Supplementary Materials (Machiavelli as a Poker Mate)

1. Glossary

Poker Hand	Depending on the context, a Hold'em poker hand may refer to either **1)** a single round of game play; the period beginning when cards are dealt and ending with the showdown (revealing of players' cards and deciding the winner of a given hand), **2)** the two cards dealt to each player at the beginning of each round of game play (also referred to as the starting hand or hole cards), or **3)** the best five-card combination that can be formed using the hole cards and the community cards. Use of the term "hand" in this article refers to definition **1**.
NLHE	No Limit Texas Hold'em – A popular variation of the standard game of poker. Any game of poker is a card game involving betting whereby the winner is determined based on the ranking of their cards. NLHE consists of two cards being dealt face down to each player, and then five community cards – cards that can be used by all players – being placed face-up. Players have the option to **check**, **call**, **bet**, **raise**, or **fold** either prior to the flop (**pre-flop**), on the **flop**, on the **turn**, and on the **river**.
Blinds	Forced bets (small and big blind) that are placed into the **pot** by players before play begins
Button	The **(dealer) button** is a marker used to indicate the player who acts last on that deal.
Pre-flop	The period beginning with the dealing of cards and ending with the **flop** in Hold'em poker
Flop	The first three cards dealt face-up to the board in Hold'em poker
Turn	The fourth card dealt face-up to the board in Hold'em poker
River	The fifth and final card dealt face-up to the board in Hold'em poker
Pot	Sum of money (or chips) that players have waged during a single **hand** (definition **1**) of game play
Bet	To wager an initial amount of money
Fold	To discard one's cards and give up playing during the current **hand** (definition **1**), thereby forfeiting interest in the current **pot**
Check	Declining to make a **bet**, but retaining the right to **call** or **raise** bets or raises made by subsequent players

Call Matching a **bet** or a **raise** made by another player

Raise Increasing the size of a **bet** required to stay in the pot, forcing all subsequent players to call the new amount (or raise more) if they wish to remain in

2. Bluffing task instructions

The following instructions were shown to the participants:

“Please read these instructions carefully!

On the next pages, you will be shown four visual online poker scenarios, one per page. The game is No Limit Texas Hold’em, cash/ring game (not a tournament!), played at a table with 4 opponents and yourself (5 players in total). The opponents are represented by avatars.

The blinds are $5 and $10, and each player has $1000 at the beginning of each round. Four rounds (or “hands”) will be played in total.

Each round is automatically “played through” as frame-by-frame animated actions made by the players (including you!) at the table. **Please pay attention during this time, as you will not be shown the actions again!**

You cannot influence these actions, and you have to wait until the animation is finished – for each round, this will take about 80 seconds.

The animation finishes before the last possible action (“on the river”), and you will be asked to make a decision to either **1) CHECK, or 2) BET**. If you decide to BET, you will also be asked to write down the size (in numbers) of your bet.

Make your decision based only on the information provided on this page, and on the animations themselves. Play as you would normally online (even if you don't normally play with the current level of stakes), against otherwise "unknown" opponents.

Click on the arrow ">>" to continue to the first scenario!

Please indicate below that you have understood the above instructions.**”**

3. Textual descriptions of the poker tasks

Task 1

You are in the button position with **[6c 7c]** (six of clubs, seven of clubs), and the actions is folded to you (before the flop, the two players acting before you have folded). You "auto-bet" $25, the small blind folds, and the big blind calls. The pot is $55, and the game is "heads-up" (one versus one). The flop is **[5c 8c Jh]** (five of clubs, eight of clubs, jack of hearts), and the opponent checks. You "auto-bet" $40, and the opponent calls. The pot is $135. The turn is **[Qd]** (queen of diamonds), and the opponent checks. You "auto-bet" $90, and the opponent calls. The pot is $315. The river is **[Ad]** (ace of diamonds). The opponent checks.
The board is now **[5c 8c Jh][Qd][Ad]**, the pot is $315, and you are holding **[6c 7c]**. Do you check or bet?

