a link between mood state and gambling behaviour does not necessarily imply anything about their causal relationship. For example, it does not tell us whether depressed mood might be a cause of excessive gambling or whether excessive gambling might be a cause of depressed mood.

Furthermore, while Griffiths (1995) suggests that gambling may function to relieve depressive states, Hills *et al.* (2001) present evidence more in line with the view that

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gambling itself may lead to depression. In line with the Forgas Affect Infusion Model (e.g. Forgas, 1995), induced negative (depressed) mood in regular gamblers did not enhance persistence, although it did inhibit to some extent the play of non-regular gamblers.

An association between positive mood state, physiological arousal and gambling has also been made in the literature. For example, the excitement and arousal that gambling engenders has been proposed as a motivation to gamble (Griffiths, 1995). However, despite a number of studies that have shown gambling to be physiologically arousing (e.g. Anderson & Brown, 1984; Coventry & Constable, 1999; Coventry & Hudson, 2001; Coventry & Norman, 1997; Griffiths, 1993; Leary & Dickerson, 1985; Meyer *et al.*, 2000), studies that have compared gamblers at different points on the occasional gambler to pathological gambler continuum have, in the main, failed to find differences between groups. Furthermore, as a number of authors point out (e.g. Coventry & Constable, 1999; Hills *et al.*, 2001), increases in arousal during gambling are not necessarily indicative of positive hedonic tone.

It seems reasonable to assume that the valence of arousal will depend on its emotional context (e.g. Thayer, 1989). For example, placing a desperate bet with the last of one's money might be associated with arousal in the form of anxiety. Placing a bet of a similar size when one is financially secure might instead be associated with pleasurable excitement. To understand how mood state and gambling are related we need to measure subjective arousal and anxiety before, during, and after gambling.

Despite the first evidence by Hills *et al.* (2001) that mood state and gambling may be related in a way fundamentally different from the usual mechanism adopted in the literature, measuring mood state and tracking changes across gambling episodes has proven problematic. Traditional self-report techniques have several drawbacks. Asking people to recall their state during a subsequent interview brings with it obvious problems of reliability. Tracking gamblers in the field raises serious practical and resource issues, as well as risking problems of reactivity. The alternative, which is to test gamblers in laboratory settings, can lack ecological validity (see, for example, Anderson & Brown, 1984), not least because it is considered unethical to get participants to gamble with their own money in the laboratory. The use of mood induction techniques in the laboratory is also fraught with difficulties, especially the concern that the responses to mood checks may reflect the expectations of the researchers rather than induced mood states themselves.

Ideally, what is required is a way of getting measures of mood state, and other potential variables of interest, that are contemporaneous with a gambling episode without interfering with the normal gambling routines of the participants involved. In an attempt to achieve this, we adopted a data recording method that, as far as we are aware, has not been used previously in studies of gambling or any other behaviour.[1] The method involves the use of mobile telephones and computer-based telephone software running on a modem-equipped computer.

It is now commonplace to interact with a computer via a telephone. Systems that use the touch-tones provided by modern telephone handsets as responses to pre-recorded or synthesized voice questions are known as interactive voice response (IVR) systems. Many companies and services rely on this technique to interact with the public.

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[1] *See Collins, Kashdan, and Gollnisch (2003), for a similar application in the study of alcohol consumption that was published after this report was submitted.*

    Despite the increasing prevalence of these systems, only a small number of behavioural studies have used this technology as a means of collecting behavioural or psychological data. However, these few studies cover a fairly wide variety of research. A recent review by Corkery and Parkinson (2002) showed that IVR has been used in patient monitoring and consumption monitoring, psychological assessment, psychological experimentation, behavioural interventions, and in surveys. For example, Baer *et al.* (1995) used IVR to carry out a fully automated survey to screen for depression using a 20-question multiple-choice scale. Of the 1,812 people who used the system, 88.1% completed all the questions. A similar system has been used to collect self-report data on daily tobacco and alcohol consumption over a 112-day period (Mundt, Perrine, Searles, & Walter, 1995).

