Dores, A., Rocha, A., Paiva, T., Carvalho, I., Geraldo, A., Griffiths, M.D. & Barbosa, F. (2020). Electrophysiological correlates of the near-miss effect in gambling. *Journal of Gambling Studies.* DOI 10.1007/s10899-020-09937-2

Abstract

The near-miss effect in gambling refers to a losing situation that is (or perceived to be) close to a win by the gambler. This effect is one of the many cognitive distortions that can occur during gambling games. The main objective of the present study was to analyze the electrophysiological correlates of the near-miss effect via an event related potential (ERP) study examining four distinct gambling outcomes: win, full miss, near-miss before the payline, and near-miss after the payline. This study comprised 23 healthy voluntary participants (10 women) with ages ranging between 19 and 34 years (*M* = 22.5; *SD* = 3.65). All participants completed the South Oaks Gambling Screen (SOGS) and played a computerized slot machine, programed to induce the near-miss effect and specifically designed for an ERP study. By splitting the near-miss effect in two subtypes (before and after the payline), increased feedback-related negativity (FRN) was found for the near-misses after the payline in comparison to losses and also to near-misses before the payline. Results also indicated an increased P300 amplitude for the near-misses before the payline compared both with losses and with near-misses after the payline. The results suggest that both FRN and P300 present different sensitivities to near-miss subtypes, suggesting a payline effect that is not demonstrated when the data of near-misses before and after the payline are analyzed together. This is the first study to analyze the effect of the near-miss subtype in an ERP study and confirms the findings of previous behavioral studies.

Introduction

Among the factors associated with repetitive gambling are an individual's motivations. Increased motivation to play might be explained, at least in part, by the near-miss effect (also called near-wins) (Wu et al. 2015; Xia et al. 2018). In gambling situations, the near-miss effect refers to a losing situation that is (or perceived to be) close to a win by the gambler (Griffiths and Parke 2004). Because these negative (losing) outcomes are perceived by gamblers as close to winning (Griffiths 1997), they are positively reinforcing and can stimulate the desire to continue gambling and increases the possibility that, among vulnerable individuals, they will develop a gambling problem (Clark et al. 2009; Côté et al. 2003; Reid 1986). The near miss effect can be found in games of chance (e.g., slot machines, scratchcards) (Griffiths 1997) and does not reflect the skills of the gamblers. Despite the lack of monetary reward (Côté et al 2003; Griffiths 1999; Reid 1986) the positive reinforcement is commonly explained through the increase of a prize expectation via the anomalous recruitment of the reward circuit, as observed in functional magnetic resonance imaging (fMRI) of near-miss studies (Clark et al. 2009; Clark et al. 2013; Sescousse et al. 2016).

Near-misses have been shown to elicit cognitive distortions (i.e., biased processing of chance, skill, and/or probability). One such representation – or arguably misrepresentation – is the illusion of control (Langer 1975). The near-miss effect can facilitate the illusion of control among gamblers because near nisses can be interpreted by gamblers as reflecting some level of skill acquisition (Billieux et al. 2012; Clark et al. 2009; Clark et al. 2013; Côté et al. 2003; Griffiths, 1999; Reid, 1986). Near misses can also make gamblers feel that they are not constantly losing, but constantly nearly winning (Griffiths, 1991; 1994). The biopsychological basis of these cognitive distortions can be studied by analyzing the processing of near win outcomes in gambling (Ulrich and Hewig, 2018).

In many gambling games, the outcomes are determined purely by chance, and near-misses do not provide any information about future successes, making the attribution of a value to this outcome fallacious (Clark, 2010; Griffiths, 1994). Yet, it appears to induce greater motivation to gamble and increases the amount of money gambled (Clark et al. 2009; Qi et al. 2011). Even though the outcomes of near-misses and full misses are the same (i.e. both are losing situations without financial gain), significant differences in neuropsychophysiological responses appear to exist between these two effects, suggesting motivational or emotional differences, with a near-miss being reportedly more pleasant than a full miss (Griffiths 1991).