Task 2

You are in the big blind position with **[8s 9s]** (eight of spades, nine of spades). Before your turn to act, three opponents call the big blind of $10, and the opponent in the small blind position raises to $30. You "auto-reraise" to $130. Three opponents fold, and the opponent in the small blind position calls. The pot is $290, and the game is "heads-up" (one versus one). The flop is **[2d Jd 6d]** (two of diamonds, jack of diamonds, six of diamonds), and the opponent checks. You "auto-check". The turn is **[3d]** (three of diamonds), and the opponent checks. You "auto-check". The river is **[Qh]** (queen of hearts), and the opponent checks.
The board is now **[2d Jd 6d][3d][Qh]**, the pot is $290, and you are holding **[8s 9s]**. Do you check or bet?

Task 3

You are in the button position with **[Ac 6s]** (ace of clubs, six of spades). Before your turn to act, two opponents call the big blind of $10. You "auto-raise" to $50, the opponent in the small blind calls, and the two other opponents (who called $10) fold. The pot is $130, and the game is "heads-up" (one versus one). The flop is **[Ks Tc Qh]** (king of spades, ten of clubs, queen of hearts), and the opponent checks. You "auto-bet" $90, and the opponent calls. The pot is $310. The turn is **[2h]** (two of hearts), and the opponent checks. You "auto-check". The river is **[9h]** (nine of hearts), and the opponent checks.
The board is now **[Ks Tc Qh][2h][9h]**, the pot is $310, and you are holding **[Ac 6s]**. Do you check or bet?

Task 4

You are in the button position with **[2s 2c]** (two of spades, two of clubs). Before your turn to act, the opponent who is first to act raises to $50, one opponent folds, and you "auto-call" the bet of $50. The opponents in the small and big blinds fold. The pot is $115, and the game is "heads-up" (one versus one). The flop is **[7h Th 9s]** (seven of hearts, ten of hearts, nine of spades), and the opponent checks. You "auto-bet" $90, and the opponent calls. The pot is $295. The turn is **[3h]** (three of hearts), and the opponent checks. You "auto-check". The river is **[Jc]** (jack of clubs), and the opponent checks.
The board is now **[7h Th 9s][3h][Jc]**, the pot is $295, and you are holding **[2s 2c]**. Do you check or bet?

4. Further details on the poker tasks

Below, we first briefly introduce the rules of NLHE, and then explain how our bluffing tasks were constructed.

In NHLE, two cards are first dealt face down to each player, followed by a round of betting (period called *pre-flop*). Then, five community cards that can be used by all players are placed face-up on the table. The first three community cards are called the *flop*, and the last two cards the *turn* and *river*, and there is a round of betting after each. This period of play beginning with pre-flop and ending at latest on the river is called a *hand*.

During a NLHE hand, players have multiple opportunities to bluff during pre-flop, on the flop, turn, and river (also known as *streets*). Bluffs on the river almost always end the hand (they are either called down or folded against[1]), whereas bluffs on other streets are sometimes followed by another round of betting (if a bluff on the turn is called, another round of betting takes place on the river). For simplicity, participants in our experiment bluffed only on the river.

In order to make an informed bluffing decision on the river, it is highly important for players to know what the opponents' preceding betting actions were. A realistic bluffing task needs to give participants this information. We accomplished this by presenting each task as an animated sequence of "automated" betting actions beginning pre-flop, and ending on the river, upon which participants decided to either *bet* or *check.* Participants could not influence these automated actions. We took special care in emulating typical betting actions observed in online NLHE games for five players: We consulted professional poker players to make sure the betting actions were as realistic as possible.

The opponents (avatars) and the participant were "sitting" in the same table position across the four tasks. Participants made one decision against each opponent, and each

[1] A bluff on the river might get *raised*, but in these cases the bluffer almost always gives up and folds.

decision was made in a *heads-up* situation (one versus one; the other three opponents had folded their cards and were not “in the hand”).

5. Additional analyses

Table S1. *Pearson correlations (two-tailed) between the Machiavellian Personality Scale subscale "distrust of others" items, and Average bluffsize (one of the three dependent variables used in the study).*

Variable	1.	2.	3.	4.	5.	6.
1. People are only motivated by personal gain	1	.30***	.37***	.32***	.35***	.08[a]
2. I dislike committing to groups because I don't trust others		1	.51***	.35***	.44***	.12*
3. Team members backstab each other all the time to get ahead			1	.52***	.46***	.09[a]
4. If I show any weakness at work, other people will take advantage of it				1	.61***	.19***
5. Other people are always planning ways to take advantage of the situation at my expense					1	.13**
6. Average bluffsize (DV)						1

Note: N=452. *a*: *p.*<.1; * : *p.*< .05; **: *p.*< .01; ***: *p.*<.001; Hypothesis-relevant cells are highlighted (see main text).