    However, these studies involved participants interacting with the researchers using fixed-line telephones. Very few studies have used mobile telephones (either with or without IVR) as a research tool. One study explored the potential value of the technology for the treatment of psychological disorders such as driving phobias (Flynn, Taylor, & Pollard, 1992). Another used a mobile telephone as part of a screening programme for depression (González, Costello, Valenzuela, Chaidez, & Nuñez-Alvarez, 1995).

    In a recent report by the UK Office of Telecommunications, it was estimated that 83% of households had at least one mobile telephone, and that 75% of adults (approximately 34.5 million individuals) owned a handset (Office of Telecommunications, 2003). Given that the use of mobile telephones is so commonplace, few potential participants are likely to feel intimidated by the technology, or feel self-conscious about using it in public contexts.

    There are several advantages to using mobile instead of fixed-line telephones. The most obvious one is that there are few places in which a mobile telephone cannot be used. Even in places where their use may not be allowed, or where a participant may be reluctant to use them for other reasons, the telephone is available for use the moment the circumstances change. These features provide a practical opportunity to collect contemporaneous or near contemporaneous self-reports of behaviour and psychological states. Furthermore, the technique has the potential to work with gambling and other activities that may be relatively irregular or rare, as well as with those that are regular and frequent.

    The present study explored the potential of the mobile telephone in tracking mood state and gambling. Participants who were regular gamblers were provided with a mobile telephone and asked to call when they felt the urge to gamble, and again when they had completed a gambling episode. The computer requested various details about the gambling episode. It also administered an anxiety subscale from the State portion of the Spielberger State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970). We used this because it has previously been used as a measure of subjective arousal in gambling studies (e.g. Coventry & Constable, 1999; Dickerson & Adcock, 1987), and because we presumed that changes in anxiety levels would index any functional role for mood state in gambling.

Method

Participants

Originally, 22 males agreed to take part in the study. One participant dropped out because he felt uncomfortable using mobile telephones. Two participants were eliminated at the initial screening as they did not meet the criterion for regular gambling

adopted in the study (more than one episode per week) and so were unlikely to call in during the study period. The data for two participants were lost when the computer system crashed as a result of a power failure.

The remaining 17 participants had an approximate age range of 19–60, and were paid for their participation. Four were university students, and three were university or college lecturers, recruited through flyers placed on notice boards around the University of Plymouth campus. The remainder were recruited outside off-course betting offices or through flyers placed on notice boards in the betting offices themselves. All of these participants either worked outside of education or were unemployed.

All participants were treated in accordance with the ethical standards of the British Psychological Society.

Materials

A paper and pencil questionnaire was administered during the initial briefing. This questionnaire consisted of the following scales:

(a) Questions concerning type of gambling participated in, frequency and expenditure on gambling.
(b) Questions regarding impaired control of gambling as used previously (DSM-IV– American Psychiatric Association, 1994; Breen & Zuckerman, 1999; Coventry & Constable, 1999; Coventry & Hudson, 2001; Coventry & Norman, 1997; Dickerson, Hinchy, & Fabre, 1987; Lesieur & Blume, 1987). The 15 questions were answered using yes/no responses, and consisted of the following items:
   i) Do you see your gambling as ever having led to a problem?
   ii) Have you sought or thought of seeking help for your gambling behaviour?
   iii) Was there any time when the amount you were gambling made you nervous?
   iv) After winning, do you feel you ought to gamble more to increase your winnings?
   v) Do you gamble until all your spare cash is gone?
   vi) After losing, do you spend more money to try to make up for your losses?
   vii) Do you ever get into debt as a result of your gambling?
   viii) Have you ever borrowed money to gamble or pay gambling debts?
   ix) Do you find you gamble for longer than you intended?
   x) Do you need to gamble with more money to achieve the desired excitement?
   xi) Do you ever have unsuccessful attempts to control, cut back, or stop gambling?
   xii) When you gamble, do you go back another day to win back the money you lost?
   xiii) Do you ever gamble more money than you intended to?
   xiv) Have you felt guilty about the way you gamble or about what happens to you when you gamble?
   xv) Have you hidden betting slips, lottery tickets, gambling money, or other signs of gambling from your spouse, children, or other important people in your life?
(c) The Trait portion of the Spielberger State-Trait Anxiety Inventory (Spielberger, Gorsuch & Lushene, 1970). This is a 20-item questionnaire that is designed to measure how people generally feel. Statements, such as, 'I feel nervous and

