# City, University of London Institutional Repository

Running head: RESPONSE PERSEVERATION IN PATHOLOGICAL GAMBLERS

A Feedback-Response Pause Normalises

Response Perseveration Deficits in Pathological Gamblers

Stephen J. Thompson

Department of Psychology

Swansea University



Philip J. Corr

Department of Psychology

City University London

Address for Correspondence: Department of Psychology, City University London, Northampton Square, London EC1V 0HB, UK. Email: philip.corr@btopenworld.com

Abstract

A failure to inhibit punished responses is central to problematic gambling. We used a computerised card playing game to determine if this failure can be ameliorated by imposing a delay between feedback from the previous trial and the opportunity to play the next card. We compared two experimental conditions: No pause (Standard task) and a 5-s pause (Pause task). Community-based problematic gamblers (n = 42) were compared with a control group (n = 39). Number of cards played (and cash won/lost) and latency of response were measured. Results shows that, compared to a control group, problematic gamblers perseverated longer and lost more money on the Standard task, but this deficit was abolished by the imposition of a 5-s pause. Results suggest that, by strengthening inhibitory control processes, problematic gambling on computer gaming machines can be significantly reduced by the imposition of a simple short-delay before the next bet.

A Feedback-Response Pause Normalises

Response Perseveration Deficits in Pathological Gamblers

In many countries around the world, in recent years the prevalence of gambling has markedly increased as a result of the liberalisation of legislation and the resulting greater availability of outlets, including the proliferation of internet-based gaming. Unsurprisingly, pathological gambling has increased too, and this presents a major problem for society and a pressing issue for government policy. While many definitions of 'pathological gambling' exist, there is agreement that the consequences disrupt, compromise and/or damage personal, occupational, family and/or recreational pursuits (Griffiths, 2004). For example, since the most recently amended legislation of UK gambling activity (Gambling Act, 2005) dramatically relaxed rules and restrictions on gambling outlets and advertising in the UK, results from the British Gambling Prevalence Survey (BGPS) 2010 points to an increase in the percentage of pathological gamblers in the UK adult population, from 0.6% in 1999 and 2007 to 0.9% in 2010 (Wardle et al., 2011). These trends are not limited to the UK – national official review bodies in the USA and Australia have concluded that increased availability leads to more gambling and, thus, an increase in the number of pathological gamblers (National Research Council, 1999; Productivity Commission, 2010).

Internet gambling poses it own problems as it is especially prone to foster pathological gaming because of the nature of the gaming environment. Not only is this form of gambling usually done in private, and is thus less constrained by social influences found in the typical ambient environment of real situations, but it affords much faster response times as the usual constraints of real-life gambling conditions (e.g., speed of dealer and delay imposed by the actions of other gambling on, for example, the Blackjack table) are not present. In addition to internet-based gambling, computerised gambling is wide-spread in casinos. These forms of gambling are not thought to be any different from other forms of gambling (e.g., a real roulette table). Empirically-informed design features of these virtual gambling environments provide one way to address this problem. In this paper, one such feature is examined: The time delay between response feedback and next response.

For research purposes, computerised games offer the opportunity to study gambling in a controlled laboratory environment, especially their underlying motivational dynamics. One such game is the card perseveration (CP) task (Newman, Patterson, & Kosson, 1987) which is designed to assess the ability of an individual to adjust a previously rewarded response to a decreasing rate of reward and increasing rate of punishment. Specifically, the CP task is used to assess response perseveration (RP; i.e., a lack of response inhibition), which is 'the tendency to persist in making previously rewarded responses that have become maladaptive (i.e. punished)' (Vitaro, Arseneault, & Tremblay, 1999, p. 569). To perform well on the CP task requires 'response modulation' (Newman & Lorenz, 2003), described by Newman and Wallace (1993, p. 700) as entailing 'a brief shift of attention from the organization and implementation of goal-directed behavior to stimulus evaluation'. Failure of response modulation results in poor performance on the CP task, resulting from perseveration: Continuing to play when the ratio of wins to losses is clearly no longer positive (Newman et al., 1987).