Electrophysiological studies provide researchers a method by which they can disentangle the activations elicited by the different outcomes with high temporal resolution (Alicart et al. 2015). Two components of interest, feedback-related negativity (FRN) and P300, have been identified as useful in assessing outcome evaluation process in gambling tasks (Gehring and Willoughby, 2002; Holroyd and Coles, 2002; Nieuwenhuis et al. 2004), namely the near-miss effect. However, there are several contradictory results in research examining near-misses. In relation to P300, while some studies report that near-misses have larger amplitudes than full-misses (Alicart et al. 2015; Qi et al. 2011), other studies report greater P300 amplitudes for the full-miss compared to the near-miss (Hajcak et al. 2006; Kreussels et al. 2013; Ulrich and Hewig, 2014). Also, there are studies reporting similar P300 amplitudes for near misses and full misses (Hajcak et al. 2006; Lole et al. 2013; Luo et al. 2011).

The same holds for the FRN, with studies reporting a larger FRN following near-misses (Kreussels et al. 2013; Ulrich and Hewig, 2014), a smaller FRN following near-misses (Hajcak et al. 2006; Luo et al. 2011), and no differences in FRN between near-misses and full-misses (Habib and Dixon, 2010; Qi et al. 2011).

The aforementioned inconsistent results might be due to the study of different samples (e.g., clinical samples, community dwelling participants), or to methodological artifacts, such as the use of different types of gambling protocols (e.g., blackjack, slot machine, wheel of fortune), which may involve diverse cognitive processes. Further research is necessary to cope with these shortcomings.

In addition to the limitations above, few studies consider other types of outcomes apart from traditional wins, losses, and near-misses, and their subsequent impact on gambling/gaming behaviors (Dillon and Tinsley 2008; Wohl and Enzle 2003; Wu et al. 2014; Zhang and Covey 2014). Hence, another issue for further research is whether there is a difference in near miss that occurs before or after the payline (see Figure 1).

Although insipient, the literature suggests that the same objective event can be at the origin of different expectations and that could be independent of the absolute value of the event. Although the near-miss before and after are still (ultimately) losses, they can be processed differently depending on the expectations (Mushtaq, Stoet, Bland and Schaefer 2013). For example, in a 'wheel-of-fortune' task this means comparing the results when the spinning wheel stops just before or just after the winning number (hereafter called the 'payline'). In the former, gamblers anticipate that they will win, but they narrowly lose. In the latter, gamblers anticipate that they will lose, and they do, but only narrowly. The near-miss in which the spinning wheel stopped before the payline was found to be more motivational and enjoyable than the near-miss in which the spinning wheel stopped after the payline (Wu et al. 2017). This highlights different emotional and motivational effects generated by these two distinct near-miss events. In another study among videogame players, Wu et al. (2018) also found a near-miss position effect. Near-misses in which the selected symbol stopped before the payline were rated as more motivating than near-misses when the selected symbol stopped after the payline. The difference was smaller in the Internet Gaming Disorder group, possible due to counterfactual thinking deficits. However, additional studies are needed to confirm these findings.

The goal of the present study was to analyze the neurophysiological correlates of the near-miss effect via an ERP study. The study examined the effects of the outcome condition (win, loss, or near-miss event) in the mean amplitude of P300 and FRN among healthy participants. Two different types of near-miss events were also examined: a near-miss occurring before the payline and a near-miss occurring after the payline.

Given the literature (i) suggests that near-misses and losses are processed differently, despite having identical monetary consequences (Lole et al. 2013; Qi et al. 2011; Ulrich and Hewig, 2014), and (ii) associates the near-miss effect with greater motivation to play (Clark et al. 2009; Qi et al. 2011), it was hypothesized that the mean amplitude of the P300 would be greater in the win condition than in the near-miss condition, and that it would be greater in the near-miss condition than in the loss condition (e.g., Qi et al. 2011; Alicart et al. 2015). On the other hand, it was hypothesized that the mean amplitude in the FRN would be greater in the loss condition than in the near-miss condition (Luo et al. 2011). Supported by previous studies (Mushtaq et al. 2013; Wu et al. 2017; Wu et al. 2018), it was hypothesized there would be a greater amplitude in the near-miss before the payline condition than the near-miss after the payline condition, in both P300 and FRN.