restless' are responded to by circling either *almost never*, *sometimes*, *often*, or *almost always*. The scale produces a score out of a maximum of 80; the higher the score the more anxious the person generally feels.

(d) The dissociation scale as devised by Jacobs (1988) in order to measure dissociative-like feelings among addicts. It has since been used by Diskin and Hodgins (2001) and Gupta and Derevensky (1998). This scale included four questions with a 5-point scale ranging from *never* to *all the time*. In addition, a fifth question regarding losing track of time during gambling was also included following Diskin and Hodgins. The items were as follows:

   i)   After a session of gambling, have you ever felt like you had been in a trance?
   ii) Did you ever feel like you have taken on another identity while gambling?
   iii) Have you ever felt that you were outside yourself watching yourself while you were gambling?
   iv) Have you ever experienced a memory blackout for a time when you were gambling?
   v)   Have you ever 'lost all track of time' when you have been gambling?

(e) A four-item subscale from the State portion of the Spielberger State-Trait Anxiety Inventory (Spielberger *et al.*, 1970), as used previously as a measure of subjective arousal during gambling by Coventry and colleagues (Coventry & Brown, 1993; Coventry & Constable, 1999; Coventry & Hudson, 2001) and Dickerson and colleagues (Dickerson & Adcock, 1987; Dickerson *et al.*, 1987; Leary & Dickerson, 1985). The items consisted of asking the extent to which the participant felt calm, tense, at ease, and over-excited. They were included as a baseline measurement for subsequent telephone responses to the same items.

The four-item version of the State portion of the Spielberger State-Trait Anxiety Inventory described in (e) above was also administered on paper during the debriefing, together with a few questions on each participant's use of the telephone and the amount of money won or lost during the participation period.

The handsets used were Phillips C12 mobile telephones. These are relatively cheap and robust, and have a good battery life. The telephones were connected to the BTCellnet network and used pre-paid vouchers. This meant that the maximum potential loss through fraudulent use was restricted to £15. The tariff also included 500 minutes of free calls to one designated landline, which meant that we were never charged directly for calls made as part of the study. The handsets were set up so that the computer could be called simply by pressing and holding either of two keys. A third key connected to the researcher's office to report problems or for technical support.

The computer used was an Apple Macintosh Power PC 6500 fitted with an Apple Geoport modem. This software modem permitted relatively high quality voice input and output compared to other solid state voice modems tested. The operating system was Mac OS 8.1.

The programme used to run the study was written using PhonePro 3.5 from Bing Software (www.bingsoftware.com). This controlled the response of the computer to incoming calls, playing pre-recorded voice prompts as necessary, recording voice and touch-tone data, and branching according to input.

Procedure

Potential participants who reported gambling more than once per week were asked to give their name and address. To reduce the risk of the handsets being stolen, the

researcher consulted the local electoral register and telephone directory to confirm that the address was real and that the person was listed as living there. The person was then invited to a meeting with the researcher. Each participant was seen separately. At the start of this briefing meeting they were told that the purpose of the study was to examine the role of mood in gambling. They were also informed that they would be required to use a mobile telephone to answer questions about gambling. If they agreed to participate, the paper and pencil questionnaire was administered.

On completing the paper and pencil scales, participants were shown how to use the mobile telephone. They were then asked to make a practice call to report on their most recent gambling episode in front of the researcher. This confirmed that they were able to use the system properly, and allowed any problems to be addressed. Participants were also given written instructions to take away with them.

