*Journal of Behavioral Addictions 1(3), pp. 135–139 (2012)*
*DOI: 10.1556/JBA.1.2012.004*

# Tempo in electronic gaming machines affects behavior among at-risk gamblers

RUNE A. MENTZONI[1]*, JON CHRISTIAN LABERG[1], GEIR SCOTT BRUNBORG[2], HELGE MOLDE[1] and STÅLE PALLESEN[1]

[1]Department of Psychosocial Science, University of Bergen, Bergen, Norway
[2]Norwegian Social Research – NOVA, Oslo, Norway

(Received: April 6, 2012; revised manuscript received: July 17, 2012; accepted: July 22, 2012)

*Background and aims:* Electronic gaming machines (EGM) may be a particularly addictive form of gambling, and gambling speed is believed to contribute to the addictive potential of such machines. The aim of the current study was to generate more knowledge concerning speed as a structural characteristic in gambling, by comparing the effects of three different bet-to-outcome intervals (BOI) on gamblers bet-sizes, game evaluations and illusion of control during gambling on a computer simulated slot machine. Furthermore, we investigated whether problem gambling moderates effects of BOI on gambling behavior and cognitions. *Methods:* 62 participants played a computerized slot machine with either fast (400 ms), medium (1700 ms) or slow (3000 ms) BOI. SOGS-R was used to measure pre-existing gambling problems. Mean bet size, game evaluations and illusion of control comprised the dependent variables. *Results:* Gambling speed had no overall effect on either mean bet size, game evaluations or illusion of control, but in the 400 ms condition, at-risk gamblers (SOGS-R score > 0) employed higher bet sizes compared to no-risk (SOGS-R score = 0) gamblers. *Conclusions:* The findings corroborate and elaborate on previous studies and indicate that restrictions on gambling speed may serve as a harm reducing effort for at-risk gamblers.

**Keywords:** gambling, tempo, structural characteristics, behavior, electronic gaming machines

Electronic gaming machines (EGM) are widely regarded as one of the most addictive forms of gambling (Chóliz, 2010), and EGM users are overrepresented among problem gamblers (Productivity Commision, 2010; Volberg, 1997). High percentages of pathological gamblers have been found among EGM users outside of casinos (Cantinotti & Ladouceur, 2008). Furthermore, there is a preponderance of EGM gamblers among patients seeking help for gambling problems (Griffiths, Scarfe & Bellringer, 1999; Productivity Commision, 2010). In Australia, decline in EGM gambling has been suggested as an important factor in the decline in prevalence of problem gambling during the last few years (Productivity Commision, 2010; Volberg, 1997).

Structural characteristics of EGM contributing to increased addictiveness may include fast reel spins and short payout intervals, the presence of bill acceptors, opportunities for large bet-sizes and multiplier potentials, as well as credited wins (Blaszczynski, Sharpe, Walker, Shannon & Coughlan, 2005; Dowling, Smith & Thomas, 2005). A study investigating variations in reel spin speed (3.5 s versus 5 s), maximum bet-size and removal of a high denomination bill acceptor found that neither reduced maximum bet-size nor removal of the bill acceptor had any effect on gamblers' reported satisfaction from playing. Importantly for the present discussion, game tempo showed only small effects on satisfaction and did not seem to influence the gamblers' intentions to gamble (Blaszczynski et al., 2005). Following up on the findings on gaming tempo, another study reported that participants in a condition with a typical bet-to-outcome interval (5 s) played more games and underestimated the number of games played compared to participants who gambled with longer bet-to-outcome intervals (15 s). However, concentration, motivation and loss of control over time or money were not affected, hence the overall effect of bet-to-outcome intervals was limited (Ladouceur & Sévigny, 2006). In sum, these two studies seem to indicate that bet-to-outcome interval has little effect on behavior and cognition in gambling situations.

In contrast, effects of bet-to-outcome interval have more consistently been found in studies of pathological gamblers. For instance, one study comparing quick (2 s) and delayed (10 s) reinforcement among 10 pathological gamblers found that more games were played in the short bet-to-outcome condition (Chóliz, 2010). Another study found that pathological gamblers, but not recreational gamblers, spent more time playing, reported more excitement and a stronger desire to play again if the bet-to-outcome interval was two seconds, compared to three seconds (Linnet, Rømer Thomsen, Møller & Callesen, 2010).

