Deception and Arousal in Texas Hold 'em Poker

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

In our pilot study investigating Texas Hold 'em poker, we found that players bluffing (with a losing hand) elicits a similar physiological arousal response (as measured by skin conductance levels) to those in a position of strength and poised to win. Since arousal has been suggested to be a reinforcing factor in problematic gambling behaviour, we sought to replicate the findings of our pilot study in the current investigation. We aimed to extend our previous findings further by: isolating truthful betting (strong betting) to disambiguate deception when players are in positions of strength (i.e. trapping), measuring subjective excitement levels and risk assessments, investigating the physiological arousal responses following wins versus losses, and finally, exploring group differences (i.e. problem gambling status, experience levels). 71 participants played 20 naturalistic rounds of Texas Hold 'em poker for monetary rewards. We were able to replicate our previous findings that bluffing triggers a physiological arousal (as measured by skin conductance responses) similar to truthful strong betting. Trapping was also found to elicit a skin conductance response similar to both bluffing and strong betting. Measures of subjective excitement revealed a pattern that converged with physiological data. Furthermore, wins were found to be more arousing than losses. Finally, our exploratory analysis of group differences (i.e. problem gambling status, experience) proved to be an insignificant factor with all measures. We conclude that the effect of bluffing on physiological arousal is so powerful that it pervades all participants; which is problematic due to its risky nature and potential to be self-triggered. With its ever increasing popularity and availability, more research on Texas Hold 'em poker is warranted for treatment implications.

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List of Abbreviations

ANOVA – Analysis of Variance

CPGI – Canadian Problem Gambling Index

NPG – Non-Problem Gambler

PEI – Poker Experience Index

PG – Problem Gambler

SCL – Skin Conductance Level

SCR – Skin Conductance Response

Introduction

All forms of gambling have an underlying element of luck and chance. However, there are games in which a player's skill level can influence and increase their chances of winning. For example, gamblers who are knowledgeable in probability and statistics can increase their chance of winning against the casino in games such as blackjack or horse-betting. Another game in which skilled players can gain an advantage when playing but which is distinct from all other forms of gambling, is the game of poker. Instead of playing against the house (or casino), poker players compete against one another. A poker player can still manage to win even when they are dealt cards that are considered to be a weaker hand. This feat can be accomplished by influencing all other players to "fold" (to drop out of the current stage and thus the round) before all the cards are revealed. This potent combination of skill and chance has resulted in a steady rise in the popularity of poker (Montlake, 2013; Vitka, 2009).

One particular form of poker, Texas Hold 'em Poker, has seen the greatest increase in popularity. As its name suggests, the game of Texas Hold 'em poker most likely originated in Texas – as a deviation from another form of poker, 7-card stud. In televised poker, the more popular the game (the more viewers watching), the larger the advertising revenues. This in combination with more players entering tournaments allow casinos to offer incredibly high stakes to the winners - in the most recent World Series of Poker event held in Las Vegas the top prize was over 8.5 million dollars (http://www.wsop.com/2012/index.asp). In recent years, Texas Hold 'em poker has gone on to become one of the most popular forms of online gambling – 3rd most popular on Facebook as of Jan.7, 2013 (http://www.appdata.com/) and produced worldwide revenues close to $15 billion in 2006 (http://www.economist.com/node/10281315). Still, for a game that has grown to be so popular and even has spawned many computer “apps”, there has been little research conducted regarding the traditional – “kitchen table” forms of playing. Therefore, the goal of the current research is to examine the game in a naturalistic setting.

A game of Texas Hold ‘em poker can have anywhere from two to ten players (theoretically the maximum number of players is 15, though most casino tournaments limit it to ten). Before the cards are dealt at the beginning of the round, the player seated to the left of the “dealer” (an arbitrary name for the player who gets dealt last) has to post the “small blind” (a forced bet to ensure action), whereas the player to the left of the small blind has to post the “big blind” (twice the amount of the small blind). The dealer then shuffles a standard deck of playing cards and each player is dealt two face-down cards (also known as “hole cards”). The first stage of betting (known as the “pre-flop”) then commences beginning with the player to the left of the big blind. Players have four options: folding, checking (to make a bet of zero if no bets have been made; in the pre-flop stage, only the big blind may check if no additional bets have been made), calling (matching the big blind or another players bet if one is put in), or raising (betting any amount that is greater than the big blind or twice the amount of the current bet). When all betting is completed, the dealer first discards the top card and then turns over three cards face-up (also known as the “flop”). Any cards that are placed face-up by the dealer are communal cards – meaning that all players will use them in combination with their two down cards to make the best hand. After the flop has been revealed, the player left of the dealer then decides which one of his/her four options (i.e. fold, check, call or raise) to take. When all betting has been completed, the dealer again discards the top card and reveals the fourth card face-up (also known as the “turn”). Betting again begins around the table starting with the player left of the dealer. When all betting has been completed, the dealer again discards the top card and reveals the final card (also known as the “river”). Players can now use any of the communal cards in combination with their two hole cards to create the highest ranking poker hand. A final round of betting starts with the player to the left of the dealer. After that, all remaining players then reveal their two down cards and the player holding the highest ranking 5-card poker hand takes the entire pot. In situations where players hold the same hands, the pot is split between them.

The majority of academic research on Texas Hold ‘em poker has focused on the specific cognitive biases that many players suffer from (Linnet et al., 2011; Germain & Tenenbaum, 2011; Wood, Griffith, & Park, 2007), the strategies they employ (Siller, 2009), and the differences in their skill levels (McCormack, Griffiths, 2011; Linnet et al., 2010). However, the vital question of what specifically makes Texas Hold ‘em a popular card game has yet to be investigated fully. A recent study by Bjerg (2010) posits that the structural composition (i.e. a social game that combines skill and chance) has implications for the development of problem gambling in Texas Hold ‘em poker players. Still, the main focus of Bjerg and all other previous studies has been limited to the differences between the types of players (e.g. professional vs. novice; recreational vs. problem gamblers) and not on the actual features of the game itself.

Literature examining gambling behaviour in other domains has revealed that arousal can be a potent reinforcing factor (Brown, 1986; Anderson & Brown, 1984; Blaszczynski & Nower, 2002; Wulfert et al., 2005; Sodano & Wulfert, 2010; Seifert

&Wulfert, 2011). Positive reinforcement from intermittent wins can produce spikes in physiological arousal, which are said to be the equivalent of a “drug-induced high” (Blaszczynski & Nower, 2002). Physiological arousal can also produce negative reinforcement by alleviating hypo-arousal and or anxiety (Blaszczynski & Nower, 2002). Increases in arousal have been found across many different gambling forms including: blackjack (Anderson & Brown, 1984), electronic gaming machines (Leary & Dickerson, 1985; Coventry & Constable, 1999; Coventry & Hudson, 2001; Wilkes, Gonsalvez & Blaszczynski, 2010), off-track horse racing (Coventry & Norman, 1997), and roulette (Studer & Clark, 2011). Differences in physiological arousal profiles following the outcome of a gamble have also been found. Typically, wins are more physiologically arousing than losses (Dixon et al., 2010; Dixon et al., 2011; Wilkes, Gonsalvez, Blaszczynski, 2010; Anderson & Brown, 1984; Goudriaan et al, 2006). Arousal appears to increases linearly with win size (Wulfert et al., 2008; Dixon et al, 2011); though exceptions can be found (Studer & Clark, 2011). Most importantly, even though some studies revealed high frequency gamblers to show the greatest increases in arousal, other studies found that both high and low frequency gamblers show marked increases in arousal in a gambling context (Coventry & Norman, 1997; Dixon et al., 2011).

Gambling research has also identified different sub-types of gamblers (Blaszczynski & Nower, 2002; Coventry & Brown, 1993; Coventry & Norman, 1997). The one categorical grouping most related to Texas Hold ‘em poker is sensation seeking (Blaszczynski & Nower, 2002). According to Bonnaire, Bungener and Vaescon (2006), gamblers classified as high-sensation seekers tend be those who play exciting and risky games at the casino. A study by Pantalon et al. (2007) also found that excitement seeking gamblers were more likely than non-excitement seeking gamblers to engage in risky betting patterns as well as having impaired control. This led us to posit that those who play Texas Hold'em poker regularly might be those who gamble for the "arousal high". Gambling studies have further found that problem gamblers specifically experience greater increases in subjective arousal (Brown et al., 2004) as well as increases in physiological arousal (as measured by skin conductance levels) during gambling tasks that compared high frequency to low frequency gamblers without gambling problems (Sharpe et al., 1995).

