

The Security of Online Poker

In the last few years the growth of poker, both online and off, has been substantial. It is commonly believed that the key event was Chris Moneymaker winning the 2003 World Series of Poker. Moneymaker was an amateur player who beat several pros, showing that anyone could win. ESPN used card cameras which made it easier for viewers to follow the action. He won his entry to the tournament online, which brought a lot of attention to Pokerstars.com and the online gambling scene as a whole.¹ It is estimated by Albert Tapper, the General Manager of Ladbrokespoker.com, that in 2004, \$180 million was put into play online ever day.²

There are risks involved with any kind of financial transaction, and this is doubly so for online poker. It is illegal to run an online poker site in the United States, therefore companies are processing billions of dollars of money, completely unregulated by the US government. The legality of a United States citizen gambling online is up for debate, this paper makes no judgment on this account. This has a large effect on the steps one must take to move assets around online. It places a limit on the means to process money, and the options one has to settle disputes.

Once the money is online and put into play, a completely different type of threat arises, the security of the game itself. Marked cards and collusion have been a part of live poker for as long as it has been around, and their digital counterparts can be more hazardous to your assets than anything else.

One of the standard ways for paying for online purchases or putting money into an online wallet such as Paypal is through a credit or debit card. Due to the legal gray area of online poker, many banks will not allow their cards to deposit with a site affiliated with online poker, and no North American sites will allow a “cash-out” back to the card from an online poker site.³ Neteller is the poker equivalent to Paypal and is the market leader for processing poker payments. It uses the https protocol for security when managing an account and when the first deposit is made someone from the company will actually call you to confirm your account details. This, in addition to it being a publicly traded company on the London Stock exchange, makes it a relatively trustworthy site for doing business. According to the Security Page, “Military-grade encryption is used for the transmittal of all sensitive information, and the information is stored in a highly secured data centre. Highly redundant systems and regular backups are used to ensure that your transaction history remains safe.”⁴

The security risks for any other online site still exist in Neteller though. Although the path to give them your banking information is secure, it is difficult to guarantee the security of it once they posses it. The bank account information allows you to perform Electronic Fund Transfers, basically direct withdrawals from your bank account to Neteller, and theoretically a rogue employee could exploit this information. To be fair, this could happen at any online site that handles debit card transactions, and Neteller is probably the most secure part of the chain of money.

Once money is online at Neteller it can then be moved to a poker site it begins to get less secure. The very difference in nature between the two different places to manage money presents a few significant security risks. An active poker player may log onto his account several times a day, but probably does not log onto his Neteller account more than once a week. Neteller is only needed to withdrawal money from his standard bank account and to deposit back to it, but the money on the poker site is used for the day to day playing.

The first consequence in this is the difference in how one logs on. To log on to Neteller, one needs a 12 digit ID number, a 6 digit secure ID number, and a password. The two numbers are assigned by Neteller, so they could not be similar to logins or passwords used in any pre-existing accounts. To log in to a poker site, one only needs an ID that is selected by a user, and a password selected by the user. These can be similar to IDs and passwords used for other purposes, so if those login/password combinations are compromised, then the combination used on the poker sites are compromised as well. Since the poker site is accessed much more often, a remember password or auto-login feature is probably enabled, which would allow anyone who had access to the computer to access the account.

If someone illegally accesses a Neteller account and makes fraudulent transactions, these leave definitive records of the amounts and the recipient, and if the break-in is caught within a short period of time, it is possible that the fraudulent transactions may be reversed before they are finalized, and the recipients would obviously be investigated for instigating the break-in.

If a poker account is compromised, the attacker does not necessarily have a direct way to steal the money, but this can actually work in his favor. An attacker that broke into an account could use the victim's money to sit down at a cash table and proceed to give away the money through terrible play to anyone at the table. Sitting at the table would be one or more of the attacker's accomplices, but there would also be several legitimate players. The money would be dispersed to several different players who may or may not be clean, but it would be very difficult to prove who was involved and who was not.

