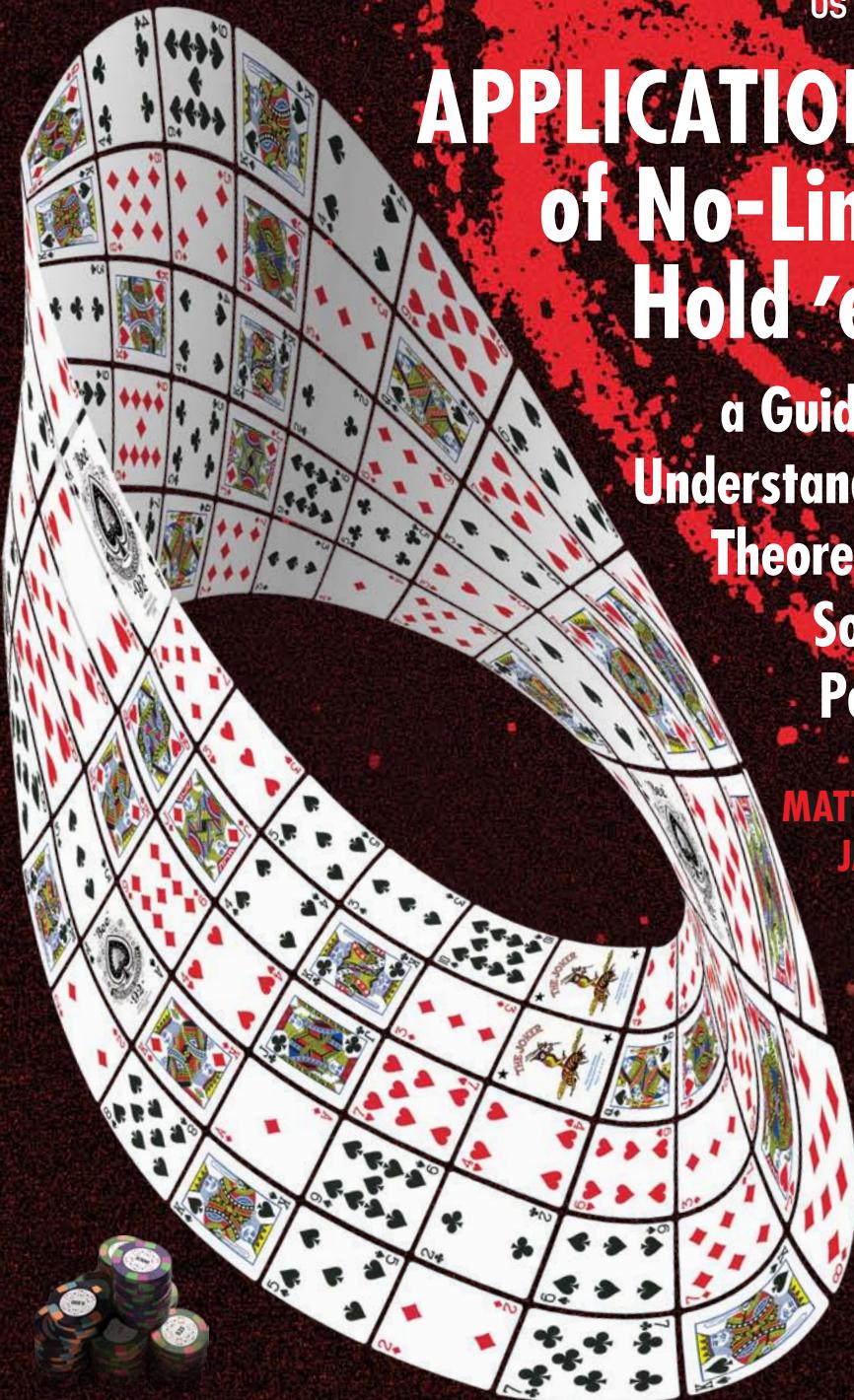


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APPLICATIONS of No-Limit Hold 'em

a Guide to
Understanding
Theoretical
Sound
Poker

MATTHEW
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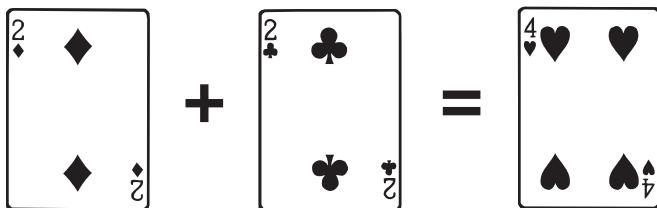


Applications of No-Limit Hold 'em

A Guide to Understanding Theoretical Sound Poker

By
MATTHEW JANDA

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About Matthew Janda

Matthew Janda has had an interest in card games his entire life, and began playing poker with friends in high school before playing online cash games in college. While originally studying business economics at UCLA, a game theory course sparked his interest in poker theory and optimal play.

Currently, Matthew continues to make poker training videos for CardRunners and all of his videos are theory based and designed to teach players the math necessary for improving their play without going into unnecessary or impractical details. He's never been one to discuss what line is best with a specific hand, but rather uses computer programs to display what action he thinks is best with each hand in his entire range.

Matthew is applying for medical school in 2013 and hopes to be a physician one day. He's currently finishing up his required science classes and volunteering, but poker remains his favorite hobby.

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Perhaps the most rewarding aspect of playing poker was all the amazing people I got to know over the last several years, many of whom deserve recognition for making this book possible. Their input and encouragement allowed me to continue forward even at times when it appeared the project was beyond my abilities. While there are far too many to name, Jaime Kaplan, Matt Groves, Nick Hall, Roy Bhasin, Michael Marinakis, and Nick Howard have all been especially important to me over my poker career. Additionally, without the help of Johannes Nowak in the early stages of this book, I'm nearly positive it would not be produced in its current form. And lastly, I've been very fortunate to have the opportunity to discuss poker with Ben Sulsky, as few players will ever understand the game as well as he does, much less be able to implement complex strategies so effectively.

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A Cautionary Note About “Bluff Catching”

by Mason Malmuth and David Sklansky

Because we at Two Plus Two know that many of the readers of this book are presently intermediate players who play against non-experts, we felt that it was necessary to add an important point regarding this advanced text.

One of the main aspects of Game Theory Optimal Play that Matthew Janda emphasizes is that you should usually strive to stop your opponent from showing a profit if he were to bet all of his hands. From this axiom, he derives many of his strategies.

To keep an opponent from gaining from constantly bluffing profitably you need to make a lot of calls with mediocre hands. That is, hands which are only bluff catchers since they won’t beat a legitimate bet.

Our concern is that those of you who are not playing against experts may not realize that the calling strategy that Janda assumes may be too loose for your game. For instance, if your opponent bets the pot, you should theoretically call with about half your hands which usually include many weaker ones.

Janda mentions a few theoretical exceptions. But the biggest exception occurs in games that Janda doesn’t usually address. Namely games when you are playing against players who are very tight or very timid. So if your opponent bets the pot in a situation where, even before he bet, you thought he was a big favorite to have a monster, bluff catching calls will just lose money. Similarly, if you are against someone who will often be beaten, it makes no difference if you know he almost never bluffs. Hence, if he bets, you should almost always fold. (Well, probably not always since that may “teach” him to change his ways.)

Introduction

This book is designed to develop and explain the math and theory behind no-limit Texas hold 'em with extra emphasis placed on how the game should be played against "perfect," or theoretically optimal, opponents. It will show how many winning players approach the game and with talent and hard work, give the tools needed to continue to develop as a player.

Many of the concepts in this book have been largely ignored by the poker community, and the few players who understand them usually like to keep this information private. On the other hand, many winning players are not even aware these concepts exist since they are not required to beat strong opponents. However, difficult concepts shouldn't be ignored if your goal is to slowly tune your game closer to "game theoretically optimal" with the purpose of moving up in stakes and beating other strong players. While it's true no-limit hold 'em is far from a "solved" game, players who understand theory well will usually be the players best able to recognize and exploit their opponent's mistakes and make sure their opponents are not able to easily exploit them.

The theory and hand examples all focus on 6-max. This game is my specialty where I've played almost all of my hands. Nevertheless, nearly all the concepts discussed will be transferable to 9-max and heads-up games. The majority of the theory will even be useful in other poker games such as Omaha.

Note that some important poker concepts have been left out of this book, or are only mentioned briefly. Life and bankroll management skills, tilt control, and understanding how to implement reads are all-important skills every great poker player needs. But these topics have already been discussed numerous times elsewhere in great detail.

2 Introduction

Therefore, my goal is to present theoretical concepts as clearly as possible, and for your learning not to be encumbered by unnecessary mathematics and terminology. To assist in accomplishing this, I will frequently be using the pronoun “we.” There are two main reasons. First, it helps get us in the right mind set. We’re on the same team with the same goal; to greatly increase your understanding of poker theory and make you a better poker player. Second, it’s often simply too difficult to try to analyze hands and concepts in poker using multiple perspectives at once. So by using the pronoun at the beginning of a sentence or paragraph, you’ll know right at the beginning from which perspective we’re analyzing the hand.

Lastly, please note the book is divided into 16 sections: theory intensive content and hand examples. The theory intensive content is the larger portion of the book and presents the necessary information for balancing hand ranges and bet sizes. The hand example section of the book puts the theory into practice and shows how players attempting to play close to optimal will balance their ranges.

Part One

The Basics

The Basics

Introduction

One of the difficulties with discussing poker theory is it's not usually possible to talk about single concepts in isolation. For instance, it's impossible to adequately discuss flop play without also understanding river play, and it's difficult to comprehend why position is so advantageous without a solid fundamental understanding of how equity works. This makes approaching poker theory for the first time feel somewhat daunting.

This section is designed to quickly introduce many important theoretical concepts before discussing them in detail. The goal is not to make sure all of these concepts are fully understood, but rather make them somewhat familiar so they can be explained mathematically and showcased with examples in future sections.

If you're already a winning no-limit hold 'em player who understands theory reasonably well, feel free to skim over or skip some of what follows. However, make sure you have at least some understanding of every concept in this section before moving on.

Calculating Pot Odds

Pot odds are the ratio of the current size of the pot to the cost of a potential call. If, on the river, a player bets \$30 into a \$50 pot, the potential caller will be risking \$30 to win \$80 and is said to be getting pot odds of \$80-to-\$30 or 8-to-3. And for his call to be profitable, he must win at least 27.3 percent of the time.

$$0.273 = \frac{3}{8 + 3}$$

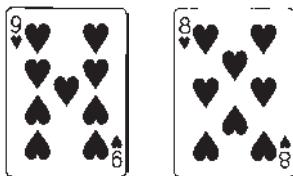
When a player bluffs, he risks however much he bets to try to win all the money in the pot. So if on the river, the pot is \$50 and a player makes a river bluff for \$30, he risks \$30 to try to win \$50. This produces pot odds of \$50-to-\$30 or 5-to-3, and for his bluff to be profitable, his bluff needs to be successful at least 37.5 percent of the time.

$$0.375 = \frac{3}{5 + 3}$$

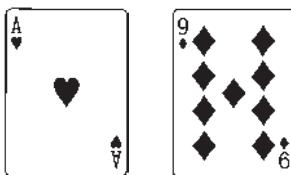
Understanding Equity

Equity represents the odds that a hand will win after the river card is dealt against the opponent's hand or range. It also takes into account that the pot will sometimes be split. In addition, it's also important to note that because a hand has more equity than another hand, it does not make it a better and more profitable hand.

Here's an example. A reasonable opponent opens in middle position and it's folded to us on the button. We would rather call with the



than the



despite the former having less equity. To understand why, we will discuss the key qualities we look for when deciding whether or not to play a hand other than simply the hand's total equity.

Retaining Equity Against Strong Ranges

We want to emphasize playing hands which have a high amount of equity against our opponent's betting and calling range. Hands which only have a high amount of equity against those hands our opponent will frequently fold by the river are much less useful. Unfortunately, simply looking at the equity of a hand against a range using computer software will not take this key difference into account.

For instance, one of the reasons why ace-nine offsuit is a poor call on the button against a middle position open is because it has so much equity against the opponent's check-folding range. Specifically, ace high with no kicker is usually too weak to be checked on all three streets to try to win at showdown, but when we do bet the hand, its equity is never realized since all worse hands in our opponent's range should fold. In addition, on the flop, ace-nine offsuit will almost never beat any hands in the opponent's value betting range and it's unlikely to improve when behind. And lastly, when we do have a pair and our opponent does check, it's unlikely he'll be check-calling multiple streets with worse.

On the other hand, consider nine-eight suited. While it's unlikely nine-eight suited will flop a hand which beats strong hands our opponent will value bet on the flop, it will however often flop a flush draw, straight draw, or a pair with five outs. These draws all have the potential to become strong hands which can beat hands in our opponent's value betting or check-calling range.