We suggest that one particular psychological aspect of playing Texas Hold 'em might contribute to the level of arousal and excitement of the players. As aforementioned, unlike many other forms of gambling, a player may still win the pot regardless of what cards they possess so long as all other players fold. This is likely to happen when a player is portraying clear signs of strength by their pattern of betting. A player who raises, *may* have a strong hand. More importantly however, a player who has a weak hand may also raise in an attempt to deceive others about the actual strength of their hand. This is more commonly known as a bluff. Formally, we define bluffing as, "the act of deceiving other players into believing you have a hand with a much HIGHER probability of winning than the hand you have been dealt". By bluffing, players are able to win a hand and make a profit on an otherwise sure loss. Bluffing is not the only form of deception in poker. A player holding an extremely strong hand can also deceive other players into a false sense of strength by feigning weakness – this is more commonly known as trapping. Formally, we define trapping as, "the act of deceiving other players into believing you have a hand with a much LOWER probability of winning than the hand you have been dealt".

Bluffing and trapping are both forms of deception, then, that occur within a gambling context.

Research investigating the effectiveness of using physiological measures for the detection of lying (Podlesny & Raskin, 1977) suggests that the act of attempting to deceive others elicits different physiological responses compared to truth-telling (Ambach et al., 2008). Such physiological responses most commonly manifest as physiological arousal. Previous research has shown that differences in physiological arousal can reliably differentiate between those who are lying and those who are telling the truth (Ambach et al., 2008; Podlesny & Raskin; Furedy et al., 1988). Deception research has found that electrodermal responses (e.g. galvanic skin response; changes in skin conductance levels) are the most reliable measure of physiological arousal in differentiating between liars and truth-tellers (Godert, Rill & Vossel, 2001; Ambach et al., 2008). Cardiovascular measures (e.g. heart rate) are also commonly used as a marker of deception (Cutrow et al., 1972; Gödert, Rill, &Vossel, 2001; Gamer et al., 2006; Peth, Vossel & Gamer, 2012), but are influenced by both sympathetic and parasympathetic systems of the autonomic nervous system. Electrodermal activity is predominately influenced by the former (Dawson, Schell, & Filion, 2000) and is therefore a more "pure" and reliable measure of arousal. Heightened electrodermal activity is most commonly measured by changes in skin conductance levels (SCL) and frequency of skin conductance responses (SCRs). In Podlesny and Raskin's extensive review of the early literature (Podlesny & Raskin, 1977) they report a number of studies that show skin conductance levels increase during deception. More recent studies have found similar results (Kircher & Raskin, 1988; Gamer et al., 2006). Gödert, Rill, and Vossel (2001) showed that skin conductance levels discriminated truth telling from deception. They used the differentiation-of-deception paradigm where participants are given pairs of questions and instructed to lie on one, and be honest for the other. After controlling for both mental load and emotional affect they found significantly higher skin conductance levels when participants were lying than when being honest.

Davis (1961) proposed three theories concerning why truth telling and deception lead to different arousal responses. Most applicable to bluffing in poker is his punishment theory. This theory predicts, "…a person will give a large physiologic response during lying because he anticipates serious consequences if he fails to deceive." (p.163). Consequently, whenever an individual commits a deceptive act (i.e. anticipating losing money if caught during the act of trying to "steal the pot" in poker), physiological arousal should increase. Although there is evidence for arousal stemming from a deceptive action, the same autonomic responses may be attributable to the affect experienced while lying (Zuckerman et al., 1981; Fukada, 2001). Most commonly, guilt and anxiety are triggered by an act of deception (Knapp et al., 1974). However, in a gambling context where deceptive acts are authorized as an integral part of the game (Ekman & Frank, 1993) and can maximize profits, one would predict minimal guilt, though feelings of anxiety should still increase due to the fear of being detected. At the extreme, research concerning general anxiety disorders has shown that those who suffer from this disorder show elevated levels of skin conductance (Pruneti et al., 2010). Lying in Texas Hold'em poker then, despite not inducing feelings of guilt, should still lead to an increase in physiological arousal due to the anxious feelings that arise in players during their deceptive acts. Taken a step further, dependent on the success of a lie, even greater arousal can be generated from a deceptive action. Known as “duping delight” (Ekman & Frank, 1993), liars can have positive feelings of accomplishment and proudness following a successful lie. Though no research has investigated the relationship between duping delight and physiological arousal, a successful lie should result in further increases in physiological arousal (though ceiling effects are also a possibility).

Arousal during bluffing may rise not just because of deception though, but also because of the risk involved. Even during normal play if players are holding a strong hand but wish to be deceptive (in order to maximize profits), the level of risk is rarely none. The only situation when players are 100% certain that they have won the hand is if they hold the absolute best hand – which is extremely rare. As such, it is possible that players holding a very strong hand (e.g. straight) can still lose to a hand that is better (e.g. flush, a higher straight). When bluffing, one holds a weak hand, yet bets to deceive others. If any one of the players calls another player’s bluff, the bluffer will lose his bet, and the pot. Thus the risk is higher during bluffing than during any other time in game play.

The Iowa Gambling Task (IGT) highlights the relation between risk and arousal (Bechara et al., 1997). In the IGT one must make a choice between a “risky” deck that has large occasional payouts but will result in a net loss in the long run; and a “safe” deck that had smaller but more frequent payouts that result in a net gain in the long run (Bechara et al., 1994). Results indicate that skin conductance levels increase when one is about to make a risky decision (Goudriaan et al., 2006; Botvinick & Rosen, 2008). In poker, risk also changes as a function of the progression of a hand. It is LESS risky for a player to be deceptive (specifically bluffing) at the beginning of a round with a weak hand when there are more chances for the weak hand to improve (i.e. flop, turn, river) and the monetary investment is lower. On the other hand, players bluffing with the final community (i.e. river) card revealed have no more chances to improve their hand strength and must make their final bluff as convincing as possible to avoid losing the pot. For players who trap to maximize profits though, objective risk can still increase as the round progresses in circumstances if a community card tends to favor another player. In a recent study that allowed for players to control their level of risk (through bet size selection) in a roulette type game, Studer and Clark (2011) found that electrodermal activity to be greater with riskier bets.

To our knowledge, only our own pilot study has investigated physiological arousal in Texas Hold 'em poker. In that study, 65 University of Waterloo undergraduate students were recruited in groups of 3 to play 18 hands of Texas Hold 'em poker against each other. Participants were instructed to bluff when they saw a designated hand that was weak in strength (e.g. King of clubs, 2 of spades). At times, they were also given hands of high winning probabilities (e.g. pair of aces) and hands that were equally weak as the bluffing hands (e.g. King of hearts, 2 of diamonds) but were not explicitly instructed on how they should play these hands. The cards were pre-determined (i.e., "stacked") to force players to bluff as well as ensure that players received an equal number of strong and weak hands over the course of the eighteen rounds. Throughout play, their skin conductance levels were continuously recorded. We found that when players were dealt a bluffing hand, their physiological arousal was significantly greater than when players were dealt a weak hand. More importantly, the arousal level when bluffing was no different than when players were dealt strong hands with a high probability of winning. Though our findings were significant and contributed to the lacking body of studies investigating Texas Hold ‘em poker, there were several limitations to this initial investigation.

First, participants were given explicit instructions that they had to bluff whenever they saw designated cards. This manipulation removes the sense of “agency” from the gamblers – players are not in control of *when* or *if* they choose to bluff. Previous studies have found that this sense of agency during gambling can markedly influence physiological arousal levels (Studer & Clark, 2011). Second, our pilot study concentrated only on bluffs. As stated previously, deception can also occur when players have a strong hand (i.e. trap). Thus, the equivalence in SCRs between those holding a strong hand, and those holding a weak hand could have been due to the deception in each case. Finally, participants were playing for participation credit and not for real money. Gambling researchers have argued that removing money from gambling paradigms can greatly reduce generalizability and minimize effect sizes (Ladouceur et al., 2003; Wulfert et al., 2005).