Materials and Methods

Participants

Twenty-three healthy university students (10 women) with ages ranging between 19 and 34 years old (*M* = 22.5, *SD* = 3.65) participated in this study. Twenty were right-handed and all of them had normal or corrected-to-normal vision. In order to compare these results with those reported in the literature (i.e., not including pathological gamblers), the two inclusion criteria were being a healthy university undergraduate student and having a score of zero on the South Oaks Gambling Screen, meaning problem with gambling (SOGS; Portuguese version) (Lesieur and Blume, 1987; Lopes, 2009). The participants were not paid for taking part in the study. The three exclusion criteria were: (self-reported) history of psychiatric or neurological conditions, scoring below the cut-off score of the Montreal Cognitive Assessment (MoCA; Portuguese version (Freitas et al. 2011), and currently taking medication that might interfere with central nervous system functioning.

Instruments and EEG apparatus

Montreal Cognitive Assessment (MoCA) (Freitas et al. 2011): The MoCA is a brief screening instrument for the assessment of mild cognitive impairment. The scale assesses eight cognitive domains: executive function, visuospatial ability, memory, attention, sustained attention, working memory, language, and orientation. The administration time is approximately ten minutes, and the total score ranges from 0 to 30 points, with values below 26 suggesting cognitive impairment. Overall score was used as a measure of general cognitive functioning. The MoCA has good psychometric characteristics and sensitivity in the early detection of mild cognitive impairment (Freitas et al. 2011).

South Oaks Gambling Screen (SOGS; Portuguese version) (Lopes, 2009): The SOGS is a 20-item scale that assesses the criteria of the DSM-III for pathological gambling, and assesses the impact of the gambling in several life domains of the player: family, social, professional, financial resources, and emotional aspects. The player is considered to have a pathological gambling pattern when the total score is five or more out of a total of 20. The higher the score, the higher the severity of the gambling problem (0 = no problem/recreational player; 1-4 = some problems/at-risk player; 5-20 = good probability of being a pathological gambler).

Electrical brain activity was recorded via 128 scalp electrodes mounted on a HydroCel^{TM} Geodesic Sensor Net by Electrical Geodesics (EGI Inc., Eugene, EUA), selected according to the head circumference. For brain signal acquisition, the EGI apparatus was used with the Net Station acquisition software v.4.5.2. The EEG was recorded using a NetAmps 300 system from Electrical Geodesics Inc. (Eugene, Oregon, USA) and the signal was digitized at 500 Hz with a vertex reference (Cz). The electrode impedances were kept below 50 KΩ (high-impedance amplifier). During acquisition, an antialiasing filter was automatically applied by the acquisition software. Data processing and analysis was conducted using EEGLAB toolbox v13.6.5b (Delorme and Makeig 2004) and the ERPLAB plugin v6.1.3 (Lopez-Calderon and Luck 2014), which are open-source MATLAB packages for EEG/ERP analysis.

Procedure

The study was approved by the ethics committee of the research team's university and followed the Declaration of Helsinki, the European Code of Conduct for Research Integrity, and General Data Protection Regulation recently approved (2016) for EU countries. It consisted of two phases. Initially, the SOGS was emailed to students' associations of different universities. After students signed the informed consent, they completed the SOGS (Lopes 2009). If they agreed to participate and had a score of zero on the SOGS, they were invited to take part in Phase 2 of the study. This second phase of the study was conducted in a neurophysiology laboratory. Twenty-three students were randomly selected for Phase 2 from the initial pool of approximately 1000 participants. In Phase 2, the participants signed a new informed consent form. The MoCA was then administered, and the students played a simplified two-reel slot machine in an ERP study. The ERP study was conducted in an EEG shielded room. The participants sat down one meter away from a 17-inch LCD screen. The horizontal and vertical visual angles were adjusted for each participant according to their preferences to assure better vision.

EEG recordings and data analysis

Initially, the EEG data sampling rate was reduced to 250 Hz and then filtered using a high pass filter of 0.1 Hz and a low pass of 30 Hz. Through visual inspection, channels with excessive noise were eliminated, having been interpolated later. Because a high-density sensor net was used, the channels of interest were defined as the average of the channels located in the region of interest. For P300 data extraction, Cz was defined as the average of channels E7, E31, E55, E80, E106 and E129. For FRN data extraction, FCz was defined as the average of channels E5, E6, E7, E12, E13, E106, and E112.

