

PSYCHOPHYSIOLOGICAL AROUSAL IN DIFFERENT GAMBLING PHASES IN YOUNGS AND ADOLESCENTS

ACTIVACIÓN PSICOFISIOLÓGICA ANTE LAS DIFERENTES FASES DEL JUEGO CON APUESTA EN JÓVENES Y ADOLESCENTES

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Abstract

Nowadays, gambling is increasing as a more frequent problem among the young people. In order to shed light about the physiological correlates of the three phases that were identified in the roulette gambling game (phase of betting, phase of watching the rotation of the roulette and phase of watching the final result), 24 participants, with no pathological gambling problems, participated in three attempts of this game. Heart rate, skin conductance level and skin conductance response were recorded. The results showed that betting phase is the phase where highest arousal is experienced by the participants, followed by the phase of watching the rotation of the roulette. Likewise, it was verified that not getting the prize provokes a quick habituation that is evidenced in the decrease of the arousal in the second phase. Finally, clinical implications of the results are discussed.

Keywords: Gambling, Heart rate, Skin conductance level, Skin conductance response, Habituation.

Resumen

En la actualidad, el juego de apuesta constituye un problema cada vez más grave entre la gente joven. Con el objetivo de arrojar luz sobre los correlatos fisiológicos de las tres fases identificadas en un juego de apuesta como es el de la ruleta (fase de apuesta, fase de ver girar la ruleta y fase de visualización del resultado), 24 participantes sin problemas de juego patológico llevaron a cabo tres ensayos de este juego, mientras se registraba la tasa cardiaca, el nivel de conductancia eléctrica de la piel y la respuesta de conductancia eléctrica de la piel. Los resultados mostraron que la fase que mayor activación genera es la de realización de la apuesta, seguida por la de ver girar la ruleta. Igualmente se vio que el hecho de no conseguir premio produce una brusca habituación que se evidencia en la caída del nivel de activación en la segunda fase. Se comentan las implicaciones clínicas de estos hallazgos.

Palabras clave: Juego, Tasa cardiaca, Nivel de conductancia, Respuesta de conductancia, Habitación.

Gambling is an extended activity in the majority of the societies and it has generated a great amount of research because it is maintained through lifespan, in spite of the losses implied in gamblers' life. Specifically, the study of pathological gambling has raised a special interest because, according to the DSM-V (APA, 2013) it appears in the category of non-substance addiction. The traditional profile of the pathological gambler was a man of about forty years old; however, in recent years a great decrease in the age of the typical gambler has been observed (Sarabia, Estévez, & Herrero, 2013). Following with this, some studies about the prevalence of pathological gambling in young adults and adolescents show a high rate of this disorder in these age-groups. In Spain, the data evidences that prevalence among adolescents and young adults is above 2%, being higher than the prevalence among adults (Dominguez-Alvarez, 2009). Other study evidences that prevalence in these age groups is between 3% and 18%, depending on several factors (Volberg, Gupta, Griffiths, Ólason & Delfabbro, 2010). In fact, several studies have showed that adult pathological gamblers begin to gambling during the adolescence or youth (Jacobs, 2000). Therefore, in recent years it has been observed an increase of young gamblers who could be diagnosed as pathological gamblers (Hardoon, Gupta, & Derevensky, 2004), although the studies about youth and gambling are scarce. It is expected an increasement of the gambling problem prevalence in young people (Griffiths & Parke, 2010). Some authors explain that it is very easy for young people to access to gambling games than imply money bets through new technologies and this could be one of the main factors that has enabled its spreading among young people (King, Delfabbro & Griffiths, 2010; McBride & Derevensky, 2009).

