THE FIVE DECISION FACTORS FOR TEXAS HOLD'EM POKER

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The key to making intelligent poker decisions is to understand that successful poker is not about winning hands, it is about winning money. Since everyone has the same chance of being dealt a winning hand, winning hands are, in the long run, equally distributed among the players. Over time, money is accumulated by the players who make the best decisions.

Poker decisions require knowledge of mathematical probabilities, but the game is far more complex and cannot be completely described mathematically. In blackjack, where the dealer always plays the same way, it is possible to calculate the best decision for each hand. No such calculation is possible in poker because you are competing against different players, each of whom plays their own way. Not only do individual players differ, but each poker table develops its own group dynamics that changes as players enter and leave the game. The replacement of a single passive player with an aggressive one can instantly alter the mood of a poker table and necessitate changes in decision making.

The combination of mathematics, psychology, and social dynamics makes poker a rich and fascinating game. Mastering poker requires hours and hours of playing in different settings with different people. However, many people place too much emphasis on the psychological aspects of the game. They think poker is all about bluffing and reading body language. The fact is, poker has an underlying strategy that must be followed for there to be any chance of survival, let alone winning.

Correct strategy bases decisions on the knowledge available to you of the cards and your opponents. You never have perfect knowledge of your opponents, their cards, and the cards to come. Given imperfect information, you must assess what is most likely to happen. Decisions must be based on the most probable outcome of a hand, not on what you hope will happen.

Before discussing the actual play of hands, it is necessary to have the facts that intelligent decisions are based on. This section, which is meant to be used as a reference, contains tables, graphs, and summaries of important information and concepts. There are five factors to consider in every poker decision. After summarizing the five decision factors, each one is discussed in detail. How knowledge of these factors translates into actual play is the subject of the next chapter.

The Five Decision Factors

The decisions you make during the course of a hand should always take the following five factors into consideration:

Your cards—Betting in poker means you wager that, at showdown, your hand will be ranked the highest. Unless you believe that to be a likely possibility, you should not bet. Statistically, in a ten-handed game, you will only have the highest hand 10% of the time. Knowing when it is your time to have the best hand is of course the difficulty. When you have a strong hand, bet aggressively and force the other players to chase you. It is rarely correct to slow-play; that is, not bet a strong hand. If you don't have a strong hand, fold. In poker, money saved is the same as money won, and staying out of the 90% of the hands you are destined to lose is as important as being in the hands you win.

Your position is an important factor in Hold'em because it is a fixed-position game. When you are in an early position (close to the blind) you have no way of knowing how large the pot will be at the end of a betting round, and how many players will be contesting it. To compensate for this disadvantage, you need to play stronger cards than you would from later positions.

The number of players contesting a pot determines the kinds of hands that are playable. The irony is that you can play weaker starting cards when many players contest the pot, but you must have a stronger final hand at showdown. A high pair is a strong favorite to win against one or two opponents, but if ten players enter the hand, someone is likely to beat a high pair with a flush or a straight. Conversely, drawing hands (weak initial cards that may give you a flush or straight) are playable against a large field since the final pot will be large, but drawing hands are seldom worth playing for small pots against one or two players.

Pot odds are the costs of staying in the hand compared to the pot size. In each betting round, you decide if the amount of money it will cost you to finish the round is worth the size of the pot being contested. The cost to play can range from nothing (if everyone checks) to three large bets (if there is a lot of raising late in the game). Like any sound investment decision, riskier plays must have greater rewards for success.

Opponents' playing styles—During the hands that you don't enter, observe the playing style of each player and of the group as a whole. Does a certain player only bet when he has good cards or does he bet with anything? Does a player buy-in for a small amount of money and carefully guard it, or does she buy new chips from the dealer frequently? For the table as a whole, are showdowns frequent or rare? How do your opponents react to your play? A big mistake beginning poker players make is playing only their cards and not considering how other people are playing theirs. Your opponents' actions are a source of information that must be used.

Over the course of a hand, some of these factors become more important than others. Early in the hand, your position, the initial strength of your cards and the potential number of opposing players are the most important factors. Later in the hand, pot odds and the playing styles of the remaining players become more important. Before presenting a detailed discussion of these five factors, I need to clarify some mathematical language.

Math Concepts for Poker

Poker is inherently a game of incomplete information and uncertainty. Correct decisions do not always lead to desired outcomes. Even with the best possible play the outcome of any single hand is unpredictable. To profit over the long run, it is necessary to make decisions that are correct in a probabilistic sense because events at the table are not determined. To understand the decision making process, it helps to have some ideas and language from the mathematics of probabilities.

Probabilities and Odds

Throughout the discussion that follows and in the mathematical charts and tables, references will be made to the *probabilities* of events occurring and the *odds* against events occurring. Judging by the mail I received following the first edition of this book, the two terms—*probabilities* and *odds*—are frequently confused. Probabilities are related to odds, but these quantities are defined differently.

Probabilities are expressed either with a number between zero and one, or as a percentage. A probability of zero means the event will never happen while a probability of one means that the event is a certainty. When the probability is between zero and one that means the outcome is uncertain. Consider the common occurrence of having four cards of the same suit (a four-flush) with one card to come. There are nine remaining cards that complete the flush out of 46 that have not been seen (you see the two cards in your hand and four on the board). You will make a flush 9 out of every 46 times this situation happens, or about one-fifth of the time and not make the flush four-fifths of the time. The probability for a flush can be expressed as one-fifth, as its decimal equivalent 0.2, or as 20%. The probability for not making a flush is four-fifths, or 0.8 or 80%. Note these combined probabilities add to one, or 100% because it is certain that you will either make the flush or not.

Odds are expressed ratios. The odds are the average number of failures for each success. For the example of the flush where success occurs 20% of the time, there will be four failures on average for each success. That means the odds against making the flush are 4 to 1. If the probability of an event is 50% then there is one success on average for every failure. In this case the odds against success are 1 to 1.