Another limitation of our previous pilot study was that player’s poker playing experience was not assessed. Thus, there was likely a mix of novice, and more skilled, experienced players. Optimally, a player would employ a deceptive strategy and maximize their winnings by bluffing with a weak hand and trapping with a strong hand to lure other players into investing more chips into the pot. However, how a player applies such strategies can depend on their expertise. Within the Texas Hold ‘em community, some forums suggest that inexperienced players may not be compelled to execute deceptive actions as they are not familiar with the game whereas experienced players will have played enough hands to realize that it is necessary to be deceptive at selective times to maximize their earnings. Furthermore, while it is certain that all those who were bluffing were attempting to engage in the act of deception, when considering trapping, as mentioned, some novice players may not be familiar enough with the game to employ this strategy. As such, calculating the average reaction to holding a "strong hand" may be suspect, as this average will be based on experienced players engaging in deception (trapping) and others who are simply betting without attempting to deceive.

Studies investigating differences in expertise in Texas Hold'em gamblers have found that novices are not as capable as expert poker players in correctly rejecting a hand that had a lower probability of winning – and therefore took greater risks (Linnet et al., 2010; Germain & Tenenbaum, 2011). As such, experts should opt to employ bluffs that tend not to extend to the latter stages of a hand, whereas novices may fail to correctly assess the situation and continue to bluff although their chances of succeeding in their bluff and winning the hand are slim to none. Research has further suggested that problem gamblers may suffer from erroneous cognitions which may lead them to inaccurately assess the probability of winning a gamble over the risk of losing (Fletcher, Marks, & Hine, 2011). With the advent of various online, Texas Hold 'em poker "tools", a player's probability of winning a hand can be calculated using a Texas Hold 'em Poker Odds calculator (http://www.cardplayer.com/poker-tools/odds-calculator/texas-holdem). As such, these tools can be used to investigate the risk assessments of players when they take their action. Therefore, the probability of winning can then be used to both: confirm that bluffs are objectively risky as well as reveal any group differences (experience, problem gambling status) in their risk assessments before taking their actions.

Our main goal of the current study aims to replicate the findings of our pilot study while addressing the previous limitations. In this study, decks are no longer stacked and hands pre-determined – instead, a naturalistic approach was taken where cards were shuffled (randomized) in the usual way. Along with boosting ecological validity, this naturalistic paradigm also restores the sense of agency among players – they choose when to fold, trap, or bluff. To further validate physiological measurements of arousal, subjective measures of excitement and risk were also included in the current study. This also has the added benefit of revealing the true intentions of players when dealt a strong hand. We could now separate those who were trapping from those who were simply betting without deception. This allowed us to compare those arousal levels triggered by deception (while bluffing) to a strong hand condition where no deception was involved (data from those trapping were not considered). This would allow us to better gauge the true effects of deception in Texas hold 'em poker.

In the current study, we also aim to confirm that the best method to feign strength with a bluff is by betting similar chip amounts as a regular truthful bet. However, if a players' intention is to deceive other players into a false sense of security, then they should feign weakness by not betting as many chips. Finally, with the help of a Texas Hold 'em Poker Odds calculator, the probability of winning can be tracked to investigate any group differences in their risk assessments.

Taken together, several hypotheses were generated to investigate physiological profiles and behavior of players when they are engaged in the game of Texas Hold 'em poker:

1) Similar to the results obtained in our initial study, it is predicted that:

    a. Physiological arousal will increase significantly more during bluffing and strong bets (assessed using skin conductance responses) than weak hands that are folded.

    b. Subjective arousal ratings should show results that mimic physiological arousal.

2) To complement our arousal measures we also measured risk: We predicted that:

    a. Subjective ratings of risk during bluffing will be rated significantly higher than strong bets or folds.

    b. The amounts bet during bluffs should be indistinguishable from truthful bets on strong hands.

    c. Objective win probabilities of truthful bets will be greater than when players are bluffing.

    d. Subjective ratings of risk will correlate with bet amounts and objective win probabilities.

3) Congruent with the majority of previous gambling findings, we predict that:

    a. Wins will be significantly more arousing than losses.

    b. We also predict that duping delight should elicit a greater physiological response than wins that occur with a truthful strong bet.

    c. Experience and problem gambling status will be a significant factor in eliciting different physiological and subjective responses.

The main focus of the study is to examine arousal. The extensive literature on gambling has suggested that arousal is **the** reinforcing factor among high frequency gamblers (Anderson & Brown, 1984; Blaszczynski & Nower, 2002; Wulfert et al., 2005). If we can again show that bluffing leads to increases in arousal even when not given instructions to play a certain way, it may have treatment implications for those who have gambling problems.

Method

Participants

We tested 71 participants in total (17 females). Gamblers ranged in age from 19 to 64, with a mean age of 27 years old. Gambling status was assessed using the PGSI (Problem Severity Gambling Index) of the Canadian Problem Gambling Index (CPGI). In accordance with the updated scoring of problem gambling status (Currie et al., 2010), participants who scored 4 and below were classified as non-problem gamblers (NPG) and those who score above 4 were classified as problem gamblers (PG). Poker experience was assessed using a short questionnaire, the Poker Experience Index (PEI) that we had developed (Appendix A). The Poker Experience Index consists of seven questions that ask participants about the frequency and duration of play for Texas Hold 'em poker. The format of the questions follows closely the format of questions on the CPGI (e.g. "In the past 12 months, how many times did you play Texas Hold 'em poker?"). Participants were labeled as inexperienced if they had not played Texas Hold 'em poker for at least 25 hours in total in the past 12 months whereas participants who had were categorized as experienced. Participants were recruited from the community using paper flyers and on-line advertisements posted on Craigslist and Kijiji. The demographics of participants are shown in Table 1.

Table 1. Number of participants, mean ages (standard deviation in parentheses), gender and mean poker experience. NPG = Non-problem gambler, PG = Problem gambler.

Group	No.	Age (SD)	Male	Female	Poker Experience (# of hours played in past 12 months)
Inexperienced (All)	43	27.31 (8.88)	39	13	4.95
Inexperienced (NPG)	38	28.26 (9.41)	27	11	4.95
Inexperienced (PG)	5	27 (8.66)	5	0	5
Experienced (All)	28	25.95 (4.99)	15	4	274.98
Experience (NPG)	14	24.71 (6.9)	12	2	138.99
Experience (PG)	14	25.57 (3.3)	10	4	410.96
NPG (All)	52	28.12 (9.24)	32	11	41.04
PG (All)	19	25.14 (5.32)	22	6	304.13

Apparatus

Skin conductance responses were acquired using an eight channel, ADinstruments Powerlab (model 8/30). Skin conductance levels were recorded using non-gelled electrodes attached to the upper phalanges of the ring and index fingers of the non-dominant hand. A Canon FS2000 video camera was mounted on a tripod and recorded the tabletop throughout the games. Events were marked post-experiment to time-lock actions that participants took with changes in skin conductance levels. The videos were examined post experiment to record the amount of chips that each player committed for every action. To examine the probability of winning for each player, a research assistant recorded all down cards and community cards. The probability of winning for each player was calculated by submitting the recordings to "http://www.cardplayer.com/poker-tools/odds-calculator/texas-holdem". The change in winning probability whenever a player opted to fold was controlled for by moving the folded cards into the "Dead card" area. Since all bets in poker would seem alike without knowing the true intention of the player, a checklist that contained all possible actions of a round (Appendix B) was given to participants at the beginning of each round to complete throughout the different stages of the hand. This checklist contained the following options: Fold, Check, Call a et (or a raise) put in by another player, Bet/raise a HIGH amount so others would call (or raise), Bet/raise LOW amount so others would call (or raise), Bet/raise a HIGH amount so others would fold, Bet/raise a LOW amount so others would fold.

Note that the checklist did not contain the words bluff or trap. Rather the action associated with bluffing for example was explicitly described but the term was not mentioned. In the checklist the phrases "Bet/raise a HIGH amount so others would fold" indicated a bluff. So too did "Bet/raise a Low amount so others would fold" (the latter being a type of strategy used by more experienced players). The phrase "Bet/raise a LOW amount so others would call (or raise)" indicated a Trap, whereas "Bet/raise a HIGH amount so others would call (or raise)" indicated a Strong Bet (without deception).

Subjective excitement was assessed by asking participants, "How exciting was that action?" with the 9-point Likert Arousal sub-scale of the Self-Assessment-Manikin Scale (Lang, 1980). These arousal Manikins (appendix A) were visible to players throughout the game (on a frame in front of where their down cards were dealt), but were not on the checklist itself. Subjective risk was assessed by asking participants, "How risky was that action?" answered on a 9-point Likert scale. The action checklist, and excitement and risk rating scales were presented on slips of paper that were passed out to participants at the beginning of each round.