Pathological gambling problems among adolescents have been associated with mental problems like depressive symptomatology, higher risk of alcoholism and abuse of substances (Hardoon, Derevensky, & Gupta, 2002), higher risk of suicidal ideation and suicide attempts, higher anxiety (Gupta & Derevensky, 1998; Ste-Marie, Gupta, & Derevensky, 2006), and poor health overall (Molde, Pallesen, Bartone, Hystad, & Johnsen, 2009). Further, adolescents with pathological gambling problems have a higher risk of delinquency behaviors and higher risk of suffering family problems and / or with peers and a poorer academic performance (Wynne, Smith, & Jacobs, 1996), than those without pathological

gambling problems. Consequently, early consequences of pathological gambling are serious and the harm can be devastating, specially during adolescence. Likewise, it has been demonstrated that the early beginning of gambling for an adolescent is associated with a more severe gambling problem in the adulthood (Rahman et al., 2012).

One of the characteristics that has been identified as more relevant in the development and maintenance of gambling is the physiological arousal that is implied (Blanchard, Wulfert, Freidenberg, & Malta, 2000; Brown, 1987; Sharpe, 2002; Sharpe, TARRIER, Schotte, & Spence, 1995). In this sense, several studies have been conducted aiming the analysis of the physiological response pattern in different situations that integrate a gambling task, such as basal arousal, during the game, depending on the consequence (gain or loss), on the recovery of the physiological status and on the moment of returning to the basal level of activation. The main indices that have been measured are heart rate and electrodermal activity. Although heart rate has been the most utilized in gambling research (Coventry & Constable, 1999; Coventry & Hudson, 2001; Freidenberg, Blanchard, Wulfert, & Malta, 2002; Griffiths, 1993), electrodermal activity seems to be the most indicated in the assessment of emotional arousal that underlies decision making processes, because it detects very well the activation that results from the conscient and inconscient cognitive processes of gambling (Crone, Somsen, Van Beek, & Van Der Molen, 2004; Dawson, Schell, & Courtney, 2011; Yucha, Bernhard, & Prato, 2007). Concretely, skin conductance level is one of the best indices in the assessment of physiological arousal, because of its great sensitivity to detect changes related to arousal (Barry, 1996, 2006). Likewise, some studies have showed the efficacy of the skin conductance response in detecting the physiological changes related to gambling behavior (Lole, Gonsalvez, Blaszczyński, & Clarke, 2012; Miu, Heilman, & Houser, 2008).

In one hand, a first approximation of the psychophysiological study of gambling is based on the analysis of the effect of external stimuli. Stimuli that are implicated in a gamble are mainly visual and acoustic. In one of the studies carried out with visual stimuli it was observed that red lights triggered participants to bet more money and to assume higher betting risk than blue lights (Stark, Saunders, & Wookey, 1982). Regarding acoustic stimuli, one study evidenced that the exposure

to an 80 db noise every 120 seconds provoked an increase in the skin conductance response. This increase in the skin conductance response was also associated with the increase in the amount of money bet by gamblers who have never had pathological gambling problems in comparison to those who have had pathological gambling problems. This fact was interpreted arguing that those gamblers who had had previous pathological gambling problems associated the physiological arousal to loss of money and, therefore, did not bet. However, those gamblers who had not had gambling problems before associated the arousal with the possibility of winning, and consequently increased their bet rate (Rockloff, Signal, & Dyer, 2007).

On the other hand, it has been discovered that pathological gamblers have a hypo arousal tonic in addition of a phasic hypersensitivity to gain and a phasic hyposensitivity to loss, in comparison with non-pathological gamblers (Coventry & Constable, 1999; Goudriaan, Oosterlaan, de Beurs, & Van den Brink, 2004; Wilkes, Gonsalvez, & Blaszczynski, 2010). Additionally, respect to non-pathological gamblers it was observed that when a prize was attained, although changes in heart rate were no evidenced, an increase in skin conductance level was observed, compared with base line; further, no changes were shown when losses happened (Wilkes et al., 2010). However, according to two studies where pathological and non-pathological gamblers were compared, respect to pathological gamblers it was observed that heart rate decreased both when a bet was won and when it was lost. In opposite to this, respect to non-pathological gamblers, when the bet was lost a reduction in heart rate was observed, but when they won heart rate increased (Goudriaan, Oosterlaan, de Beurs, & van den Brink, 2006; Griffiths, 1993). This fact could be interpreted from the physiological catharsis theory as negative reinforcement procedure that would maintenance the gambling behavior (Hokanson, 1974).