Converting from probabilities to odds

If you know the probability of an event (p), the odds against the event occurring are [(1/p) –1]. For the example of the flush, 1 divided by 0.2 equals 5, subtract 1 to get 4 and the odds are 4 to 1. For unlikely events, the probabilities are small, which means 1/p is a large number and is very close to the odds against the even happening. For example, the probability of receiving two Aces for pocket cards is 0.004525 or 0.4525%. That means 1/p is 221 so the odds against receiving two Aces are 220 to 1. On average, for every hand with two Aces there are 220 without. For events that are much more likely 1/p is not very close to the odds. The probability of completing a flush with two cards to come when you have a four-flush is 0.35 or 35%. In this case 1/p is 2.86 so the odds are 1.86 to 1 (almost 2 to 1). You will have about 2 failures for each success when drawing to flush if you already have four of the cards.

In the charts that follow the frequencies of events are expressed as probabilities in some cases and odds against in other cases. The probabilities are expressed in percentages. For example if you start with a pocket pair, 71.84% of the time your five-card hand after the flop will be one-pair. The remaining 38.16% of flops will improve your hand to better than one pair (two pair, trips, full house or quads). For frequent events percentages are a useful way of thinking. But for remote events it is often easier to remember the odds. The odds against being dealt pocket Aces are 220-1 while for Ace-King the odds against are 82-1.

Expected Values

When betting on an uncertain outcome, it helps to think in terms of the average profit that results if the same bet in the same situation is made repeatedly. It is useful to define the *expected value* of a bet as the average profit that results after many repetitions. Expected values can be positive, negative or zero depending on whether the bet wins money over the long run, loses money, or breaks even. The expected value of a bet depends on the odds against success and the payoff if the bet succeeds.

For example, consider having four cards to a flush with one card to come and it costs $1 to contest a $5 pot. The odds against success are 4 to 1, which means on average, four out every five times this bet will lose. It costs $5 to make this bet five times and its one success will return $6—the $5 already in the pot plus the $1 put in to contest it. The ratio of 6 to 5 is 1.2. That means the expected value of the bet is $1.2 -$1 or $0.20. The bet expects to return a profit $0.20 per dollar on average every time it is placed.

Now consider the same situation with the cards but a different pot size. It cost $1 to contest a $3 pot. Again it will cost $5 to make this bet 5 times but the one success will return $4. The ratio of 4 to 5 is 0.8, so the expected value is $0.8 - $1 or –$0.20. On average this bet will lose $0.20 per dollar each time it is placed.

The expected value of a bet is a useful concept but keep in mind the following:

- Bets with positive expected values can lose just as often has bets with negative expected values. For the examples just given the winning frequencies are the same. A bet that is “good” in a mathematical sense might lose most of the time.

- Conversely, bets with negative expected values can win just as frequently as bets with positive expected values. Bets that are "bad" in a mathematical sense do win a certain fraction of the time.

- For a bet to have a positive expected value, the payoff must be greater than the odds against success.

- The expected value is an average of many repetitions, it is not the outcome of a single event. For each hand usually you either win or you lose. Fractional outcomes, such as split pots, are rare.

- To win over the long run at poker, you must consistently place bets with positive expected values and avoid ones with negative expected values.

- The expression "on average" does not mean that if the odds against success are 4 to 1, every five bets placed will always include one success. If poker were that predictable no one would play the game.

Your Cards

To succeed at Hold'em, you must have the ability to judge the winning potential of the first two cards you are dealt (your pocket cards). There are exactly 1326 equally probable combinations for two cards dealt from a deck of 52. However, because the suits are all equally ranked, the number of unique starting hands is reduced to 169. Not all 169 starting hands occur with the same frequency because the number of combinations required to produce each unique starting hand differs. For example, of the 1326 combinations, six result in AA, four result in AK suited, and 12 result in AK unsuited. In terms of percent, this means the chance for AA is 0.45%, AK suited is 0.30%, and AK unsuited is 0.90%.

To compute probabilities, it is useful to divide the 169 starting hands into five distinct groups. The groups and the number of hands in each group are *pairs* (13), *straight flush draws* (46), *straight draws* (46), *flush draws* (32), and *no draws* (32). Each group is based on what type of hand can be built when initial cards are combined with favorable community cards. The chart below summarizes the five groups and their frequency.

Frequencies of Starting Hands

Starting Hand	Frequency	Description
Pairs	5.9%	Two cards of the same rank.
Straight Flush Draws (SFD)	13.9%	Two suited cards that are also part of a straight. The hand 10♥ 8♥ is a straight flush draw (the flop could come up J♥ 9♥ Q♥).
Straight Draws (SD)	41.6%	Two cards that form part of a straight, but not a flush. With 10♥ 8♣ only a straight is possible after the flop.
Flush Draws (FD)	9.7%	Two suited cards that cannot form a straight.
No Draws (ND)	28.9%	Two cards that cannot be used as part of a straight or flush. For example Q♥ 4♣.

Subcategories of starting hands can be identified within these five groups. For example, a hand that contains two of the top five cards such as Ace, K, Q, J, or 10 is an Ace-high straight draw. The subcategories of starting hands can be grouped into roughly four categories of strength. The strength of a starting hand, identified in the next table, is described as premium, strong, drawing, or garbage.

Strength Categories of Starting Hands

Strength	Description	Examples
Premium	Hands that can win on their own.	Big pairs—AA, KK, QQ, JJ, 10 10; straight draws with aces such as A♣K♣, A♥ K♦.
Strong	Hands that will probably need improvement to win.	Medium pairs—99, 88, 77; Ace-high straight draws such as K♥Q♦; Royal Draws such as K♥J♥.
Drawing	Hands that will need help from the board to win.	Little pairs—66, 55, 44, 33, 22; connected straight flush draws such as 5♦6♦; Ace-high flush draws such as A♥7♥.
Garbage	Should not be played.	All other hands not listed above.