The victim also has very little recourse in this case, as it is his responsibility to keep his password secure, and this attack cannot be differentiated from a case where the victim logs into his account while heavily inebriated, loses a lot of money, and wants to recover his losses. Even if he could prove that he was not at the location where his account was logged in, there is no way to recover the money short of stripping his losses from those that won it from him, which would be an extremely unpopular, and to the legitimate players, fundamentally unfair, solution.

In general, the amount of money kept on a poker site is more volatile due to it being in play. This means that if the victim does not keep his own records his account could theoretically be continuously raided for relatively small amounts without him noticing.

The poker websites have possession of your money as a bank does, but they are not FDIC insured like a bank is. The FDIC ensures that if a bank you are using goes under, your deposit is insured up to a certain amount.⁵ If a poker

website goes out of business or one's money on the site are otherwise jeopardized then the user has no way to recover that money. This is not just speculation as it has already happened.

PokerSpot was an online poker room that started up when the market was very young in 2000. The site was started by a young professional poker player named Dutch Boyd. There is a lack of legitimate news coverage of the online poker business, especially during this time period, and the facts of this situation are still debated. This is Dutch Boyd's side of the story. Since online poker was in its early stages, Neteller did not yet exist. PokerSpot did its business through credit cards.⁶ It used a separate company called Net Pro to process the credit card transactions. PokerSpot was very successful for that time period and according to Boyd made \$100k in rake in December 2000, and \$160k in January 2001. Rake is how a poker room makes money. A small percentage of every pot is taken out for the house. At most modern poker sites, this figure is capped at three dollars.

Although PokerSpot was theoretically making money, Net Pro contacted Boyd and said that they were having trouble processing the credit card deposits and had not received funds from a deposit since the middle of December. Soon after that the people behind Net Pro disappeared along with all the money they were holding for PokerSpot and the means for processing deposits and withdrawals. Those that recently deposited could contact the credit card companies to cancel payment and get their money back, but all the money that was on the site was effectively irretrievable.⁷

A player's money is at risk even at a stable reputable site. PartyPoker, currently the largest poker room online,⁸ has this clause in its Terms and Conditions:

21. Forfeiture & Account Closure.⁹

21.1 THE COMPANY RESERVES THE RIGHT, IN ITS UNFETTERED DISCRETION AND IN RELATION TO YOUR ACCOUNT, ANY RELATED ESP ACCOUNT, ANY ACCOUNTS YOU MAY HAVE WITH OTHER SITES AND/OR CASINOS AND/OR SERVICES OWNED OR OPERATED BY OR ON BEHALF OF THE COMPANY AND ANY SERVICES THAT SHARE THE SHARED GAME/TABLE PLATFORM, TO WITHHOLD YOUR ACCOUNT BALANCE, SUSPEND YOUR ACCOUNT, AND RECOVER ANY PAY-OUTS, BONUSES AND Winnings IF:

- (i) You are in breach of any term of this Agreement;
- (ii) The Company should become aware that you have played at any other online gaming site or services and are suspected of fraud, collusion (including in relation to charge-backs) or unlawful or improper activity;
- (iii) You have 'charged back' or denied any of the purchases or deposits that you made to your Account;
- (iv) If you become bankrupt or analogous proceedings occur anywhere in the world.

What this means is that at any time, PartyPoker may close one of its clients accounts and absorb all their funds. As it is outside U.S. jurisdiction there is no standard legal action one can take if this were to happen. According to

PartyPoker's Terms and Conditions, it is based in Gibraltar and all legal proceedings must go through the Gibraltar legal system. This is a small risk as it would be massively unpopular if PartyPoker began to arbitrarily accounts, but the risk does exist. It is very much within PartyPoker's best interest, however to appear to be fair.

Perhaps the greatest protection the online poker player has is the marketplace itself. There are now several large reputable online poker rooms on the market, and they are bringing in millions of dollars of revenue a month. Party Gaming, the company that owns PartyPoker brought in \$977 million¹⁰ in revenue in 2005, and it is their reputation that keeps players at their site. If a company was viewed by the online community as being somehow unfair, it would be abandoned for other poker sites.