In sum, the degree to which the bet-to-outcome interval affects gambling behavior is not sufficiently investigated. To date, empirical studies of this relationship are sparse, and there is a need for studies comparing short and immediate bet-to-outcome intervals to intervals that are longer but still commonly found in commercial gambling products. This is of particular importance since none of the previous studies have investigated intervals that were shorter than two seconds. Furthermore, bet-to-outcome intervals that are typically found in naturalistic settings (2–5 s) have only been compared with long intervals that are rarely found outside of the laboratory (10–15 s).

The term *illusion of control* was originally defined by Langer and Roth (1975) as "the perception of control over objectively chance-determined events" (p. 951). Since then, several studies have indicated that illusion of control is a phenomenon that might serve as a risk factor for the development of problem gambling (for a review of the research,

* Corresponding author; Rune A. Mentzoni, Department of Psychosocial Science, Christiesgt 12, NO-5020 Bergen, Norway; Phone: +47 55588679; E-mail: rune.mentzoni@psysp.uib.no

see Johansson, Grant, Kim, Odlaug & Gotestam, 2009). Still, empirical research into how structural characteristics in gambling might moderate gamblers' level of illusion of control has been largely absent. One study revealed that the presence of a stopping device contributed to the development of illusion of control among slot machine players (Ladouceur & Sévigny, 2005). However, to the best of our knowledge, no study has yet been conducted in which the effect of gambling speed on players' illusion of control has been investigated.

The aim of the current study was to generate more knowledge concerning speed as a structural characteristic in gambling, by comparing the effects of three different bet-to-outcome intervals (BOI; 400 ms, 1700 ms and 3000 ms, respectively) on gamblers bet-sizes, game evaluations and illusion of control during gambling on a computer simulated slot machine. Furthermore, we investigated whether problem gambling moderates effects of BOI on gambling behavior and cognitions.

We hypothesized that problem gambling would be associated with larger bet size and stronger illusions of control. Further, we hypothesized that faster BOI would be associated with larger bet-size, and that this effect would be stronger among participants scoring as problem gamblers. Investigations of game evaluations and of the relationship between BOI and illusion of control were exploratory, and no hypotheses were posited regarding these aspects.

## METHODS

### *Participants*

A total of 62 participants were recruited, 31 were male and 31 female. Age ranged from 18 to 38 years, with a mean of 20.8 years (*SD* = 3.26). All participants were undergraduate psychology students from the University of Bergen. Participants volunteered to take part after being informed that the experiment would involve a computerized gambling task, that startup credit would be provided for gambling, and that 10% of the amount that remained upon completion of the gambling task would be paid out in cash as a reward. No details were given about the specific contents of the gambling task, or about chances of winning. All participants were naive about the specific purpose of the experiment. The study was approved by the Regional Committee for Medical Research Ethics, Health Region West, Norway.

### *Apparatus and materials*

*Gambling simulation.* The gambling simulation software, "The Hordaland Slot Machine" (first used in Brunborg, Johnsen, Mentzoni, Molde & Pallesen, 2011), comprises a gambling task with a simple layout showing a slot machine, with a centrally located display depicting the amount won per trial. The remaining money available for gambling was displayed in the top left corner. Each gambling session started with a loaded credit of NOK 2000 (corresponding to $340 at the time of testing). Regular Norwegian QWERTY-keyboards were used to place bets, where the number keys 1 through 9 denoted bet sizes of NOK 10–90 ($1.70–$15.40). Each trial consisted of a single bet and had three possible outcomes: big win, small win or no win. A big win was 4.5 times the bet-size, and had a 10% chance of occurring. A small win was 2.25 times bet-size, and had a 20% chance of occurring. On each trial, the slot machine software randomly selected outcomes. The Hordaland Slot Machine was programmed in E-prime 2.0 (Psychology Software Tools Inc., 2005).

Three experimental conditions were used, fast, medium and slow bet-to-outcome interval (BOI; 400 ms, 1700 ms and 3000 ms, respectively). The only difference between these conditions was the amount of time that passed from the moment participants placed a bet to the moment when the outcome of the bet was displayed on screen. All participants were required to play 100 trials.