Independent Component Analysis (ICA) was used to identify and correct for artifacts such as blinks, cardiac movements, and saccades. The data were then re-referenced to the mean of all channels. After pre-processing, the signal was segmented at 200 ms before the stimulus, and 800 ms after the stimulus, with 200 ms baseline correction. All epochs from each participant were visually inspected and the ones containing artifacts were removed. The ERP measurements (mean amplitudes) were extracted per condition, using a time window of 150 ms to 300 ms for the FRN, and a time window of 250 ms to 500 ms for the P300.

Statistical analysis

Data were analyzed using STATISTICA (version 13.2 da Dell, Inc, Tulsa, EUA). Repeated measures analyses of variance (ANOVA) of the mean amplitude of the FRN and P300 components were conducted, with outcome type (wins, near-misses, and losses) as repeated factors, followed by post-hoc tests for multiple comparisons. After the verification of the assumptions, partial η2 values are reported as estimators of the effect sizes for significant results.

Computerized Slot Machine task (adapted from Sescousse et al., 2016)

The Slot Machine task (adapted from Sescousse et al. 2016) was programmed using Presentation® software version 19.0 (Neurobehavioral Systems, Inc, Albany, USA). Each trial consisted of three main phases: choice (no time limit, until response, but a reminder "to select" appeared every 5 s), anticipation (while the slot machine reel rotates, which lasts from 5 s), and outcome (1 s). The task starts with the fixation cross (white against black background, which lasts 3 s), and ends with the presentation of the total (accumulated euros, which lasts 2 s) and after, returns to the fixation cross.

Whenever the right reel stopped at the same symbol as the one selected by the participant on the left reel (outcome), participants received 5€ of virtual money and heard a "cash register" sound (no real money was delivered). If the symbol on the right was different from the symbol in the left reel, the participant received nothing and heard a "buzzer" sound. A loss (full miss) in this task was a "non-gain". The experiment did not include monetary losses because the focus of the study was on the cognitive effect of the near miss, not on the effects associated with monetary loss, such as in the case of aversion to loss.

Participants received the following instructions: "You must choose 1 of 6 symbols in the right reel. The goal is to make as much money as possible. You will start the game with zero. When you win you will receive 5€ (virtual, in-game money only). When you lose you will receive nothing. You win when the symbols of the two reels are the same. When the symbols are different, you lose". Participants were given instructions on how to turn the left reel up, down, select the chosen symbol, and how to make the right reel turn. Figure 1 illustrates one of the trials. Participants completed 120 trials (with continuous EEG recording), with 1/6 of the total outcomes as wins, 1/6 as near-miss before, 1/6 as near-miss after, and 3/6 as losses (full misses). They were presented in a pseudorandom order.

Results and discussion

P300 for win, near-miss, and loss conditions

Considering the P300, Figure 2 shows the ERPs obtained at Cz for winnings, near-misses and losses. For each comparison, Bonferroni corrections were used. The results of repeated measures ANOVA demonstrated that there was a significant main effect of outcome type. The mean amplitudes of P300 differed significantly for the different outcomes, $F(2,66) = 21.5$, $p < .001$; $\eta_p^2 = .494$. Pairwise comparisons showed that the win condition ($M = 6.66$ µV, $SD = 3.70$) was associated with a significantly higher P300, compared with both the near-miss condition ($M = 3.42$ µV, $SD = 1.83$, $p < .001$) and the loss conditions ($M = 3.52$ µV, $SD = 1.92$, $p < .001$), but no difference between the near-miss and loss conditions was found ($p = 1.00$).

<<< insert Figure 2 here>>>

P300 for win, near-miss before the payline, near-miss after the payline and loss conditions

Figure 3 shows the ERPs obtained at CZ, incorporating the two subtypes of near miss. The mean P300 amplitudes differed significantly between the aforementioned subtypes, $F(3,88) = 32.8$, $p < .001$; $\eta_p^2 = .599$. Pairwise comparisons showed no differences ($p < .001$) between the win ($M = 6.66$ µV, $SD = 3.70$) and in the near-miss before the payline condition ($M = 6.16$ µV, $SD = 2.41$), with both these conditions eliciting a significantly higher P300 than the near-miss after the payline condition ($M = 1.34$ µV, $SD = 2.13$) and the loss condition ($M = 3.52$ µV, $SD = 1.92$, both $p \leq .001$).