In a study exploring manipulations that might reduce RP in disinhibited individuals, Newman et al. (1987) administered the task to a group of psychopaths and to a group of non-psychopaths under three different conditions: (1) With immediate feedback only (i.e., 'standard' task); (2) with a display illustrating their cumulative response feedback; and (3) with a display illustrating their cumulative response feedback accompanied by a 5-s waiting period during which participants were prevented from making their next response – this last manipulation was based on previous research (Patterson, Kosson, & Newman, 1987) which indicated that disinhibited participants, including psychopaths, are less likely than controls to pause after receiving negative feedback and that this failure to pause is related to poorer punishment-related learning.

Newman et al.'s (1987) results showed that the group of psychopaths played significantly more cards and lost more money (i.e., displayed a greater RP) than did the group of non-psychopaths when the task involved immediate feedback only. The addition of a display illustrating participants' cumulative feedback did little to reduce this difference. However, when participants played the task with a

cumulative feedback display accompanied by a 5-s waiting period, during which they were prevented from making another response, no group differences were found. These results also showed that the control group played fewer cards and won more money in this third condition than they did in immediate feedback only condition.

In accordance with a wealth of experimental evidence in the animal (Gray & McNaughton, 2000) and human (Corr, 2004) literatures, there are a number of inter-locking processes that link inhibitory control processes, arousal and impaired responding in the face of punishment to the typical forms of behaviour seen in pathological gambling. First, punishment leads to an induction of arousal and this arousal potentiates ongoing dominant responses (e.g., making rapid bets). Secondly, and in opposition to the effects of arousal, punishment lead to an inhibition of ongoing behaviour. However, when the induction of arousal exerts a greater effect than the inhibition of responding then we see, somewhat paradoxically, an increase in the frequency and strength of the ongoing behaviour that is leading to punishment. In addition, there is a related process which contributes to response modulation deficit, namely 'relieving nonpunishment', which relates to the rewarding effects of the omission/termination of expected punishment – in gambling, a win is much more than an isolated outcome as its motivational power comes, in some measure, from the fact that is it also signals the absence of expected punishment (which is known to resemble the positively reinforcing effects of reward itself). Thus, the positive motivational effects of a win is, in a manner of speaking, emotionally super-charged by the omission of a loss, which will be potentiated further by induction of arousal.

These effects have been well established in the experimental animal literature (e.g., Gray & Smith, 1969) and can readily be extended to human, including gambling, behaviour (McNaughton & Corr, 2009). Theoretically, the imposition of a time delay before the next bet can be seen as a circuit breaker in the motivation system that reflects these processes.

Consistent with claims that dysfunctional gambling is related to 'behavioural disinhibition' (McCormick, 1993), work on the standard version of the CP task has revealed that this class of gamblers perseverate longer (i.e., demonstrate weaker response inhibition) compared to controls (Goudriaan,

Oosterlaan, de Beurs, & van den Brink, 2005). The authors explained their findings as evidence that pathological gambling is related to deficient feedback processing following losses on the CP task: The normal control group deliberated longer about whether to continue or to quit playing the task after experiencing a loss than did the pathological gambling group. These empirical findings are in conformity with the theoretical considerations discussed above.

Since it is possible to reduce psychopaths' (another group, like pathological gamblers, characterised by disinhibited behaviour) RP on the CP task by imposing a delay between feedback and their next response (Newman et al., 1987), it seems plausible that pathological gamblers' relative perseverative deficit, too, might be shown to be reduced in a similar manner. Such a finding could have potentially valuable implications for informing practice in the treatment of pathological gambling. However, no previous research has investigated the effect of a forced 5-s waiting period following response feedback on pathological gamblers' n+1 trial performance.

This study investigated RP in pathological gamblers compared to non-problem gambling controls. The aim of this study was to investigate pathological gamblers' performance on the 'Standard' and 'Pause' CP tasks. If found to be effective in reducing the RP of pathological gamblers, this outcome could hold important implication for both the design of gaming environment to prevent the development of pathological gambling behaviour as well as the treatment of existing pathological gambling.

*Hypotheses*

Based on previous research demonstrating that pathological gamblers perseverated longer on the CP task compared to normal controls (Goudriaan et al., 2005), it was predicted that this same effect should be observed on the Standard task in the present study. In addition, it was predicted that the forced 5-s pause following response feedback on the 'Pause' version of the task should reduce pathological gamblers' relative RP deficit. This prediction was based on previous research showing that, while psychopaths perseverated to a greater degree than non-psychopaths on the standard CP task, there were no group differences when participants played the task with a cumulative feedback display accompanied by a 5-s waiting period during which they were prevented from making another response (Newman et al.,

1987). No predictions were made concerning response latency following wins and losses; these data are analysed and presented for completeness.