*South Oaks Gambling Screen – Revised.* Prior to the experiment, the South Oaks Gambling Screen – Revised (SOGS-R; Lesieur & Blume, 1993) was completed. Three participants obtained scores indicating probable pathological gambling (SOGS-R = 5), 27 had some problems with gambling (SOGS-R scores of 1–4), whereas 32 had no problems with gambling (SOGS-R = 0). Among the 27 participants reporting some problems with gambling, the majority obtained scores of 1 (*N* = 13) or 2 (*N* = 10). The three participants scoring above the cut-off point for probable pathological gambling were excluded from the remaining analyses.

*The Bergen Evaluation of Games Scale.* In order to measure how entertaining and enjoyable participants found the gambling task, we designed an 8-item scale (Bergen Evaluation of Games Scale; BEGS). See Appendix A for a complete English translation of this scale. Upon completion of the experiment, participants rated the degree to which they agreed to statements like "All in all, I enjoyed playing the game" on a 7-point Likert-scale. Cronbach's alpha for BEGS was .87 in the present study.

*Illusion of control.* To measure participants' illusion of control, an adapted version of the 8-item subscale of the Gamblers' Beliefs Questionnaire (GBQ; Steenbergh, Meyers, May & Whelan, 2002) measuring this aspect was used. The scale was adapted so that the items specifically referred to the gambling task the participant had completed, rather than to gambling beliefs in general (see Appendix B for a list of the adapted items). Items were rated on a 7-point Likert scale (1 = Strongly agree; 7 = Strongly disagree) Cronbach's alpha in the present study was .75.

### *Procedure*

The experiment was conducted in groups of up to five in a multi-testing laboratory. Upon arrival, participants were seated in individual testing booths where the experiment was conducted on a computer running E-prime 2. The testing booths were sound attenuated, and sound effects were presented using headphones. Sound effects were presented for the following in-game events: placing a bet, reel spin, and bet outcome (win/loss). In order of their appearance to the lab, participants were assigned to one of three experimental conditions: long BOI, medium BOI or immediate BOI. Gender was balanced across conditions. Prior to testing, SOGS-R was administered. Upon completion of the gambling task, the BEGS and GBQ scales were administered.

## RESULTS

### *Correlations*

Table 1 presents means, standard deviations and correlations for the study variables. As the SOGS-R scores were not normally distributed, correlation coefficients involving this variable represent Spearman's rho. All other correlations are Pearson's product-moment correlations. Significance level for the correlation between SOGS-R and Bet size is one-tailed due to the expected directional relationship between these variables (Aron, Aron & Coups, 2006). All other significance levels are two-tailed. SOGS-R score was significantly and positively related to average bet size, and significantly negatively related to illusion of control. Scatterplots for these relationships are shown in Figures 1 and 2, respectively. No other correlations were statistically significant.

*Table 1*. Means, standard deviations and correlations between study variables

| Variables | Mean | SD | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|
| 1. Average bet-size | 39.30 | 15.31 | – | | | |
| 2. Game evaluation | 4.16 | 1.16 | 0.22 | – | | |
| 3. Illusion of control | 5.45 | 1.04 | 0.19 | 0.00 | – | |
| 4. SOGS-R score | 0.80 | 1.06 | 0.25* | 0.133 | 0.29* | – |

*Note:* Correlations involving SOGS-R are Spearman's rho, due to violations of normality in this variable. Other correlations are Pearson's product-moment correlations.
* $p < 0.05$

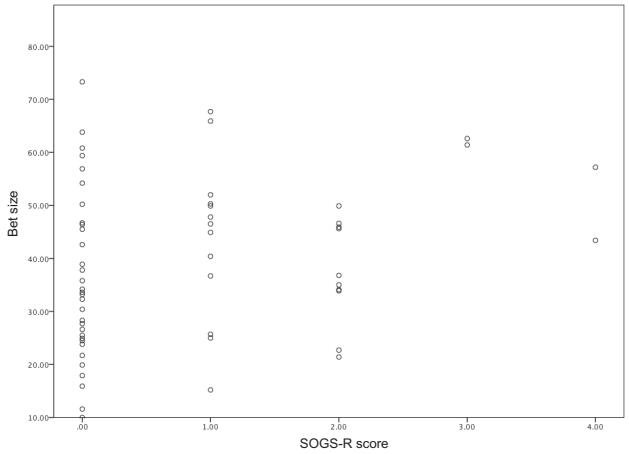


*Figure 1*. Scatterplot depicting the relationship between SOGS-R score and mean bet size