The researcher asked participants to use the handset to call whenever they felt the urge to gamble, and as soon as possible after they had completed a gambling episode. The researcher also asked each participant to call after gambling, even if he had been unable, or had forgotten, to call when he had the urge to gamble. However, participants were not instructed to call in while a gambling episode was in progress. This would have been impractical in most casess, and in cases where it would have been possible, the procedure would have disrupted the behaviour of interest. Use of the telephone for personal calls was discouraged, but not forbidden.

Individual meetings with participants lasted approximately 1 hour. When the researcher was satisfied that the participant understood all that was required of him he was paid £5 for his participation so far. An appointment was then made to meet up again at a mutually convenient time between 7 and 14 days later. Participants were informed that they would be given a further £30 on returning the handset at that meeting.

On calling the computer during the study period, a participant would first be asked whether he currently had the urge to gamble or had just finished gambling, so that the computer could access the correct question pool. The program would then ask for a two-digit identification code (our telephone line operated through the University exchange, which did not allow automatic caller identification).

If, at the start of the call sequence, the participant had indicated that he was calling because he had the urge to gamble, he was first presented with the four-item subscale from the State portion of the Spielberger State-Trait Anxiety Inventory. Participants responded in relation to their current state by pressing numbers between 1 and 4. The higher the number, the more the participant agreed with the statement he had just heard, and the more he felt anxious/aroused. If he failed to respond, or responded with an invalid digit, the item was repeated.

Next, participants were asked which forms of gambling they had the urge for, and their verbal response was recorded. They were then asked to press keys on their telephone to enter the amount of money (to the nearest pound) they intended to bet. Finally they were presented a series of four statements about reasons for wanting to gamble. These were 'because I think I will win money', 'because it is enjoyable', 'because I need a change of scene', and 'to feel better'. The extent to which the caller agreed with each statement could be indicated by pressing a key between 1 and 5, with 1 indicating *strongly disagree*, 2 indicating *disagree*, 3 indicating *not sure*, 4 indicating *agree*, and 5 indicating *strongly agree*. Again, if the caller failed to respond, or responded with an invalid number, the question was repeated. Participants were then thanked and the call was terminated.

If, at the start of the call sequence, the participant had indicated that he was calling because he had just finished gambling, he was also first presented with the anxiety subscale, and asked to respond in relation to how he currently felt. He was then asked to state the types of gambling he had just finished, and to enter the time at which he started and finished the current episode. Next, the anxiety subscale was re-administered, but this time the caller was asked to respond in relation to how he had felt during the gambling episode. Callers were then asked how much money they had won or lost and whether they thought they would gamble again in the next 24 hours. Finally, they were asked whether they had called when they had had the urge for the episode they were now reporting and, if they had not, were asked to state why they had wanted to gamble. They were then thanked and the call was terminated.

When participants returned for debriefing, they were again given the paper and pencil version of the anxiety subscale, and asked questions on the amount of money they thought they had won or lost during the study period. They were also questioned about their use of the telephone and any problems were noted. They were then paid and thanked for participating.

Results

Data from the questionnaires (pre- and post-study) and from the telephone calls during the testing period (with the urge to gamble and after gambling) were collated. Voice recordings were also transcribed and categorized where appropriate.

All the gamblers taking part in the study had reported gambling at least once a week in the initial questionnaire, confirming criteria for selection. The mean number of gambling forms they claimed to participate in was 4 ($SD = 1.7$). The mean amount reported spent on gambling in the last year was £785 ($SD = £728$). In relation to impairment of control of gambling questions, the mean score was 6.6 ($SD = 3.5$). Twelve participants scored 5 or more, which means that they would meet the criterion for pathological gambling according to the South Oaks Gambling Screen (SOGS Lesieur & Blume, 1987) and Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition DSM-IV (American Psychiatric Association, 1994). For the dissociation questions the mean score was 23.2 ($SD = 3.3$). Correlations between these variables are displayed in Table 1.