Method

*Participants*

Forty-two participants (40 males, 2 females) recruited from a betting shop (bookmakers) in the city of Swansea, UK, and scoring in excess of 4 on the SOGS (Lesieur & Blume, 1987), composed the pathological gambling (PG) group. With the permission of the shop manager, gamblers were approached instore and asked to participate. Thirty-nine non-problem gambling control participants (19 males, 20 females) were drawn from the general public in the City of Swansea; they were recruited from an existing participant pool. They also completed the SOGS and had to score below 3 to be included in the study. Ages ranged between 18 and 48 years (mean = 25.02, S.D. = 7.35) for the pathological gambling group and between 18 and 53 years (mean = 24.85, S.D. = 8.90) for the control group. The two groups were matched on age: There was no significant difference in age between the two groups, $t(79) = 0.10$, $p > .05$. As expected, there was a significant difference in SOGS scores between the PG group (mean = 9.07, S.D. = 2.86) and the control group (mean = 0.74, S.D. = 0.79), $t(47.60) = 18.16$, $p < .01$. All were paid £15 cash for participating.

*Materials*

Two computer-based card perseveration (CP) tasks, designed in VB.net, were used to measure Response Perseveration (RP): (1) A task with no forced pause between cards drawn (Standard task); and (2) a task with a forced 5-s pause between each card drawn (Pause task).

The standard CP task was similar to that used by Newman et al. (1987). It consisted of a deck of 100 playing cards, including picture cards (i.e., Jack, Queen, King or Ace) and number cards (i.e., 2-10) presented face down on a computer screen. Participants were seated approximately 50-cm in front of the screen. As well as the deck of cards, a 'Draw' button and an 'Exit' button were displayed on the right-hand side of the computer screen. The amount of cash in dollars available to the participant throughout the task was presented on the computer screen, below the deck of cards on the bottom left-hand side of

the screen. Unlike Newman et al.'s tasks, the participant was not playing to keep the amount of cash they won. Instead, and in order to motivate them, they were told prior to the task that the amount of cash they won would be compared with the average winnings on the task and that if a picture card was drawn then they would win $10, but if a number card was drawn they would lose $10. They were informed it was not a normal deck of cards and they could click on the exit button to end the game at any point to exist with their winnings.

The task was programmed to display playing cards face-up, one at a time, each time the participant clicked on the 'Draw' button until either (1) the participant clicked on the 'Exit' button to end the task, or (2) 100 cards had been played. Each time the participant drew a picture card the computer displayed the message 'You Win!' and $10 was added to the participant's cash balance. Each time the participant drew a number card the message 'You Lose' was displayed on the screen and $10 was subtracted from their cash balance.

Participants began the task with $100. The 100 cards were arranged in a pre-programmed order so that the probability of drawing a winning (picture) card decreased by 10% after every block of 10 cards. The probability of drawing a winning card was set at 90% for the first block of 10 cards and so decreased to 0% for the final block of 10 cards. The order of the picture and number cards was random within each block of 10 cards, and different random orders were administered to each participant. The participant won the greatest amount of cash ($350) if they clicked on the 'Exit' button after drawing approximately half of the cards, before the probability of losing became greater than the probability of winning. If the participant drew all 100 of the cards, they lost all of their winnings, including the $100 with which they began the task.

The forced Pause version of the task was introduced in the same manner as the Standard task. It differed only in the fact that it contained a 5-s interval between response feedback (i.e., the card being shown face-up and cash being added/subtracted accordingly) and the presentation of the next opportunity to respond (i.e., the 'Draw' button being available to click on). This 5-s interval was accompanied by the text "Please Wait…" displayed on the computer screen below the deck of cards (see Figure 1). This 5-s

interval was imposed in an attempt to disrupt participants' response set and to increase their attention to response feedback on each trial (i.e., whether they won cash or lost cash and how much cash they had remaining).

The two dependent measures of task performance were: (1) Number of cards played; and (2) amount of cash won/lost. A greater number of cards played and a smaller amount of cash won indicated greater RP. Two other dependent measures were also analysed: (1) Response latency following wins; and (2) response latency following losses (i.e., before they drew the next card).