Table S2. *Pearson correlations (two-tailed) between the Machiavellian Personality Scale subscale "desire for control" items, and Bluffing frequency (one of the three dependent variables used in the study).*

Variable	1.	2.	3.	4.
1. I like to give the orders in interpersonal situations	1	.63***	.42***	.12**
2. I enjoy having control over other people		1	.49***	.14**
3. I enjoy being able to control the situation			1	.11*
4. Bluffing frequency (DV)				1

Note *: $p.< .05$; **: $p.< .01$; ***: $p.<.001$; Hypothesis-relevant cells are highlighted (see main text).

Table S3. *Summary of multiple regression analyses predicting sensitivity to slow-play, and controlling for self-reported level of Competitiveness.*

	DV: Sensitivity to slow-play (N=458)		
Variable	B	*t*	*p*
Constant	2.77		
Distrust of Others	0.21	3.45	<.001
Desire for Status	0.04	0.73	ns
Desire for Control	0.08	1.59	ns
Amorality	0.22	3.51	<.001
Competitiveness	-0.74	-1.51	ns
Age	0.01	1.45	ns
Gender	-0.06	-0.23	ns
Education	0.01	0.06	ns
Income	-0.06	-1.50	ns
adj. R^2	.12		
F	7.54		<.001

Note. Participants with missing data on demographics are omitted from the analyses. Gender is calculated at Male = 0, Female = 1. All other predictors are centered. "Competitiveness" is a self-report measure where the statement "I am competitive" was evaluated on Likert 1 "Never or almost never true" to 7 "Always or almost always true" scale. Heteroscedasticity-consistent standard error estimators in OLS regression (robust regression) are employed.

5.1 Correlations between Sensitivity to losses, Sensitivity to slow-play, and MPS

Sensitivity to Losses is an 11-item scale measures the extent to which poker players experience negative emotions (e.g., feelings of unfairness, anger and frustration) elicited by poker losses. Example items are: "I feel losing is unfair" and "When I lose, I feel anger". All items are anchored from 1 ("Completely disagree") to 7 ("Completely agree"). Higher scores indicate a higher tendency to experience negative emotions of, e.g., unfairness, anger and frustration elicited by losses.

Source: Palomäki, J., Laakasuo, M., & Salmela, M. (2014). Losing more by losing it: Poker experience, sensitivity to losses and tilting severity. *Journal of Gambling Studies*, *30*(1), 187-200.

Table S4. *Spearman correlations (two-tailed) between the Machiavellian Personality Scale, its subscales, Sensitivity to Slow-Play, and Sensitivity to Losses.*

Variable	1.	2.	3.	4.	5.	6.	7.
1. Sensitivity to Slow-play	1	.42***	.31***	.25***	.14**	.12**	.28***
2. Sensitivity to Losses		1	.27***	.24***	.09*	.05	.29***
3. MPS (full scale)			1	.67***	.62***	.58***	.74***
4. Distrust of Others				1	.19**	.14**	.32***
5. Desire for Status					1	.37***	.28***
6. Desire for Control						1	.31***
7. Amorality							1

Note *: $p.< .05$; **: $p.< .01$; ***: $p.<.001$.

5.2 Poker experience scale (PES)

PES has been shown to predict mathematical accuracy in poker decision-making and has been used in several studies to measure players' level of poker skill and knowledge. Thus, we included PES as an exploratory variable (for complete coding and abbreviations of the original scale, see Palomäki, Laakasuo, & Salmela, 2013a). To reduce previously observed skewness in PES, we modified it slightly. In the current study, PES consisted of three 11-point and one 10-point Likert items: How many years have you played poker? (1 = Less than 0.5 [6 months]; 11 = More than 15); At what level of stakes do you usually play? (1 = No real money stakes, just for fun; 11 = Above NL600, PLO600, SNG500, MTT500); What is the rough estimate of how many poker hands you have played during your life? (1 = 0–10 000; 11 = more than 5 million); and Do you consider yourself to be a professional poker player? (1 = Definitely not a [full time] professional poker player; 10 = Definitely a [full time] professional poker player). The 4-item scale (M = 5.23, SD = 2.12, range = 1–10) was normally distributed and had a satisfactory inter-item reliability (Cronbach's α = .80). Higher scores on PES indicate higher level of poker experience and skill.