Procedure

Participants signed a consent form and were administered the Canadian Problem Gambling Index (CPGI) and Poker Experience Index (PEI). The experimenter then attached the Galvanic Skin Response electrodes. Verbal rules of the game were given to the participants explaining that they would be playing 20 hands of pot-limit Texas Hold ‘em poker where the maximum amount a player can bet at any time is the total amount of chips in the pot at that moment. They were informed that the small and big blinds were fixed at values of 1¢ and 2¢. A total of $5.00 in chips was allocated to each participant. Players were told that they had an additional $5.00 in the bank in case they went bust. The subjective scales were then introduced to all participants and they were shown the arousal manikins associated with the excitement ratings. Participants then played two practice rounds to ensure that they understood the rules and how to fill out their subjective scales. To minimize movement artifacts, players were instructed to fill out their subjective scales at the end of each stage and to keep all non-essential hand movements to a minimum. After the practice rounds, participants then played a further twenty rounds. At the end of the rounds, their remaining chips were counted and exchanged for monetary compensation.

Results

Due to the naturalistic design of our paradigm, individual differences in the frequency of actions exist. Dependent on the analysis, there may be participants that do not qualify for each analysis (due to missing cells). The number of participants that qualified for each analysis is listed prior to each analysis below. When sphericity assumptions were violated, Greenhouse-Geisser corrections were applied to the p values.

Skin conductance response magnitudes

To measure the skin conductance response to each action, we defined a 3-second time-window beginning 1 second after a player completed the action. This window was chosen because of the slight latency in SCR initiation after stimulus onset (Dawson, Schell, & Filion, 2000). Action completion was marked by the retraction of the player's hand (e.g., after betting, when their hand began to return to its standard position away from the pot). SCRs were defined as the maximum within this window minus the value at the beginning of the window. Average SCRs were calculated for each action (fold, strong bet, trap, bluff). Epochs were excluded if participants turned their body to complete the subjective reports prior to the end of the 3-second window (to eliminate movement artifacts).

The SCRs of each individual's action were pooled and averaged. Prior to calculating these averages, the raw SCRs were subjected to Van Selst and Jolicoeur's (1994) outlier removal procedure which uses a sliding criterion based on the number of observations making up the mean for that particular action. This outlier trimming procedure was necessary because folds occurred far more frequently than all other actions. Following the outlier removal procedure, the average SCR amplitudes for each participant were re-calculated.16.9% of the data was eliminated by the outlier analysis.

Our analytical strategy was the following. Since the primary goal of this thesis was to replicate our previous pilot study but remove the contamination of deception in the betting from the strong hands condition, we first analyzed the data using a repeated measures analysis of variance with action (fold, strong bets, bluff) as the repeated factor. To ensure there was no deception involved in betting from a position of strength, we removed from the analysis all actions where the checklist indicated that players were trapping. Following this analysis, we conducted planned comparisons comparing folds to strong bets, folds to bluffs, and strong bets to bluffs.

Note that planned comparisons allowed us to maximize the number of participants that could be used (e.g., if a player had data for folds and strong bets, but did not bluff) that player's data would be eliminated in the overall ANOVA because of the missing data from the bluffing cell, but their data could be used in the a priori fold vs. strong bet comparison). Next we re-analyzed the data using a mixed model analysis of variance with action (folds, strong bets, bluffs) as the repeated factor, and gambling status (NPG, PG) and experience (novice, experienced) as between subjects factors to see if these latter variables had either main effects or interactions with actions. Lastly, we conducted an exploratory analysis in which we included traps as a separate action. To avoid low numbers of participants in a large scale ANOVA due to missing data, we conducted only planned comparisons for traps. Traps were compared to folds, then to strong bets, then to bluffs.

Following this analytical strategy SCRs were analyzed using a repeated measures ANOVA (N=44) with action (fold, strong, bluff) as the factor. The SCRs of the actions were found to be significantly different $F(2,86) = 4.120$, $MSE = .936$, $p = .024$. Planned comparisons indicated that Strong bets triggered greater arousal than folds $t(51) = 2.401$ $SE = .190$, $p = .020$. Bluffs also triggered greater arousal than folds $t(43) = 2.679$, $SE = .160$, p = .010. Strong bets and bluffs were not found to be significantly different $t(52) = .323$. Figure 1 depicts these findings.

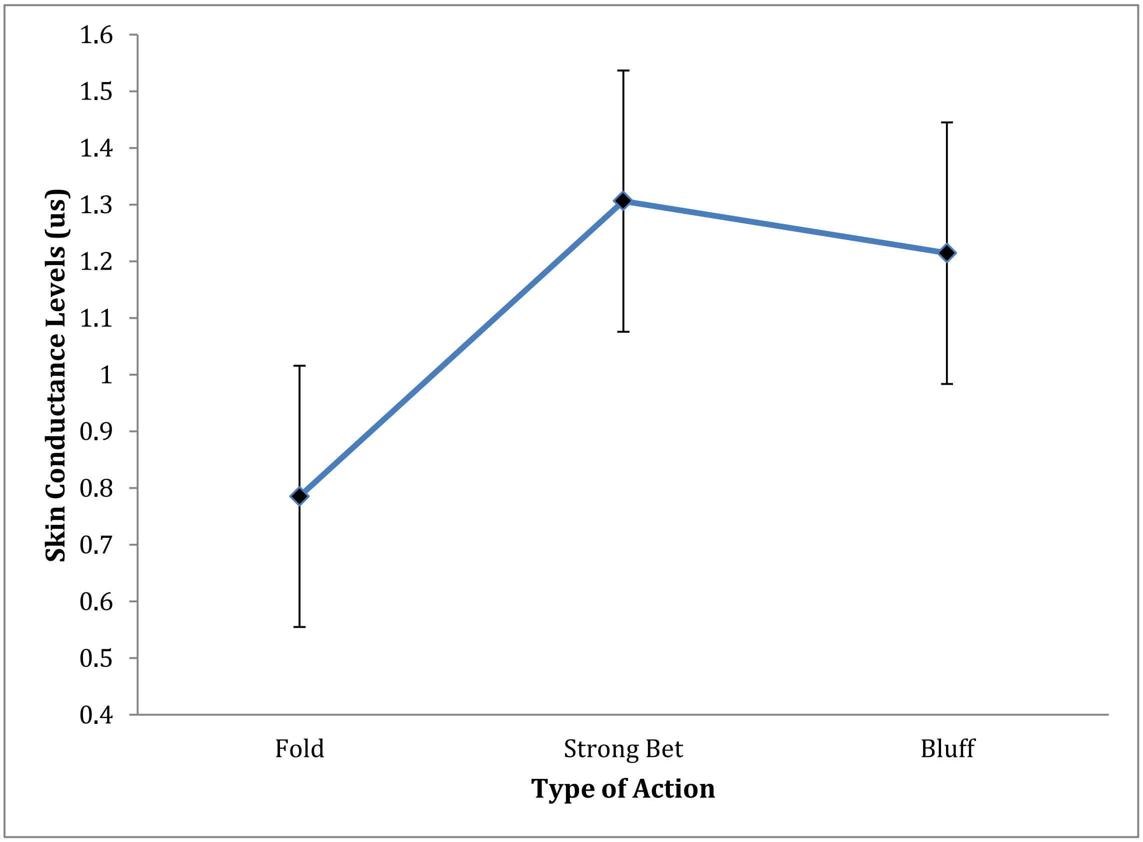

Figure 1. Skin conductance responses analysis for each action averaged over the 3 second window (i.e., from 1 second after action to 4 seconds after action). Error bars are Masson and Loftus 95% confidence intervals for repeated measures designs.

We then redid the repeated measures ANOVA (N=44) for SCR and included gambling status (NPG, PG) and experience (novice, experienced) as between subject variables. Neither gambling status, nor experience led to main effects, and were not involved in significant interactions.

Finally, we conducted the three planned contrasts involving traps. Traps were found to be significantly more arousing than folds $t(51) = 2.401$, $SE = .190$, $p = .020$. Strong bets and bluffs were not found to be significantly different than traps. Figure 2 portrays the mean skin conductance response of all four actions for participants that conducted all four actions.