Patience is required to play Hold'em because you rarely receive premium and strong starting cards. The next table summarizes the frequencies of selected premium and strong starting cards and the odds against occurrence.

Frequencies of Selected Starting Hands

Starting Hand	Frequency (%)	Odds
AA	0.45	220-1
KK	0.45	220-1
AK (mixed or suited)	1.2	82-1
Any Premium Pair A A-10 10	2.3	43-1
Any Royal Draw	3.0	32-1
Any Ace-Face Combination	3.6	27-1
Any Ace High Flush Draw (Including Royals)	3.6	27-1
Any Ace High Straight Draw	14.3	6.0-1
Any Hand with an Ace (Including AA)	15.4	5.5-1

A sense of the relative strength of the 169 starting possibilities can be obtain by examining expected value statistics compiled by the online cardroom—PokerRoom.com. Statistics for 122,031,244 pairs of pocket cards dealt at real money tables were compiled and published on their Website. The next chart lists all 169 hands along with the expected value that resulted expressed in units of "big bets." For example, the expected value for pocket Aces was 2.32. That means that at a $5-10 table where the big bet is $10 the average profit from pocket Aces was $10 times 2.32, or $23.20. An "s" designation means suited.

Expected Values of Starting Hands*

Cards	E. V.
AA	2.32
KK	1.67
QQ	1.22
JJ	0.86
AK s	0.77
AQ s	0.59
TT	0.58
AK	0.51
AJ s	0.43
KQ s	0.39
99	0.38
AT s	0.33
AQ	0.31
KJ s	0.29
88	0.25
QJ s	0.23
KT s	0.2
AJ	0.19
A9 s	0.18
QT s	0.17
KQ	0.16
77	0.16
JT s	0.15
A8 s	0.1
K9 s	0.09
AT	0.08

Cards	E. V.
A5 s	0.08
A7 s	0.08
66	0.07
KJ	0.07
A4 s	0.06
Q9 s	0.06
T9 s	0.05
J9 s	0.04
QJ	0.03
A6 s	0.03
55	0.02
A3 s	0.02
K8 s	0.01
KT	0.01
98 s	0
T8 s	0
K7 s	0
A2 s	0
87 s	-0.02
QT	-0.02
Q8 s	-0.02
44	-0.03
A9	-0.03
J8 s	-0.03
76 s	-0.03
JT	-0.03

Cards	E. V.
97 s	-0.04
K6 s	-0.04
K5 s	-0.05
K4 s	-0.05
T7 s	-0.05
Q7 s	-0.06
K9	-0.07
65 s	-0.07
86 s	-0.07
A8	-0.07
J7 s	-0.07
33	-0.07
J9	-0.08
T9	-0.08
54 s	-0.08
Q6 s	-0.08
K3 s	-0.08
K2 s	-0.08
Q9	-0.08
75 s	-0.09
22	-0.09
64 s	-0.09
T8	-0.09
Q5 s	-0.09
96 s	-0.09
J8	-0.1

Cards	E. V.
98	-0.1
97	-0.1
A7	-0.1
T7	-0.1
Q4 s	-0.1
Q8	-0.11
J5 s	-0.11
T6	-0.11
Q3 s	-0.11
75	-0.11
J4 s	-0.11
74 s	-0.11
K8	-0.11
86	-0.11
53 s	-0.11
K7	-0.11
85 s	-0.11
63 s	-0.11
J6 s	-0.11
85	-0.11
T6 s	-0.11
76	-0.11
A6	-0.12
T2	-0.12
95 s	-0.12
84	-0.12
62	-0.12
T5 s	-0.12
95	-0.12
A5	-0.12
Q7	-0.12

Cards	E. V.
T5	-0.12
87	-0.12
83	-0.12
65	-0.12
Q2 s	-0.12
94	-0.12
74	-0.12
A4	-0.12
T4	-0.12
82	-0.12
64	-0.12
42	-0.12
J7	-0.12
93	-0.12
73	-0.12
53	-0.12
T3	-0.12
63	-0.12
K6	-0.12
J6	-0.12
96	-0.12
92	-0.12
72	-0.12
52	-0.12
Q4	-0.13
K5	-0.13
J5	-0.13
43 s	-0.13
Q3	-0.13
43	-0.13

Cards	E. V.
K4	-0.13
J4	-0.13
T4 s	-0.13
54	-0.13
Q6	-0.13
Q2	-0.13
J3 s	-0.13
J3	-0.13
T3 s	-0.13
A3	-0.13
Q5	-0.13
J2	-0.13
84 s	-0.13
82 s	-0.14
42 s	-0.14
93 s	-0.14
73 s	-0.14
K3	-0.14
J2 s	-0.14
92 s	-0.14
52 s	-0.14
K2	-0.14
T2 s	-0.14
62 s	-0.14
32	-0.14
A2	-0.15
83 s	-0.15
94 s	-0.15
72 s	-0.15
32 s	-0.16

* Data reprinted with permission of PokerRoom.com and originally published at http://www.PokerRoom.com. Expected values determined from the analysis of 122, 031, 244 actual hands played.

These statistics are not the result of a simulation or mathematical computation. The expected value averages are based on the actual outcomes of all 122,031,244 hands analyzed. An examination of this table confirms some common beliefs but also reveals some surprises.

Confirmations

- Premium pairs play best—AA, KK, QQ, JJ in that order are the top four hands in terms of expected value.
- Any Ace with a face card—AK, AQ, AJ, has a positive expected value whether the cards are suited or not.
- Most hands should not be played. Only 40 of the 169 possible starting hands have produced a positive expected value.

Surprises

- Any hand AX unsuited, where X is 9 or less had a negative expected value.
- J-10 and Q-10 unsuited had negative expected values.

Real world poker plays differently than poker theory. The so-called worse starting hand—7-2 unsuited—because these are the lowest cards you can hold with no possibility of a straight or flush after the flop, has done better in practice than 37 other starting hands including many that contain Aces, Kings, Queens and Jacks. This is evidence that players routinely overplay hands with Aces and face cards and lose more money than they should. This is also my explanation for why 7-2 suited and 3-2 suited end up at the bottom in places 168 and 169 respectively on the list.