*Gambling Questionnaire*

The South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987) is a sensitive measure of gambling severity comprising 20 items relevant to the Diagnostic and Statistical Manual of Mental Disorders fourth edition (*DSM-IV*; American Psychiatric Association; APA, 1994) criteria for pathological gambling. It is the most widely used diagnostic tool for identifying pathological gamblers (score of 5 or greater) and problem gamblers (score of 3 or 4), has been validated by cross-tabulating scores with both family members' assessments and counsellors' individual ratings and has demonstrated satisfactory validity and reliability both in gambling treatment samples and in the general population (e.g., Stinchfield, 2002). Scores in excess of 4 are frequently correlated with abnormal patterns of gambling (Dixon, Marley, & Jacobs, 2003).

*Procedure.* On arrival at the laboratory, participants read a detailed explanation of the study and signed a declaration of informed consent. Then they individually completed the SOGS, followed by the CP tasks. The order of the two CP tasks was counterbalanced in an attempt to minimize the impact of any carry-over effects. Participants were instructed to follow written instructions provided at the beginning of each task. On completion of the final task, participants were debriefed, thanked and paid £15 cash. Procedures were approved by the Swansea University Department of Psychology Ethics Committee.

*Results*

Performance data for the two groups are shown in Table 1.

*Group differences in response perseveration (RP) on the Standard task.*

The two Groups differed in terms of the amount of cash won, $F(1, 77) = 4.46$, $p < .05$, and near significantly in terms of number of cards played, $F(1, 77) = 3.16$, $p = .08$. As shown in Table 1, the pathological gamblers group played a higher number of cards and won a smaller amount of cash (i.e., they showed greater RP) on the Standard task than the control group. This finding is in conformity with prediction.

----------------------

Table 1 about here

----------------------

*Group differences in response perseveration (RP) across tasks.*

The two versions of the CP task differed in terms of the number of cards played, $F(1, 77) = 110.50$, $p < .01$, and, as expected, the amount of cash won, $F(1, 77) = 63.88$, $p < .01$. In addition, and of most importance, there was a Group $\times$ Task interaction involving the amount of cash won, $F(1, 77) = 7.77$, $p < .01$, and a near significant Group $\times$ Task interaction involving number of cards played, $F(1, 77) = 2.98$, $p = .09$. These interactions are plotted in Figures 1 and 2, respectively, and show that, as predicted, the Pause task reduced the pathological gambling group's relative perseverative deficit.

-----------------------------

Figures 1 & 2 about here

-----------------------------

*Effects of wins/losses on response latency.*

For completeness, we analysed the effects of Task and Group on response latencies following wins and losses. Several participants (two in the PG group and five in the control group on the Standard task and three in the PG group and two in the control group on the Pause task) exited very early in play,

producing very few reaction times after losses, and so they were excluded from further analysis, reducing

the sample size to 74 on the Standard task (40 in the PG group, 34 in the control group) and 76 on the

Pause task (39 in the PG group, 37 in the control group).

A significant main effect of Outcome was revealed on the Standard task, $F(1, 70) = 7.93$, $p < .01$.

Examination of the means in Table 1 indicates that, for both groups, mean response latency was faster

following losses than following wins, consistent with prediction. No other main or interaction effects

were significant, $p > .05$.

A significant main effect of Outcome was revealed on the Pause task, $F(1, 72) = 12.53$, $p < .01$.

Examination of Table 1 indicates that, for both groups, mean response latency was again faster following

losses than following wins. No other main or interaction effects were significant, $p > .05$.

## Discussion

The aim of this study was to explore the effects of imposing a pause between feedback and

response on an experimental task designed to model real-world gambling behaviour, and to examine if

this added pause would reduce the response perseveration (RP) deficit seen in pathological gamblers in

the standard version of the task. RP deficits were measured in terms of number of cards played and cash

won/lost). Results confirmed that the imposition of such a Pause had significant effects on RP, overall

reducing the total number of cards played and money lost, and this pause abolished the response

modulation deficit seen in the pathological gamblers in the standard version of the task. Thus, such a

pause seems to disrupt preservative response set and allows a period of time for reflection – in the words

of Newman and Wallace (1993, p. 700), allowing 'a brief shift of attention from the organization and

implementation of goal-directed behavior to stimulus evaluation'.