The banking risks of online poker are only one facet of the risks of online gambling. The gambling itself makes up the other facet of risk. A player who keeps copious records may discover the smallest discrepancy between the amount he should have on his account and the amount that is displayed by the server. By the very definition of the word 'gamble', there is a certain risk associated with any action. A clever gambler may know which wagers have a positive expectation and which have a negative expectation, based on the odds he calculates. This player though, would have no way of knowing whether the wager's he makes are fair, that is, if the apparent odds of him winning matched the true odds.

When a player loses an online wager in which he had a 50 percent chance of winning, there is no apparent way to know that he had a 50 percent chance, and not a 45 percent chance. While that may seem like a small difference, a serious online player is involved in many such wagers, and if he is not winning the correct percentage of the time that he should be winning, then he will be a loser over the long term regardless of how well he plays.

The integrity of the game is vitally important to an online gambler. If the game is no fair, then no amount of security and caution will make a player's money safe, short of withdrawing his money and taking it offline. The vulnerable aspects of the game's integrity are the shuffling algorithm, collusion, and automated poker-playing programs known as "bots". All the examples used here will be for the game Texas Hold 'em as it is currently the most popular game.

An ideal shuffle has two properties. It should be uniformly distributed, that is, that any card has an equal chance to be in any given spot. In practice it means that in the long run, every player is dealt aces at the same frequency. The other property is that this shuffle should be completely unpredictable. There should be no method available to accurately predict what cards were dealt.

When a human shuffles the cards in a live poker game, the initial order of the cards is typically unknown as the cards are gathered together from the previous hand. This adds some element of randomness. In addition to this, the cards are riffled a few times and cut. This is not perfectly random, as there may be some sequences of cards in the original deck that remain in the second deck, but for the purposes of live play this is typically sufficient, as it is very difficult to

predict what remained the same. Ideally, a computer could produce a truly random deck since it can manipulate a digital deck of cards much faster than a human dealer.

On their own, computer cannot produce random numbers. Computers are deterministic machines and when given a certain input always returns a certain output. Many programming languages have “random” functions which take an integer as an input and return another integer. This second integer is difficult to predict given the first integer, however, this second integer is always the same. When the call `Random(x);` is made, `y` is *always* returned. In 1999, a team published how they were able to use this information to crack PlanetPoker’s shuffler.¹¹

The algorithm had a fundamental flaw to its uniformity that is somewhat related to its flaw in predictability. At the beginning of a shuffle, the software started with an ordered deck and a Random Number seed that was derived from the system clock. In a 52 card deck, there are $52!$ (about 8×10^{68}) different ways to order the cards. The seed was only a 32 bit number though, and only one seed was used, so there were only about 4 billion possible decks using this system. In addition to this, the program used the Pascal random function, which uses the number of milliseconds elapsed since midnight, which means that there are only 86 million possible decks.

For the purposes of trying to deduce the shuffle, the team could synchronize their computer’s clock with the clock on the gaming server to narrow down the potential shuffles into a searchable quantity, about 200,000. With the

potential decks known, the team wrote a program that took in five cards as input, the initial two dealt to a player along with the flop, and knew exactly what the other player's held and what the final two community cards would be.

In the seven years since PlanetPoker's shuffling algorithm was exposed, shuffling algorithms have gotten better. Paradise Poker has a lengthy article published on their website about their algorithm.¹² They use a 2016 bit random seed with those bits gathered from sources immeasurable by any individual user, as opposed the PlanetPoker method of using its own system clock. These sources include the server's own timestamps in addition to the timestamps of the systems of the individual players along with data from their mouse and keyboard. The deck is also reshuffled between rounds of betting, so that even if the original shuffle was somehow discovered, the cards that are dealt for the rest of the hand would still be unknown.

PokerStars uses a similar but slightly different method.¹³ They use a smaller random seed, a 249-bit number, but still big enough to produce every possible shuffle. They also use player's systems as sources for randomness, and they encrypt this data before putting it into the seed, for further security.

What this all means is that, for a modern poker site, the shuffler does not constitute a significant threat to the fairness of the game. It would seem that the PlanetPoker incident provided a wakeup call to the other online poker rooms to ensure that their algorithms are strong enough to meet the two qualities of a good shuffle. By drastically increasing the size of the number used as a seed,

the shuffles are now uniformly distributed, and through the varied ways of generating that random seed the unpredictability of the card order is ensured.