Dominated Hands

The problem with playing high cards paired with low cards (A 3, K 5 etc.) is that these hands are frequently "dominated." You might pair the Ace or King and have a winning hand, but if you get any action it will be from another player who at a minimum has paired the Ace or King and has higher hole card (stronger kicker). It is costly to routinely play cards that only get action when the hand is second best. It is not enough to just have the winning hand. To profit you must get paid when your hand is best. If a hand with a weak kicker holds up it will usually not be paid.

Your Position

You must play starting cards appropriate for your position. In an early position, you are forced throughout the hand to make decisions with the least amount of information. For example, if before the flop, you call the blind with a drawing hand, you could be faced with a raise from one or more players with premium pairs. Since you don't know what raises you will be faced with, don't play cards from an early position that are too weak to justify calling a raise.

Compared to Seven-Card Stud, the importance of position in Hold'em is one of the key differences between the games. Position changes throughout the hand in Stud. The critical factor in determining a playable stud hand isn't position, but rather, how "live" is the hand. If your first three cards in Seven-Card Stud are A, J, J and you look at the board and see the other two Jacks and one other Ace, you have a "dead" hand. The Jacks with Ace-kicker may look pretty, but your action should be to fold.

However, in Hold'em, only three cards initially appear on the board and they are your cards. To know when your hand is "dead" is more difficult in Hold'em because fewer cards are exposed. To judge if your Hold'em hand is "live," you must observe the bets from the other players. Therefore, position matters, and since your position stays fixed throughout the hand, you know ahead of time the betting order for the entire hand.

Prior to the flop the person to the left of the big blind is said to be "under the gun" and must act first. That player is not allowed to check he or she must fold, call, or raise. The small blind will act next to last and the big blind last. Both the big blind and small blind have the option of raising. Pre-flop, the big blind is the only player with the option to check and that is only if the pot is has not been raised.

After the flop and for all subsequent betting rounds, the small blind acts first, the big blind second, and the action continues in turn with the player on the button acting last. That means the blinds will be "out of position" for the remainder of the hand and the player closest to the button will have the advantage of acting last. A player's position allows some hands that are usually unplayable to become profitable if played when acting last.

To understand the effect of position the expected value data from PokerRoom.com can be further broken down and sorted by both pocket cards and position. Three-dimensional plots showing expected value on the vertical axis versus both pocket cards and position can be constructed. In the plots that follow the seat number refers to the player position shown in the diagram in Chapter 2. The role of each seat number is listed below. The

Playing Positions

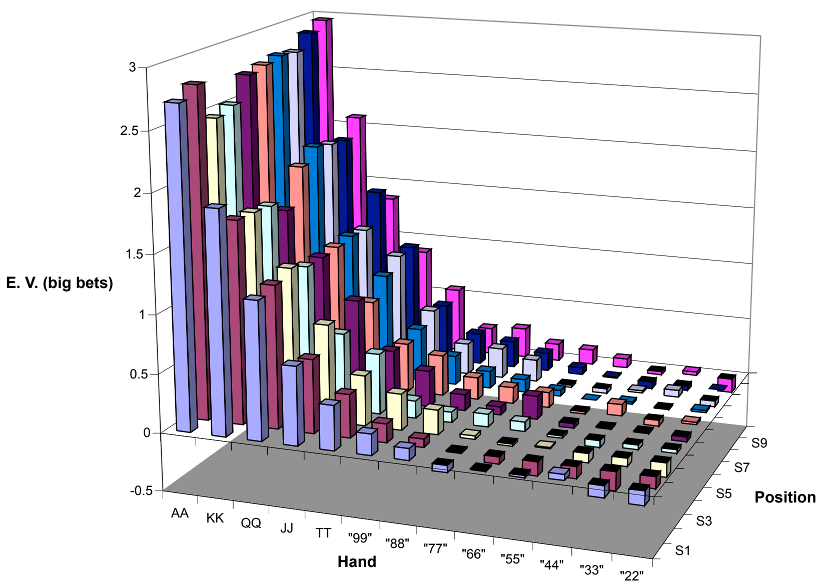
Seat 1 – Small blind	Acts first for all rounds after the flop.
Seat 2 – Big Blind	Acts last prior to the flop.
Seat 3 – "Under the gun"	Acts first prior to the flop.
Seat 4 – Early Position	
Seat 5 – Mid position	
Seat 6 – Mid position	
Seat 7 – Mid position	
Seat 8 – Late position	
Seat 9 – Late position	
Seat 10 – "button*"	Acts last for all rounds after the flop.

* The button position is also referred to as the dealer position because it marks the position of the player who would theoretically deal in a player dealt game.

three-dimensional plots constructed show three categories of pocket cards—pairs, Ace-face, and connected suitors. The three plots show that position matters more for some categories of pocket cards than others.