In addition, nine-eight suited also utilizes its equity efficiently when it flops a draw but does not make a strong hand. We can semi-bluff on the turn or river if our opponent checks and we don't have a pair, and if he does check-call our turn bet, our draw outs will almost certainly be live. Therefore, notice that suited

8 Part One: The Basics

connectors are usually profitable holdings since when they do make the best hand, they'll usually be strong enough to beat hands in our opponent's value betting and check-calling range. In addition, when they don't make strong hands and are instead used as bluffs, they will almost always make our opponent fold better hands so little equity is wasted.

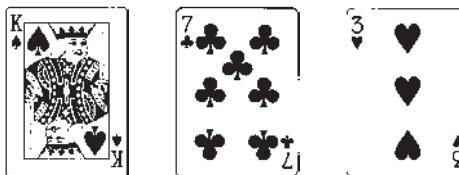
“Hand Signaling” To See Additional Cards

“Hand signaling” occurs when our hand tells us whether or not we should try to see additional cards to make the best hand by the river. For instance, after seeing a flop with a suited connector, we'll almost always know exactly what we need in order to make the best hand, and we'll usually want to see a turn card if we flop a pair, straight draw, flush draw, or three to a flush and three to a straight. Since we only fold suited connectors on the flop and turn if our hand has little equity, if we don't see a river card, it's unlikely we would have outdrawn our opponent on the river anyway.¹

Other hands do not allow us to effectively call on the flop and give ourselves a chance to outdraw our opponent. This occurs frequently with weak pocket pairs. If he bets, we'll usually have to fold since our pair only beats bluffs and doesn't have enough outs to justify a call. Consequently, despite the fact that pocket pairs on the flop will improve to sets by the river about 10 percent of the time, it's not enough equity to make us want to invest additional chips to see if we hit our set.

Here's an example. We call on the button a middle position opener and the flop comes the

¹ Of course, this assumes a normal size bet with additional chips still in play.



While both the $6\spades 6\clubsuit$ and the $9\hearts 8\hearts$ have around 10 percent equity against a top pair hand, calling with nine-eight suited is a much stronger play than calling with sixes. That's because when we hold the $9\hearts 8\hearts$ there are twenty-two cards in the deck which will give us a straight draw, flush draw, or pair with five outs. If the turn is one of these twenty-two cards, as it will be 46.8 percent of the time, we can call again and hope to make the best hand on the river (and sometimes bluff if we don't improve and our opponent checks to us).

While we may get lucky immediately on the turn with sixes, if we do not immediately hit our set, we are usually going to have to fold to a bet. This means even if the river card would come a six, we will not end up seeing it and winning a large pot. So despite having the same amount of equity as the $6\spades 6\clubsuit$ on the flop, the $9\hearts 8\hearts$ will be able to call a turn bet when it can outdraw our opponent on the river and is thus the superior hand.

Hand Equity Distribution on Different Board Textures

As we'll see in future chapters, hands which flop or turn either a lot or a small amount of equity are better than hands which always flop or turn a medium amount of equity. In other words, a hand which has 100 percent equity on the flop one-third of the time and 0 percent equity two-thirds of the time is better than a hand which always has 33.3 percent equity (on the flop). Notice that despite both hands having the same average amount

10 Part One: The Basics

of equity, it's much easier to realize the equity of strong hands than it is to realize the equity of marginal hands.

Here's an example. On the flop, our opponent goes all in for a \$100 bet into a \$50 pot and our hand has 33.3 percent equity, we should fold since 40 percent equity is needed to profitably call.

$$0.40 = \frac{\$100}{\$150 + \$100}$$

But we will never run into the problem of having to fold a high equity hand when our range consists only of hands which are the pure nuts or pure air. This concept will prove especially important when we discuss turn play in 3-bet pots where we often have a difficult time effectively playing hands with 20 to 25 percent equity.

Comparing Equity To Expected Value

Throughout this book, we'll be using both the terms expected value (EV), sometimes written as expectation, and equity. Oftentimes players get these two concepts confused, and while we should keep in mind that they are related, expected value and equity are not interchangeable. Specifically, expected value of a hand tells us how much we expect to win on average and considers all the money previously invested in the pot as dead money. This means folding at the point of calculation always has an expectation of zero regardless of whether we lose money overall on the hand.

In addition, expected value is not solved for by taking the equity of a hand and multiplying it by the size of the pot unless every player in the hand is all in. For instance, suppose we flop a set in an 8 big blind pot and the hand has 90 percent equity against our opponent's flopping range. Inexperienced players may incorrectly assume the expected value of the hand is 7.2 big blinds.

$$7.2 = (0.90)(8)$$

However, this is *not* true since this formula does *not* solve for the expected value of the hand unless both players are already all in. In fact, the expectation of this hand will be higher than 7.2 big blinds since we'll usually bet or raise and hope our opponent decides to continue putting more money into the pot.

So in conclusion, despite being unable to convert equity directly into expected value, a clear correlation between expected value and equity exists. And we will regularly look at the equity of our hands to figure out which ones should be used as calls,

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value raises, bluff raises, and folds since we won't be able to solve directly for the expectation since we can't predict with certainty the betting action for the rest of the hand.

Hands Cannot Simply Be Ranked From Strongest To Weakest

Since having more equity does not necessarily make a hand better, hands cannot be ranked from strongest to weakest. This means that different types of holdings will be useful in different spots and we must not get in the habit of thinking some hands are always better than others. This is especially true preflop since a slight change in stack depth or position can significantly impact the expected value of a hand.

For instance, against a button opener who has a wide range, a hand like king-ten offsuit will work much better as a call from the big blind than a hand like seven-five suited. That's because cold calling with king-ten offsuit keeps the button's weaker kings and tens in his range while 3-betting would make most of them fold. Since the button's opening range is so wide, we do not need to make an extremely strong hand by the river to usually have the best hand and win a reasonable sized pot. But seven-five suited plays less effectively as a call since it will more often flop the second best pair which includes making the same pair but with a weaker kicker.

On the other hand, seven-five suited will play much better in a 3-bet pot than king-ten offsuit. Here, stronger hands are required to win at showdown than in raised only pots, and seven-five suited has the potential to make more very strong hands than king-ten offsuit. In addition, this allows us to double barrel semi-bluff the turn effectively when we hold a straight or a flush draw since if we hit our draw, we will almost always make the best hand. Finally, there is the problem that 3 bets preflop greatly

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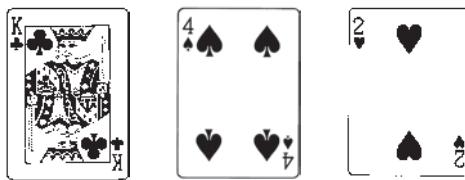
increases the chances that king-ten is “dominated” (by KK, TT, AK, AT, KQ, or KJ).

We must remember that some hands will play better as calls and others will play better as semi-bluff raises, and our job as a strong theoretical player will be to put hands into the right ranges against tough opponents. Unfortunately, there is no simple formula for deciding which hands go into what ranges, so we must understand no-limit theory well to accomplish this task.

Understanding Polarized and Condensed Ranges

A range is considered to be a “polarized range” when it consists of mostly strong and weak hands and has few or no medium strength hands. This occurs in many spots such as 3-betting ranges preflop and flop raising ranges, but it’s most clearly illustrated on the river. When a player bets on the end he’s usually doing it either with a bluff to make stronger hands fold or with a strong hand to get value from weaker hands, since it doesn’t make sense to bet medium strength hands if the opponent only calls when you are beaten.

Here’s an example. A player opens in the cutoff and the button calls. The flop is the



the turn is the 7♥, and the river is the J♦. If the cutoff bet on the flop and the turn, we would expect him to continue betting on the river with strong hands like ace-king and better for value and occasionally with weak hands such as missed draws as a bluff. But we would not expect him to bet a hand like the Q♥J♥ since betting is unlikely to attract a call from a weaker hand or get a better hand to fold.

The opposite of a polarized range is a “depolarized range” which we will refer to as a “condensed range.” This is a range that consists mostly of medium strength hands and has few or no strong or weak hands. A player will usually have a condensed

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range after calling or checking several times on a board texture where giving additional cards with strong hands is risky.

Here's an example. A player check-calls on the Q♥T♥4♣ flop and check-calls again when a 7♠ comes on the turn. We would expect this check-calling range to include few or no strong hands since most of them would raise on either the flop or turn. Likewise, we would also expect this range to include few or no weak hands since most weak hands would fold on either the flop or the turn. So as long as the river card does not cause many hands in the check-calling range to improve, the range should remain condensed on the river.

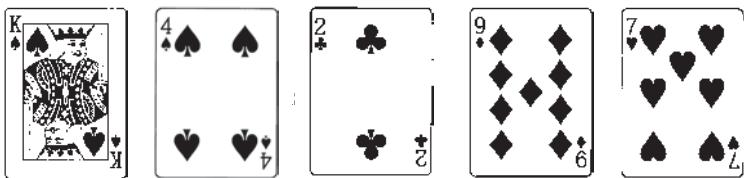
It's worth noting that a polarized range of strong and weak hands is usually quite profitable and easy to play. Yet if our strategy is to always raise our strong and weak hands, when we don't raise we're left with a condensed calling range which is usually quite problematic. That is, our opponents can effectively make large bets when they know our range is condensed since their value hands cannot be beat. Therefore, we will sometimes need to slowplay strong hands against skilled opponents to prevent them from being able to overbet against us effectively.

Lastly, ranges do not have to be polarized or condensed. This often occurs on the flop in raised pots when both players have wide ranges and the flop texture changed the strength of many hands which were called or raised preflop. For example, a bet in position on the T♥8♥4♣ flop will usually consist of strong made hands, medium strength made hands, draws, and bluffs, and it's neither a polarized or condensed range.

Making Our Opponent Indifferent to Calling on the River

A balanced river betting range consists of the right ratio of value bets and bluffs so our opponent is indifferent to calling with a large group of hands commonly referred to as “bluff catchers” since they only beat our bluffs. The EV of calling and folding on the river with a bluff catcher against a balanced range is approximately 0.

Here's an example. The board is the



and we value bet king-queen and better for a pot-sized bet (PSB) on the river. We also bluff all hands worse than a pair of nines for the same pot-sized bet. Since our opponent will be risking one pot-sized bet to win two pot-sized bets, he needs to win 33.3 percent of the time when he calls to break even.

$$(2PBS)(X) - (1PBS)(1 - X) = 0 \Rightarrow$$

$$X = 0.333$$

That is, without taking into account card removal effects, we need to have two value bets for every one bluff to make our opponent indifferent to calling with all hands weaker than king-queen and stronger than seven-x.

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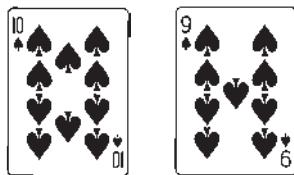
The reason why making our opponent indifferent to calling is crucial is due to the fact that when we bet the river, our opponent is likely to have a bluff catcher. Thus, if we bluff too much, he'll always call with these hands, and if we bluff too little, he'll learn to throw these hands away. Stated another way, using the wrong ratio of value bets to bluffs will give our opponent the opportunity to correctly call or fold all of his bluff catchers, and excellent players will be sure to capitalize on this flaw in our strategy.

On the other hand, if we do bet the river with a balanced range, our opponent should respond by calling with enough hands to make us indifferent to bluffing. These holdings should always include the hands in his bluff catching range which have the best removal effects. For example, if our opponent has the K♥J♣ above, he's blocking some of our top pair combos and should usually call.

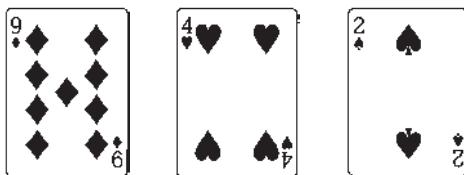
The Grey Area Between Value Betting and Bluffing

It's often tempting to try to oversimplify complex situations by taking a binary or "all or nothing" approach. This often makes problems easier to visualize and understand, and while being able to break down complex situations in an effort to better understand them is often useful, we must be careful not to go overboard. This concept can be seen clearly in poker when players attempt to visualize bets on the flop and turn as either value bets or bluffs. Oftentimes, especially on the flop, the best line available will be to make a bet which has both bluffing and value betting properties.

Here's an example. We open with the



in middle position and the button calls. If the flop comes the



and we bet, are we value betting or bluffing? Notice that our opponent may call with AK, AQ, 98s, 88, or 77, and we'll usually win at showdown if the turn and river check through.