Similarly, some studies have shown that there is no correlation between objective arousal (psychophysiological arousal) and subjective arousal, although it has been found a negative association between physiological arousal and frequency of gambling. Also, a negative correlation between gambling frequency and sensation seeking has been found (Coventry & Constable, 1999). In this sense, a study demonstrated that both lottery pathological gamblers

and non-pathological ones got a similar arousal according to their heart rate, skin conductance level and muscle tone, but the pathological gamblers informed a higher subjective arousal. The conclusion of this research was that pathological and non-pathological gamblers perceive gambling situations differently (Diskin & Hodgins, 2003; Diskin, Hodgins, & Skitch, 2003). However, contrary to these results, a non-significant correlation between heart rate and perceived arousal was found in another study (Coventry & Constable, 1999).

Therefore, the results obtained in the different studies regarding the psychophysiological correlates of gambling behavior, and more specifically of each phase, do not seem to be fully conclusive. In addition, in our knowledge there is no research with these characteristics that had been conducted with adolescents. Consequently, the goal of this study is to analyze the differences in the physiological pattern in the different phases that compose gambling, and the effect of habituation to each phase in non-pathological gamblers. In order to reach this goal, heart rate and electrodermal activity (skin conductance level and skin conductance response) have been measured during a fictional gambling task.

METHOD

Participants

The sample was composed by 24 participants, all of them students of the University of Deusto. From these 24 participants, 8 (33.3%) were male (age: $M = 19.50$, $SD = 0.93$) and 16 (66.6%) were females (age: $M = 19.19$, $SD = 1.42$) and they completed an online roulette gambling task (see *Stimuli* section). None of them had gambling problems (see *Procedure* section).

Apparatus

The experimental task was conducted in a Faraday jail, which was completely electromagnetically isolated from outside. A computer Intel Celeron model, with a TFT 19" screen, was used to present the stimuli. This computer has Internet connection through an Ethernet wire to conduct the experimental online task. Each participant sat in front of the screen at 60 cm of distance. In order to register psychophysiological signals, a

photoplethysmograph was used to record the heart rate (HR) on the first phalanx of the non-dominant index hand finger. Moreover, two cup electrodes were used to capture the skin conductance level and response (SCL and SCR, respectively), considering a response every increase of the level that is bigger than 0.05 μ Siemens. These electrodes were placed on the first phalanx of the middle and ring non-dominant hand fingers, and an electrolytic paste was utilized (saline solution at 0.5%). In order to process these signals, a polygraph, Biopac brand and a MP150 model, was used and it sent the signal to a computer identical to the one previously described. The signal was evidenced and quantified by the software Acqknowledge 4.0.

Stimuli

The participants carried out an Internet-based experimental task (with access in <https://www.juegosonce.es/wmx/dicadi/erascas/lightbox/Demo.cfm?productId=E06>). It is a web page where several online gambles are available. The selected gamble

consisted of a freeware demo of the roulette game, which in its full version is designed to bet real money, so the only difference is that in demo version the gambler bets fake money. In the experimental task each participant made three attempts, and each attempt was composed by three different phases. The first one was the betting phase, where the participant bet three cards on three different numbers. Each of the cards had associated a random amount of money that represented the betting amount. Thus, when the betting phase was completed, the second phase followed, and it consisted in watching the rotation of the roulette for every of the three betting cards. The participant observed the rotation and how the roulette stopped little by little. When the roulette stopped, the participant watched the result, verifying if the pellet had fallen in the number on which he had bet or not. Thus, the sequence “roulette rotation – result” was completed three times in every attempt. The experimental design according to the sequence of events is graphically represented in Table 1.