One does not necessarily need to know the order of the entire deck to have a significant advantage though. A game of poker can only be fair if every player only knows the cards that were dealt to him. While a player might not gain much in a single hand by knowing a friend's hole cards, he would have a significant long term advantage over the table. Any instance of two or more players sharing their hole card information is considered collusion. Any method of two or more players working together to gain an advantage over the rest of the table is collusion. In its most subtle forms it is almost impossible to detect, therefore it is the biggest single risk to the security of online poker.

In a live poker room there are many ways to detect and discourage collusion. The most powerful form of collusion is sharing information about your hole cards, and this is the easiest to stop at a real table. At a casino, a player cannot simply turn to his friend and say, "I have ace-five of hearts."

The dealer would at the very least warn the player and he could potentially be thrown out of the casino. A deliberate cheater would certainly not be so obvious with his signals; however, casino employees roam the poker room looking for suspicious activity and cameras cover the ceiling recording all that takes place. Collusion is certainly possible between two savvy collaborators, but the limitation of their communication ability helps to prevent some of the damage they would do to the game.

On the internet however, the players can be in the same room, or thousands of miles apart, and either way there is no physical oversight of the play. The software provides chatting software, but this, of course, would be a foolish way to exchange card information. There is a mind-blowing assortment of ways for two colluding players to exchange card information and even specific plans for cheating; this includes instant messaging, VOIP, or even a regular telephone. Not only is it much easier for a cheater to get his accomplice's cards, but he can also discuss with him how to play a hand at every point. Here are some of the possible ways for two players to achieve an unfair advantage over the table.

Starting hand selection is a key aspect of Texas Hold 'em and large part of any strategy guide written for the game.¹⁴ In a ten-person game, most hands are unplayable, many are marginal, and there are a few that are always playable. Two colluding players can make a small, but still dishonest, profit by using their partner's hole cards to make a more informative decision on which cards to play.

If a player is dealt pocket 4's(two 4's), he could easily fold them before the flop if he knew his partner had a 4 in his hand. This is because a player with a pocket pair will make a set (three of a kind with two of those cards being in the player's hand) on the flop 11.8% of the time, assuming both of the other cards are still in the deck.¹⁵ The cheater knows that his odds of making a set on the flop for this hand are closer to 5%.

A similar advantage can be gained through suited cards. If the pot is raised preflop, a colluder might throw away his suited Ace-five of hearts if his

accomplice has 8-4 of hearts. There are thirteen hearts in the deck, and the first player has two of them, leaving eleven hearts. Since he knows his accomplice has two other hearts, that leaves only nine hearts left, and he needs three of them to show up on the board to make a flush. Without knowing about the other two cards, a tight player would typically fold here and a looser player would consider it a marginal situation. The extra information turns a marginal situation into a clear fold.

Colluded starting hand selection cheats the other players at the table in a slow methodical manner. Every time that a cheater folds a hand he would have otherwise played were it not for his extra information, it effectively robs the eventual winner of the hand of the money that the cheater would have put into the pot.

A similar idea to modifying the starting hand selection is modifying the nuts evaluation. The “nuts” is the best hand possible given the community cards. A player that has the nuts can bet his hand very aggressively knowing that he cannot be beaten. If the player does not have the nuts, he must be wary of his opponent having a better hand. Even if his opponent does have a lesser hand, that opponent may not lose as much money because the winner of the hand may have called or checked on the last card instead of betting or raising.

The most obvious case of this coming into play is when the nuts is and Ace-high flush. That is, the board does not contain a pair (no possible full house or four-of-a-kind), and the suited cards are not connected enough for a straight flush. An example board for this would be, “2h 4c 9h Jh 7d”. Where h is hearts,

c is clubs, and d is diamonds. A player with the Ace of hearts and any other heart would have the nuts.

Consider player A with the King of hearts and eight of hearts for a King-high flush, and player B with the Queen of hearts and the ten of hearts for a Queen-high flush in a no-limit cash game. The final card has been dealt and player B bets three-fourths of the pot. Player A would almost certainly not fold, but he would be much more likely to call than to raise due to the possibility of player B having the Ace-high flush. This would save player B some money because he has a strong hand too and would possibly call a raise from player A.