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Notice that this makes the hand seem like a value bet since we are getting value from worse hands. Yet we also make our opponent fold hands such as ace-jack and king-queen which have over 24 percent equity against our holding because they do poorly against our overall betting range which includes many overpairs and better overcards. Thus, making our opponent fold hands with 24 percent equity is a significant accomplishment. This is especially true when there are two streets left to act, a large amount of stack depth, and our opponent has position on us. In fact, if we do decide to bet our pair of nines with a ten kicker on this flop, it's largely because making our opponent fold hands with two overcards is so desirable.

Before understanding theory well it may be tempting to think, "How is this situation complicated? We are value betting since our opponent should call with worse hands as well as protecting our hand by not letting him see a free card. Just because we want to deny free cards doesn't make our bet less of a value bet." Yet this would be a huge oversimplification.

It's important to understand that betting this flop has several important consequences. They are:

1. We make our opponent's turn range stronger.
2. We make the pot bigger. And,
3. We risk getting raised when there are still two streets left to act.

Also, there are now a couple of questions to consider. They are:

1. Even if we are ahead on the flop, how can we keep getting value on almost any turn or river cards?

The Grey Area Between Value Betting and ... 21

2. Was betting the flop really a “value bet” if we have to check the turn and now play a big pot out of position against a strong range?

Notice that the hand doesn’t simply end once we bet this flop and our opponent calls since we will often have a difficult time realizing our equity once our flop bet is called. Therefore, claiming our flop bet is a “value bet” is at best an extreme oversimplification.

Furthermore, in general, the terms “value bet” (or “value raise”) and “bluff” will be imperfect terms on every street except the river. That’s because there are always additional cards to come on earlier streets, and weaker hands have the opportunity to improve and outdraw stronger ones. In addition, since not all value hands and bluffs have the same amount of equity, some will be more likely to win at showdown than others.

To illustrate, suppose we usually 3-bet aces and ace-king on the button against a cutoff open. Most players would simply refer to these 3-bets as value raises since our opponent will often call with dominated hands such as tens or ace-queen. Yet there is a huge difference in strength between aces and ace-king, as the former has much more equity. Consequently, simply referring to these hands as “value 3-bets” is an oversimplification, but one which is often necessary when discussing and analyzing hands. As we’ll see in “Part Two: Preflop Play,” starting on page 31, this makes analyzing preflop play especially difficult.

Likewise, bluffs can also vary greatly in how likely they are to make the best hand by the river. For example, if we raise the 5♥4♥ on the J♦6♥2♦ flop, we’ll sometimes improve to the best hand on the turn or river since our hand is a gutshot with 3 cards to the flush. Yet the 9♥7♥ might also make a fine bluff raise on this flop despite the fact that it has less equity since there is no possible gutshot. Nevertheless, both of these hands are often raised on the flop hoping to make better hands fold, so it’s

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reasonable to refer to them as bluff raises despite one being more likely to improve than the other.

Lastly, players usually call hands “draws” when they have little showdown value but a significant amount of equity. Whether or not to call a hand a bluff or a draw is decided arbitrarily, as a draw is more or less just a very good bluff (sometimes with so much equity that we’re actually hoping our opponent calls rather than folds). For instance, we could just have easily called the $5\heartsuit 4\heartsuit$ from the above example a draw rather than a bluff since it’s a draw to the straight, a running flush, running trips, or two pair.

However, although throughout this book and your poker career you’ll commonly be using imperfect terms, this won’t be a problem once you develop a strong understanding of poker theory. And while using imperfect terms may not be ideal, there frequently isn’t a better option, and each word’s meaning can usually be understood in context. Furthermore, it’s important to be able to discuss hands without getting bogged down by details even when the terms don’t work perfectly.

Making Our Opponent Indifferent to Bluffing

We often think our opponent should not be able to profitably bluff. When this occurs, there should be some hands in his range that are +EV to bluff while others are -EV. In these cases, our opponent is required to bluff hands with the right equity for his bluffs to be profitable.

Here's an example. A player opens in the cutoff and only the button calls. If the flop comes the Q♥7♣6♠, the cutoff will almost certainly be able to profitably bet the T♠9♠ since it has four outs to the nuts, can catch a running flush, and can also turn a winning middle pair. This is almost certainly a profitable bet against an optimal playing opponent.

Much weaker hands, such as a pair of deuces, are not likely to be profitable as a continuation bet because they only have two outs to a set. The small pair also should not be able to double barrel bluff the turn effectively since it can't pick up additional outs and is unlikely to win at showdown with just a pair.

A player who consistently bluffs with the right hands is "randomizing well," and this player makes sure his range is balanced by bluffing with hands which have the right equity. This gives him the best chance of getting lucky with his bluffs and outdrawing his opponent on future streets. Notice that this player bluffs in a random way that is determined by the hand he's holding and the board texture rather than if he simply feels like bluffing.

In this book, when we say "we want our opponent to break even with his weak bluffs," it will usually mean we want him to be close to indifferent between check-folding or bluffing with the worst hand in his betting range. That is our opponent's best bluffing hands are clearly going to be profitable since they have

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the best chance to improve on future streets or the best removal effects. However, in many spots, the worst hand in our opponent's theoretically correct betting range should only be slightly profitable.

If a player folds so much that his opponent can profitably bluff anything in his range, this will often (but not always) tell us he isn't defending as aggressively as he theoretically should. For instance, imagine a player folds so much to flop raises that his opponent can profitably raise the flop with any two cards. His opponent will simply never fold because folding is 0 EV whereas bluff-raising yields a positive EV. (We will discuss when it is acceptable to allow our opponent to make a profit by bluffing with any two cards in future chapters, but there are many situations where a player should not be able to profitably bluff with any two cards.)

Lastly, note it's often possible to take two lines which have the same expectation against an optimal opponent. For instance, we may find ourselves holding a bluff catcher on the river where calling and folding both have an expectation of zero. Against an optimal opponent, it won't matter which line we take since he'll never change his strategy to exploit us. But against any real opponent, calling too frequently encourages him to stop bluffing whereas folding too frequently incentivizes him to bluff too much. So it's important to remain balanced against good opponents even in spots where the expectation of both lines is the same against an optimal opponent (unless you are planning to reverse strategy in the future).

An Optimal Player Always Takes the Most +EV Line

Two players are playing theoretically optimally when they are at what is known as a Nash Equilibrium which occurs when neither player ever has an incentive to deviate from the way he's playing. That is, if a player ever takes a line with a hand that isn't the most +EV, they have an incentive to deviate and instead take the most profitable line.

Many players often get this concept confused and think sometimes an optimal player will take a less +EV or even a -EV line if it makes other hands in their range play more profitably after their opponent adjusts to them. But this will never happen against an optimal opponent who will not change his strategy when he sees his opponent take a non-optimal line. That's because his strategy cannot be beaten and by adjusting he can be exploited by an opponent who recognizes the change.

However, since an optimal player will never change his strategy, this means that when playing against weak opposition, an exploitative strategy should be more profitable than an optimal strategy. For instance, if a player folds too frequently, constantly winning small pots from him while refusing to give him action on large pots without the near nuts is likely more profitable than playing optimally. So while an optimal player always takes the most profitable line against an optimal opponent, more profitable exploitative lines will usually be possible when facing weak opposition.

Large Bets Make Our Opponent Put More Money Into the Pot

Small bets relative to the pot require our opponent to frequently call in order to prevent us from being able to profitably bet any two cards. The opposite is true for large bets which require our opponent to occasionally put a lot of money into the pot. Therefore, picking the right bet sizing is extremely important and will be discussed in great detail throughout the book

But for now, let's note that one key aspect of bet sizing is the average amount of money our opponent must put into the pot increases for larger bets. For example, suppose we want to compare how much money our opponent must put into the pot if we bet 0.5 PSB, 1 PSB, or 2 PSB on the river and our opponent does not want us to be able to profitably bluff any two cards.

1. For 0.5 PSB, our opponent must call or raise 66.7 percent of the time to keep us indifferent to bluffing. He thus ends up putting in on average at least 0.334 pot-sized bets.

$$0.334 = (0.5)(0.667)$$

2. For 1 PSB, our opponent must call or raise 50 percent of the time to keep us indifferent to bluffing. He thus ends up putting in on average at least 0.5 pot-sized bets.

$$0.5 = (1)(0.5)$$

3. For 2 PSB, our opponent must call or raise at least 33.4 percent of the time to keep us indifferent to bluffing. He thus ends up putting in at least 0.668 pot-sized bets.²

$$0.668 = (2)(0.334)$$

Big bets get more money into the pot but they also make our opponent's felting range much stronger than small bets. So betting the right amounts with the proper hands without making our range too transparent is one of the most important and difficult concepts to master.

² How we arrive at these call percentages will be discussed later in the book.

The Value of Position

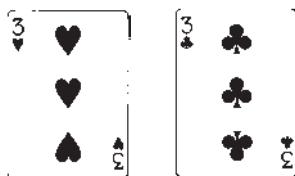
While we usually cannot quantify the exact value of being in position, we know it provides several advantages. The player in position gets to act last which gives him access to more information, gives him the first opportunity to stop the betting and see the next street, and allows him to call more effectively on the turn with draws. How valuable position is in any given spot will depend on a variety of factors.

Rather than doing an inadequate analysis on the value of position right now, simply keep in mind that being in position on the flop is a significant advantage even if we can't quantify its exact value. Because of this, we'll (try to) see many flops in position while limiting the flops we see out of position.

Position is also sensitive to stack size. When only a small amount can be bet, position has little value. But in this book, most of our discussion will assume that starting stacks are 100 big blinds, and at this stack depth, there should be enough chips to bet throughout the hand so that position is almost always important.

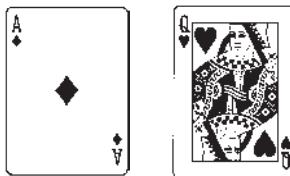
Summary

1. Pot odds are the ratio of the current size of the pot to the cost of a potential call. They are critical for determining how often we need to expect to win to justify a call.
2. Equity tells us the odds a hand will be the best hand by the river against an opponent's hand or range.
3. The expected value of a hand tells us how much money we expect to win when we take a certain line. It considers all money invested in the pot as dead money up to the current decision.
4. Hands with more equity are not necessarily better than hands with less equity. It's important our hand retains its equity against our opponent's raising and calling ranges. That's why hands like the 9♥8♥ are almost always better than hands like the A♦7♣.
5. Hands cannot simply be ranked from strongest to weakest. Different hands perform better in different spots. For example, the



is better in multiway pots and the

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plays best in a heads up pot.

6. A polarized range consists of mostly strong and weak hands. A condensed range consists of mostly medium strength hands. A betting or raising range will often but not always be polarized, and a calling range will often be condensed.
7. Our betting range will almost always be polarized on the river. If we bluff too much, a strong opponent will always call with his bluff catchers, and if we bluff too little, he will always fold his bluff catchers. Thus, our goal is to make this player indifferent to calling and folding with his marginal hands.
8. Hands cannot always be classified as either a value bet or a bluff. This is especially true on the flop when a bet can have both bluffing and value properties.
9. Our opponent should often be close to indifferent between bluffing and folding the worst hands in his bluffing range.
10. Being in position provides many benefits and greatly increases the profitability of a player's range.

Part Two

Preflop Play

Preflop Play

Introduction

As we continue through this book, you'll start to notice a few general trends when approaching problems from a theoretical perspective. First, we'll not always be able to approach a solution using math and theory alone, and such problems require a trial and error approach. Specifically, a powerful computer could theoretically solve the game of poker and develop an optimal strategy through such an approach, but such a solution would require nearly a countless amount of simulations. On the other hand, the game of checkers was solved in 2007 using this method, and the solution would require a player to memorize 5×10^{20} possible positions to ensure he always plays perfectly. But poker is much more complex because not all the information is available to both players. So while it's possible for the game of poker to eventually be solved, it's unlikely to happen anytime soon.

Second, we should note that the best way to approach a problem may often seem backwards or cause us to pause for a while and come back later when we have more information. For instance, suppose on the flop we want to figure out what our bluffing to value raising ratio should be. To accomplish this, we must first know how often we're going to bet the river with a balanced range, what bet sizing should be used on the turn and river, and how position effects our range. Notice that this is a large amount of information, and obviously it would be quite difficult to know where to start if a new player asked us "Can you explain how to balance a value to bluff raising ratio on the flop and where the numbers come from?"

We will approach many problems like this, and it's important to remember to remain patient and know these questions will

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eventually be answered as we discuss more concepts. Your confusion will come to an end as we cover more topics and have more “ah-hah” moments when multiple concepts come together and the math and logic behind theoretically sound poker begins to make more sense.

Last, and perhaps most important, notice that while we usually can’t solve for the exact solution, theory can be used to tell us when something is *not* optimal. This is especially important for this current section of the book. When we know something must be wrong with our ranges or bet sizing, we can focus our attention to that specific area of our game and try to find a strategy which has no glaring theoretical errors.