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FRN for win, near-miss and loss conditions

The mean amplitudes of FRN differed significantly for the different outcomes ($F[2,66] = 60.17$, $p < .001$; $\eta_p^2 = 64.48$). An ANOVA was used to examine differences in FRN mean amplitudes between the win ($M = 4.539$ µV , $SD = 3.31$), near-miss condition ($M = 2.337$ µV, $SD = 1.78$), and loss condition ($M = 2.118$ µV, $SD = 1.67$).

No differences were observed for FRN mean amplitudes between the near miss and loss conditions, *t*(22) = -0.201, *p* = .842 but were found between these two (I changed 'to' to 'two' – is this correct?) conditions and wins (Figure 5).

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FRN for win, near-miss before the payline, near-miss after the payline, and loss conditions

Significant differences were observed in FRN mean amplitudes for the different types of outcomes (*F*[3,88] = 64.48.0, *p* < .001; η_p^2 = .746). Pairwise comparisons showed no differences (*p* > .05) between the win condition (*M* = 4.54 μV, *SD* = 3.31) and in the near-miss before the payline (*M* = 3.73 μV, *SD* = 2.64), with both of these conditions eliciting an FRN of higher amplitude than the near-miss after the payline condition (*M* = 1.37 μV, *SD* = 2.29, *p* < .001 and *p* < .05, respectively) and the loss condition (*M* = 2.12 μV, *SD* = 1.67, both *p* < .05).

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Using a slot machine computerized task, the near-miss effect was examined via an experimental protocol that involved the analysis of its neurophysiological correlates utilizing brain Event-Related Potentials (ERP) techniques. By using EEG/ERP, the present study represents an extension over the many existing behaviorally-based and fMRI-based studies. Furthermore, few previous studies have considered the two different subtypes of near-misses: near-misses before the payline and after the payline. Studies that have examined these subtypes either used another kind of gambling task (i.e., 'wheel of fortune') or methodological technique (e.g., self-report, fMRI). Furthering our understanding of the near-miss effect and its subtypes is important because the mechanisms involved appear to be different in each case, even though the objective outcome (no win) is the same and equivalent to a full-miss.

Based on the results here, two ERP components were related to near-misses: P300 and FRN. As predicted, and as found in previous studies (e.g., Alicart et al. 2015; Lole et al. 2011; Luo et al. 2011; Qi et al. 2011; Ulrich and Hewig 2014), a larger P300 amplitude was found for the win condition compared to the near-miss and loss conditions. If the near miss presented greater amplitude than the loss, this reflects a motivational difference in the gambler. However, contrary to the predicted hypothesis the study did not find a significant P300 difference between the near-miss and the loss (full-miss) conditions. This result has also been inconsistent in the literature (e.g., Ulrich and Hewig 2014) suggesting the need of additional studies. However, when the two near-miss subtypes were analyzed separately, results showed that the near-miss before the payline elicited a greater P300 than both the loss and the near-miss after the payline conditions. This result suggests that as the near-miss before the payline approaches a win, it promotes a positive expectation of result, and that the near-miss after the payline approaches to a loss (full-miss), even both represent total absence of effective win.

Although most studies approach the near-miss as one type of outcome in the comprehension of its effects in gambling/gaming behaviors, recent behavioral studies have suggested the possibility of a distinct effect dependent on the near-miss position. This effect appears to be independent from the task used (e.g., wheel of fortune, slot machine) and occurs despite the fact that the objective outcome is the same in both near-miss types, i.e., a loss (Wu et al 2017; Wu et al 2018). Previous research has found a distinct near-miss effect before and after the payline, suggesting the need for additional research to better understand its occurrence. One possible explanation given by the authors (which authors? If it's others, provide references; if it's us, say 'the present authors') is the counterfactual thought. The near miss before the payline would generate an additive counterfactual thought, given that the reel's trajectory might have continued to the jackpot position. After the payline, it would generate a subtractive counterfactual thought. The different types of counterfactual thinking could therefore be in the origin of distinct emotional and motivational effects found in the two types of near-miss effects (see also Clark et al. 2013; Markman and McMullen 2003). In addition, and as suggested by Wu et al. (2017), the position effect can be considered within the framework of the reflection and evaluation model (REM) of comparative thinking. According to this framework, two psychologically distinct models of mental simulation operate during comparative thinking. Experiencing a near miss "before" increases the self-perception of luck, whereas experiencing a near miss "after" increases the perception that the situation was "unlucky" (see Markman & McMullen, 2003 for a review). Future studies are needed to better understand whether this effect is enhanced or attenuated among participants with gambling and gaming disorder, compared with healthy and sub-clinical participants, as suggested by Wu et al (2018).