Table 1. Experimental design, detailing the different phases of the task

	Phase 0	Phase 1	Phase1	Phase 2	Phase 2	Phase 3	Phase 3
Attempt 1	Bet 1 (3 numbers)	Rotation of the Roulette 1.1	Result 1.1	Rotation of the Roulette 2.1	Result 2.1	Rotation of the Roulette 3.1	Result 3.1
Attempt 2	Bet 2 (3 numbers)	Rotation of the Roulette 1.2	Result 1.2	Rotation of the Roulette 2.2	Result 2.2	Rotation of the Roulette 3.2	Result 3.2
Attempt 3	Bet 3 (3 numbers)	Rotation of the Roulette 1.3	Result 1.3	Rotation of the Roulette 2.3	Result 2.3	Rotation of the Roulette 3.3	Result 3.3
Mean	Mean of Bets	Mean of Rotation of the Roulette 1	Mean Results 1	Mean of Rotation of the Roulette 2	Mean Results 2	Mean of Rotation of the Roulette 3	Mean Results 3

Procedure

The recruitment for this study was made through announcements at the University of Deusto asking for participating in a gambling experiment. Not having any gambling problem was the only requirement to be accepted as participant. This issue was assessed through

SOGS-RA (Echeburúa, Báez, Fernández-Montalvo & Páez, 1994) and Multicage (Pedrero, et. al., 2007) questionnaires. The cut off to be accepted as participant was established if there were not any affirmative response in the SOGS-RA and less than two affirmative responses in the four items about gambling behavior of the Multicage.

There are two reasons that explain why people with gambling problems were not recruited. First, the main goal of this research was to analyze the psychophysiological response pattern and the habituation process in non-pathological gamblers. Second, ethics implications would not have allowed design a realistic gambling task for pathological gamblers.

Therefore, firstly the participant sat in front of the computer where the task was going to be presented and the researches gave him/her the informed consent to be read and signed, indicating that the participation was absolutely voluntary and informing about the possibility of leaving the experiment in any moment. When the participant agreed and signed the consent, the sensors were connected as it was explained, and the base line of the three physiological indices was recorded during three minutes. Subsequently the instructions of the task were presented in a Power Point presentation in the computer that was also used for the experimental task. These instructions were about the sequence of the gamble and the task, so the participant could expect the different parts of the experiment. After this presentation, once it was verified that the participant had understood the instructions, the experiment started. The experimental sequence (gambling task) was recorded through the Camtasia Studio software, which records all of the events that are evidenced in the screen. This recording allowed afterwards the synchronization between the experimental task and the physiological register that was implemented through the Observer XT 8.0 software. The length of the whole experimental task was approximately about 20 minutes.

Experimental design and data analyses

First, a design of repeated measures was carried out, comparing the arousal differences in the three phases of the gamble (betting phase, rotation of the roulette phase and result phase). First, the physiological arousal differences between betting phase (counting the average arousal in the three times when participant bet), the phase of rotation of the roulette (counting the average arousal of the nine times when the participant watched the rotation of the roulette) and the phase of the result (counting the average arousal of the nine times when the result of the gamble was observed) were analyzed. Second, the habituation of the physiological arousal was analyzed comparing each of the three times when the

participant bet, the three times when the rotation of the roulette was being watched and the three times when the result was being observed. For more details of the experimental design see Table 1.

Concerning to data analyses, respect to HR and SCL the data fitted to a normal distribution, so they were analyzed through an ANOVA of repeated measures, using the Bonferroni Post-Hoc test to analyze the differences between variables. Mauchly's test showed the violation of the sphericity assumption in some of the contrasts, so in these cases the Greenhouse-Geisser's degrees of freedom correction was conducted in order to calculate the F value. Finally, in every ANOVA test both statistical significance and effect size (η^2) were calculated. This last index was interpreted according to the Cohen's criteria, so values between .01 and .04 were considered small; between 0.5 and .14 medium, and above .14 high (Cohen, 1988).