For instance, we’ll quickly see that it likely doesn’t make sense for every position to 3-bet QQ+/AK against a pot-sized under-the-gun (UTG) open. If every player 3-bets these hands for value and balances the range with the proper amount of bluffs, then the UTG player will be 3-bet too much and will stop opening with those hands he plans on folding to a 3-bet. So while this doesn’t tell us exactly what the optimal ranges are for defending against an UTG open, it still provides a useful starting point for designing ranges.

Our general approach to preflop play will be to start with analyzing the basic ranges most winning players currently use and then modify them as we see how they can be exploited. Once we’re using ranges and bet sizings that give our opponents no clear way to exploit us, our strategy will probably be closer to game theoretical optimal than it originally was. This will make approaching preflop play much easier than starting out completely from scratch which would at best be difficult and at worst close to impossible.

Preflop 3-Betting, 4-Betting, and 5-Betting Frequencies

Although there is no way to solve for the perfect 3-bet, 4-bet, and 5-bet sizings and frequencies from every possible position, we can analyze the effects of the most commonly used sizings and see how they affect each player's ranges and frequencies. In addition, notice that the methodology we discuss will be much more important than making sure we used the perfect sizings. In reality, small changes in sizing usually only slightly alter each player's range. Also, keep in mind that online most players have 100 big blind stacks and a common opening size is a pot-sized open for 3.5 big blinds in most positions other than the button. In addition, good players usually 3-bet a 3.5 big blind open to between 10 and 12 big blinds.

Let's consider how often we must defend versus a 3-bet in order to make our opponent indifferent to bluffing. When a player 3-bet bluffs a 3.5 big blind open in position to 10 big blinds, he's risking 10 big blinds to win 5 big blinds (the opening bet and the posted blinds). Thus, this needs to work more than 66.7 percent of the time to yield an immediate profit.

$$0.667 = \frac{10}{10 + 5}$$

Likewise, if the 3-bet was to 12 big blinds instead of 10, it would need to work 70.6 percent of the time.

$$0.706 = \frac{12}{12 + 5}$$

Preflop 3-Betting, 4-Betting and 5-Betting ... 35

Observe that even a 20 percent increase in 3-bet sizing only changes how often the original raiser must defend by 4 percent. Also note the original opener is not the only player who can defend against the 3-bet — there are still players yet to act who may have a strong hand or decide to bluff.

Here's an example. The cutoff opens to 3.5 big blinds and the button 3-bets to 10 big blinds. Since the 3-bettor needs folds 66.7 percent of the time to make an immediate profit, the remaining players must defend a combined total of at least 33.3 percent. If each of the blinds 4-bets cold 3 percent of the time and otherwise folds, then the original raiser would need to defend at least 29.1 percent.

$$(1 - X)(1 - 0.03)^2 = 0.667 \Rightarrow \\ X = 0.291$$

where

X is the probability that the original raiser defends, and
 $1 - 0.03$ is the probability that each blind folds.

But no-limit hold 'em isn't always this simple. That's because players usually make smaller 3-bets in position than out of position since they want to encourage their opponent to call so they get to see a flop (in position). If we raise first in and an opponent makes a small 3-bet, he'll usually be in position and there will be multiple people left to act who can help us defend. If this player is out of position, his 3-bet will usually be larger so we won't have to defend as much even if there are no other players left to act. In general, our strategy will usually be to defend at least 27 to 31 percent of our opens against 3-bets.³

³ This number will increase the more we are calling rather than 4-betting as we will discuss later in this section of the book.

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The most common 4-bet sizings are usually around 22 to 24 big blinds to win a pot of around 15 to 16 big blinds. If the original raiser 4-bets, he effectively only risks 18.5 to 20.5 big blinds since his original 3.5 big blind open is now dead money. Therefore, a 4-bet from the original preflop raiser must succeed around 55 percent of the time to make an immediate profit, whereas a 4-bet cold from one of the blinds must succeed around 60 percent of the time to make an immediate profit.

Lastly, a player can 5-bet bluff which will almost always result in him going all in when stack sizes are 100 big blinds or less. So when someone 5-bet bluff jams, he'll usually be using a small pocket pair or a weak suited ace since these hands have the most equity when called.

However, how much equity a specific hand has will change significantly based on the opponent's calling range. For instance, against a calling range of JJ+/AK, a pair of treys and ace-five suited have 32.2 and 30.7 percent equity respectively. But against a calling range of aces and kings, the pair of treys has only 18.4 percent equity while the ace-five suited has 26.7 percent equity.

Another point to consider is the 5-bet bluff will usually come from the original 3-bettor, and since he has already invested around 11 big blinds, he's only risking on average another 89 big blinds (assuming he starts the hand with 100 big blinds) by going all in. Therefore, since the final pot will be 201.5 big blinds, his expectation is just over 2 big blinds back for every 1 percent of equity. So if, for instance, his hand has 31 percent equity when called, his expectation is 62.5 big blinds when his opponent does not fold,

$$62.5 = (201.5)(0.31)$$

which is the same as an overall expectation of -26.5 big blinds.

$$-26.5 = 62.5 - 89$$

Preflop 3-Betting, 4-Betting, and 5-Betting ... 37

But when the opponent folds, assuming that the 4-bet (to 24 big blinds) comes from the preflop raiser, the 5-bet bluffer will win on average 36.5 big blinds.

$$36.5 = 24 + 11 + 1.5$$

where

- 1.5 is the amount of the blinds,
- 11 is the amount of the 3-bet raise, and
- 24 is the amount of the 4-bet raise.

Therefore, in this example, the 5-bet bluff needs to work more than 42 percent of the time to yield a profit.

$$\begin{aligned}(X)(36.5) + (1 - X)(-26.5) &= 0 \Rightarrow \\ 63X &= 26.5 \Rightarrow \\ X &= 0.42\end{aligned}$$

And in general, 5-bet bluffs need to work somewhere between 40 to 50 percent of the time to be profitable. The precise percentage is dependent on the equity versus the 5-bet calling range, and the bet sizings used for opening, 3-betting, and 4-betting respectively.

Summing up, the frequencies at which 3-bet, 4-bet, and 5-bet bluffs must succeed will usually fall within the following percentages:

- 3-bet bluffs usually need folds around 67 to 70 percent of the time to yield an immediate profit.
- 4-bet bluffs usually need folds around 54 to 60 percent of the time to yield an immediate profit.
- 5-bet bluffs usually need folds around 40 to 50 percent of the time to yield an immediate profit.

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So despite each additional bluff getting significantly more expensive (in terms of the number of big blinds placed into the pot), each bluff needs to be successful less frequently than the one before it to be profitable. Again, it should be made clear that the above frequencies are for how often our 3-bets and 4-bets must succeed to yield an immediate profit.

If our opponent sometimes defends by calling rather than re-raising, as he almost certainly will, then our 3-bets and 4-bets do not need to work as often to be profitable. That's because even our weakest bluffs will sometimes get lucky on the flop. Likewise, we can also state the following:

- Preflop opens need to defend by 4-betting around 25 to 30 percent of the time if they never defend by calling. This number is lower than it would otherwise be because there are usually players left to act which can help defend.
- 3-betting ranges which never flat when facing a 4-bet should 5-bet jam around 40 to 46 percent of the time.
- 4-betting ranges should usually call between 50 to 60 percent of the time when facing a 5-bet jam.

These frequencies are important for determining the ratio of value raises to bluff raises in 3-bet, 4-bet, and 5-bet situations. While they do not tell us exactly what hands belong in each range, they do allow us to check and see if a range is too heavily skewed towards value bets or bluffs.

Preflop Raise First In Ranges

Before we can develop 3-bet ranges versus opens from different positions, we must first understand what makes a hand theoretically correct to raise first in. Since the expected value of folding is zero, a player should raise first in with any hand that has a positive expected value.⁴ That is, the worst hand in a raise first in range should be close to 0 EV since it's just barely above or equal to the expectation of folding. Therefore, we can make the following four assumptions about the properties of the worst hand in a game theoretically optimal player's raise first in range.

1. The expected value of the hand should be close to if not exactly 0 EV. A hand has an expected value of approximately 0 if it should be opened some but not all of the time. For instance, if an UTG player raises six-five suited only 75 percent of the time then the expected value of the hand should be close to 0. But if he raised with it all the time, he's seen to be playing too many highly speculative hands early and thus is vulnerable to reraises and other plays. Hence the expectation for the six-five suited would likely now be negative.
2. The hand should frequently fold when facing a 3-bet. It does not usually make sense to defend against raises with the

⁴ Of course, in games with certain player types, the expectation for some hands may be highest by calling (often referred to as limping). But that possibility will not be considered here.

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weakest hands in the opening range.⁵ The EV lost will be equal to the size of the preflop open.

3. The hand will have a total EV of better than -3.5 big blinds when players respond by calling rather than 3-betting. (Even the weakest hand in an opening range can become a strong hand on the flop.)
4. The hand will not have an EV of greater than +1.5 big blinds when it sees a flop. Poker is a zero sum game, and if the worst hand in a preflop opening range expects to win more than just the blinds, this implies that the cold caller is not playing optimally — his cold call would have to have a negative expected value.

The above assumptions provide us with a useful guideline for beginning to figure out what preflop 3-betting and opening ranges must look like. Since a player risks 3.5 big blinds to win 1.5 big blinds with his weakest opening hands, it must succeed at least 70 percent of the time to yield an immediate profit. This means if all the opponent's combined 3-betting frequencies result in the preflop raiser getting 3-bet a total of 30 percent or more, it will not be profitable to raise first in with a hand which has to fold to a 3-bet.

⁵ There may be rare exceptions to this if the hand works especially well as a 4-bet bluff or if the hand is disguised which helps implied odds.

Maximum 3-Betting Ranges

We now know enough math and theory to figure out what 3-betting ranges make sense based on which position opened. In order to accomplish a quick estimate, we'll assume players are using the same 3-betting frequencies from all possible remaining positions. This assumption is dropped in the final hand chart at the end of this section, but will be useful now for giving us a starting point for figuring out what sort of 3-betting ranges are possible.

We should also note that simply dividing 30 percent by the number of players left to act will give us an accurate estimate for the maximum amount each player can 3-bet, but it will not get us the exact correct answer. That's because the estimate does not take into account the fact that two or more players can have a hand which will 3-bet the same open. Therefore, we should instead figure out how often each player must *not* 3-bet in order for the open to be 3-bet less than 30 percent total.

Here's an example. Since there are five players left to act when the UTG player opens, we must multiply the odds each player does not 3-bet the open together to get the correct answer.

$$\begin{aligned} X^5 &= 0.7 \Rightarrow \\ X &= 0.931 \end{aligned}$$

Hence, the maximum that each remaining player can 3-bet is 6.9 percent.

$$0.069 = 1 - 0.931$$

As we saw in "Preflop 3-Betting, 4-Betting, and 5-Betting," starting on page 34, a player cannot fold more than 40 to 46 percent of his 3-betting range to most of his opponent's 4-bets.

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This means 40 to 46 percent of the 3-betting range should be prepared to either play a 4-bet pot post-flop or 5-bet jam preflop.

However, this also means we should fold between 54 and 60 percent of the time against our opponent's 4-bet to make him indifferent to bluffing (assuming we always either 5-bet or fold versus his 4-bet). So if we are the one 3-betting 6.9 percent of the time, then we should defend with 2.76 percent of our total hands against a 4-bet which is a range of AA-QQ/AK. The following chart includes the ranges solved for using the previous methodology.

Opening Range	Maximum 3-Betting Percentage	Value 3-Betting Percentage	Value Component of 3-Betting Range
UTG	6.9	2.76	AA-QQ, AK
MP	8.5	3.4	AA-JJ, AK, AQS
CO	11.2	4.6	JJ+, AJs+, AQo+
Button	16.3	6.52	TT+, ATs+, KQs, AJo+

We have not, by any means, proved these hands must be theoretically correct 3-bets. We can 3-bet some non-premium hands to use as 5-bet bluffs when facing a 4-bet, and we can slowplay some very strong hands by cold calling preflop.

This does, however, give us a great starting point for determining if players are 3-betting too aggressively. That is, if they are defending by 3-betting at near the above frequencies, then, as we will soon see, the preflop raiser is going to be losing money by opening the worst hands in his raise first in range.

In addition, most people would agree the worst hand in a preflop raising range will on average lose money when called. While it's true the dead money in the blinds increases the

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expected value for both the preflop raiser and the cold caller, this is unlikely a strong enough effect to make the weakest hand win money once called.

Consequently, the worst hand in an opening range will likely lose money once called for several reasons.