### *Bet-to-outcome intervals*

To test for associations between BOI, gambling problems and study outcomes, a multivariate analysis of variance (MANOVA) was conducted with the following three dependent variables: average bet size, evaluation of game and illusion of control. BOI (long/intermediate/immediate) and gambling problems (no problem/at-risk) constituted the independent variables. The MANOVA revealed a significant overall main effect of gambling problems ($F(3, 51) = 3.69$, $p = .02$), but not of BOI ($F(6, 104) = 0.40$, $p = .88$). There was no BOI*Gambling profile interaction effect ($F(6, 104) = 0.47$, $p = .83$). Univariate follow-up ANOVAs revealed that

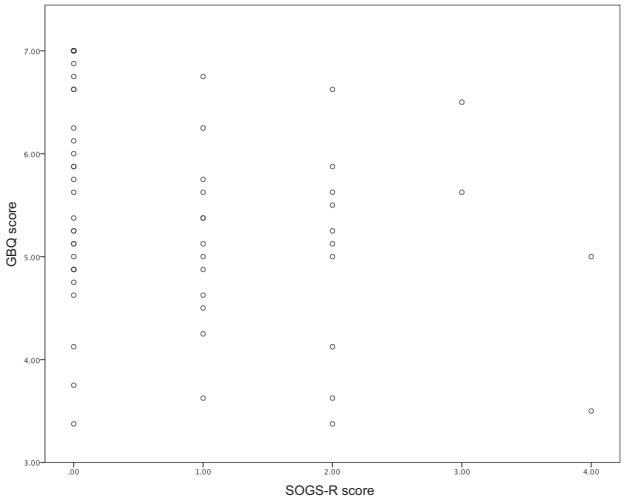


*Figure 2*. Scatterplot depicting the relationship between SOGS-R score and GBQ (illusion of control) score

there was a significant effect of gambling problems on illusion of control ($F(1, 53) = 5.36$, $p = .03$). Specifically, no-problem gamblers reported more illusion of control ($M = 5.8$, $SE = .19$) compared to at-risk gamblers ($M = 5.1$, $SE = .24$). No other significant main effects or interaction effects were found. Of particular interest was the relationship between gambling profile, BOI and average bet size, illustrated in Figure 3. A planned comparison revealed that in the immediate condition, at-risk gamblers had significantly higher average bet size ($M = 47.2$, $SD = 12.89$) compared to no-problem gamblers ($M = 32.9$, $SD = 14.3$), $t(18) = 2.37$, $p = .03$, no such difference was found with either intermediate BOI ($t(17) = .64$, $p = .53$) or long BOI ($t(18) = .20$, $p = .85$).

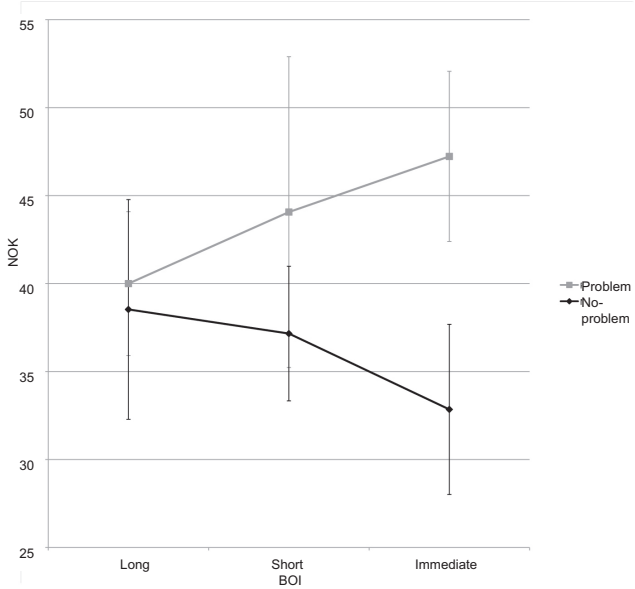


*Figure 3.* Bet size in NOK as a function of gambler category (Problem/No-problem) and length of the BOI