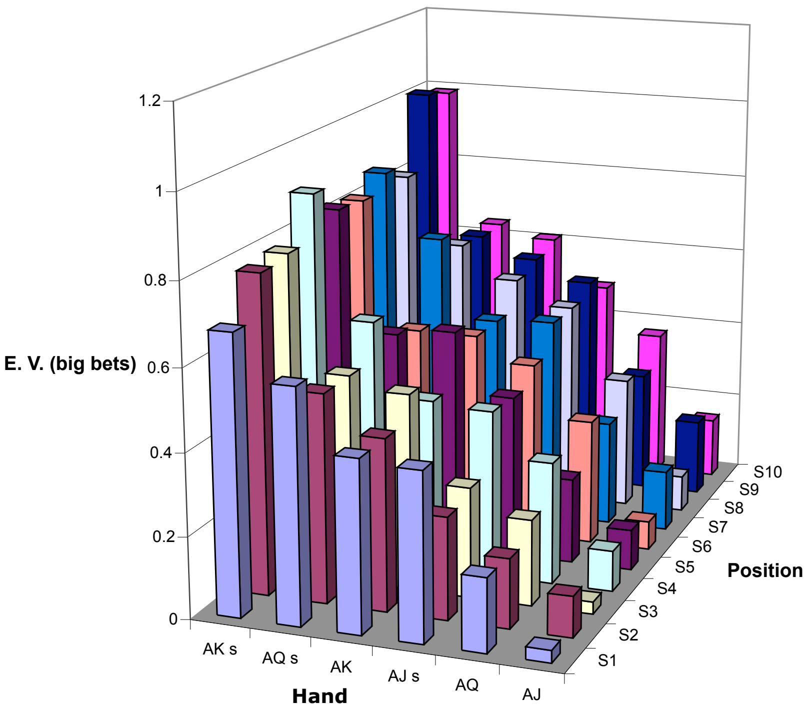
The effect of position on pairs

The expected value of pocket pairs depends strongly on the rank of the pair and is roughly independent of position. Pocket pairs of rank 66 and below do poorly from almost any position while premium pairs rank JJ and above do well from all positions. The plot shows that the decrease in the expected value of pairs as rank falls is substantial. A pair of Aces is 50% more profitable than a pair of Kings. A pair of Kings is 50% more profitable than a pair of Queens.



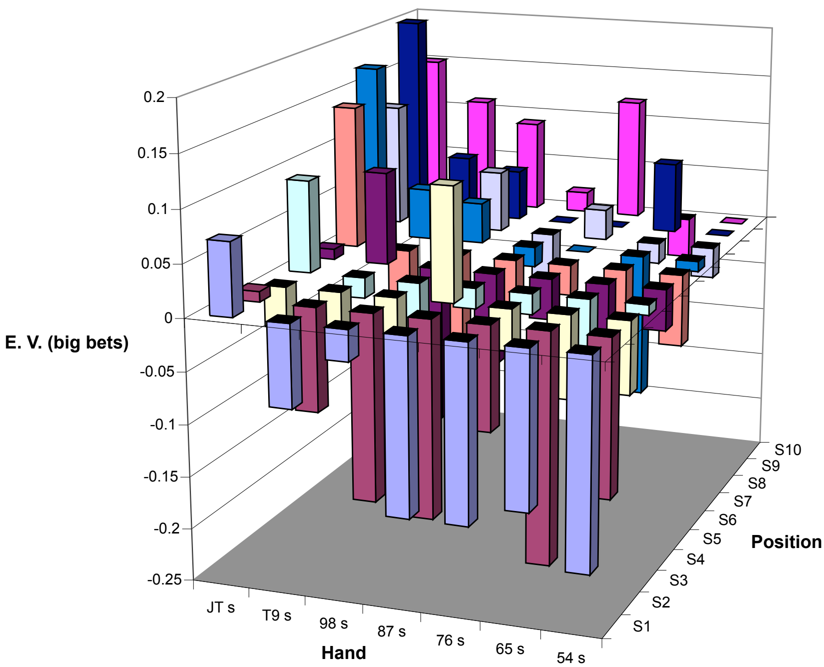
The effect of position on "Ace-Face"

Hands with containing "Ace-Face" —meaning an Ace with a King, Queen or Jack—have a positive expected value from *all* positions. Like pocket pairs, the effect of position on expected value is small. Not surprisingly the higher the face card the higher the expected value and suited combinations do better than unsuited. The one exception is that Ace-King unsuited does slightly better than Ace-Jack suited. Ace-Face combinations in general do better than small pocket pairs from any position.



The effect of position on connected suitors

The expected value of connected suitors is strongly dependent on both the rank of the cards and the seat position. These effects can be seen in the chart by looking at the increase in expected values of Jack-10 suited as the seat number increases (position becomes later), and of the expected value increase for seat 10 (last position) as the rank of cards increase. The peak of this three-dimensional plot is for Jack-10 suited in seat 10. Suited connectors that do not contain a card of at least rank 10 have done poorly from all but the last three seat positions. The one anomaly is 87 suited which has done well for players "under-the-gun". It has a negative or zero expected value for all other positions. I have no explanation for this anomaly.



The results of this position analysis are summarized in the chart below. What the position chart tells you is that the later your position, the more kinds of hands are potentially playable. Drawing hands, such as connected suitors, increase in value with later positions, because more information (number of players, potential pot size) is available. The chart does not mean you should always play a drawing hand from a late position. It means that if other decision factors are favorable—factors that are only known from having a late position—a drawing hand is playable.

Position Recommendations for Starting Hands

Position	Seat	Playable Hands
Early-position	(seats 1-3)	premium hands
Mid-position	(seats 4-6)	premium and strong hands
Late-position	(seats 6-9)	premium, strong and drawing hands

Position in pot-limit and no-limit games

Position is more of a factor in pot-limit and no-limit games than it is in limit. The charts analyzing position using the PokerRoom.com statistics are for limit games and are not valid for pot-limit or no-limit play. Players in a limit game with a good drawing hand can often get away with checking and calling a last position bet because the cost to see one more card is by definition limited. An early position player with a good draw in a no-limit game often cannot afford to put his or her entire stack at risk if a late position player makes a big bet.

Number of Players

It is a general truth, that for all premium starting cards, the more players dealt in the hand, the more likely it is someone else will have at least as good a starting hand. The effect of the number of players dealt in the hand on the probabilities is most clearly seen by calculating the occurrences of high-ranked pocket pairs. If you hold a pocket pair, the chart below summarizes the odds against one or more players at the table holding a higher-ranked pocket pair.*

The chart shows that in short handed games, premium pocket pairs increase in value. If you hold JJ and are up against two opponents (a deal of 3), the odds against one or both of them having a higher pocket pair are 33-1. These are the same odds against KK competing with AA in a deal of seven hands.