The present study found no differences between near-miss and loss in FRN amplitudes. Given that that FRN reflects a fast good-bad evaluation of feedback, and that a near-miss is (in effect) a non-win outcome, no differences would be expected between losses and near-misses, such as in the studies of Qi et al. (2011). However, when the different types of near-misses are taken into account, distinct results for near-miss after and before the payline were observed. More specifically, while the near miss after the payline elicited a FNR amplitude near to the win condition and higher than the loss, the near miss before the payline did not. In the literature, some studies suggest that FRN amplitudes reflect that near-misses and losses are processed differently, despite having equal monetary consequences (Lole et al. 2013; Qi et al. 2011; Ulrich and Hewig, 2014).

The study by Mushtaq et al (2013) showed the potential of ERP studies precisely through FRN and P3 component analyses, for the understanding of the value of the expectations. For the authors, the change relative to a previous situation meant that an improvement or a worsening in overall expectations had greater effect in the behavior than the objective value of the outcome. To the best of the present authors' knowledge, the study here is the first to investigate the effect of the near-miss subtype in an ERP study, and reinforces data from previous behavioral studies concerning the existence of near-miss sub-types.

Using the EEG technique and these two components analyses, the present study represents one step further in the understanding of the moderating effect of near miss on gambling/gaming behaviors. More specifically, it suggests that a near miss before increases motivation to game, in line with some previous studies (Clark et al., 2009, 2013; Qi, Ding, Song and Yang, 2011; Wu et al. 2017).

The present study is not without its limitations. The overall sample size was relatively small, and the participants were all university students (and therefore not representative of gamblers or the Portuguese population). Therefore, future studies should attempt replications with bigger sample sizes and more representative populations including those that would consider themselves as real gamblers. Other limitations include the lack of ecological validity. Although the study used a wellestablished gambling procedure adapted to an EEG study, the participants played on a simplified two-reel simulated slot machine in a laboratory (adapted from Sescousse et al. 2016), and no real money was involved, and the wins were hypothetical (Camerer and Mobbs 2017). Therefore, future experiments could be carried out in a real gambling venue using real slot machines (although not all conditions could be controlled for and is one of the advantages of carrying out such studies in controlled laboratory conditions). Finally, concerning the trial numbers, 60 of 120 trials were full losses, 20 were near-misses before, 20 were near-misses after, and the remaining 20 trials were wins. A different number of trials affects the signal to noise ratio, but this makes the task more realistic.

It has also been demonstrated that hypothetical wins may understate the strength of brain activity and give an incomplete picture concerning neural mechanisms (Camerer and Mobbs 2017). It should also be noted that the initial sample comprised a higher number of participants, but some were excluded due to the identification of artifacts.

A better (and more nuanced) understanding of the near-miss effect could be an important step in understanding the mechanisms of gambling and inform intervention strategies. The results here suggest that P300 and FRN are sensitive to the near-miss payline position, confirming recent studies that have collected and analyzed behavioral data (Wu et al. 2017; Wu et al. 2018). This also reinforces the empirical evidence in favor of the existence of near-miss subtypes, with their own neurophysiological correlates, indicating the performance of different mechanisms.