This interpretation is supported by the fact that, unlike the Newman et al (1987) study, cumulative

feedback was not delivered during this time for reflection. These results are of theoretical significance

and, potentially, of practical importance.

Failure to pause following punishment has been shown to be related to poorer learning from

punished errors (Patterson et al., 1987). Therefore, it seems likely that increasing the time period between

bet outcome and initiation of another bet on other types of gambling tasks, on which it has been shown that losing (i.e., punishing) trials result in faster initiation of the start of the consecutive trial (i.e., faster betting) than winning trials (e.g., video poker simulations (Dixon & Schreiber, 2002) and slot machines (Dixon & Schreiber, 2004; Schreiber & Dixon, 2001), should moderate maladaptive gambling behaviour in a similar manner to that demonstrated on the pause version of the CP task in the present research.

In terms of practical implications, gambling environments, especially the virtual types that populate the internet, could be redesigned to force a pause between bets. Imposing such a pause between feedback and response, to allow a moment of reflection might be a simple but effective means to modulate behaviour that reduces response preservation and, thus, retards the development of problematic gambling (McNaughton & Corr, 2009). This means might be of special significance in internet gambling where speed of response is not limited by constraining factors of the ambient environment (e.g., the natural response delay imposed by the action of other players).

In terms of treatment implications, pathological gamblers could be instructed (or conditioned) to count to five and to check the amount of money they have remaining to gamble following the outcome of every bet placed, with the expectation that this 5-s pause should result in greater attention to response feedback following each bet placed (i.e., whether it was a win or a loss, how much money was won/lost, and how much money remains to gamble with). This period of reflection may lead to an earlier termination of gambling behaviour in the presence of unfavourable odds. In theoretical terms, this reflection would entail the activation of controlled-attentional processes as opposed to habitual prepotent automatic reactions (Corr, 2010); by this means, automatic responses could be relearned to be more responsive to the changing ratios of wins and losses.

Turning to the potential limitations of this study, the lack of monetary rewards/punishments, unlike real commercial gambling games, is one issue. However, participants did respond to the task conditions as expected. It might be the case that the effects and associations observed would be even stronger with more psychologically engaging incentives. In any event, clearly greater ecological validity would have been achieved with the use of monetary task contingencies, providing participants with the opportunity to

win, lose, and keep real cash winnings. In addition, the use of a predominantly male pathological gambling sample (due to the fact that most pathological gamblers who use public betting environments are more frequently males), all of whom were recruited from a single betting shop (i.e., bookmakers) in Swansea City, UK, limits the generalisibility of the findings. It is, therefore, recommended that future studies should recruit pathological gamblers from a more diverse population and include more females. In any such study, it would be important to subdivide these broad samples and assess any differences between subgroups since gender and cross-cultural differences in pathological gambling have been documented in the literature (Goudriaan et al., 2005; Raylu & Oei, 2002). In addition, another limitation was that the pathological gambling group were not screened for co-morbid disorders (e.g., alcohol or substance abuse or dependence, attention deficit/hyperactivity disorder (AD/HD), psychopathy, etc.) and so it could be argued that the effects observed might not have been due to the effects of pathological gambling per se but to the confounding effects of these (potentially present) co-morbid conditions. However, had the pathological gambling group been carefully screened for any and all co-morbid disorders this would have further limited the generalisation of the results to a general  pathological gambling population. In support of the findings, participants did respond to the task conditions as expected and it is not easy to conceive of how these effects and associations could have been a spurious artifact unrelated to the theoretical framing of this study.

In conclusion, our results throw new light upon experimental gambling behaviour, confirming the importance of imposing a short pause between feedback and response especially in the abolition of the response perseveration deficits seen in self-reported pathological gamblers. This delay imposition led to fewer cards played and less cash lost, and it normalised the behaviour of the problematic gamblers. Whether this effect would extend to real-world gaming environments has yet to be tested. The practical implications of such results have yet to be explored, but at least they point in a positive direction, namely the modification of one important aspect of the gambling environment to reduce the development of an addiction that is posing significant problems and costs to many societies around the world.

References

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: American Psychiatric Press.

Corr, P. J. (2004). Reinforcement sensitivity theory and personality. *Neuroscience and Biobehavioural Reviews*, *28*, 317-332.