We observed an interaction between level of poker experience (as measured by PES) and desire for control (both predictors were centered) when predicting average bluffsize (B = -2.82, t(448) = -2.62, p = .009). Simple slopes analysis of this interaction showed that desire for control predisposed inexperienced poker players (PES values -1 SD below the mean) but *not* experienced ones (+1 SD) to bluff in higher average amounts. See Table S5 and Figure S1.

Table S5. *Full interaction model and simple slopes analysis for Desire for Control (MPS subscale), with Poker Experience Scale (PES) as the moderator and Average Bluffsize as the DV.*

Variable				Simple slopes when Poker Experience Scale (PES) is the moderator		
	B	*t*	*p*	Slope	B	*p*
Constant	201.25					
Desire for Control	2.32	0.99	ns	-1 SD	10.90	.016
PES	6.20	4.31	<.001	+1 SD	-4.47	ns
PES x Desire	-2.82	-2.62	.009			
adj. R^2	.054					
F	8.53		<.001			

Note. Unstandardized B-values are shown.

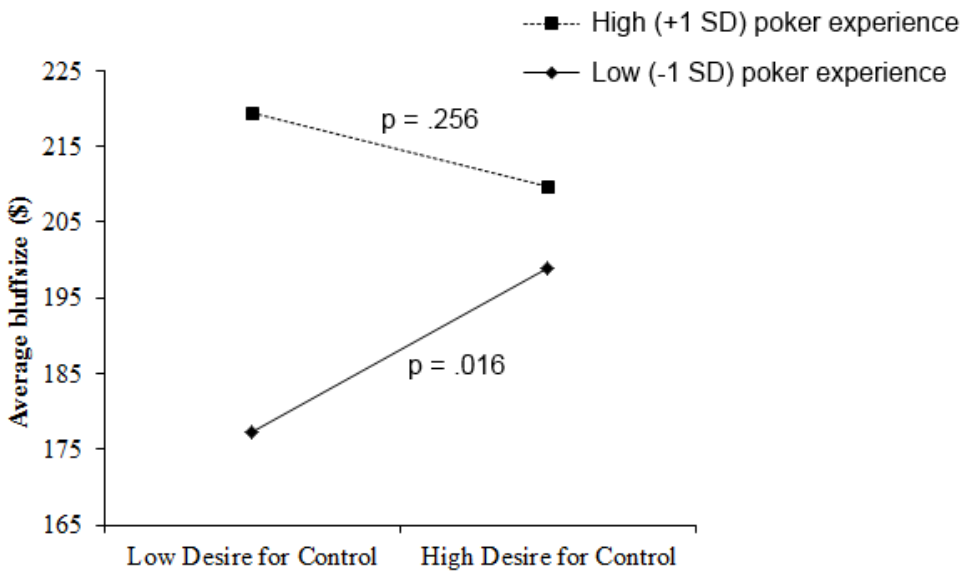

Figure S1. Association between Desire for Control (MPS subscale) and Average Bluffsize ($) in individuals with high (+1 SD) and low (-1 SD) poker experience (PES scores). See Table S5 for full statistics.

6. Expected monetary value of bluffing

In order to evaluate the monetary implications of individual differences in bluffing, we performed *post hoc* expected value calculations. These were made possible by having data on the participants' bluffing frequency and their average bluff sizes. Specifically, we calculated the expected value of calling the bluffs made by the participants – or, in other words, the monetary implications for the hypothetical *opponents* in our experiment. Below, for clarity, we will refer to the hypothetical opponent as "Player 1" and the participant as "Player 2".

We focus on the MPS subscale "Desire for control", since it was the strongest individual predictor of bluffing frequency[2]. In a simple regression model predicting Bluffing frequency with Desire for control, for every one unit increase in Desire for control (measured between 1 and 7), Bluffing frequency increases by 0.028 (with a constant value of 0.453, which represents the hypothetical value of Bluffing frequency when Desire for control equals 0). This increase is significant at $p = .002$ (95% bootstrapped CI: 0.013 – 0.043). In a similar model predicting Average bluffsize, for every one unit increase in Desire for control, Average bluffsize increases by 4.13 (with a constant value of 213.9), but this increase is not statistically significant, $p = .26$. Thus, in the calculations below, we treat the association between Desire for control and Average bluffsize as zero (i.e. not significant).