1. It is weaker than the average hand in a preflop cold calling range.
2. On the flop, the preflop raiser will often be out of position unless he opened on the button or is just called by a blind.
3. If one of the blinds does call (thus letting the preflop raiser see a flop in position), the pot will be smaller since there is less extra dead money from the blinds.

It's important to design ranges where all of our theory and beliefs make sense and must not allow ourselves to have a contradicting thought process. We now are equipped with a great set of restrictions, or parameters, which will tell us what we can and cannot do when designing opening ranges and defending ranges from all the positions.

In order to quickly illustrate this concept, let's imagine we are playing at an aggressive table and open the worst hand in our theoretically correct UTG opening range for 3.5 big blinds. We are 3-bet 30 percent of the time total and are cold called another 25 percent of the time. Furthermore, let's be generous and assume our expected value when our open is called is on average 0 EV. We can now plug in these variables to figure out that the expected value of opening the worst hand in an UTG opening range at this table is -0.375 big blinds.

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$$-0.375BB = (0.3)(-3.5BB) + (0.25)(0BB) + (0.45)(1.5BB)$$

where

- 0.3 is the 3-bet frequency,
- 3.5BB is the EV when facing a 3-bet,
- 0.25 is the total call frequency,
- 0BB is the EV when called,
- 0.45 is the total all opponents fold frequency, and
- 1.5BB is the EV when all opponents fold.

That is the UTG player expects to on average lose -0.375 big blinds when he opens the worst hand in his theoretically correct UTG opening range.

Notice we are not breaking even at this table by opening the worst hand in our theoretically correct raise first in range. Our opponents are playing too aggressively and our weak hand does poorly against opponents who 3-bet 30 percent total. The fact that theoretically correct raises can have a negative expected value against certain opponents shouldn't surprise anyone. For instance, a theoretically correct bluff on the flop will lose money against opponents who refuse to fold.

While we would break even if our opponents always 3-bet or folded and they 3-bet 30 percent total, we must not forget to take into account our open will sometimes be called. This is something which can easily be forgotten when performing calculations. It's easy to think "since I break even when my opponent calls, it doesn't change anything," but this is not true. When our opponents fold we win 1.5 big blinds, yet when one of them calls, we win 0 big blinds.

This showcases the fact that as long as our opponents have any sort of reasonable cold calling ranges, they must be 3-betting significantly less than 30 percent of the time combined. If instead they always reraise with all these hands, we have no incentive to open with the weak hands in our theoretically correct opening range.

The Expected Value of 4-Betting or Folding Against Opponents Who Don't Flat 4-Bets

For 100 big blind stacks, players rarely like to flat 3-bets out of position. One of the most commonly given pieces of advice is “Don’t flat 3-bets out of position, instead either 4-bet or fold. You don’t want to play a 3-bet pot out of position post-flop if you can avoid it.” Another common piece of advice when facing 4-bets is “If you were 3-betting for value, value jam when facing a 4-bet, and if you were 3-bet bluffing, fold. Don’t call and risk getting unlucky on the flop.” This is not theoretically sound advice, but it does allow players to avoid tough decisions for very large pots, and as such it’s often useful to newer players.

Since it’s impossible to directly solve for the expected value of a hand which sees a flop, this makes comparing the EV of jamming to flatting quite tricky. Nevertheless, we can analyze the effects of only 4-betting or folding against a 3-bettor who doesn’t flat 4-bets. Later, we’ll use the results of this analysis to conceptually show why this cannot be the theoretically optimal way to respond.

When a player responds to a 3-bet by only 4-betting or folding, we have established that they must 4-bet between 25 to 30 percent of their preflop opening range. When facing a 5-bet, they must call between 50 to 60 percent of their 4-betting range. So by multiplying the averages of both, we see that approximately 15.2 percent of the preflop raising range should call a 5-bet.

$$0.152 = (0.275)(0.55)$$

Stated again, if the preflop raiser 4-bets 27.5 percent of the time and calls a 5-bet 55 percent of the time, he will end up felting 15.2 percent of his opening range.

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This is an important frequency to keep in mind when playing against opponents who refuse to flat 3-bets out of position. Against these players, we need to defend at least 15.2 percent of their total opening range or else bluffing with hands like ace-rag suited and pocket pairs becomes profitable for them.

We will now examine what typical 4-betting and 5-bet-calling ranges look like for a number of opening ranges where players refuse to flat 3-bets. We can figure this out by looking at the raise first in frequency. Note that many of the ranges are estimates since they don't require using all the possible combinations of one type of hand.

Raise First In %	4-Bet %	4-Bet Range (of First in Raiser)	5-Bet-Call %	5-Bet-Call Range (of First in Raiser)
10	2.75	QQ+, AKs, AKo	1.52	QQ+, AKs
15	4.13	TT+, AQS+, AKo	2.28	QQ+, AKs, AKo
20	5.5	TT+, AJS+, KQs, AQo+	3.03	QQ+, AQS+, AKo
25	6.88	TT+, ATs+, KQs, AJo+	3.78	TT+, AQS+, AKo
30	8.25	TT+, ATs+, KQs, AJo+	4.54	TT+, AQS+, AQo+
40	11	88+, A9s+, KJs+, QJs, ATo+, KJo+	6.05	TT+, AJS+, KQs, AJo+

These defending ranges allow us to get a glimpse of what hands make effective value 3-bets against opponents who defend only by 4-betting or folding. For instance, against a 15 percent raise first in it makes little to no sense to 3-bet and 5-bet a hand like queens or ace-king offsuit since the preflop raiser will never feel worse. A raise first-in of 15 percent is around what many players use for an UTG open, and the inability to 3-bet and 5-bet

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ace-king offsuit for value against an UTG open in six max is consistent with the theory from “Maximum 3-Betting Ranges” starting on page 41. This does not mean ace-king offsuit will never be a 3-bet against an UTG open, but it’s usually a call.

Let’s now analyze the profitability of 4-betting with the intention of calling a 5-bet. To accomplish this, assume we win 12.5 big blinds total for the hand when our 4-bet is successful and that our 4-bet is successful 60 percent of the time.⁶ We will thus win on average 7.5 big blinds from our fold equity alone every time we 4-bet.

$$7.5 = (0.6)(12.5)$$

The remaining 40 percent of the time our opponent will jam and we’ll call, and our expectation will be decided by our equity times the final pot-size. For example, in a 201.5 big blind pot, if our 4-bet has 45 percent equity against our opponent’s 5-bet jamming range, the total amount we will expect to win with our hand will be -9.325 big blinds.

$$-9.325 = (0.45)(201.5) - 100$$

And since this only occurs 40 percent of the time (with the remaining 60 percent producing a profit of 7.5 big blinds), our overall expectation is 0.77 big blinds.

$$0.77 = (0.60)(7.5) + (0.40)(-9.325)$$

Note the following tables show how much we expect to win or lose overall for the hand when we 4-bet. So since folding to a 3-bet results in us losing 3.5 big blinds, it’s still more profitable to

⁶ Remember, slight changes in these numbers will not greatly affect our results.

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4-bet with the intention of calling a 5-bet provided our total expected value is greater than -3.5 big blinds.

The following data shows the profitability of 4-betting and calling a 5-bet against various potential 5-betting ranges.

Equity Versus a 5-Bet Jamming Range of KK+, AKs, A5s (1.5%)*		
Hand	Percent Equity When All In	Total Expected Value (BB)
QQ	35.1	-4.2
KK	42.8	2.0
AA	81.0	32.8
AQs	34.8	-4.4
AKo	37.4	-2.4
AKs	41.5	1.0

* This is a commonly used jamming range against an UTG open.

Equity Versus a 5-Bet Jamming Range of QQ+, AKs, A5s, AKo (2.9%)*		
Hand	Percent Equity When All In	Total Expected Value (BB)
JJ	39.4	-0.7
QQ	43.4	2.5
KK	58.7	14.8
AA	84.3	35.5

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AQs	33.1	-5.8
AKo	42.5	1.8
AKs	45.4	4.1

* This is a commonly used jamming range against a middle position opener.

Equity Versus a 5-Bet Jamming Range of JJ+, AKs, A5s, AKo (3.3%)*		
Hand	Percent Equity When All In	Total Expected Value (BB)
JJ	39.7	-0.7
QQ	49.4	7.3
KK	63.1	18.4
AA	83.7	34.9
AQs	35.4	-4.0
AKo	42.7	1.5
AKs	45.5	4.2

* This is a commonly used jamming range against a cutoff opener.

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Equity Versus a 5-Bet Jamming Range of TT+, AJs, AQo (5%)*		
Hand	Percent Equity When All In	Total Expected Value (BB)
99	38.2	-1.7
TT	41.2	0.7
JJ	47.5	5.8
QQ	56.0	12.6
KK	67.6	22.0
AA	84.7	35.8
AJo	28.5	-9.5
AJs	32.8	-6.1
AQo	36.6	-3.0
AQs	39.9	-0.3
AKo	50.5	8.2
AKs	52.9	10.1

* This is a commonly used jamming range against a button opener.

Note we assumed our 4-bets would get folds 60 percent of the time, but in practice, removal effects will impact our 4-bet success frequency. For instance, aces will face a 5-bet less often than other hands because it blocks so many combos of aces and ace-king. However, it also blocks hands in the opponent's 3-bet bluffing range. Hence, this makes it impossible to solve exactly how often

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our opponent will be 5-betting, but we can still calculate the equity our hand will have once we face a 5-bet.

Notice the above results should be quite surprising even to experienced players. 4-betting with ace-king or jacks in the cutoff against a 3-bet is mediocre, with the hands only having a total expected value of 1.5 and -0.7 big blinds respectively. This suggests we should be calling 3-bets with these hands, especially in position, where we will almost certainly have a higher expectation since this keeps the opponent's range wider.

Many players would also be surprised to learn that the only hand they should be happy to get all in preflop after opening UTG is aces. In fact, even kings show only a small profit by being 4-bet — we are hoping our opponent folds rather than 5-bets. An UTG player who decides to 4-bet and call with queens should expect to lose over 4 big blinds on average with the hand.

These felting ranges are probably stronger than most players would expect and further reinforce what the math in “Maximum 3-Betting Ranges” suggested. We cannot 3-bet ace-king and queens against an UTG open and expect to do well when facing a 4-bet. Although it’s much easier to play by only 4-betting or folding when facing a 3-bet preflop, especially when we are out of position, these results show just how ineffective this strategy actually is. Our opponent’s 3-betting range should be polarized meaning that our best strategy is to defend by calling much more often than 4-betting.

One final note. As we discuss more theory, it’s often important for us to stop for a moment and think if our experiences match what the math is telling us. Players who 3-bet or 4-bet ace-king and queens recklessly from any position and claim they are just unlucky when they get it in behind are mistaken. The theory and math behind preflop play implies they’re often making a big mistake against strong opponents.

Flatting 3-Bets and 4-Bets

We're almost ready to begin analyzing the effects of flatting a 3-bet. Yet before we can do this, it must be understood why we also need to have a flatting range against 4-bets. As mentioned previously, most players will not flat 4-bets whether they are in or out of position. This is often justified by claiming there is too much money in the pot and bluffs have at least 20 percent equity against even a very strong calling range. More importantly, they do not want to be faced with a tough decision post-flop. However, this is a poor approach and players should be willing to call 4-bets for the following reasons:

1. Hands in the value 4-betting range are stronger than the weakest hands in the value 3-betting range. If a player 5-bets the weakest hand in his value 3-betting range, he will never be ahead when called.
2. 5-betting ensures either all the money gets in preflop or no one sees a flop. This takes away the positional advantage the 3-bettor would have if he called the 4-bet when in position.
3. Even if a hand has only 20 percent equity against a monster like aces or kings, it likely needs to see the turn or river to become best. Overpairs can ensure all the money gets in on the flop or turn on threatening boards before the opponent gets to see additional cards. In other words, our opponent will have a difficult time realizing the equity of his semi-bluffs.
4. For 100 big blind stacks, it's extremely difficult to 5-bet and fold. This means a player can 4-bet very small if he knows his opponent will always respond by 5-betting or folding.

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Always 4-betting or folding when out of position becomes ineffective once players start flatting 4-bets in position. The 4-bettor can no longer destroy the 3-bettor's positional advantage by 4-betting and instead risks playing an even larger pot out of position. Rather, it now makes sense to call 3-bets with a balanced range which can be defended effectively on the vast majority of common board textures.

Examining Complex Ranges — Defending Enough Against Opens

We're now ready to begin making complex ranges by building on the concepts we've previously discussed. Our ultimate goal is to find ranges where neither player has an incentive to change, but unfortunately this is difficult to do with preflop ranges. That's because we have no clear starting point and need at least one theoretically correct range to help us design other theoretically correct ranges.