The pattern shown in the previous chart, of premium cards being less likely to hold up as the number of players increases, is also true as the hand progresses. The more players that compete for the pot, the more likely it is that the best hand will be out drawn. The best starting hand in Hold'em, AA, is always more likely to win than any other starting hand. However, the absolute probability of AA winning decreases as the number of players in the hand increases.

Odds for Multiple Pocket Pairs

	Number of Players Dealt in the Hand (Including You)								
Your Hand	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
KK	200-1	100-1	67-1	50-1	40-1	33-1	29-1	25-1	22-1
QQ	100-1	50-1	33-1	25-1	20-1	16-1	14-1	12-1	11-1
JJ	67-1	33-1	22-1	16-1	13-1	11-1	9-1	7.8-1	6.9-1
10, 10	50-1	25-1	16-1	12-1	9.5-1	7.9-1	6.7-1	5.8-1	5.1-1
9, 9	40-1	20-1	13-1	9.5-1	7.5-1	6.2-1	5.2-1	4.5-1	3.9-1

* Computations performed using the methods of Brian Alspach, described in his paper on "Multiple Pocket Pairs" at http://www.math.sfu.ca/~alspach/comp35. and published in *Poker Digest*, Vol. 5, No. 2, January 2002.

Short-handed games

Short-handed play requires much more aggression than a full table. At a full table with a board that has straight and flush possibilities, the chances are good a premium pocket pair will not hold up at the end, specially if it is a multi-way pot with a good deal of action. But, in a short-handed game, players are more likely to "back" into straights and flushes than to play for them. That means you must play high cards and premium pairs more aggressively than in a full game, even when the board appears threatening.

Pot Odds

Pot odds are the ratio of the amount of money in the pot to the amount it costs to stay in the hand. For example, when you bet $10 to contest a $100 pot, your bet is paid off 10:1 if you win. That ratio (the pot odds) should be greater than the odds against winning. For a flush draw with one card to come, the odds are 4:1 against making the flush. Calling when you are on a flush draw and the pot odds are 10:1 is a good bet. Calling in the same situation when the pot odds are 2:1 is a bad bet. Your odds of winning the hand haven't changed, but the payoff has, and that should determine the decision. *Poker is about winning money, not about winning hands.*

The tables and graphs that follow provide the statistical data you need to compute the pot odds both before and after the flop. The tables and graphs communicate three main points. The points are:

- Straights and flushes are rare after the flop. Unless there are a large number of players entering the hand, you rarely will have the correct pot odds to play only for a straight or flush.

- Unless you have a 10 or higher in your hand, you rarely will have the best hand after the flop. You are not getting good pot odds to enter a hand with low cards.

- The person with the best hand after the flop is a favorite to win. For almost all common drawing situations, odds of improvement on the draw are less than 50%.

Probabilities on the flop

The tables on the next page show the probabilities of having a particular ranked hand after the flop. The first table presents probabilities for starting hands in the pairs, flush draw, and no draw groups. Straights and straight flushes are not possible after the flop for starting hands in these groups. Of course any two cards could improve to a straight or straight flush later on in the hand if the right cards appear.

For starting hands in the straight draw and straight flush draw groups, the probabilities on the flop are more complicated to summarize. Connected starting cards, such as 9-8, are more likely to flop a straight than gapped cards, such as 9-7. To summarize the probabilities, straight draws and straight flush draws must be separated into four groups: connected (such as 9-8), one-gap (such as 9-7), two-gap (such as 9-6), and three-gap (such as 9-5). A three-gap straight draw, such as 9-5, can only make one straight on the flop (9 high). Connected cards such as 9-8 have four straight possibilities on the flop (Q - high, J - high, 10 - high, 9 - high). Each straight possibility has a 0.3265% chance of occurring. Therefore 0.3265% times the number of straight possibilities gives the chance of a straight on the flop. The second table on the next page shows the probabilities after the flop for the different straight draw categories.

The third table shows the probabilities for starting cards that are straight flush draws. In this case, the probabilities for straights are slightly reduced when compared to straight draws, and the probabilities for flushes slightly reduced when compared to flush draws. The reason is that a small fraction of the possible

Probabilities on the Flop for Five-Card Hands

NO STRAIGHT POSSIBLE

Starting Hand	Straight Flush	Four of Kind	Full House	Flush	Straight	Three of Kind	Two Pair	One Pair
	After the Flop the Probability (in percent) of Having:							
Pair	—	0.245	0.980	—	—	10.77	16.16	71.84
FD	—	0.010	0.092	0.842	—	1.571	4.041	40.41
ND	—	0.010	0.092	—-	—	1.571	4.041	40.41

STRAIGHT DRAWS

Starting Hand	Straight Flush	Four of Kind	Full House	Flush	Straight	Three of Kind	Two Pair	One Pair
	After the Flop the Probability (in percent) of Having:							
Connected	—	0.010	0.092	—	1.306	1.571	4.041	40.41
One-gap	—	0.010	0.092	—	0.980	1.571	4.041	40.41
Two-gap	—	0.010	0.092	—	0.653	1.571	4.041	40.41
Three-gap	—	0.010	0.092	—	0.327	1.571	4.041	40.41

STRAIGHT FLUSH DRAWS

Starting Hand	Straight Flush	Four of Kind	Full House	Flush	Straight	Three of Kind	Two Pair	One Pair
	After the Flop the Probability (in percent) of Having:							
Connected	0.020	0.010	.092	0.821	1.286	1.571	4.041	40.41
One-gap	0.015	0.010	.092	0.827	0.964	1.571	4.041	40.41
Two-gap	0.010	0.010	.092	0.832	0.643	1.571	4.041	40.41
Three-gap	0.005	0.010	.092	0.837	0.321	1.571	4.041	40.41