Overall, 148 individual telephone calls were recorded (63 calls with the urge to gamble and 85 calls after gambling). On average, participants called in 3.71 times ($SD = 2.34$) with the urge to gamble and 4.72 times ($SD = 2.14$) after a gambling episode.

Table 1. Pearson product-moment correlations (two-tailed significance) between variables related to impairment of control and other measures recorded at initial meeting with participants

	Impairment of control	Frequency of gambling	No. of forms participated in	Episode length	Jacobs' dissociation
Frequency of gambling	.50*				
No. of forms participated in	.15	.09			
Episode length	.63**	.19	.32		
Jacobs dissociation	.72**	.63**	.05	.48	
Total Spielberger score	.21	.11	.28	.33	.40

*$p < .05$; **$p < .01$.

The number of gambling episodes reported corresponded with the frequency of gambling indicated in the initial questionnaire for all but three of the participants. In one case the frequency of gambling was higher, and in two cases lower, than had been claimed at the initial interview.

The forms of gambling reported in the calls were as follows: there were 33 episodes of gambling on fruit machines; 25 on horse racing; 11 on lotteries; 9 on football matches; 8 on scratch cards; 3 on dog racing; 2 on each of quiz machines, pool games and card games; and 1 on each of motor racing, gambling machines and on the result of a general election. These figures include data from 12 calls in which multiple forms were reported in a single episode. In all other cases only a single form was reported per episode.

In the 33 cases where we were able to relate a specific call about the urge to gamble with a subsequent call about having finished a gambling episode, the median interval between the time at which the *urge* call was received and the time at which the participant reported starting to gamble in the subsequent *finished* call was 25 minutes (minimum = 0 min, maximum = 3 h and 35 min, inter-quartile range = 1 h).

The 81 finished calls with valid or adjusted[2] stop times allowed us to calculate a median delay of 1 hour and 5 minutes (minimum = 0 min, maximum = 22 h and 54 min, inter-quartile range = 10 h and 24 min) between the end of a gambling episode and the time that the computer received the call.

There were 76 finished calls for which both the start and stop times were valid or could be adjusted.[2] From these we were able to calculate a median episode duration of 34 minutes (minimum = 4 min, maximum = 6 h, inter-quartile range = 2 h and 12 min). This can be compared with the median value of 11–30 minutes (from a choice of 0–10, 11–30, and 30–60 min, and 1–2 and more than 2 h) for participants' own estimates of the duration of a typical gambling episode given in response to the initial questionnaire.

In 63 urge calls the mean amount of money intended to bet was £9.84 (*SD* = £13.10). This corresponds well with the median for participants' estimates of the typical amount they would spend per session of £6–10 (from a choice of £1–5, £6–10, £11–25, £26–50, £51–100, and over £100) given in the initial questionnaire.

Out of an overall 85 finished calls, there were 30 cases in which the caller claimed to have ended the episode with more money than they started, and 47 episodes where an overall loss was reported. In the remaining eight calls no overall gain or loss was reported. The mean reported gain was £21.70 (*SD* = 32.94) and the mean reported loss was £7.55 (*SD* = £7.33). One call was excluded as the claim of a win of £500 in 1 hour playing fruit machines seemed likely to have resulted from mis-keying.

Three of the 63 calls with the urge to gamble were terminated before the reasons for wanting to gamble were recorded. The percentage of each response to the statements on reasons for gambling in the remaining calls is given in Table 2.