Here's an example. It's easy to see that we need to know what the button opening range is before we can design effective defending ranges in the blinds. Yet we won't know what a good button opening range is until we know how aggressively the blinds are 3-betting and calling. Likewise, how can we know what hands to 3-bet on the button against a cutoff open if we don't know exactly what range the cutoff is opening and how he responds to a 3-bet? So this requires us to take a much more "trial and error" approach when analyzing preflop play than we would like.

In addition, changing one aspect of strategy will often impact other areas of our game as well. For instance, suppose we decide to defend a wider range against our opponent's 3-bets to make his 3-bet bluffs successful less often. While this does force our opponent to play a 3-bet pot out of position at a higher frequency, it also weakens our calling range which in turn increases the expected value of our opponent's weak post-flop hands.

These problems make it critical we use a sound methodical approach to design strong ranges. Doing this for every single possible raise first in spot would quickly become quite cumbersome, so the methodology used for examining ranges will

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be shown now and a recommended hand chart included at the end of this section. While once again perfect ranges cannot be solved for, we can make sure every range designed makes sense and there are no contradictions in our thought process. The best we can do is make ranges where no player has a clear incentive to change his strategy.

We'll start by attempting to figure out how the blinds should respond to a first in button raise. These ranges are arguably the most important ranges in 6-max since this situation occurs so frequently and it will be assumed the button open is to 2.5 big blinds and the 3-bet is to 9.5 big blinds. This means a button open cannot be successful more than 62.5 percent of the time or else he will make an immediate profit by opening with any two cards.⁷

$$(1.5)(X) - (2.5)(1 - X) = 0 \Rightarrow \\ X = 0.625$$

Moreover, 3-bets from the small blind cannot be successful more than 69.3 percent of the time.

$$(4)(X) - (9)(1 - X) = 0 \Rightarrow \\ X = 0.693$$

and for the big blind the percentage is 68.0 percent.

$$(4)(X) - (8.5)(1 - X) = 0 \Rightarrow \\ X = 0.68$$

⁷ This isn't exactly accurate since the button will make a small profit anyway due to its position. On the other hand, a button raise that successfully steals less than 62.5 percent of the time can still make a profit because it sometimes wins when it is just called.

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Last, when the button 4-bets we will assume he uses a 4-bet sizing to 19 big blinds. While the exact required success frequency will change based on whether the 3-bet came from the small blind or big blind, the two values are similar and against a big blind 3-bet the 4-bet must succeed about 57 percent of the time to make an immediate profit.

$$(12.5)(X) - (16.5)(1 - X) \Rightarrow \\ X = 0.569$$

So far in this chapter we've done a lot of math. Therefore, it's probably a good idea to summarize what we've found and make sure we don't have any contradicting thoughts.

1. The button raise first in cannot succeed more than 62.5 percent of the time or else he should open with any two cards — even two blank cards.
2. The weakest hand in the button opening range will lose 2.5 big blinds every time one of the blinds 3-bets.
3. The blinds cannot defend by 3-betting more than 37.5 percent of the time combined.
4. The blinds must defend more than 37.5 percent of the time if they ever just call preflop.
5. The worst hand in the button opening range is indifferent to raising and folding preflop.
6. The big blind will not cold call unless the entire expected value for his hand is greater than -1 big blind
7. The small blind will not cold call unless the entire expected value for his hand is greater than -0.5 big blinds.

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8. Hands in the small and big blind flatting range will on average have a higher expected value against weaker hands than stronger hands in the button opening range.

The weakest hand in the big blind calling range will most likely be indifferent to calling and folding preflop. This means the hand has an expected value of approximately -1 big blind against the button opening range. We will know we're at a possible equilibrium when the weakest hand in the button opening range is indifferent to opening and folding, and the weakest hands in the big blind and small blind flatting ranges are indifferent to calling and folding.

We now have the opportunity to make a long and cumbersome equation (which can't be solved) to try to find the expected value of a button open. However, instead of doing this, we'll use a less precise but more practical equation to try to figure out what button opening and blind defending ranges make sense.

$$(EV \text{ when both blinds fold})(\text{frequency both blinds fold}) + (\text{average EV when called})(\text{frequency called}) - (EV \text{ when 3-bet})(\text{facing 3-bet frequency}) = 0$$

We can begin by plugging in the values we already know.

$$(1.5)(\text{frequency both blinds fold}) + (\text{average EV when called})(\text{frequency called}) - (2.5)(\text{facing 3-bet frequency}) = 0$$

This problem would be solvable if we knew the average expected value of the worst hand in the button opening range when called. Unfortunately, there is no way for us to get this value. We would practically (quite possibly even literally) need to solve the entire game of poker to get this information.

Yet there are still ways this equation can be useful. We can start by plugging in values for commonly used ranges to solve for the unknown. If the ranges look reasonable, we can attempt to use

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them against good opponents while continuing to refine them through trial and error.

Let's start by designing what we think are theoretically reasonable 3-betting ranges. We know the 3-bet percentage from the blinds must be less than 37.5 combined, and at least 43 percent of the 3-bets must be defended against 4-bets. Hence, a good starting point is a 3-betting range from the blinds which consist of 5 percent value hands (TT+, AJs+, AQo+) and 7.5 percent bluffs. This brings the total 3-bet percentage to 12.5 percent in each position.

This is a pretty standard 3-betting range many good players use. Since 40 percent of the 3-betting range consists of strong hands, it's not hard to defend at least 43 percent of the range to a 4-bet by mixing in some calls and 5-bet bluffs. If the small blind and big blind each 3-bet 12.5 percent of the time, then the button will be 3-bet 23.4 percent of the time total.

$$0.234 = 1 - (0.875)^2$$

Let's also assume the small blind and big blind call 10 and 20 percent of the time respectively when there is no 3-bet. This means either one or both positions will call approximately 24.3 percent of the time.

$$0.243 = (0.1)(0.875) + (0.2)(0.775)$$

where

0.875 is the fraction of the time the big blind does not 3-bet after the small blind calls, and

0.775 is the fraction of the time the small blind folds to the button open.

We now have enough values to plug into our equation. If we defend the blinds this way, let's see how much money we expect

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the button to win or lose on average when he opens with the worst hand in his opening range if he's to remain indifferent.

$$(0.234)(-2.5) + (0.243)(X) + (1 - 0.234 - 0.243)(1.5) = 0 \Rightarrow$$

$$X = -0.82$$

where

$(0.234)(-2.5)$ is the EV when button is 3-bet,

$(0.243)(X)$ is the EV when button is called, and

$(1 - 0.234 - 0.243)(1.5)$ is the EV when both blinds fold.

That is, the button expects to lose on average 0.82 big blinds when the worst hand in his opening range gets called if he's to remain indifferent.

Now let's interpret the significance of this value. When the button open is called by just one of the blinds, he gets to see in position a flop of either 5.5 or 6 big blinds. And if he expects an average result to be -0.82 big blinds, his expectation is to get back only 1.68 big blinds from the pot. Does this value seem reasonable?

While I by no means know the exact correct answer, my opinion is no! The blinds both have fairly wide calling ranges and the button will always have position.⁸ And since an expected value of only 1.68 big blinds is less than one-third of an at least 5.5 big blind pot, it appears that the button could open with extremely weak hands and still have an expectation greater than this. Therefore, this leads me to believe the blinds are not 3-betting and/or calling as aggressively as they need to be with the values we used.

Let's pause for a moment and emphasize the importance of the last few pages. This concept wonderfully shows how despite

⁸ In future sections of this book, we'll see that position is extremely valuable when both players have wide ranges.

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the fact that we're often very restricted on what we can prove theoretically, we can check our thought process for contradictions as well as make models and ask ourselves "Do these ranges seem reasonable?" Theory is much better at showing us when something must be wrong than when something must be correct. This means theory can be used to estimate what are likely reasonable ranges and then slowly improve them over time as well as adjust them to exploit our specific opponents as needed.

It's also important to stress the difficulty of explaining theory in a methodical and efficient way. Of course, as the author, this is my problem and not yours. But right now there is a lot of other theory available to help us analyze these ranges that I simply can't use yet. Put another way, it's not possible to answer every question you likely have or I'll constantly be going off on tangents and won't be efficiently moving through all the theory we need to cover.

For instance, you might ask, "Well, what's the big deal if the button can open an extremely wide range profitably? This may not suggest the blind defending ranges we used are wrong, only rather that the button can open an extremely wide range profitably." The problem is once a player starts opening a wide range on the button, he becomes extremely vulnerable to aggressive 3-betting — see "Understanding Complex Ranges — Defending Enough Against 3-Bets" starting on page 69. And while I do have a choice in what order the information is presented, it's often difficult to discuss one concept without having first discussed another related one. Nevertheless, I must discuss one concept first.

Finally, you likely noticed we treated all flats from the big blind and small blind the same when plugging values into the equation. This is an estimate we used to allow us to solve for a single variable. Models always simplify complex problems and we cannot leave too many variables in our final equation. More advanced readers should feel free to build on the methods we've previously discussed. A slightly more complex formula which

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plugs in different values for a big blind and small blind cold call could easily be used if one desires.

Before moving on, let's use the formula one more time with different values. We'll assume the small blind 3-bets 16 percent and calls 8 percent of the time, and the big blind 3-bets 14 percent and calls 20 percent of the time. We first should notice the blinds will be 3-betting the button open 27.8 percent of the time.

$$0.278 = 0.16 + (0.84)(0.14)$$

In addition, the button open will also be called 21.7 percent of the time.

$$0.217 = (0.08)(0.86) + (0.20)(0.74)$$

Plugging in these numbers show the button must on average have an expected value of -0.29 big blinds when called to be indifferent to opening the worst hand in his range.

$$(0.278)(-2.5) + (0.217)(X) + (1 - 0.278 - 0.217)(1.5) = 0 \Rightarrow$$

$$X = -0.29$$

The button expects to on average lose 0.29 big blinds when the worst hand in his opening range is called. This value looks more reasonable to me. The button's hand will be weak compared to the average hand in the small blind and big blind flatting ranges, but there will also usually be some dead money in the pot and he has the advantage of position. So while we do not have game theoretically perfect defending ranges, we likely have reasonable values for defending against a button open that we can slowly tweak over time.

Examining Complex Ranges — Designing Defending Ranges To Maximizing EV

Although the previous concept showed us how to examine if blind defending ranges look reasonable, it did not address what hands go into each of those ranges. An oversimplified rule which many beginning players often find useful is to raise strong hands for value, call with hands not quite strong enough to raise, bluff raise hands just not strong enough to call, and fold the worst hands.

While this rule provides a simple starting point, it also causes a couple of problems.

1. It encourages players to think hands can accurately be ranked from strongest to weakest based on their equity alone.
2. It does not take into account that the opponent's range will change based on what line we take and this causes the equity of our hands to change. For this reason, hands which work best as calls don't always have more equity than hands which work best as bluff raises.

Since a game theoretically optimal player will always take the line which maximizes his expectation, we should be 3-betting and cold calling with the hands which work well in those ranges. No simple rule will suffice, and this requires us to always be aware of what our opponent's range consists of and how calling, betting, and raising all impact that range.

Let's continue with designing blind defending ranges when facing a button open. When we call in the big blind against a button open, we'll almost always play against a wide range for a small pot. This means our calling range should put more emphasis

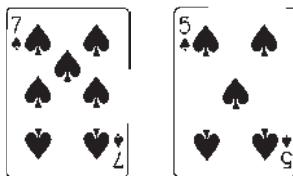
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on flatting with hands which make marginal pairs at a high frequency and can win small and medium sized pots.

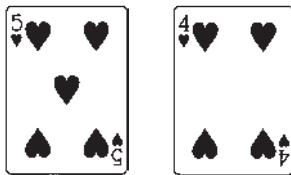
The most obvious hands to call a button open with in the big blind will be suited hands such as king-ten, queen-ten, queen-jack, and king-nine. Of course, other types of hands will be needed in the flatting range, but all of these can make good pairs on the flop which do well against a wide opening range.

While these hands do well in small raised pots, they will be much trickier to play in 3-bet pots. That's because 3-betting results in our opponent's flop range being much stronger, and it's often difficult, when out of position, to play top pair with a mediocre kicker for a large pot. So calling preflop with hands like the K♣9♣ and Q♣T♣ is probably best since this keeps our opponent's range wide and allows us to frequently have the better kicker when we make a pair.

Continuing on, hands which work particularly well as 3-bet bluffs are hands which have the potential to make very strong hands by the river and can be bluffed on the flop and turn effectively. For example, hands like the



and the



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make effective bluffs since they have the potential to make nut hands by the river. We almost always know we hold the best hand with suited connectors and rarely have trouble realizing their equity.