## DISCUSSION

Our study showed no overall main effect of BOI on either average bet size, evaluated entertainment from the game or illusion of control. That is, we found no support for our hypotheses that game tempo would lead to more intensive or risky gambling. Furthermore, there was no observed effect

of game tempo on illusion of control. Although not in line with our hypotheses, the findings are in accordance with the overall conclusions from Blaszczynski et al. (2005) who compared longer bet to outcome intervals.

However, in the condition with immediate bet-to-outcome interval, we found that problem gamblers had significantly higher bet sizes compared to no-problem gamblers, thus supporting our hypothesis. This finding is in line with the conclusions from previous studies comparing problem gamblers with recreational gamblers, where it has been found that problem gamblers tend to show more risky or intensive gambling in conditions with short compared to long intervals (Chóliz, 2010; Linnet et al., 2010).

In sum, our findings corroborate findings from previous investigations on speed in gambling situations by showing that speed does not appear to have a strong overall effect on gambling behavior or cognitions. Our study adds to existing knowledge by showing that this holds true even in games with very fast bet to outcome intervals (< 2000 ms). However, we also demonstrate that for problem gamblers, quicker bet to outcome intervals might lead to more intensive gambling. Thus, it seems plausible that restrictions on gambling speed might be effective as a harm reducing initiative.

In line with our hypothesis, our study revealed that scores on SOGS-R were positively associated with average bet-size, showing that participants with more signs of problem gambling tended gamble with higher stakes. More surprisingly, and in contrast with our hypothesis, our findings revealed that problem gamblers reported lower illusion of control in the gambling situation than did no-problem gamblers. One possible interpretation of this finding is that problem gamblers might be more knowledgeable about how gambling machines function, and thus are less prone to develop illusions of control.

## STRENGTHS AND LIMITATIONS

A particular strength of our study is the inclusion of an immediate bet-to-outcome interval, allowing for an investigation of the effects of game speeds that are even quicker than the ones commonly found in naturalistic settings.

One notable limitation is that the study was conducted in a laboratory setting, which means that the gambling occurred in a non-typical context. For instance, participants gambled at pre-booked times, regardless of their existing intentions to gamble, whereas naturally occurring gambling will typically occur more spontaneously as gamblers act on impulses or intentions. However, participants did have the opportunity to win money, thus increasing the overall ecological validity. These factors should be taken into account when interpreting the results.

## CONCLUSIONS

Our findings corroborate previous findings by showing that speed does not appear to have a strong overall effect on gambling behavior and cognitions, and that this holds true even in very fast conditions. However, for problem gamblers, very fast games might produce more intensified gambling.

## REFERENCES


Aron, A., Aron, E. N. & Coups, E. J. (2006). *Statistics for psychology* (4th ed.). New Jersey: Pearson.

Blaszczynski, A., Sharpe, L., Walker, M., Shannon, K. & Coughlan, M.-J. (2005). Structural characteristics of electronic gaming machines and satisfaction of play among recreational and problem gamblers. *International Gambling Studies, 5*(2), 187–198.

Brunborg, G. S., Johnsen, B. H., Mentzoni, R. A., Molde, H. & Pallesen, S. (2011). Individual differences in evaluative conditioning and reinforcement sensitivity affect bet-sizes during gambling. *Personality and Individual Differences, 50,* 729–734. doi:10.1016/j.paid.2010.12.026

Cantinotti, M. & Ladouceur, R. (2008). Harm reduction and electronic gambling machines: Does this pair make a happy couple or is divorce foreseen? *Journal of Gambling Studies, 24,* 39–54. doi:10.1007/s10899-007-9072-6

Chóliz, M. (2010). Experimental analysis of the game in pathological gamblers: Effect of the ommediacy of the reward in slot machines. *Journal of Gambling Studies, 26,* 249–256. doi:10.1007/s10899-009-9156-6