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[2] *Some of the entries for the start and finish times of gambling episodes were either adjusted or dropped because they did not represent valid times. Eight of the start times given were actually prior to the time of the urge call that preceded them. For six of these the discrepancy was less then 10 minutes. These were assumed to be a result of timing inaccuracy and were adjusted to the actual time of the urge call for analysis. In the two cases where the discrepancy was greater than 10 minutes the data were dropped. In one further case, the digits entered did not represent a valid time. This entry was also dropped. Five of the times at which the finished calls were received were up to 10 minutes earlier than the stop times reported in those same calls. Again, this was assumed to be due to timing inaccuracy and these times were adjusted to the reported stop time in the analysis. In two cases where the discrepancy was greater than 10 minutes the data were dropped. In one case, the digits entered did not represent a valid time and this was dropped.*

Table 2. Percentage of each response to statements on reasons for wanting to gamble, taken from
$N = 60$ urge calls

	Response				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Because I think I will win money	8.33	6.67	15.00	53.33	16.67
Because it is enjoyable	1.67	10.00	25.00	43.33	20.00
Because I need a change of scene	23.33	40.00	15.00	10.00	11.67
To feel better	33.33	26.67	25.00	8.33	6.67

Table 2 shows that 70% either agreed or strongly agreed with the statement, 'I want to gamble because I think I will win money'. For the statement, 'I want to gamble because it is enjoyable', 63.33% either agreed or strongly agreed and 36.67% either were not sure, disagreed or strongly disagreed. Sixty-three per cent disagreed or strongly disagreed with the statement, 'I want to gamble because I need a change of scene'. Only 15% agreed or strongly agreed with the statement, 'I want to gamble to feel better'. Sixty per cent disagreed or strongly disagreed with this statement.

The subjective anxiety/arousal scores, as measured by the subscale of the State portion of the Spielberger State-Trait Anxiety Inventory, were compared at baselines (questionnaire scores at screening and on debriefing) to the scores reported over the telephone when participants had the urge to gamble, and to their reports of how they had felt during gambling, and to their reports of how they currently felt when they called in after gambling. A one-way ANOVA revealed a significant difference in these mood state scores, $F(4, 64) = 11.21$, $p < .01$. The means are displayed in Figure 1. Follow-up analyses using Newman–Keuls tests with $\alpha = .05$ revealed that subjective anxiety/arousal scores during gambling were significantly higher than scores at any other point. Scores after gambling were also significantly higher than scores at both baselines, but not significantly higher than scores for the urge to gamble.
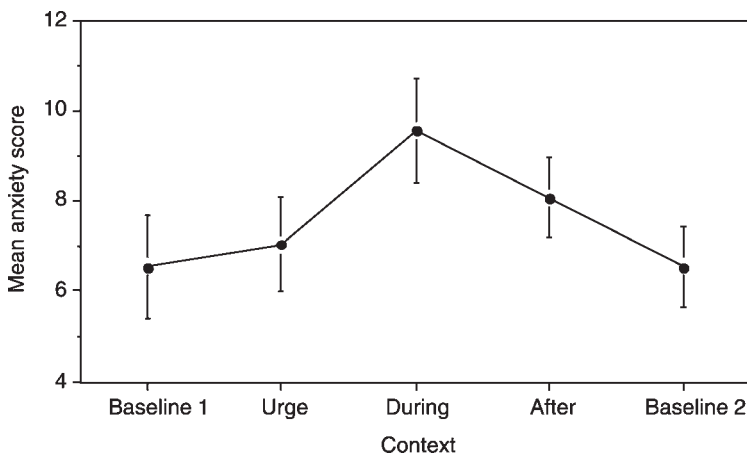

Figure 1. Mean score ($\pm$ 95% confidence intervals, $N = 17$) on the anxiety subscale taken from the initial briefing (Baseline 1), from calls reporting the urge to gamble (Urge), from calls made after gambling reporting state during the episode (During) and at the time of the call (After), and from the final debriefing meeting (Baseline 2).