Respect to SCR, the data showed a high positive skewness (≥ 1.5), so Friedman's ANOVA test was conducted to analyze the data of this index. In this case the Post-Hoc comparisons between pairs of variables were conducted through the Wilcoxon's T test. Also respect to SCR, both statistical significance and effect size (r) were calculated and interpreted according to the Cohen's criteria.

RESULTS

Arousal in the different gambling phases

First, average physiological arousal in each of the three gambling phases (betting phase, rotation of the roulette and result) was compared. HR did not showed significant differences, $F(1.41, 30.93) = 0.47, p = .561$. Contrarily, SCL attained a significant effect, $F(2, 46) = 11.53, p < .001, \eta^2 = .33$. More concretely, Bonferroni's test showed that SCL was higher during the betting phase ($M = 2.26, DT = 1.12$) than during the rotation of the roulette phase ($M = 2.18, DT = 1.10, p = .008$) and the result phase ($M = 2.17, DT = 1.10, p < .001$). There were no differences between the rotation of the roulette phase and the result phase. Respect to SCR, a similar significant effect was verified, $\chi^2(2) = 12.43, p = .002$. Wilcoxon's test evidenced significant differences between betting phase ($Mdn = 0.02$) and result phase ($Mdn = 0.01$), $T = -2.20, p =$

.026, $r = -.45$, as well as between the rotation of the roulette phase and result phase ($Mdn = 0.01$), $T = -3.10$, $p = .002$, $r = -.63$. Finally, no significant differences were observed between rotation of the roulette phase and betting phase.

Habituation to the gambling phases

Afterwards, habituation to each of the three phases of the gamble was analyzed. Beginning the analysis of the three betting phases that the participants conducted, there was not a significant effect in HR, $F(2, 46) = 1.01$, $p = .371$. However, significant differences were evidenced in SCL, $F(2, 46) = 18.16$, $p < .001$, $\eta^2 = .44$. Bonferroni's test revealed that the arousal during the first betting phase ($M = 2.46$, $DT = 1.23$) was significant higher than the arousal during the second betting phase ($M = 2.18$, $DT = 1.07$, $p < .001$) and the third betting phase ($M = 2.15$, $DT = 1.09$, $p < .001$). Finally, there were no differences between the second betting phase and the third betting phase. Likewise, SCR showed significant differences, $\chi^2(2) = 13.40$, $p = .001$. Post-Hoc analyses suggested also that the arousal during the first betting phase ($Mdn = 0.03$) was higher than the arousal during the second betting phase ($Mdn = 0.00$), $T = -2.98$, $p = .003$, $r = -.61$. Finally, although the difference between the second and the third betting phase ($Mdn = 0.00$) did not attained statistical significance, a middle effect size was obtained, indicating a higher arousal during the first betting phase, $T = -1.61$, $p = .108$, $r = -.33$.

Following with the habituation in the second phase (observing the rotation of the roulette), there were not significant effect in HR, $F(1.61, 35.31) = 0.28$, $p = .709$, similarly to the betting phase. However, there was a significant effect in SCL, $F(1.58, 36.22) = 18.16$, $p = .028$, $\eta^2 = .16$. According to the Bonferroni's Post-Hoc test, there was a marginally significant effect in the difference between the first attempt ($M = 2.27$, $DT = 1.14$) and the second one ($M = 2.14$, $DT = 1.06$, $p = .069$). Regarding the SCR, there were not significant differences, $\chi^2(2) = 2.78$, $p = .249$.

Finally, habituation in the result phase was analyzed. Similar to previous cases, HR did not show a significant effect, $F(2, 44) = 0.51$, $p = .580$. However, significant differences were observed in SCL, $F(2, 46) = 7.63$, $p = .001$, $\eta^2 = .25$. Bonferroni's test revealed that the arousal in the first attempt ($M = 2.28$, $DT = 1.14$) was higher than the arousal in the second attempt ($M = 2.13$, $DT = 1.09$, $p =$

$.005$) and the third attempt ($M = 2.12$, $DT = 1.10$, $p = .028$). There were no differences between the second and the third attempts of result phase. Finally, GSR did not attain a significant effect, $\chi^2(2) = 1.87$, $p = .393$.