Now consider that player A is colluding with a third player who folded the Ace of hearts before the flop. Player A knows that he has the real nuts. With the Ace of hearts safely out of play he can raise player B's bet and possibly win much more money from him. Player A's knowledge of his partner's folded card unfairly compounded player B's loss. Player B was going to lose that hand regardless of what happened, but player A's unfair knowledge made him lose more.

There are certainly other ways to utilize the extra card information, but these examples are sufficient to illustrate the idea. In addition to using the additional card information, colluding partners may make seemingly strange plays in order to induce a victim to fold the best hand, or coerce him to put more money into a pot in which he is behind.

For the first case, assume there are three players: A, B, and C, with A and B colluding together. Before the flop A and B call and player C raises. Assuming

player C is a relatively skillful player he would need a strong hand to do this, such as a large pocket pair or two large cards such as Ace-King. Players A and B call this raise and the flop brings three cards that would be a threat to a good starting hand. This could be 3 small connecting cards, 3 cards of the same suit, or perhaps the most threatening, three small suited connecting cards. Unless player C has the Ace-King of that suit when three suited cards come, he cannot like his hand that much, and players A and B know this. Players A and B both miss the flop, but there is now a significant amount of money in the pot.

If player A makes a strong bet and player B raises him, player C would be very hard-pressed to not fold. If player A made a large bet and player B merely folded, player C might reasonably conclude that player A was on a bluff. With player A showing strength by betting and player B showing even more strength by raising, it would be very difficult for player A to conclude that both were bluffing. A skillful player would be forced to fold almost anything but the nuts, even though he probably had the best hand at the time.

Manipulating the action can be used in the opposite manner as well. Assume again that A and B are colluding and player C is merely another player. All three players see the flop and player B makes a very good but not invincible hand, such as three-of-a-kind on a board that has two hearts on it. If a third heart comes, then a player with two hearts would make a flush that would beat his three-of-a-kind. Player A completely missed the flop and player C has two hearts. Player A checks to player B, and he bets three-fourths of the pot. Player

C knows that he will make a flush about one third of the time by the river, and calls.

Normally, player A would fold here since he has nothing and player B and C have already shown strength, but it is in their team's best interest to make player B put as much money into the pot as possible before seeing the next card. They do not know what player C has, but he is almost assuredly behind player B and could potentially be on a flush draw which would be a threat. Therefore, player A makes a small raise and player B makes a small raise on top of that, with the effect of making player C call a significant but not excessively large bet. Player B's extra raise means that player C cannot end the betting on the flop. If player C calls, then Player A has another chance to raise.

This can be repeated indefinitely until player C either folds or raises. It would look very suspicious if this went on for multiple rounds, so in practice, player B would probably make a large raise within the first few passes to make player C either commit a lot of chips to the pot when he is behind or make him fold. Player A would fold behind him and none of the other players at the table would see that player A held a very weak hand.

If player B was not colluding, he would not have the power to completely shut out player C from seeing the next card, short of making a very large bet, which player C would fold to, gaining player B nothing. Player B would make a normal bet and player C would call, and player B would just have to hope that player C's hand did not improve.

Online poker sites do not discuss the specific algorithms they use to detect collusion in the theory that it would tip off cheaters to how to avoid getting flagged. The largest sites give absurdly broad descriptions about their anti-collusion systems such as PartyPoker's:

“We have developed a 'Collusion Prevention System' to detect such players and ban them from the site. The sophisticated systems are developed on a high level technological platform and work based on a combined set of algorithms, permutations and combinations.”¹⁶

True Poker, which is a much smaller site, gives a slightly more detailed description of its methods.¹⁷ It uses a multi-layered approach to combat collusion. The first layer tries to detect a connection between two players and does not let them sit at the same table if such a connection is found. Then there are two separate algorithms that go through complete hand histories, assigning a rating to each player based on how suspicious his play is. If a player receives a high enough rating, the hands he played are manually investigated by a security team.