Corr, P. J. (2010). Automatic and controlled processes in behavioural control: Implications for personality psychology. *European Journal of Personality*, *24*, 376-403.

Dixon, M. R., Marley, J., & Jacobs, E. A. (2003). Delay discounting by pathological gamblers. *Journal of Applied Behavior Analysis*, *36*, 449-458.

Dixon, M. R., & Schreiber, J. (2002). Utilizing a computerized video poker simulation for the collection of experimental data on gambling behavior. *The Psychological Record*, *52*, 417-428.

Dixon, M. R., & Schreiber, J. (2004). Near-miss effects on response latencies and win estimations of slot machine players. *The Psychological Record*, *54*, 335-348.

*Gambling Act 2005*. London: The Stationary Office.

Goudriaan, A. E., Oosterlaan, J., de Beurs, E., & van den Brink, W. (2005). Decision making in pathological gambling: A comparison between pathological gamblers, alcohol dependents, persons with Tourette syndrome and normal controls. *Cognitive Brain Research*, *23*, 137-151.

Griffiths, M. (2004). Betting your life on it. *British Medical Journal*, *329*, 1055-1056.

Gray, J. A., & McNaughton, N. (2000). The Neuropsychology of Anxiety: An enquiry into the functions of the septo-hippocampal system. Oxford: Oxford University Press.

Gray, J. A., & Smith, P. T. (1969). An arousal-decision model for partial reinforcement and discrimination learning. In R. Gilbert & N. S. Sutherland (Eds.), *Animal discrimination learning* (pp. 243-272). London: Academic Press.

Lesieur, H. R., & Blume, S. B. (1987). The South Oaks Gambling Screen (SOGS): A new instrument for the identification of pathological gamblers. *American Journal of Psychiatry*, *144*, 1184-1188.

McCormick, R. A. (1993). Disinhibition and negative affectivity in substance abusers with and without a gambling problem. *Addictive Behaviours*, *18*, 331-336.

McNaughton, N. & Corr, P, J. (2009). Central theories of motivation and emotion. In G. G. Berntson & J. T. Cacioppo (eds), *Handbook of Neuroscience for the Behavioural Sciences* (pp. 710-730). London: Wiley.

National Research Council. (1999). *Pathological gambling: A critical review*. Washington, DC: National Academy Press.

Newman, J. P., & Lorenz, A. (2003). Response modulation and emotion processing: Implications for psychopathy and other dysregulatory psychopathology. In R. J. Davidson, K. Scherer, & H. H. Goldsmith (Eds.) *Handbook of affective sciences* (pp. 1043-1067). Oxford: Oxford University Press.

Newman, J. P., Patterson, C. M., & Kosson, D. S. (1987). Response perseveration in psychopaths. *Journal of Abnormal Psychology*, *96*, 145-148.

Newman, J. P., & Wallace, J. F. (1993). Diverse pathways to deficient self-regulation: Implications for disinhibitory psychopathology in children. *Clinical Psychology Review*, *13*, 699-720.

Patterson, C. M., Kosson, D. S., & Newman, J. P. (1987). Reaction to punishment, reflectivity, and passive avoidance learning in extraverts. *Journal of Personality and Social Psychology*, *52*, 565-567.

Productivity Commission. (2010). *Gambling*. Canberra: Productivity Commission.

Raylu, N., & Oei, T. P .S. (2002). Pathological gambling a comprehensive review. *Clinical Psychology Review*, *22*, 1009-1061.

Schreiber, J., & Dixon, M. R. (2001). Temporal characteristics of behavior on random-ratio schedules observed during slot machine play. *Psychological Reports*, *89*, 67-72.

Stinchfield, R. (2002). Reliability, validity, and classification accuracy of the South Oaks Gambling

Screen (SOGS). *Addictive Behaviors*, *27*, 1-19.

Vitaro, F., Arseneault, L., & Tremblay, R. E. (1999). Impulsivity predicts problem gambling in low SES

adolescent males. *Addiction*, *94*, 565-575.

Wardle, H., Moody, A., Spence, S., Orford, J., Volberg, R., Jotangia, D., et al. (2011). *British Gambling

Prevalence Survey 2010*. London: The Stationary Office.