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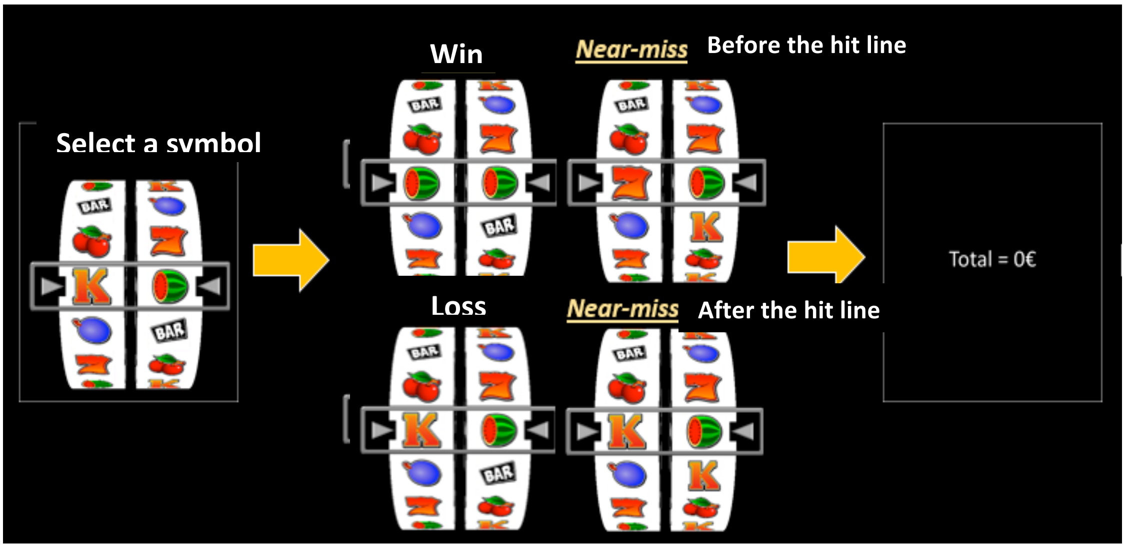
Figure 1. Example of one trial with the three possible outcomes. Slot machine task displaying the three phases of the process (selection of a symbol, anticipation, and outcome).

Topographical maps plotting means to Win, near miss before, near miss after, loss and near miss ERPs between 150 and 300 ms (FRN).



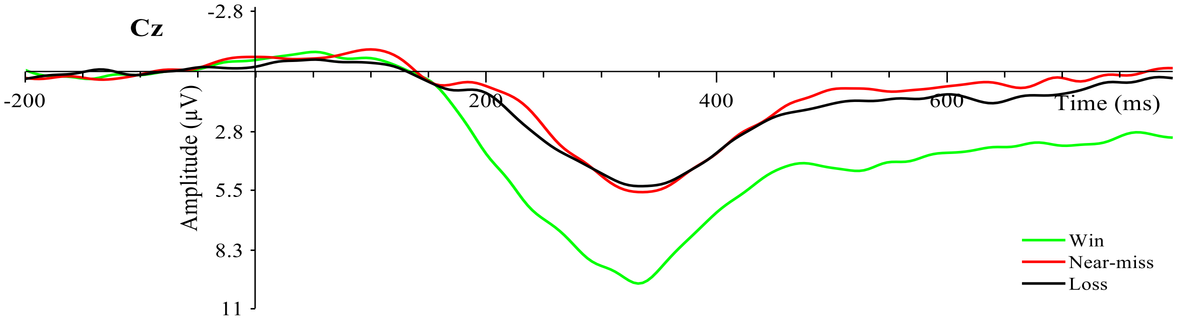


Figure 2. Mean amplitudes of P300 in Cz to the conditions win, near-miss and loss.