Often times we will 3-bet bluff a hand such as six-five suited, which also could be profitably called preflop. Although calling with a small suited connector likely has a positive expectation, it often makes weak pairs which won't win at showdown in a raised pot. However, in 3-bet pots, where we will have five outs to two pair and trips and will occasionally win a massive pot, these pairs usually work better.

Also notice that when our opponent has position, he will usually defend against our 3-bets by flatting since this requires us to play a large pot out of position. Therefore, this allows us to 3-bet with hands that do well in 3-bet pots even if they have to occasionally fold to a 4-bet.

Unfortunately, not all of our bluffs will be with ideal bluffing hands. It's often necessary to 3-bet bluff with hands like the K♦7♦ from the small blind despite the fact that they can lead to tougher situations post-flop. We simply aren't dealt enough suited connectors and suited gapers to balance out our value 3-bets, and as already seen, we should be 3-betting quite aggressively against a button open. While top pair no kicker is usually difficult to play out of position in a large pot, it's still useful to have some marginal hands in our flop checking range.

Examining Complex Ranges — Balance

Few concepts in poker are as misunderstood and misapplied as “balancing” a range. If our range is not balanced, our opponent will often be able to take extremely effective lines against that range. A balanced range is the by-product of playing every hand in our range in a way which maximizes, on average, its expected value.

There will usually be some board textures which favor our opponent’s range more than ours no matter how balanced our preflop range is. For instance, if our range is much weaker than our opponent’s, he will be able to make large bets at a high frequency since he knows we’ll rarely be strong. This encourages us to put hands in our preflop range which allow us to connect better on boards which would otherwise miss our range, and we’ll occasionally win a massive pot when we have one of the few possible strong hands in an otherwise weak range.

Let’s visualize this process by examining a cutoff versus button situation and assume the button always 3-bets aces and ace-king preflop against a cutoff open as most players do. This means that when the button does not raise he will not have many strong hands on king high flops and the cutoff can then exploit him by making large bets frequently on king high boards. Notice that it’s rare for the button to have many hands stronger than two kings with a queen kicker.

This means the button now has an incentive to change strategy. Since he may win a large pot when the flop comes king high and he holds aces or ace-king, flatting those hands preflop is now more profitable than 3-betting. In addition, by flatting some strong hands preflop the button will sometimes win a large pot when a player in the blinds squeezes — reraises preflop.

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Now once the cutoff notices the button has aces and ace-king in his range on king high flops, he should start betting less aggressively, and these adjustments back and forth eventually lead both players to playing close to game theoretically optimally and establishing an equilibrium. The button, while usually 3-betting preflop with aces or ace-king, will occasionally call with them, and the cutoff will play king high flops aggressively, but not as aggressively as before.

We may run into a similar problem if we never flat any strong hands in the small blind. If this is the case, our range will become quite vulnerable to squeezes from the big blind. Also notice that the big blind does not have this problem since no one can squeeze after he calls. While the big blind's cold calling range is condensed — no very strong hands — the flop will usually put some two pairs and sets in the big blinds range before the button can capitalize on this.

For this reason, it may make sense to put some strong hands in the small blind flattening range. We cannot prove this, and it may be the case that the small blind should almost always fold to a squeeze and expect the button to do most of the defending. Yet the idea to occasionally flat a few aces or ace-king hands at the very least seems reasonable in theory, and is something we should surely do in practice if the big blind is an aggressive squeezer.

Examining Complex Ranges — Board Texture Frequencies

Another important consideration to take into account when designing defending ranges is the frequency a certain flop will come since we're more concerned with connecting on flops which occur at a higher frequency. For instance, missing a king high flop is much more problematic than missing a seven high flop since king high flops occur much more often. This is important to consider when deciding whether or not it's problematic if a range misses on a certain flop texture.

Below are the odds that a flop comes with a certain high card. Ace high flops are of course the most common as more cards can come underneath them than any other card, while flops eight high and lower are quite rare.

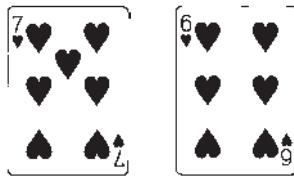
High Card	Single High Card (Axx, Kxx, etc)	Two High Cards (AAx, KKx, etc)	Total
Ace	20.4%	1.3%	21.7%
King	17.1%	1.2%	18.4%
Queen	14.1%	1.1%	15.2%
Jack	11.4%	1.0%	12.4%
Ten	9.0%	0.9%	9.9%
Nine	6.8%	0.8%	7.6%
Eight or less	-	-	14.8%

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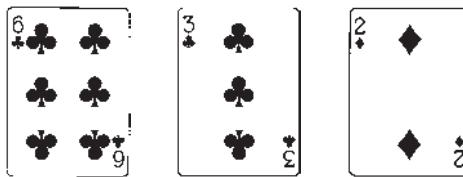
While it's useful to have a general sense of how frequently a certain flop texture will come, this is not information we need to commit to memory. Instead, we should notice how unlikely the board is to come eight high or lower and how 67.7 percent of all flops have at least one card which is a jack or higher.

As we'll see, cold calling ranges from the blinds are often designed to miss on eight high and lower flops. This is largely due to the fact that these flops are not likely so missing them when they do occur will only rarely cause problems.

In addition, as we'll discuss in future chapters, these low boards are particularly difficult to play out of position. Even if we do put more low suited connectors in our calling range, holding the



out of position on the



flop will still not be a favorable situation. This means that check-folding from the blinds at a high frequency is likely the best way to approach these boards. Instead of connecting on them, we'll design our calling range to hit the more common jack and higher boards.

Understanding Complex Ranges — Defending Enough Against 3-Bets

We know it's necessary to defend wider against a raise first in if we defend by calling instead of 3-betting since calling lets our opponent see the flop. Therefore, it should come as no surprise the same concept applies when we open and face a 3-bet. That is, when we call our opponent's 3-bet, he's guaranteed to get to see the flop and have the opportunity to either make a strong hand or profitable bluff. This forces us to defend many more hand combinations than if we only 4-bet or folded.

Let's start by assuming we use a 45 percent button opening range—a reasonable button opening range used by many winning players. When we open to 2.5 big blinds and our opponent 3-bets from the big blind to 9.5 big blinds, he risks 8.5 big blinds to win 4 big blinds. And as we've already shown, this means the big blind's 3-bet cannot be allowed to succeed more than 68 percent of the time. Put another way, it's important to defend at least 32 percent of our opening range and since our opening range is 45 percent, this means we should defend at least 14.4 percent of all hands.

$$0.144 = (0.32)(0.45)$$

However, the 14.4 percent is correct if we only defended by 4-betting, but now we need to figure out how many additional hands should be added in if we also defend by calling. This will require us to use a similar method as we did in "Examining Complex Ranges — Defending Enough Against Opens," starting on page 54, and start with either estimating a range or a value. In

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fact, the formula for the big blinds expectation when bluffing looks almost identical.

$$(\text{EV when button folds})(\text{frequency button folds}) + (\text{average EV when called})(\text{frequency called}) - (\text{EV when 4-bet})(\text{facing 4-bet frequency}) = 0$$

There are two ways we can approach this problem. The first is to plug in our typical calling and 4-betting ranges and see what the big blind's average expected value must be when his 3-bet bluff is called for him to be indifferent. In fact, it may be a good idea to do this now before moving on just to see what value you come up with.

Another option is to estimate the big blind's expected value when we call his 3-bet bluff and then design the defending ranges accordingly. Here's an example. We expect the big blind will on average lose 5.5 big blinds when the weakest 3-bet bluff in his range is called. This means he will get on average 3 big blinds back from the 18 big blind pot. This estimate may seem low, but as will be shown in the hand chart, the worst hand in the big blind 3-betting range is very weak. That is, it makes sense to expect the big blind to rarely be in a highly profitable spot post-flop when he's out of position with the weakest hand in his 3-betting range.

Furthermore, let's assume that when facing a 3-bet on the button, we will 4-bet 5 percent of the total hands we're dealt. This is a reasonable estimate if we use a small 4-bet sizing with a range of KK-JJ, AK, and bluffs. This results in us 4-betting 11.1 percent of the time we face a 3-bet.

$$0.111 = \frac{0.05}{0.45}$$

Now we can plug these values into the previous equation and solve for how wide our button calling range must be when facing a 3-bet.

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$$(4)(1 - X - 0.111) + (-5.5)(X) + (-8.5)(0.111) = 0 \Rightarrow \\ X = 0.275$$

where

- 4 is the blind's EV when the button folds,
- $1 - X - 0.111$ is the frequency that the button folds,
- 5.5 is the blind's EV when the button folds,
- X is the button's folding frequency,
- 0.111 is the frequency the button 4-bets, and
- 8.5 is the blind's EV when the button 4-bets.

Therefore, the button should defend 27.5 percent of his opening range by calling against the big blind's 3-bet. This comes out to be 12.4 percent of all hands the button is dealt preflop.

$$0.124 = (0.275)(0.45)$$

We can repeat this process and instead assume our opponent's bluffs only lose 4.5 big blinds when they are called. The same math as above will show we then need to defend 30.7 instead of 27.5 percent of our opening range by calling. Remember, these calls are in addition to the 4-bets, so we are in total defending around 40 percent of the hands we open preflop when we face a 3-bet.

Let's take a moment and examine what button 3-bet calling ranges may look like for different raise first in frequencies. The math below assumes a 2.5 big blind open in the button and a 9.5 big blind 3-bet. Remember, there's no way to prove which calls are better preflop. A player could reasonably argue it's better to flat a 3-bet on the button with queen-jack offsuit instead of sixes or seven-six suited and vice versa. In all likelihood, if the decision looks close, there is probably not a huge difference in the expected value of either hand.

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The following table produces the range of hands the button raiser will call a 3-bet from the big blind. It assumes the big blind will lose 5.5 big blinds when his worse 3-bet is called.

Button 3-Bet Calling Range			
Opening Range	Percentage of Opening Range Called	Percentage of All Possible Hands Called	Possible Cold Calling Range
30%	20.1%	6.0%	AA, TT-88, AQo, KQo, AQs- ATs, KQs-KJs, QJs, JTs, T9s
40%	25.7%	10.0%	AA, TT-77, AQo-AJo, KQo, AQs-A9s, KQs- KTs, QJs-QTs, JTs-J9s, T9s, 98s, 87s, 76s, 65s
50%	28.9%	14.5%	AA, TT-55, AQo- ATo, KQo-KJo, QJo, AQs-A9s, KQs-KTs, QJs-Q9s, JTs-J9s, T9s-T8s, 98s-97s, 87s-86s, 76s, 65s

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60%	31.4%	18.8%	AA, TT-22, AQo-ATo, KQo-KJo, QJo, AQt-A8s, A5s-A2s, KQs-K9s, QJs-Q9s, JTs-J9s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s-64s, 54s
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The next table produces a possible range of hands the button opener will call when facing a 3-bet from the big blind assuming the big blind loses 4.5 big blinds when his worse 3-bet is called.

Opening Range	Percentage of Opening Range Called	Percentage of All Possible Hands Called	Possible Cold Calling Range
30%	22.5%	6.8%	AA, TT-88, AQo-AJo, KQo, AQt-ATs, KQs-KJs, QJs, JTs, T9s
40%	28.7%	11.5%	AA, TT-77, AQo-ATo, KQo-KJo, AQt-A9s, KQs-KTs, QJs-QTs, JTs-J9s, T9s, 98s, 87s, 76s
50%	32.3%	16.2%	AA, TT-44, AQo-ATo, KQo-KJo, QJo, AQt-A9s, A5s-A4s, KQs-K9s, QJs-Q9s, JTs-J9s, T9s-T8s, 98s-97s, 87s-86s, 76s, 65s, 54s

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60%	34.8%	20.9%	AA, TT-44, AQo-ATo, KQo-KTo, QJo-QTo, AQs-A2s, KQs-K7s, QJs-Q9s, JTs-J9s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s-64s, 54s
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Notice all of these button flatting ranges include aces. Aces have a strong removal effect and are unlikely to be outdrawn by the opponent on the flop. (We can always raise the flop and turn if the board is particularly threatening.) Aces make a strong hand on board textures which would otherwise miss our flatting range and because of this, I believe there is more value in flatting aces than 4-betting them preflop. Kings and queens could also be called preflop, but since these hands fear overcards, they are more risky to slowplay.

Also notice how wide the button's 3-bet flatting range quickly becomes once the button is opening over 50 percent of the hands. Weak pocket pairs and low suited connectors get placed in the 3-bet calling range even if we assume a low expected value on the flop for our opponent's 3-bet bluffs. Specifically, assuming our opponent's worst 3-bet bluff loses less than 5.5 big blinds when called, we will need to start calling with weak suited aces and suited kings, hands that are going to be difficult to play effectively post-flop, especially against a polarized range.