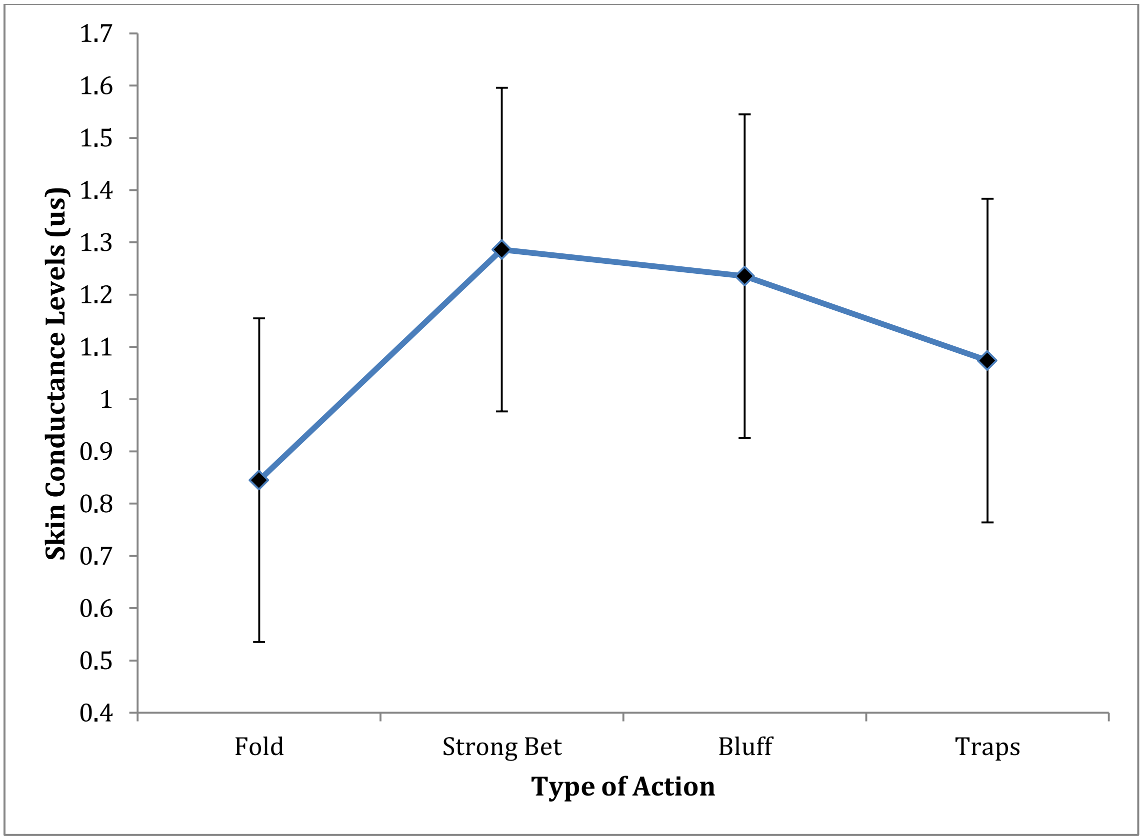

Figure 2. Average skin conductance responses for the four action types. Error bars are Masson and Loftus 95% confidence intervals for repeated measures designs.

Subjective Responses

Recall that participants filled out subjective excitement and risk scales for every action. The scores of each individual's action were pooled and averaged (e.g., all of a given participants ratings of excitement when they bluffed were averaged). Since we wished to see whether subjective ratings would mimic their physiological responses as assessed using SCRs, if a player's SCR was an outlier then that rating was also removed prior to calculating these averages.

Subjective Excitement

We used the same analytical strategy as before: a repeated measures ANOVA (N=44) on actions (fold, bluff, strong bet without traps), followed by a priori contrasts between folds and bluffs, folds and strong bets, and bluffs and strong bets. This was followed by a repeated measures ANOVA on actions (folds, strong bets, bluffs) with gambling status (NPG, PG) and Experience (novice, experienced) as between subjects factors. We then conducted three planned comparisons involving traps.

The first analysis indicated that subjective excitement scores were found to be significantly different dependent on the action $F(2,84) = 73.904$, $MSE = 1.365$, $p < .001$. Planned comparisons indicated that strong bets triggered more excitement than folds $t(49) = 11.290$, $MSE = .262$, $p < .001$. Bluffs triggered greater excitement than folds $t(42) = 9.557$, $MSE = .274$, $p < .001$. Strong bets and bluffs did not significantly differ in their ratings of subjective excitement.

We then redid the repeated measures for subjective excitement and included gambling status (NPG, PG) and experience (novice, experienced) as between subject variables. The main effect of problem gambling, the main effect of experience, the interaction between action and experience, action and problem gambling, action by experience by problem gambling were all non-significant.

Lastly we conducted the three planned contrasts involving traps. Traps were found to be significantly more exciting than folds $t(43) = 7.112$, $SE = .278$, $p < .001$. Traps were less exciting than strong bets $t(47) = 3.202$, $SE = .290$, $p = .002$, and traps were less exciting than bluffs $t(42) = 2.498$, $SE = .284$, $p = .016$. Figure 3 portrays the mean subjective excitement ratings of all four actions for participants that conducted all four actions.

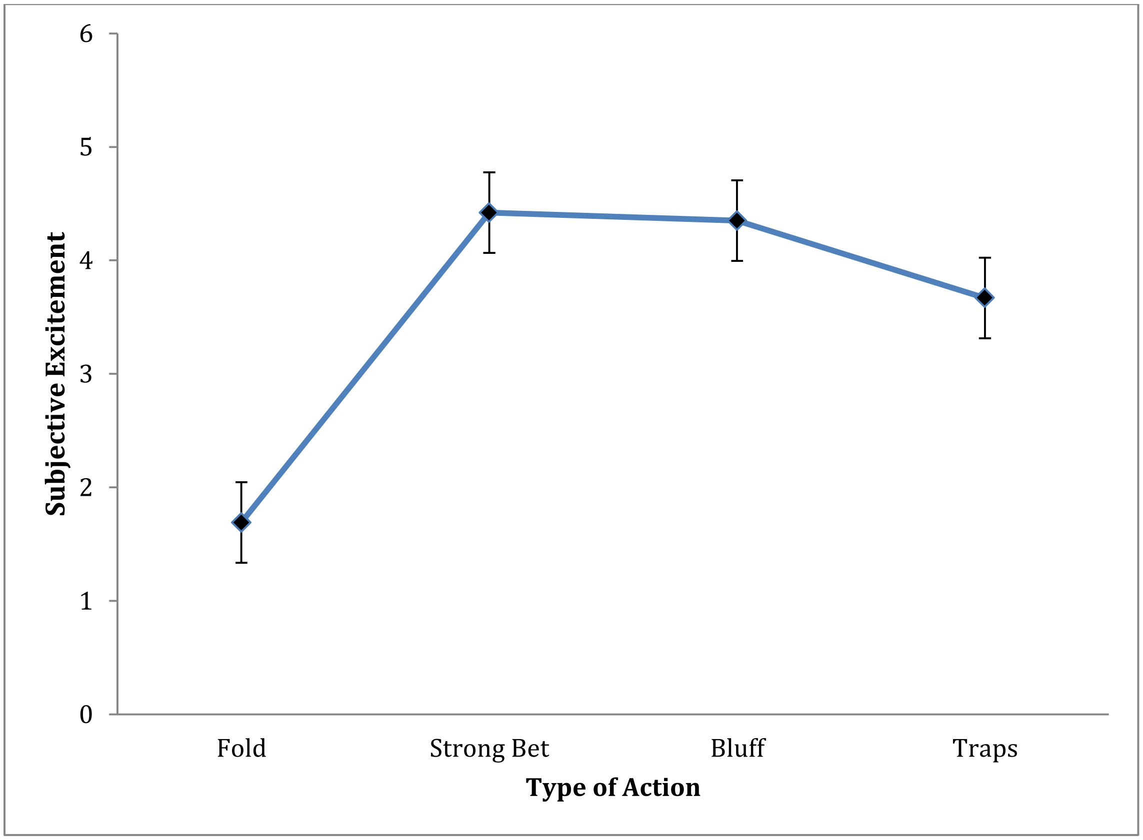

Figure 3. Subjective ratings of excitement for the different types of actions. Error bars are Masson and Loftus 95% confidence intervals for repeated measures designs.

Subjective Risk

The analysis of variance (N=44) on subjective ratings of risk of the actions, revealed a main effect of action $F(2,84) = 71.928$, $MSE = 1.313$, $p <.001$. Planned comparisons revealed that strong bets were riskier than folds $t(43) = 6.729$, $SE = .429$, *p*

$<.001$. Bluffs were also riskier than folds $t(42) = 11.165$, $SE = .259$, $p < .001$. Furthermore, bluffs were found to be significantly riskier than strong bets $t(42) = 5.307$, $SE = .257$, $p < .001$.