Across the four tasks, the average size of the pot (amount of contended money) on the river was \$301.7, and the average bluff size was \$213.9 (see above). Player 1 needs to call this amount for a potential gain (equaling the size of the pot before calling) of \$213.9 + \$301.7 = \$505.6. For simplicity, we make the following assumptions:

[2] For simplicity, we base these calculations on a statistical model where the DVs Average bluffsize and Bluffing frequency were separately predicted by "Desire for control" alone. Note that the trend or significance of the results is not affected by including demographic variables, or the experimental manipulation conditions (which were not focused on in the current article) in the model as covariates.

1) Generally, a bet on river (see Glossary) in online poker is either made as a bluff or "for value" (i.e. in hopes of getting called by a worse hand)

2) In actual online poker, in similar "river positions" as those used in our experiment, the player who is betting is typically equally likely to have a strong hand as a weak one, and very unlikely to have a hand of medium strength. Therefore, we assume Player 2 will have a strong hand (i.e. a winning hand) 50% of the time, and a weak hand (i.e. a losing hand) 50% of the time. Although this assumption is a simplification, it is based on the feedback from two professional poker players we have consulted. The exact distribution of hand strengths in similar river positions is impossible to ascertain, given the imperfect information nature of the game

3) In similar river positions as those used in our experiment, strong hands will always bet "for value" (i.e. they will never "check") and the bet sizes will be similar to those of the bluffs

Given these assumptions, we can extrapolate the results from the current experiment to actual online poker. Player 2 will have a winning hand 50% of the time, of which s/he will bet for value $\boldsymbol{P}_{\mathbf{valuebet}} = 1 = 100\%$ of the time and a losing hand 50% of the time, of which s/he will bet (i.e. bluff) $\boldsymbol{P}_{\mathbf{bluff}}$ of the time. To assess the monetary implications of bluffing between individuals with varying levels of Desire for control, we obtain the values of $\boldsymbol{P}_{\mathbf{bluff}}$ from our experimental observations: Average bluffing frequency increased by 0.028 (2.8%) for every one unit increase in Desire for control. Thus, the bluffing frequency of individuals with varying scores on Desire for control is:

$$\boldsymbol{P}_{\mathbf{bluff}} = \textbf{[Desire for control score] x 0.028 + 0.453}^{3}$$

[3] Plus an error term, which we ignore here for simplicity.

The conditional probability of Player 2 bluffing knowing s/he has bet is:

$$P(A|B) = P(\text{“}\textit{Player 2 bluffs}\text{”} \mid \text{“}\textit{Player 2 bets}\text{”}) = (0.5 \times P_{\text{bluff}}) / (0.5 \times P_{\text{valuebet}} + 0.5 \times P_{\text{bluff}})$$

If Player 2 scored high (e.g. 6/7) on Desire for control, the above yields:

(0.5 x (6 x 0.028 + 0.453)) / (0.5 x 1 + 0.5 x (6 x 0.028 + 0.453)) =~0.3831

Similarly, if Player 2 scored low (e.g. 2/7) on Desire for control, the above yields:

(0.5 x (2 x 0.028 + 0.453)) / (0.5 x 1 + 0.5 x (2 x 0.028 + 0.453)) =~0.3373

The expected monetary value of calling is:

$P(A|B)$ x **[Size of the pot before calling] – (1 –** $P(A|B)$**) x [Size of the bet]**

Against players with high (6/7) Desire for control, this yields:

0.3831 x $505.6 – 0.6169 x $213.9 =~ $61.74

Against players with low (2/7) Desire for control, this yields:

0.3373 x $505.6 – 0.6627 x $213.9 =~ $28.79

Thus, we estimate that calling the bets made by Player 2 would be **$61.74 – $28.79 =~ $33** more profitable *per bet* if said player scored high (i.e. 6/7) on Desire for control as compared with players who score low on the scale (2/7).

6. Study covariate not analyzed

Masculinity Trait Index. This 10-item scale measures one's own self-perceived "masculine" characteristics. Example items are: "I am competitive" and "I have leadership abilities". All items are anchored from 1 ("Completely disagree") to 7 ("Completely agree"). Higher scores indicate higher self-perceived masculinity.

Source: Stern, B. B., Barak, B., & Gould, S. J. (1987). Sexual identity scale: a new self-assessment measure. *Sex Roles*, *17*(9-10), 503-519.