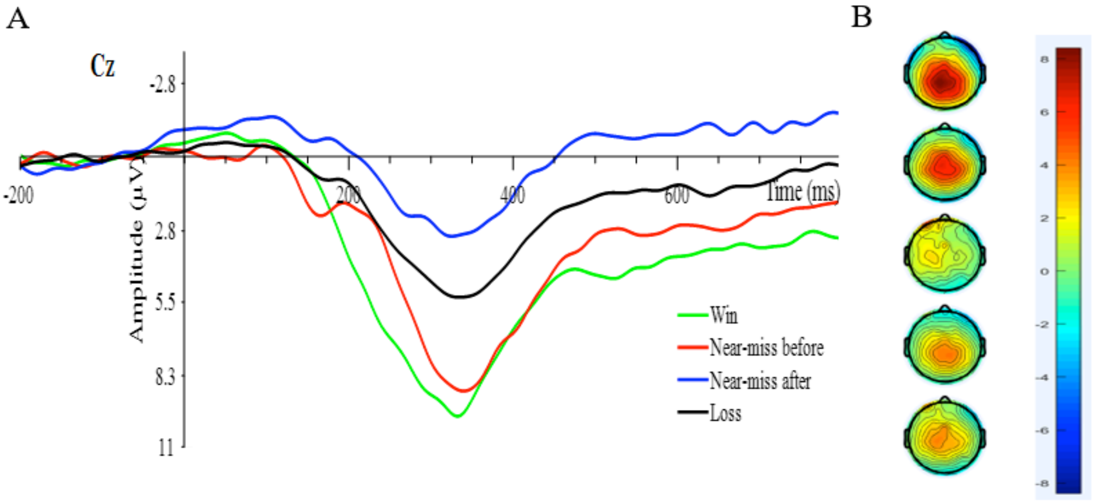


Figure 3. A. Mean amplitudes of P300 in Cz to the conditions win, near-miss before, near-miss after, and loss. B. Topographical maps plotting means to win, near miss before, near miss after, loss and near miss, 250ms to 500 ms.

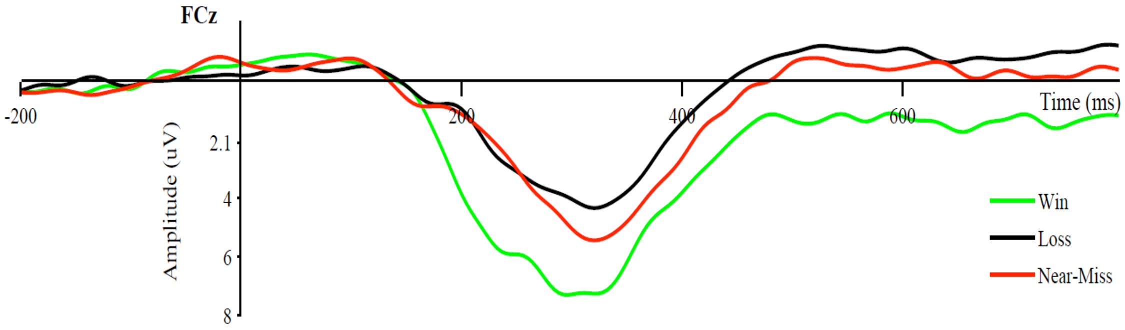


Figure 4. Mean amplitude of FRN in FCz to the conditions win, near-miss and loss.

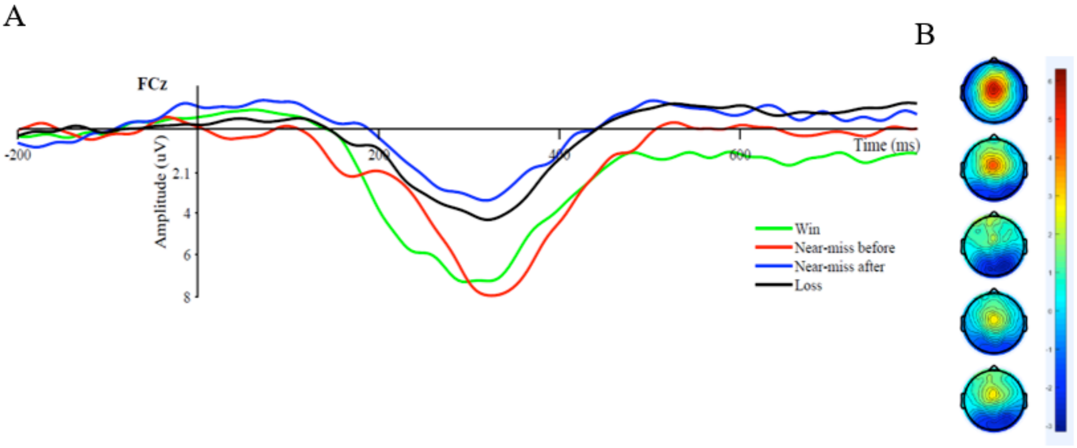


Figure 5. Mean amplitude of FRN in FCz to the conditions win, near-miss before, near miss-after, and loss. B. Topographical maps plotting means to win, near miss before, near miss after, loss and near miss, 150 ms to 300 ms.