Most participants called in more than once, and we were able to identify 11 participants who called both before, during, and after a win, and before, during, and after a loss. It was therefore possible to carry out a within-subjects analysis of changes in subjective anxiety/arousal levels as a function of winning versus losing. To take account of subjective anxiety/arousal levels existing prior to the gambling episodes, the score while feeling the urge to gamble was subtracted from the score during gambling, and also from the score after gambling. The resulting figures gave the change in subjective anxiety/arousal from the urge state to during gambling, and to after both a winning and a losing gamble. For the during gambling data, both winning ($M = 0.98$, $SD = 1.82$) and losing ($M = 2.54$, $SD = 3.02$) were associated with an increase in subjective anxiety/arousal. Although losing was associated with a larger change, this difference was not statistically significant, $t(10) = 1.33$, $p = .11$, one-tailed. For the after data, wins were associated with a decrease in subjective anxiety/arousal over the urge state of nearly two points ($M = -1.79$, $SD = 3.28$), and losses with a small increase ($M = 0.57$, $SD = 1.84$). This difference fell at the margin of statistical significance, $t(10) = 1.76$, $p = .05$, one-tailed.

It was also of interest to examine correlations between subjective anxiety/arousal levels, changes in subjective anxiety/arousal levels, and the clustering of variables associated with impairment of control. These correlations are displayed in Table 3. Absolute subjective anxiety/arousal scores during the two baselines and during the urge to gamble correlated with total Spielberger scores as expected. However, total Spielberger scores did not correlate significantly with absolute subjective anxiety/ arousal scores either during gambling or after gambling. Subjective anxiety/arousal levels during gambling and after gambling correlated significantly with Jacobs' dissociation and with impairment of control. However, subjective anxiety/arousal during the urge to gamble only correlated with Jacobs' dissociation measure. Finally, change in subjective anxiety/arousal levels only correlated with the total Spielberger score (negatively).

Discussion

As this study was the first to use mobile telephone technology to collect data on gambling, it is important to assess the value of this new technique. Only one of our participants withdrew from the study because he felt uncomfortable with the use of a mobile telephone. This participant was actually the oldest participant recruited and also the only one who had rarely used a mobile telephone before. All the other participants reported that they felt comfortable using the keypad to enter data, and in responding to instructions given by the pre-recorded voice.

Self-reports of feelings and intentions when experiencing the urge to gamble or subsequent to gambling were given while participants were actually in those states. However, delays between behaviour and self-report were not entirely eliminated in the present study. Reporting of mood state during gambling, by necessity, had to occur when gamblers phoned in after they had gambled. In that sense, it could be argued that the use of the methodology for 'during gambling' responses is no better than self-report in a questionnaire form. However, gamblers at least phoned in soon after each gambling episode (typically within about 1 hour), and therefore memory for how they felt during gambling is not so likely to have been affected by distortions that occur through the passage of time.

Table 3. Pearson product-moment correlations (two-tailed) between variables related to anxiety and variables related to impairment of control

	Anxiety baseline 1[a]	Anxiety baseline 2	Anxiety during urge	Anxiety during gambling	Anxiety after gambling	Change in anxiety 1 (urge-during)	Change in anxiety 2 (during-after)	Total Spielberger score	Impaired control questions
Anxiety baseline 2[a]	.61**								
Anxiety during urge	.60*	.37							
Anxiety during gambling	.33	−.03	.43						
Anxiety after gambling	.31	−.10	.35	.82***					
Change in anxiety (urge-during)	−.57*	−.55*	−.14	.58*	.45				
Change in anxiety (during-after)	−.82**	−.65**	−.31	.28	.44	.86***			
Total Spielberger score	.75**	.53*	.52*	.33	.23	−.36	−.53*		
Impaired control questions	.22	.21	.41	.67**	.53*	.39	.18	.21	
Jacobs' dissociation	.47	.61*	.68**	.59*	.52*	.11	−.07	.40	.72**

$*p < .05$; $**p < .01$; $***p < .001$.

[a] Anxiety baseline 1 was the measurement of the short form of the Spielberger State–Trait Anxiety Inventory (STAI) state subscale at the initial meeting and anxiety baseline 2 was measured at the debriefing session.