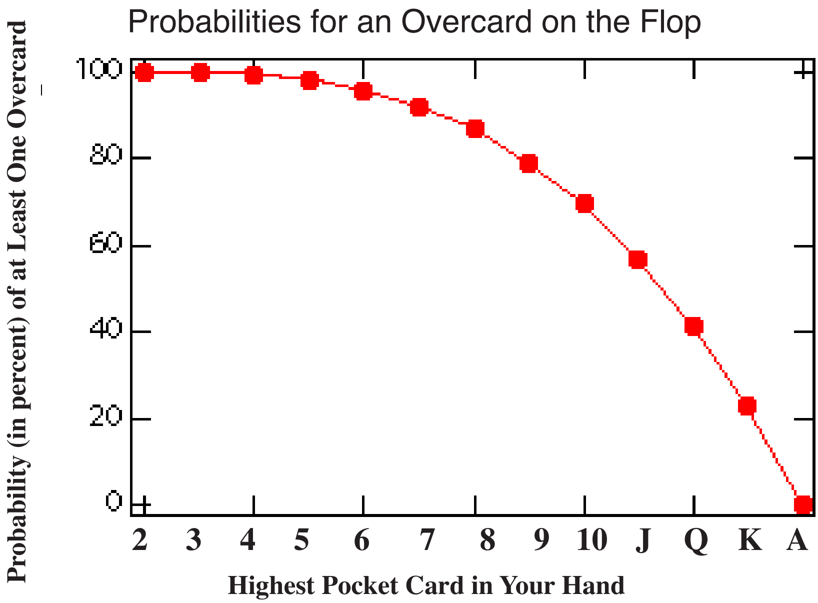
Important: *All straight draw starting hands with an Ace fall in the three-gap category because only one straight is possible. The hands AK, AQ, AJ, AT, A5, A4, A3, A2 all require three specific ranked cards to make the straight, the same as the hand 9-5. The hands KQ, KJ, 4-2, and 3-2, fall into the two-gap category because they cannot form straights higher than Ace-high or lower than Ace-low. For the same reason the hands QJ and 4-3 are in the one-gap category.*

straights and flushes will be straight flushes.

Note that even when they are possible, straights and flushes on the flop occur, at most, about 1% of the time, usually less. Also pay attention to the note at the bottom of the page, on Ace-high and Ace-low straight draws. The hand AK, for example, is a three-gap straight draw. Only one straight (Ace-high) is possible after the flop.

Importance of high cards

The figure below shows the probability that at least one overcard—a card on the board higher than either card in your starting hand—will appear after the flop. The probabilities range from 100% (if the highest card in the starting hand is a 2) to 0% (for an Ace in the starting hand). The figure demonstrates that holding an 8 as a high card is not much different than holding a 2. Since straights and flushes are rare, pairing pocket cards with cards in the flop is much more likely than any other event. To win over the long run, you must play high cards because that decreases the chance that an opponent will pair with an overcard.



Common draws

After the flop, it is the number of unseen cards that can improve a hand (*outs*) which determine the probability of improvement on the turn or river. For example, if you have an open-ended straight draw, eight cards are out that will improve your hand to a straight (four of each rank on each end). With two cards to come, you have a 31.5% chance of making the straight, but with one card to come, the chance drops to 17.4%. Next is a tabulation of common draws and the chances of improvement. Knowing these probabilities is essential for computing the pot odds when betting on the turn and river cards. For situations not listed in the table, count the number of outs to make the hand and read the percentage next to the number of outs.

Probabilities for Improving a Hand

Probabilities in Percentages for Improving a Hand After the Flop

Situation	**Improve to**	**Outs**	**Two cards to come**	**One card to come**
Open ended SFD	Straight or Flush	15	54.1	32.6
Inside straight	Straight or one pair	10	38.4	21.7
Four Flush	Flush	9	35.0	19.6
Open ended straight draw	Straight	8	31.5	17.4
Three of kind	Full House	7	27.8	15.2
Unmatched pocket cards	Pair one	6	24.1	13.0
One matched pocket card	Two pair or Three of kind	5	20.4	10.9
Two Pair	Full House	4	16.5	8.7
Inside Straight	Straight	4	16.5	8.7
One matched pocket card	Two pair	3	12.5	6.5
Pocket Pair	Three of kind	2	8.4	4.3
Three of kind	Four of kind	1	4.3	2.2

A more useful way to think about drawing hands is to examine the minimum amount of winnings needed to justify the cost of continued play. The tables that follow show for the number of available outs, the minimum pot size that must be won to justify the cost. If you cannot win the minimum amount shown in the table under the cost column, your bet is not getting the correct pot odds.

There are two tables, one for two cards to come and the other when there is one card to come. For example, playing $3-6 Hold'em, you are on a flush draw (9 outs) with two cards to come. There is a $6 bet to call and you expect to spend $12 total to get to the river. In the table for two cards to come, the intersection of the $12 column and 9 out row shows $34. You must win at least $34 to justify spending $12, because in this situation, you will have about two failures for every success.

For higher betting limits, multiply the dollar amounts by 10. Example: In a $5-10 game, you are on an inside straight draw (4 outs) and must call a raise ($20) to see the last card. In the table for one card to come, think of the $2 column as the column for $20. The value in the row for 4 outs is multiplied by 10 to give $230. You must win at least $230 to justify a $20 bet on an inside straight draw. These tables are especially useful for Internet competition, because pot sizes are precisely displayed on your screen and the table can be in front of you for reference.

Counterfeit outs

In games with community cards, such as Hold'em, not all of the outs that you have are real. Some are said to be "counterfeit." Suppose you hold J, 9 and the community cards are Queen, Jack, 10. You hold a pair of Jacks that could improve to three Jacks if another Jack appeared and an open ended straight draw that could become a King-high straight if a King appeared or a Queen-high straight if an 8 appeared. A naïve count of outs would give 10—two

Minimum Pot Size for Correct Pot Odds

For your bets (costs for additional cards) to have correct pot odds, you must win at least the amount shown under the cost column, in the row with the number of outs available to make your hand.