Similar to excitement ratings, we then redid the repeated measures on subjective risk and included gambling status (NPG, PG) and experience (novice, experienced) as between subject variables. The main effect of problem gambling, the main effect of experience, the interaction between action and experience, action and problem gambling, action by experience by problem gambling were all non-significant.

Lastly we conducted the three planned contrasts involving traps. Traps were rated to be significantly more risky than folds $t(43) = 6.729$, $SE = .249$, $p < .001$. Traps were rated less risky than Strong bets $t(47) = 2.125$, $SE = .268$, $p = .039$, and traps were less risky than bluffs $t(42) = 5.307$, $SE = .257$, $p < .001$. Figure 4 portrays the mean subjective risk ratings of all four actions for participants that conducted all four actions.

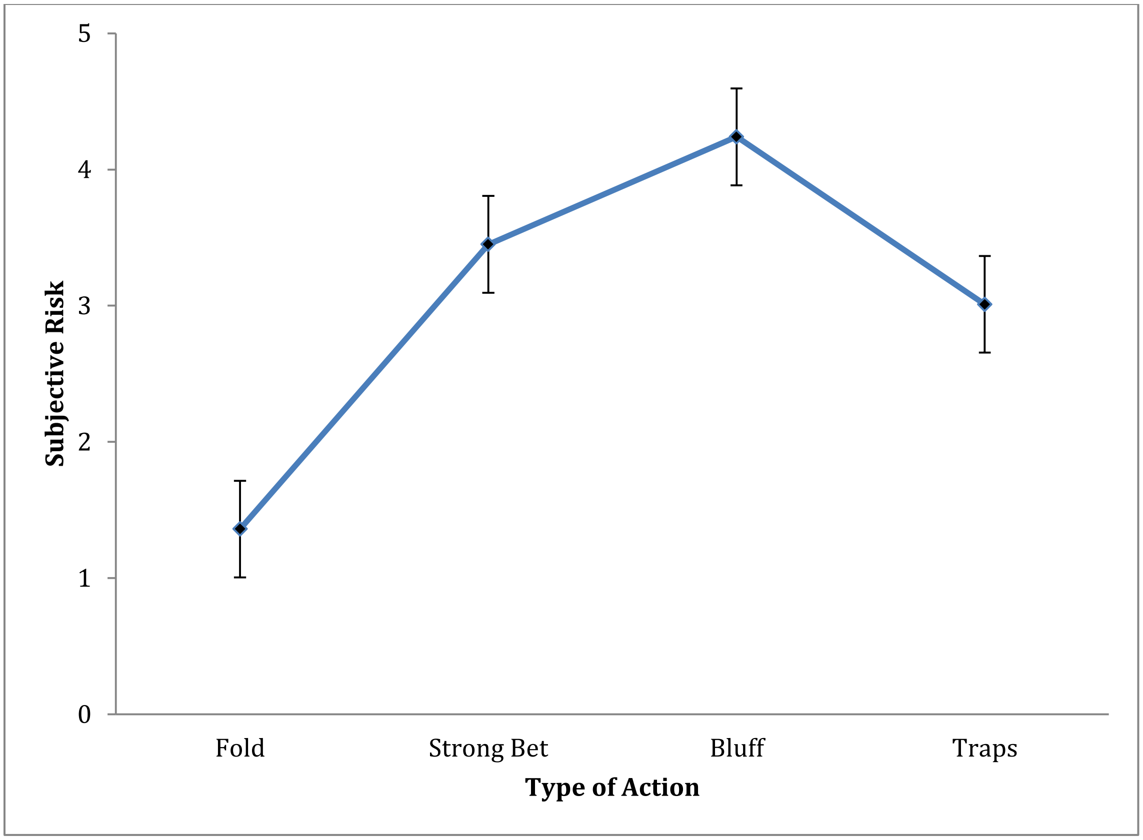

Figure 4. Subjective ratings of risk by action. Error bars are Masson and Loftus 95% confidence intervals for repeated measures designs.

Bet Amounts and Objective Winning Probability

To supplement our measurements of subjective risk, the amount of chips that was bet for all actions that required chips (i.e. strong bet, trap and bluff) were recorded. All the cards from each experimental session were also recorded by a research assistant to calculate the probability of winning when a player conducted those actions. These cards were then submitted to "http://www.cardplayer.com/poker-tools/odds-calculator/texas-holdem" – an online tool that calculates the probability that a player would win at any given stage by inputting both the community cards, and the two down cards of all players. To account for changes within a hand (i.e. anytime a player folds their hand before the showdown, leaving two remaining players), the down cards of the players who folded during a hand was entered into the "dead card" area of the probability calculator. This was to prevent the two down cards from skewing the winning probabilities of the two remaining players.

To assess the differences in bet amounts, we used a repeated measures ANOVA with actions on the bet amounts but excluding folds (since they were all coded as zeroes). Arguably, since bet amount is also a measure of risk, an exploratory repeated measures ANOVA on actions (strong bets, traps, bluffs) with gambling status (NPG, PG) and experience (novice, experienced) as between subjects factors was conducted. We then conducted three planned comparisons involving traps. Traps were compared to strong bets and then to bluffs.

The analysis of variance on bet amount (N=47) of the different actions revealed a main effect of action $F(2,106) = 34.286$, $MSE = 387.252$, $p <.001$. Planned comparisons revealed that strong bets $t(54) = 4.833$, $SE = 3.985$, $p < .001$, and bluffs $t(46) = 6.489$, $SE = 2.935$, $p < .001$ were conducted using significantly more chips than traps. Furthermore, bluffs were found to not be significantly different than strong bets in bet amounts.

We then conducted the exploratory repeated measures ANOVA on bet amount and included gambling status (NPG, PG) and experience (novice, experienced) as between subject variables. The main effect of problem gambling, the main effect of experience, the interaction between action and experience, action and problem gambling, action by experience by problem gambling were all non-significant.

We used a repeated measures ANOVA with actions on the objective winning percentages. This was followed by a repeated measures ANOVA on actions (folds, strong bets, bluffs) with gambling status (NPG, PG) and Experience (novice, experienced) as between subjects factors. We then conducted three planned comparisons involving traps. Traps were compared to folds, then to strong bets, then to bluffs.

The analysis of variance on objective winning probabilities (N = 55), revealed a main effect of action $F(2, 108) = 49.891$, $MSE = 599.790$, $p < .001$. Planned comparison revealed that both strong bets $t(64) = 12.465$, $SE = 3.041$, $p < .001$ and bluffs $t(54) = 7.722$, $SE = 3.428$, $p < .001$ had a significantly higher probability of winning over folds. Strong bets $t(54) = 2.576$, $SE = 5.076$, $p = .013$ were also found to have a higher probability of winning over bluffs.

We then conducted the repeated measures ANOVA on objective winning percentages and included gambling status (NPG, PG) and experience (novice, experienced) as between subject variables. The main effect of problem gambling, the main effect of experience, the interaction between action and experience, action and problem gambling, action by experience by problem gambling were all non-significant.

Planned comparisons revealed that traps had a higher probability of winning over folds $t(55) = 12.229$, SE 2.794, $p < .001$. Strong bets and bluffs were not found to be significantly different in winning probability than traps.

Wins and losses

To measure physiological arousal following a loss, skin conductance responses were measured during a 3-second window beginning 1 second after the player folded their hands, or 1 second after a player reveals their cards if that hand went to the showdown. To measure arousal following a win, SCR was measured during a 3-second window beginning after the final remaining player folds their hands, or 1 second after a player reveals their cards if that hand went to the showdown. Again, SCRs were defined as the value at the beginning of the window subtracted from the maximum value within the window. Average SCRs were calculated for each outcome and were subjected to the Van Selst and Jolicoeur's (1994) outlier removal procedure.

To see if winning led to higher arousal responses than losing, we contrasted the SCRs for wins to the SCRs for losses. A paired sample t-test revealed significant differences between wins and losses, $t(62) = 2.561$, $SE = .232$, $p = .013$. These results are portrayed in Figure 5.