*Figure 1.* Interaction of amount of cash won across Standard and Pause card perseveration (CP) tasks for the pathological gambling (n = 42) and the control (n = 39) groups.
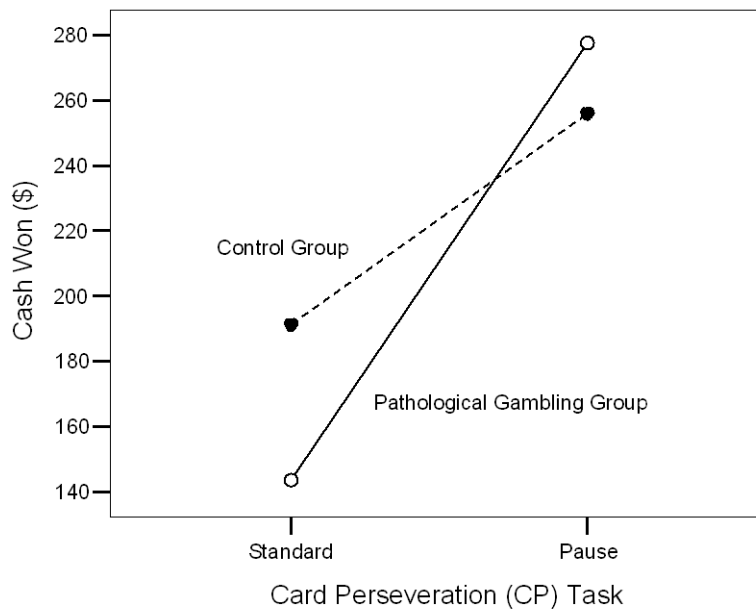
*Figure 2*. Interaction of number of cards played across Standard and Pause card perseveration (CP) tasks for the pathological gambling  (n = 42) and the control (n = 39) groups.
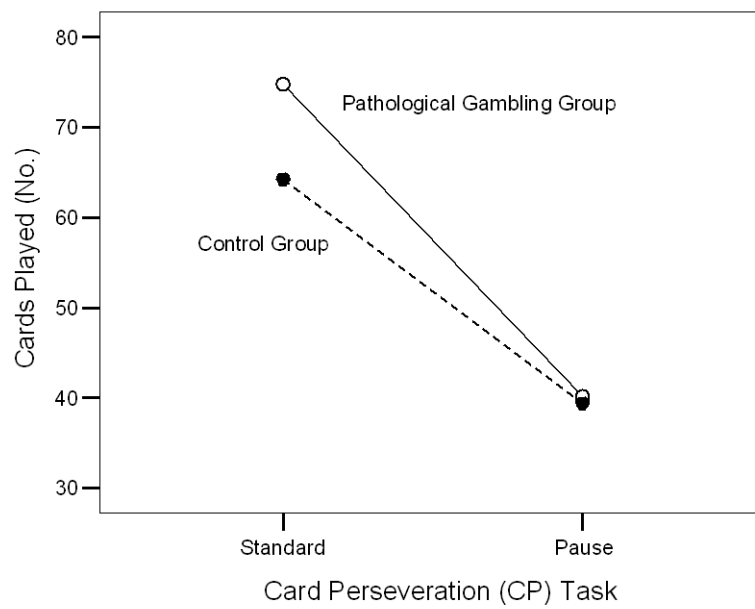
Table 1

*Mean and standard deviation of card perseveration (CP) task performance for both groups across both tasks*

| Measure | Group | Standard | | Pause | |
|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD |
| No. of cards played | PG[a] | 74.79 | 26.09 | 40.19 | 13.77 |
| | Control[b] | 64.13 | 26.98 | 39.28 | 19.27 |
| Cash won ($) | PG[a] | 144 | 106.84 | 278 | 34.98 |
| | Control[b] | 192 | 95.23 | 256 | 56.73 |
| Mean response latency following wins (sec)[c] | PG | 1.71[d] | 0.46[d] | 0.82[b] | 0.27[b] |
| | Control | 1.83[e] | 0.41[e] | 1.03[f] | 0.53[f] |
| Mean response latency following losses (sec)[c] | PG | 1.66[d] | 0.44[d] | 0.74[b] | 0.26[b] |
| | Control | 1.71[e] | 0.38[e] | 0.86[f] | 0.51[f] |

*Note.* PG = pathological gambling group.

[a]n = 42. [b]n = 39. [c]Presented minus the 5-s forced pause on the Pause task. [d]n = 40. [e]n = 34. [f]n = 37.