ONE CARD TO COME

	Cost of Final Card									
Outs	$1	$2	$3	$4	$5	$6	$8	$10	$12	$15
1	$46	$92	$138	$184	$230	$276	$368	$460	$552	$690
2	$23	$46	$69	$92	$115	$138	$184	$230	$276	$345
3	$15	$31	$46	$61	$77	$92	$123	$153	$184	$230
4	$12	$23	$35	$46	$58	$69	$92	$115	$138	$173
5	$9	$18	$28	$37	$46	$55	$74	$92	$110	$138
6	$8	$15	$23	$31	$38	$46	$61	$77	$92	$115
7	$7	$13	$20	$26	$33	$39	$53	$66	$79	$99
8	$6	$12	$17	$23	$29	$35	$46	$58	$69	$86
9	$5	$10	$15	$20	$26	$31	$41	$51	$61	$77
10	$5	$9	$14	$18	$23	$28	$37	$46	$55	$69

TWO CARDS TO COME

	Cost of Final Two Cards									
Outs	**$1**	**$2**	**$3**	**$4**	**$5**	**$6**	**$8**	**$10**	**$12**	**$15**
1	$23	$47	$70	$93	$116	$140	$186	$233	$279	$349
2	$12	$24	$36	$48	$60	$71	$95	$119	$143	$179
3	$8	$16	$24	$32	$40	$48	$64	$80	$96	$120
4	$6	$12	$18	$24	$30	$36	$48	$61	$73	$91
5	$5	$10	$15	$20	$25	$29	$39	$49	$59	$74
6	$4	$8	$12	$17	$21	$25	$33	$41	$50	$62
7	$4	$7	$11	$14	$18	$22	$29	$36	$43	$54
8	$3	$6	$10	$13	$16	$19	$25	$32	$38	$48
9	$3	$6	$9	$11	$14	$17	$23	$29	$34	$43
10	$3	$5	$8	$10	$13	$16	$21	$26	$31	$39

remaining Jacks, four remaining Kings, and four remaining 8s. But the four remaining Kings are counterfeit because if a King appeared your King-high straight would lose to anyone holding a single Ace because that person would have an Ace-high straight. In reality you only have 6 outs in this situation. Always beware of counterfeit outs. Cards that improve your hand might improve someone else's even more.

Opponents' Playing Styles

Playing styles have a big influence on how each player will choose to act in a hand. Playing styles generally fall into one of the following four categories:

Loose-passive players are free with their money, but their actions tend to follow the other players. Loose-passive players enter most hands and call just about every bet, but they rarely bet or raise on their own. Generally, these players are the most profitable people to play against. Beware though, since they play every hand, potentially they can have any hand. It's difficult to know the cards they are playing. While most of their hands are weak, they can surprise you. If the table is full of loose-passive players you can play weaker starting cards since you don't have to worry about pre-flop raises and many players will be in each hand.

Loose-aggressive players are also free with money, but they thrive on action and want to be the center of attention. Loose-aggressive players raise often, even with weak cards. If they act after you, make sure you have a strong hand that justifies calling their expected raise. It's not their hand you have to worry about beating, but other players with strong cards that call their raises. Loose-aggressive players lose lots of money, but if too many of them are at a table, the entire game becomes loose-aggressive. In such a game, there are many pre-flop raises and large pots contested by many players with the flimsiest of hands. Only play with strong starting cards that justify a large pre-flop expense. Against these players, you'll have large swings in your bankroll, but you don't have to win many pots to come out ahead.

Tight-passive players are followers at the table, but very careful with their money. Tight-passive players typically buy in for a small amount of money and guard it. They seldom bet, rarely raise, and call bets only when they have a great hand. You won't lose money at a table full of these kinds of players, but it's difficult to make much, either. When tight-passive players dominate the table, pots are smaller because few players enter each hand and there are few showdowns. To win money, you need to win many small pots by being aggressive. Bet and raise with marginal cards to intimidate these players out of the hand.

Tight-aggressive players are careful with their money, but when they do play, they seize the initiative. Tight-aggressive players enter few hands, but when they do, they have strong cards. They bet and raise aggressively, forcing the other players to pay dearly if they decide to chase. If you find yourself at a table filled with tight-aggressive players, you should consider switching to another table, especially if you are new to poker. It is easy to find yourself outplayed and your money quickly gone in this kind of game. Study the play of tight-aggressive players since you should aspire to be one.

The playing style of each person at the table influences the personality of the table as a whole. The personality of the table is important early in a hand, especially when deciding whether or not to see the flop. As the hand progresses and fewer players remain, individual personalities become more important. You need to note both the group personality (when entering a hand) and the personality of the individuals (when you go up against opponents one-on-one).

Being sensitive to playing styles and how they can change is critical. Group dynamics change as players come and go, and sometimes change for no reason at all. Tight-passive tables can suddenly become loose-aggressive tables for no apparent reason. Learning to adjust your play based on your opponents' playing styles and the group dynamics is the essence of the poker strategy described in Chapter 6.

Match the game to your personality

Certain kinds of poker games reward some personality types more than others. It is often easier to find a game that fits your personality than to change your personality to fit the game. For example if you are a naturally cautious person with a lot of patience Texas Hold'em with a full table (10 players) might be your most profitable game. A willingness to wait for the best cards, not play too many hands, and not overplay your cards is essential for making money at a full table. But when a Hold'em table is short-handed (5 or fewer players), cautious players run into problems. Always waiting for the best cards eats up too much money in the form of blinds and leaves you out of the action for too long. Short-handed games reward aggression. That means a naturally aggressive player who has to be in the action and can't stand waiting will often do well in a short-handed game. If you are the impatient kind of player who hates to wait and can't restrain yourself from betting, try short-handed games. Your style might be a profitable fit.

Resources:

The poker odds calculator on the Intelligent Poker.com Website (http://www.intelligentpoker.com) is a useful tool for testing scenarios. One feature of online play is that your hands are recorded and you can review the hand history after play. You can check out with the calculator how your play matched the mathematical expectations.

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Intelligent Poker.com —find the best places to play poker plus an interactive poker odds calculator.