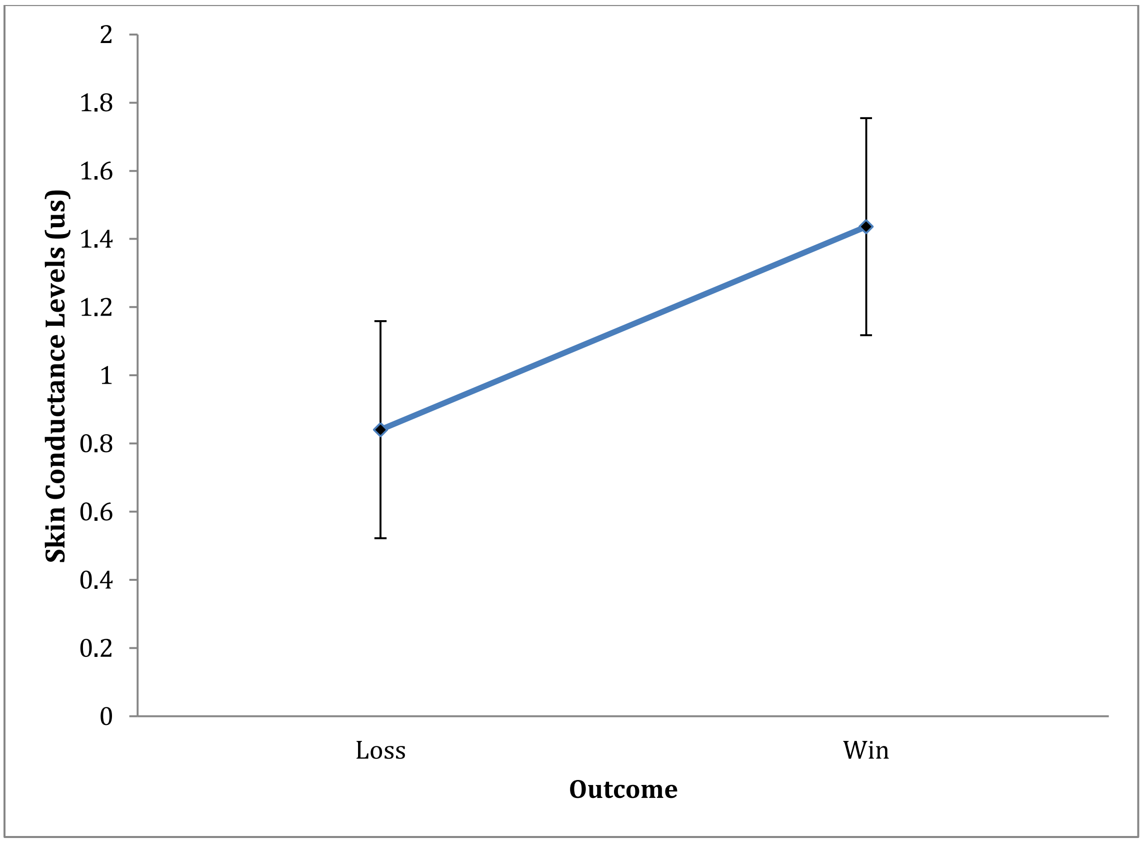

Figure 5. Skin conductance responses of participants following an outcome. Error bars are Masson and Loftus 95% confidence intervals for within-subject designs.

Next we assessed whether gambling status or experience, showed main effects or interactions with winning and losing arousal responses using a group (NPG, PG), by experience (inexperienced, experienced), by outcome (wins vs. losses) mixed-model ANOVA (N=63). Gambling status, and experience were not involved in any significant main effects or interactions.

Duping Delights

Finally we sought to assess whether the different types of win lead to different arousal responses. The SCR values of the different final actions leading up to a win (i.e. trap, strong bet, bluff) was analyzed with a group, by experience, by action (trap, strong bet, bluff) repeated measures ANOVA (N=27). None of the main effects or interactions were found to be significant. Our planned contrast involved comparing SCR values between traps and strong bets, bluffs and strong bets, as well as traps and bluffs were all non-significant.

Discussion

In our current study, we were able to replicate and extend the results of our initial study – that bluffs and strong bets significantly increased physiological arousal in players (as seen in Figure 1). This finding is important given the various limitations of our initial pilot study. First, instead of stacking the decks, the game emulated real play by shuffling the cards after every round. This naturalistic design also gave players the opportunity to fold, strong bet, bluff or trap, whenever they chose – allowing players to take control over their own actions. This situation more closely resembles what players would encounter in a real gambling scenario.

In both the previous study, and the current study we found that bluffing led to significantly higher skin conductance responses than folding a weak hand. In the former study, the bluff hands and the weak hands were exactly matched in hand strength. In the current study, hand strength could vary since players could choose to bluff on any hand they wished. Despite these differences, the findings were the same - bluffing led to higher skin conductance responses than folding, and led to skin conductance levels that were comparable to betting from a position of strength.

In this study we were able to supplement our skin conductance findings with subjective ratings of arousal. These ratings significantly correlated with players skin conductance responses ($r = .224$). In addition, the patterns of arousal ratings across conditions (fold, strong bet, bluff) mimicked the size of the skin conductance responses. This converging evidence suggests that skin conductance responses were a suitable measure of arousal and excitement.

More importantly, we were able to obtain these findings after isolating the truth-telling actions from deceptive traps when a player has a strong hand with a high probability of winning the pot. In our initial study, our strong hand condition likely measured both truthful bets and traps (in unknown quantities). In the current investigation, we removed all deception from the strong bet condition (by removing all traps), and still found that strong bets and bluffing led to equivalent arousal. Thus we can conclude that the heightened arousal in the strong-bet condition, was not due to deception, but rather the excitement generated by the impending win. This is an important finding given that physiological arousal can reinforce problematic gambling behavior (Brown, 1986; Anderson & Brown, 1984; Blaszczynski & Nower, 2002; Wulfert et al., 2005; Sodano & Wulfert, 2010; Seifert &Wulfert, 2011). Our previous work has also shown that when tonic measures are used folds lead to higher arousal than a non-gambling baseline. Still, one might argue that folds have a "de-arousing" effect due to the fact that the person is no longer playing in that round. It should be noted here that we used phasic changes in electrodermal activity that gauge the momentary arousal changes associated with a specific decision (i.e., the decision to fold, or the decision to bluff). Given that our window for folds reflect only the first few seconds after a player is no longer in the round, we would argue that these phasic data would be less influenced by ongoing cognitive load. To gauge the effects of cognitive load future research could measure tonic changes in arousal. More importantly still, our research shows that for players there are at least two independent ways to generate such arousal. First players can obtain this arousal whenever they are dealt a good hand and can bet from a position of strength. Obviously this path of arousal depends on the cards one is dealt. The second path to arousal comes from trying to deceive others. Importantly, this path can be followed at any time during the game, regardless of the hands that the player was dealt.

Bluffing may also increase arousal because of the risk involved. In this study, those engaged in bluffing gave the highest ratings of risk to this action – significantly higher than strong betting, trapping, or folding. Our subjective measurement of risk was supplemented with measurements of bet size and objective winning probabilities. First, we found that when players were bluffing, they tended to mask their deception by betting approximately the same amounts of chips as they would bet when truthfully betting while holding a strong hand. Masking deception by betting large amounts increased subjective levels of risk, as well as objective levels of risk. This notion of objective risk was supported by our examination of objective winning probabilities. Bluff hands had significantly lower probabilities of winning than strong hands, and hence were objectively riskier. Our findings are congruent with previous studies which showed that while anticipating an outcome, riskier actions elicit a greater electrodermal response (Studer & Clark, 2011). Further, our finding that low risk situations (folding) are not as arousing as high-risk situations (bluffing) are in agreement with studies using the Iowa Gambling Task - risky decisions elicit greater physiological responses (Goudriaan et. al, 2006; Botvinick & Rosen, 2008). This too is an important point since players often bluff and lose, so a player who seeks an arousal “high” through bluffing runs the risk of incurring financial losses. Importantly, as losses mount, so do gambling problems.

Our finding that there are two routes to achieving arousal in Texas Hold em, may have implications for problem gambling. If arousal is **the** reinforcing factor in problem gambling (Brown, 1986), and there are multiple ways to achieve this state, then games which allow bluffing may be more addictive than other betting games that do not have a deception component (e.g., roulette, horse racing). In addition, the periodic spikes of arousal experienced throughout the game may entice players to gamble longer, and to make riskier decisions (Blaszczynski & Nower, 2002). Since bluffing is riskier than strong betting, players may increasingly opt for this type of bet, and suffer the financial consequences when they lose.