While we have no direct way of assessing the validity of the data collected in the calls, the frequency of gambling and the reported amounts bet per episode closely matched the data from the conventional questionnaires. The episode durations reported in the calls were slightly longer, but we were not able to determine whether these were more or less accurate. Nevertheless, it might be expected that the call data would be more representative of reality because it was derived from memory for a recent specific episode and so did not encourage the gambler to abstract across a number of episodes. This is in marked contrast with the type of data that would result from conventional interview techniques, and is also likely to be more informative regarding specific events that relate to mood state.

Turning to the rest of the data, the 17 participants were all regular players (playing at least once a week, and frequently more than that) participating in gambling forms in addition to (or other than) the national lottery and pools, which included extensive play of fruit machines and horse racing gambling (or a combination of these). In relation to impairment of control of gambling behaviour, 12 of the participants scored 5 or more on the impairment of control questions, which is comparable to the identification of those participants as problem gamblers in the SOGS and DSM-IV. Therefore, the sample includes frequent gamblers who have not lost control and gamblers who clearly have lost control.

The tracking of subjective anxiety/arousal levels before, during and after gambling has provided the first reliable evidence in the field that gamblers actually feel more anxious/subjectively aroused during and after gambling than they do before gambling or at baseline. This data supports the findings of Hills *et al.* (2001); it appears to be more consistent with the view that gambling causes depression rather than the other way around. This is lent further credence by the data on reasons for wanting to gamble given during the urge calls. Unsurprisingly, most gave the possibility of winning money as an important reason, but only 15% indicated that they were motivated by a desire to feel better.

Winning and losing episodes revealed that gamblers who lose experience an increase in subjective anxiety/arousal levels after the gambling episode has finished, while those who win experience a decrease in subjective anxiety/arousal levels. Given that the majority of gamblers leave the gambling setting after a loss, it is unsurprising that high levels of subjective anxiety/arousal are predominant after gambling has taken place.

In the present study, for the first time the relationship between impairment of control, dissociation, and subjective anxiety/arousal levels at various times during and outside the gambling process has been uncovered. It is useful to separate out subjective anxiety/arousal levels at baseline (both the short version of the STAI state and the full STAI trait scores), subjective anxiety/arousal levels before (urge), during and after gambling, and changes in subjective anxiety/arousal levels during gambling. In relation to absolute subjective anxiety/arousal levels during the gambling process, subjective anxiety/arousal levels during and after gambling correlated with impairment of control and Jacobs' dissociation questions. This presents the first evidence that high levels of subjective anxiety/arousal during gambling are associated with dissociation during the gambling task, being cut off from normal conscious thoughts (see also Diskin & Hodgins, 2001). However, subjective anxiety/arousal levels during the urge to gamble only correlated with the Jacobs' dissociation measure. Furthermore, changes in subjective anxiety/arousal levels did not correlate with dissociation or impairment of control. It would be somewhat premature to speculate about what these patterns mean. However, it is clear that the factors associated with subjective anxiety/arousal levels

during the urge to gamble, subjective anxiety/arousal levels during play, and change in subjective anxiety/arousal levels during play are somewhat different. Much more detailed analyses of what is happening at various points during the gambling process are necessitated.

The method of using mobile telephones is likely to have a range of other applications in gambling and other addiction settings. For example, those working with problem gamblers might be able to use the system to gain accurate data on client behaviour. Perhaps more importantly, the system could also be set to provide therapeutic advice that is tailored to individual clients, on demand. Someone feeling a strong urge to engage in a problem behaviour, or to place themselves in a context where the risk of relapse is high, could use the telephone to report their condition and to listen to pre-recorded instructions or advice from their therapist.

In summary, we believe the method shows promise as a way to minimize or eliminate delays between the occurrence of a behaviour or state, and the reporting of that occurrence. It also provides a way of gaining information on gambling behaviour and beliefs in the field without the need to greatly compromise reliability, reactivity and ecological validity. Furthermore, the results produced by the method suggest that constellations of variables are in operation at different stages in the gambling process, and that the explanation of general anxiety levels during gambling is likely to be different from the explanation for increases in anxiety levels during the gambling process.

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