Dowling, N., Smith, D. & Thomas, T. (2005). Electronic gaming machines: Are they the crack-cocaine of gambling? *Addiction, 100,* 33–45. doi:10.1111/j.1360-0443.2005.00962.x

Griffiths, M., Scarfe, A. & Bellringer, P. (1999). The UK national telephone hambling relpline – Results on the first year of operation. *Journal of Gambling Studies, 15,* 83–90. doi:10.1023/A:1023071113879

Johansson, A., Grant, J. E., Kim, S. W., Odlaug, B. L. & Gotestam, K. G. (2009). Risk factors for problematic gambling: A critical literature review. *Journal of Gambling Studies, 25,* 67–92. doi:10.1007/S10899-008-9088-6

Ladouceur, R. & Sévigny, S. (2005). Structural characteristics of video lotteries: Effects of a stopping device on illusion of control and gambling persistence. *Journal of Gambling Studies, 21,* 117–131. doi:10.1007/s10899-005-3028-5

Ladouceur, R. & Sévigny, S. (2006). The impact of video lottery game speed on gamblers. *Journal of Gambling Issues, 17*. doi:10.4309/jgi.2006.17.12

Langer, E. J. & Roth, J. (1975). Heads I win, tails it's chance: The illusion of control as a function of the sequence of outcomes in a purely chance task. *Journal of Personality and Social Psychology, 32,* 951–955. doi:10.1037/0022-3514.32.6.951

Lesieur, H. R. & Blume, S. B. (1993). Revising the South Oaks Gambling Screen in different settings. *Journal of Gambling Studies, 9*(3), 213–223.

Linnet, J., Rømer Thomsen, K., Møller, A. & Callesen, M. B. (2010). Event frequency, excitement and desire to gamble, among pathological gamblers. *International Gambling Studies, 10*(2), 177–188.

Petry, N. M. (2004). *Pathological gambling. Etiology, comorbidity, and treatment.* Washington: American Psychological Association.

Productivity Commision (2010). Gambling Report no. 50. Canberra.

Psychology Software Tools Inc. (2005). E-Prime (Version 2.0). Pittsburg, PA: Psychology Software Tools, Inc.

Steenbergh, T. A., Meyers, A. W., May, R. K. & Whelan, J. P. (2002). Development and validation of the Gamblers' Beliefs Questionnaire. *Psychology of Addictive Behaviors, 16,* 143–149. doi:10.1037//0893-164x.16.2.143

Volberg, R. A. (1997). Gambling and problem gambling in Oregon. *Report to the Oregon Gambling Addiction Treatment Foundation*.

## APPENDIX A

## THE BERGEN EVALUATION OF GAMES SCALE (BEGS)

Below you will find a list of claims regarding the game you just played. Please read every claim carefully, and rate the degree to which you agree or disagree by circling the appropriate number (1–7).

1. All in all, I enjoyed playing the game
Completely disagree 1 2 3 4 5 6 7 Completely agree

2. The game was a positive experience for me
Completely disagree 1 2 3 4 5 6 7 Completely agree

3. The speed of the game suited me fine
Completely disagree 1 2 3 4 5 6 7 Completely agree

4. I would recommend the game to a friend
Completely disagree 1 2 3 4 5 6 7 Completely agree

5. If given the opportunity, I would like to play the game again
Completely disagree 1 2 3 4 5 6 7 Completely agree

6. The game did not suit me
Completely disagree 1 2 3 4 5 6 7 Completely agree

7. I was quickly bored by the game
Completely disagree 1 2 3 4 5 6 7 Completely agree

8. I was engaged by the game
Completely disagree 1 2 3 4 5 6 7 Completely agree

Items 6 and 7 are reverse scored.

## APPENDIX B

## ADAPTED ITEMS FROM THE GAMBLERS' BELIEFS QUESTIONNAIRE

1. I thought of the game as a challenge.
2. My knowledge and skill contributed to the likelihood that I would make money in the game.
3. My choices or actions could affect the outcome of the game.
4. I kept track of previous winning bets so that I could figure out how I should bet in the future.
5. This game was more than just luck.
6. The way I placed my bets proves that I have skill and knowledge related to gambling.
7. I used a special technique while playing.
8. I have more skills and knowledge related to gambling than most people who gamble.