Part of our exploratory analyses involved traps. We hypothesized that since traps contained deception AND a high likelihood of winning, they would give rise to higher arousal than strong betting. We found that traps elicited greater arousal than folds but *less* arousal than bluffs and strong bets. This was unexpected and we offer the following suggestion that may account for this odd finding. On our subjective scales the “trap” option read, “Bet / raise a LOW amount so others would call (or raise)”. Players engaged in trapping would endorse this option. However, it also conceivable that some players might endorse this option when their cards were somewhat strong but not “a sure thing”. When players are unsure of their hand strength but are still holding relatively strong down cards (e.g. pair of 10s but a Jack is face up in the community cards), they may simply “test the waters” with a smaller bet but may not yet anticipate winning with these cards. This is paralleled in our findings that players tended to bet significantly less chips when they are trapping as compared to when they are betting from a position of strength or when they are bluffing. Again, they may have bet fewer chips because they were actively trying to deceive other players, or they might bet fewer chips because they were “testing the waters”. Furthermore, as traps may not require a player to commit a large amount of chips, the level of risk associated with this action may be less than bluffs - as was found in our examination of bet size. Also seen in our analysis of objective winning probabilities, traps straddled a unique middle-ground in which it was nominally greater than bluffs but had less of a chance of winning than when players were strong betting. Thus the reduction in risk due to smaller bets combined with a lowered probability of winning and that some participants may have been merely testing the waters could have reduced the overall arousal levels in this group. Thus in the current sample, those endorsing the trap option on the checklist may have been a mixed sample of those engaged in deceptive trapping, and those merely testing the waters with “weak” bets. Those testing the waters would dilute the arousal effects in this group.

Our current study also found that wins in Texas Hold ‘em were more arousing than losses. These findings support previous research that has shown that winning outcomes lead to greater arousal than losing outcomes during horse racing and slot machine play (Coventry & Norman, 1997; Dixon et al., 2010; Dixon et al., 2011; Leary & Dickerson, 1985; Coventry & Hudson, 2001; Wilkes, Gonsalvez & Blaszczynski, 2010). In our study, the differences in arousal levels were unrelated to gambling status and unrelated to experience. This finding is surprising given that some studies have shown larger arousal responses in those with gambling problems (Sharpe et al., 1995; Sharpe, 2004). Our failure to show these differences may reflect a power problem (we only had 12 problem gamblers in our study). It is also true that certain game features that trigger arousal, appear to cut across all levels of gambling. For example, near-misses in slot machines trigger huge arousal responses in novices and problem gamblers alike. It may be that the excitement of holding a winning hand in poker, or the deception in bluffing, are fundamental features of the game that trigger equivalent arousal responses in all gamblers.

Furthermore, in our exploratory assays of duping delight, we did not find any differences between strong bets, traps or bluffs. Ekman and Frank (1993) first proposed the effect of additional excitement from a successful lie but we were unable to find any evidence of this effect in our study. One possibility is that the already elevated electrodermal activity from previous actions may have led to ceiling effects that masked the duping delight players still may have felt after successfully bluffing or trapping. Alternatively, it might be that winning a gamble may be the most exciting part of the game, regardless of the route that led to the win. The fact that one can achieve this feeling through bluffing, could be problematic for thrill-seekers. Even if they are dealt weak hands they can still opt to chase the arousal high that accompanies a win. This may prompt them to bluff. When they bluff and win, their actions are reinforced. We also note that players will not always win. Thus their rewards for bluffing may be on an intermittent, unpredictable schedule – the most addictive of reward schedules (Lerman et al., 1996).

In the current study, players' problem gambling statuses and their experience failed to modify their arousal, excitement and risk assessments. We offer two explanations as to why no differences were found. First, the aforementioned power problem - we were unable to obtain a large sample of participants who were problem gamblers. Also, in contrast with conventional gambling paradigms, where physiological arousal levels of participants are measured following an outcome (Dixon et al., 2010; Dixon et al., 2011; Wilkes, Gonsalvez & Blaszczynski, 2010), for the folding, trapping, strong betting, and bluffing measures, the outcomes were not known to the player at the time the measurements were made. Finally we note that expertise and experience in Texas Hold 'em poker is a relatively new trait that few studies have touched on or attempted to measure (Bjerg, 2010; McCormack, Griffiths, 2011; Linnet et al., 2010). In our study, poker experience was measured using a scale that we had recently developed but have not yet validated. As such, it is possible that our cut-off point of 25 hours of play may not optimally segregate the players into two distinct groups. There are also other factors that may be intrinsic to the designation of an "experienced" poker player but may have been absent in our questionnaire. As an example, a player may spend more time improving their play (e.g. reading books, analyzing previously played hands and errors, watching televised events to emulate professional strategies). Since our questionnaire measured only time spent playing (not studying) poker, our questionnaire would fail to capture the time spent by players honing their expertise. That said, the combination of risk and deception may be fundamental to the arousal response during bluffing, that we would elicit this response in all strata of gamblers. Similar to near-miss outcomes in slot machine gambling, the arousal responses that were triggered by bluffing appeared to be similar to all gamblers regardless of experience or problem gambling status (Dixon et al., 2012).

Limitations and Future Directions

Although we were able to replicate the results of our previous study and provide further converging evidence of how unique the deceptive component of Texas Hold 'em poker is, there are still limitations of the current study that need to be addressed.

Given the naturalistic nature of the paradigm, the frequency with which participants act in a particular manner (e.g., fold, bet, trap) is unpredictable, and resulted in numerous cases of missing cells (e.g., some players never trapped). In a repeated measures design, missing data in one cell results in elimination of that subject, and as such, reduces the number of cases that are analyzed. However, it can be argued that having players play naturally is worth incurring the down-side of missing data since it offers a more realistic view of gambling behavior.

Also, although we successfully eliminated deception from those betting on a strong hand (by removing the trappers) further ambiguities surfaced when we attempted to analyze trapping responses. Further precision would be required to disambiguate the true trappers engaging in deception from those simply testing the waters hoping for a new communal card to turn a middling hand into a strong one.

Conclusion

In our current study of Texas Hold 'em poker, we were able to isolate and examine deception within a gambling context. We found that the bluffing in Texas Hold 'em poker elicits an arousal response that many have suggested to be a reinforcing factor of problematic gambling behavior. We were able to provide foundational evidence that the bluffing element intrinsic to Texas Hold 'em poker can greatly affect a player's gambling behavior. Although live tournaments continue to flourish, many players now choose to play this game online. Since online games can be played on smartphones anywhere and anytime, the unlimited availability of poker to gamblers means that the frequency with which players bluff and self-trigger arousal highs is also theoretically, unlimited. This combination of high-risk, high arousal, and ubiquitous availability may provide a unique recipe for developing gambling problems.

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Appendix A

Poker Experience Index

<u>Poker Experience Index</u>

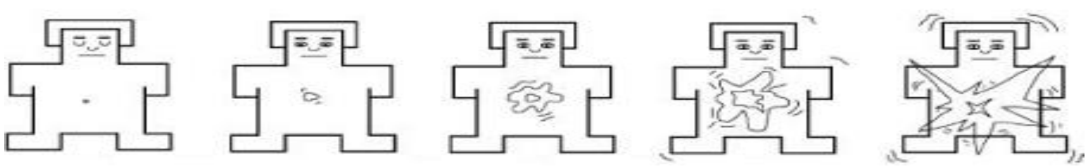
1) In the past 12 months, how many times did you play Texas Hold ‘em poker?
2) In the past 12 months, on average, how many hours do you play Texas Hold ‘em poker per session?
3) Where do you play Texas Hold ‘em poker? (Casino, online, household, other)
4) Do you play any other form of poker? Yes No

(If YES) What kind?

(IF YES) In the past 12 months, how many times did you play these other forms of forms of poker?

(IF YES) In the past 12 months, on average, how many hours do you play these other forms of poker per session?

Self Assessment Manikin



Subjective Scale

Please fill out the below questionnaire after <u>EVERY</u> action that you take in chronological order.								**Please fill out the below questionnaires before the dealer proceeds to the next stage.**	
Hand#	**Fold**	**Check**	**CALL a bet (or a raise) put in by another player**	**Bet /raise a HIGH amount so others would *call (or raise)***	**Bet /raise a LOW amount so others would *call (or raise)***	**Bet /raise a HIGH amount so others would *fold***	**Bet /raise a LOW amount so others would *fold***	**Risk** 1 (Not at all Risky) - 9 (Very Risky)	**Excitement** 1 (Not at all Aroused) - 9 (Very Physiologically Aroused)
Pre-flop									
Flop									
Turn									
River									