DISCUSSION

The present research aimed the analysis of the differences in psychophysiological arousal triggered by each of the three phases that were identified in gambling. With this purpose, 24 participants carried out three attempts of the roulette gamble online, while heart rate, skin conductance level and skin conductance response were recorded. Thus, both the differential arousal between every phase and the habituation to each of them were analyzed.

Firstly, the results about differential arousal in each of the phases have demonstrated significant differences in SCL and SCR indices. This is coherent with studies that suggest that electrodermal activity indices are more sensitive than heart rate to arousal changes in gambling studies (Crone, et al., 2004; Dawson, et al., 2011; Lole, et al., 2012; Miu, et al., 2008; Yucha, et al., 2007). On one hand, respect to skin conductance level it was evidenced that the arousal was higher in the betting phase than in the other two phases. On the other hand, skin conductance response showed that the highest arousal accounted in the betting phase and in the rotation of the roulette phase. This increase could be due to the expectation of achieving the prize that is displayed both in the betting phase and in the rotation of the roulette phase, and this expectation would disappear drastically (effect sizes of the contrasts were middle to high) when the non-rewarded result phase begins.

Secondly, the effect of habituation in every gambling phase was analyzed. The differentiation pattern of the psychophysiological indices was similar to the previous results, so only electrodermal activity indices (especially SCL) attained significant effects. Thus, the results of the analyses respect to the betting phase revealed habituation effects in the second and third phases, because the arousal is significantly higher in the first phase, besides a high effect size. Similar results were evidenced in SCR, so the arousal in the second attempt was significantly lower than in the first one, also with a high effect size. Regarding the second phase (the rotation

of the roulette), skin conductance level was significantly higher in the first attempt than in the other two (although the difference with the third attempt was marginally significant), so the habituation pattern was similar to the betting phase. Finally, in the case of the third phase (watching the result), SCL showed that the amount of arousal was higher in the first attempt than in the two following attempts, with a high effect size. Therefore, it is again suggested the existence of habituation in the second and third attempts compared with the first one.

Overall, the results of this second part of the study show that, at least in young non pathological gamblers, the gambling habituation is very quick. Although more research is needed regarding this topic, according to the previous information it could be hypothesized that the expectative of achieving a prize the first time of gambling is higher than the real probability of achieving the prize. This fact could provoke a high psychophysiological arousal that is evidenced through the skin conductance level. However, at least in non-gamblers, habituation process appears quickly in the second attempt, showing also a high magnitude of the effect in all gambling phases (betting phase, rotation of the roulette and result). For future studies these results should be verified in other gambles with different stimuli properties, given the effect that these features have in the arousal and behavior of gamblers. In addition to this, the habituation differences in the different phases according to the achieving the prize or not and its magnitude.

The results of the present research are coherent with other gambling studies that suggest that achieving the prize is necessary to maintain a high the psychophysiological arousal during it (Coventry & Hudson, 2001; Lole, et al., 2012), but that having the expectation of being able to win the prize is more relevant than winning it (Ladouceur, Sévigny, Blaszczynski, O'Connor, & Lavoie, 2003; Wulfert, Roland, Hartley, Wang, & Franco, 2005). According to the design of the present research, gamblers showed this expectation in the first attempt, and especially in the betting and rotation of the roulette phases. From a more clinical viewpoint, it has been concluded that the achievement of a prize in the first times when a person gambles is one of the best predictors of pathological gambling, with a stronger association than other variables such as misleading believes, impulsivity and emotional vulnerability (Turner, Umesh, Spence, & Zangeneh, 2008). Therefore, it is

important to control some aspects like high awareness of the psychophysiological arousal due to achieving a prize in the first gambling attempts.

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