Paradise Poker,¹⁸ PokerStars¹⁹, and PokerRoom²⁰ all use a similar system. Hand histories, with knowledge of all players' cards, are checked for unusual patterns. Here is where an online casino actually has an advantage over their live counterparts, because once a hand is folded in a live game, there is no way for the casino to know what that player held. If for some reason a hand or a player is flagged by the system, or another player contacts the security department about something suspicious, then it is manually investigated. If the

investigation concludes that there was some form of cheating, then the account is closed and the money on it is forfeited.

The security pages of the various sites are all worded to be very confident, but collusion certainly occurs. The poker sites do not release figures on how many cheaters they catch, and it is impossible to know how many are not caught. In addition to detecting for collusion, several sites also detect for “bots”, programs that play poker in place of humans. Bots themselves do not pose a threat to the integrity of the game. Poker is a game of imperfect information, as opposed to chess, so it cannot simply solve for optimal move. Bots have the same options and information that a human player does. The only question is whether a bot is somehow unfairly better than a human poker player.

The lack of perfect information makes programming a bot that would be competitive against a good poker player. A good player can make judgments about what other players might be holding, and can deceive the other players about the strength of his own hand. He can also make radical adjustments to his overall strategy based on how the table is playing. There are many subtleties to high-level poker that would be extremely difficult to code. The only real advantage a bot has over a computer player is endurance.

The reality however, is that many online players are far from good players, especially at the lower stakes. It is at the lower stakes where bots supposedly thrive, as a straightforward set of rules is enough to beat a weak player. These bots can be left running for several hours at a time at several tables slowly but surely grinding out a profit at the low-stakes tables. It has become widespread

enough that there are platforms that automate the most general parts of running in writing bots, such as interpreting what hole cards the bot holds, translating the bot code into actions, and even automating the process of leaving tables that empty and joining other tables. One of these programs is WinHoldEm.²¹

PartyPoker and ParadisePoker will specifically check a user's running processes for evidence of WinHoldEm and according to the WinHoldEm site they will suspend an account for running the program and potentially lock up the money as well. WinHoldEm provides a way to hide itself by running on a different computer than the one that is actually connected to the poker site, by using a program called WinPP to communicate between the two machines.

The true threat from WinHoldEm is not its bot features though, it is its "Team" features. A user running WinHoldEm can connect to another user running WinHoldEm and the software will automatically display the other user's cards. This can only be done between two cooperating users, so it cannot be used to peek at an opponent's cards, but it can streamline collusion. The website even has a section of their forum dedicated to discussing "Team play".²²

Although collusion through any means can be detrimental to the integrity of the game, there is only so much a colluder can safely do. There is a proportional relationship between how much of an advantage a colluder can gain versus how likely a colluder is to be detected. If a cheater takes every possible advantage he can from the illicit information he has, then he will eventually get caught. He could probably avoid detection indefinitely if he only seldom took

advantage of his extra information, but then his edge through cheating is significantly reduced.

When one proceeds carefully, online gambling can be as secure as any other online activity. Neteller appears to be fairly secure and is within legal striking distance in England if an issue were to arise. While the poker sites themselves may not be as trustworthy as Neteller in a legal sense, their desire to avoid bad publicity helps ensure that they treat their customers fairly.

The security of the actual game is slightly murkier, but perhaps no less so than in a live casino. Due to the PlanetPoker disaster, modern poker websites now ensure that their shufflers work properly. Collusion is still a problem, but a manageable one as cheaters can only do so much with the information they posses.

Additional steps can be taken to further guarantee a player's security. General password security should be followed with any poker site, and different password/ID combinations should be used to ensure that if one account is compromised then all the accounts are not compromised. Playing at a larger site is safer than playing at a smaller site, because if the site was not trustworthy, than people would not play there. One should also keep a watch on online poker forums for relevant information about sites that they play at.

In gambling in general, one should never play with more money than he can afford to use, and that is even more important on the internet where many more hands per hour are played than in a live game. This also limits the damage to a player's available funds if he is scammed by a team of colluders. Perhaps

the most important advice for any potential online player is to learn how to play poker. An unskilled player is destined to eventually lose all the money he plays with to skilled players, and no amount of security will stop this from occurring.

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