As mentioned previously, one of the biggest problems when designing 3-bet calling ranges is as the range gets wider, the big blind's 3-bet bluffs also get more profitable opportunities post-flop. While it may be possible the expected value of a weak 3-bet bluff will only be on average 3 big blinds on the flop against a very strong range, as the 3-bet calling range gets wider, it's going to become more difficult to prevent the 3-bettor from profitably bluffing his weak hands. When flatting against 3-bets with hands as weak as the 5♦4♠ and the 3♥3♣, it's unlikely the big blind will

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lose 5.5 big blinds or more when the worst 3-bet in his range is called. Again, that's because the defending range is so weak.

This suggests it's unlikely the button's opening range should be exceptionally wide for a 2.5 big blind open. It's simply too difficult to defend against 3-bets on the button once we are opening over half the hands we're dealt preflop. Some players may disagree with this, but if they do, they must either be comfortable defending an extremely wide range against 3-bets or believe the opponent's 3-bet bluffs will only rarely get into profitable spots post-flop.

In reality, this is most likely the opposite of what many good players think. That's because the best players at a given stake can open the button much wider than they should theoretically be able to since they are more skilled than their opponents. In addition, it's much easier to make mistakes when out of position than in position which further reinforces the superior player's advantage.

Likewise, mediocre players look at how the best players play and try to mimic them. If the biggest winners are able to open 70 percent of their hands on the button, many mediocre players will copy them and it won't take long before it's generally accepted among poker players to open the button much wider than is theoretically correct. Mob mentality is alive and well in the poker community, and it gets increasingly difficult to improve as a player when one finds themselves no longer able to simply copy what other successful players are doing.

Understanding Complex Ranges — Defending Against 4-Bets

One of the more difficult aspects of preflop play is deciding how to defend against 4-bets. We've already discussed how conceptually it can make sense to flat against a 4-bet both in and out of position, so we won't repeat that here. Nevertheless, deciding how to handle a 4-bet is a difficult concept to approach and often there is no clear answer.

We will now attempt to analyze possible ways to defend against button 4-bets after 3-betting from the blinds. There are two general ways to approach this problem:

1. Design our 3-betting range so that every hand can comfortably 5-bet jam or fold when facing a 4-bet. This allows us to avoid playing large pots out of position, but makes small 4-bets very effective against us.
2. Defend some hands against 4-bets by calling and other hands by 5-betting. This allows us to call when our opponent gives us excellent odds and is likely the best line with hands like king-queen suited which we do not want to fold but cannot effectively 5-bet.

Also, when calling a 4-bet, it's important to remember that the call only needs to be profitable relative to folding which results in losing 9.5 big blinds overall for the hand. So calling the 4-bet will have a positive expected value as long as we expect to lose, on average, less than this amount. In addition, this allows us

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to check-fold the flop at a high frequency since we are just trying to lose less than 9.5 big blinds overall for the hand.

After calling a 4-bet out of position, we are likely not going to be able to prevent our opponent from being able to profitably bet any two cards on the flop. When his 4-bet bluff is called, he'll have already invested 19.5 big blinds preflop, so allowing him to make a profitable bet post-flop with any two cards is not a problem. That's because he'll still lose money by 4-bet bluffing too weak of hands preflop despite the fact that he can often make profitable bluffs post-flop.

For example, suppose we fold enough to our opponent's flop bet in a 4-bet pot that his expected value is +5 big blinds when he bets any two cards on the flop. When he has no equity on the flop, he'll still expect to lose on average 14.5 big blinds total for the hand.

$$- 14.5 = 5 - 19.5$$

where

19.5 big blinds is how much money he's investing into the pot to get the profitable post-flop opportunity, and

5 big blinds is the expected value of our opponent's bet post flop.

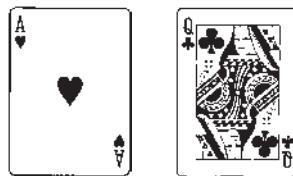
Finally, if our opponent notices our 4-bet calling range is weak, he'll start betting on the flop at a high frequency. This makes slowplaying, as we did before by flatting 3-bets from the blinds with aces on the button, some very strong hands, such as the just mentioned aces, more profitable than 5-betting. We already utilized this strategy earlier.

Although we understand the theory behind 4-bet flatting ranges well at this point, there are a few practical problems with designing and using the ranges. The first is even if we use a very aggressive 3-betting range, we will still have relatively few hand combinations in our 4-bet flatting range and 5-betting range. This

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often requires us to put the same hand in both a 4-bet calling and 5-betting range (and sometimes the folding range as well). This makes designing the ranges quite difficult.

Here's an example. The button opens and we 3-bet in the big blind with the



If we have the best hand preflop and call the 4-bet, we are out of position and quite likely to be outdrawn or bluffed off the best hand on the flop. Therefore, 5-betting is an option since the holding blocks aces, queens, and ace-king in the button's 5-bet calling range, but ace-queen has less equity when called than many suited connectors. Arguments for both 5-betting and calling with ace-queen can be made and it's possible the hand goes into both ranges.

Likewise, we may find if we are always flatting a 4-bet with hands like ace-jack and king-queen, that our calling range consists of too many of these types of hands. Imagine what our 4-bet calling range will look like if we call with all our ace-queen, ace-jack, and king-queen hands. Since each hand makes 16 combinations, this would result in our 4-bet calling range including 48 combinations of these three hands, and this may make our range too transparent enabling our opponent to play extremely effectively against us. That's because he will know we often have many strong but not amazing hands on ace and queen high boards.

So to avoid having too transparent of a range, this likely requires us to flat 4-bets with a few combinations of suited connectors. And if we are flatting only a few combinations of suited connectors, we must believe the expected value of flatting

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and folding (as well as possibly even 5-betting) is approximately equal.

Finally, we must also remember that neither our opponents nor ourselves are capable of playing theoretically optimally post-flop. With this in mind, who do you think is more likely to make a mistake in a 4-bet pot, the player who is in position with a polarized range, or the player out of position with a condensed range? Remember, a polarized range in position is much easier to play, so this encourages players to minimize flatting 4-bets out of position when possible unless they are very confident with their post-flop play.

For these reasons, it's not likely a productive use of time to attempt to design and memorize 4-bet calling ranges. They are simply too difficult to develop precisely since there are probably many hands which have approximately the same expected value taking different lines. It would instead be wiser to know what hands are reasonable to flat 4-bets with out of position and then consider calling with those hands against the right opponents.

Recommended Hand Chart

The following hand chart was created with one of my poker friends, Nick Howard. These ranges assume a 3.5 big blind open in all positions except for the button where it is 2.5 big blinds. While far from perfect, these ranges are reasonable for players to examine and use against strong opponents if they don't want to spend the time creating their own.

In addition, while a small change in bet sizing will not greatly impact most ranges, the smaller the opening sizing, the more aggressively the remaining players must defend. If the open is 3 big blinds, the remaining positions will have to defend more aggressively than if the open is to 3.5 big blinds. Likewise, if we use a smaller opening size, we should be able to open a bit wider, but as implied, our opponents will be able to call more hands profitably from the blinds and elsewhere.

It's also worth pointing out that I chose to defend very aggressively from the blinds against a button open, much more than most players are probably used to. In fact, the button must win on average 0.74 big blinds when his worse open is called for him to break even. Yet since most all the calls will come from the big blind, who, with the worse hand in his calling range, is only trying to lose less than 1 big blind overall, I think this is best. However, newer players should likely defend less aggressively since playing out of position with a weak range is difficult.

Finally, note that many percentages are rounded or estimates, and to make a more accurate and detailed hand chart is quite difficult and can quickly become cluttered. In addition, the bluffs listed are meant to give a sense of the type of bluffs which are reasonable for that position. They are not in the sense that these are the only recommended bluffing hands. In fact, if we only bluffed with these hands, our range might become too transparent.

Recommended Hand Chart 81

Preflop is far from solved and while strong preflop play is critical to success in no-limit hold 'em, it's much more important to have a general sense of what types of hands go into what ranges and to understand why rather than memorize specific ranges. So don't needlessly spend time memorizing an imperfect hand chart when your time would be better spent elsewhere, and don't use "but it's likely correct in theory!" as an excuse for taking a line that is terrible in practice against your specific opponent.

Also, a * appears with some of the hands. This means the hand either goes into multiple ranges or is meant to draw attention to the fact that only a limited combination of these hands are used.

Opening Ranges		
Position	Opening Percentage	Range
UTG	13.9%	AA-33, AKo-AJo, KQo, AKs-ATs, KQs-KTs, QJs-QTs, JTs-J9s, T9s, 98s, 87s, 76s, 65s
MP	17.9%	AA-22, AKo-ATo, KQo, AKs-A7s, A5s, KQs-KTs, QJs-QTs, JTs-J9s, T9s- T8s, 98s-97s, 87s-86s, 76s-75s, 65s, 54s
CO	23.7%	AA-22, AKo-ATo, KQo-KJo, QJo, AKs-A2s, KQs-K6s, QJs-Q7s, JTs-J8s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s-64s, 54s
Button	47.5%	AA-22, AKo-A2o, KQo-K7o, QJo-Q9o, JTo-J9o, T9o-T8o, 98o, 87o, AKs-A2s, KQs-K2s, QJs-Q2s, JTs-J5s, T9s-T6s, 98s-96s, 87s-85s, 76s-74s, 65s-64s, 54s-53s, 43s

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SB	36.3%	AA-22, AKo-A7o, KQo-K9o, QJo-Q9o, JTo-J9o, T9o, 98o, AKs-A2s, KQs-K2s, QJs-Q4s, JTs-J7s, T9s-T7s, 98s-97s, 87s-86s, 76s-75s, 65s-64s, 54s
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Cold Calling Ranges		
Position	Cold Calling Percentage	Range
MP Flat vs UTG	8.5%	QQ-55, AKo-AQo, AQs-ATs, KQs-KJs, QJs, JTs, T9s, 98s, 87s
CO Flat vs UTG	9.5%	QQ-44, AKo-AQo, AQs-ATs, KQs- KJs, QJs, JTs, T9s, 98s, 87s, 76s, 65s
Button Flat vs UTG	11.2%	QQ-33, AKo-AQo, AQs-ATs, KQs-KTs, QJs-QTs, JTs-J9s, T9s, 98s, 87s, 76s, 65s, 54s
SB Flat vs UTG	3.6%	QQ-88, AKo*, AQs, KQs
BB Flat vs UTG	8.0%	QQ-44, AKo-AQo, AQs-ATs, KQs-KJs, QJs, JTs
CO Flat vs MP	9.4%	JJ-44, AKo-AQo, AQs-ATs, KQs- KTs, QJs-QTs, JTs, T9s, 98s, 87s, 76s
Button Flat vs MP	10.7%	JJ-33, AKo-AQo, AQs-ATs, KQs- KTs, QJs-QTs, JTs-J9s, T9s, 98s, 87s, 76s, 65s, 54s
SB Flat vs MP	4.1%	JJ-77, AKo*-AQo, AQs, KQs

Recommended Hand Chart 83

BB Flat vs MP	8.5%	JJ-22, AQt, AQs-ATs, KQs-KJs, QJs, JTs, T9s, 98s, 87s
Button Flat vs CO	14.2%	AA*, TT-22, AKo*-AJo, KQo, AQs-A8s, KQs-KTs, QJs-QTs, JTs-J9s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s, 54s
SB Flat vs CO	5.6%	TT-88, AQt-AJo, KQo, AJs-ATs, KQs-KJs, QJs
BB Flat vs CO	9.8%	TT-22, AQt-AJo, KQo, AJs-ATs, KQs-KTs, QJs-QTs, JTs-J9s, T9s, 98s
SB Flat vs Button	6.9%	99-66, KTo, QJo-QTo, A9s-A8s, KTs-K9s, QJs-QTs, JTs, T9s
BB Flat vs Button	28.2%	99-33, A9o-A2o, KTo-K7o, QJo-Q8o, JTo-J9o, T9o, 98o A8s-A2s, KTs-K5s, QJs-Q7s, JTs-J8s, T9s-T8s
BB Flat vs SB	45.4%	TT-22, ATo-A2o, KJo-K7o, QJo-Q8o, JTo-J8o, T9o-T8o, 98o-97o, 87o, 76o, AJs-A2s, KJs-K2s, QJs-Q2s, JTs-J4s, T9s-T5s, 98s-95s, 87s-85s, 76s-74s, 65s-64s, 54s-53s, 43s

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3-Betting Ranges		
Position	3-Betting Percentage	3-Betting Range
Vs UTG 3-Bet IP	3.6%	AA-KK, AJo, KQo, AKs, A5s-A4s
Vs UTG 3-Bet SB and BB	3.8%	AA-KK, AKo*, 44-33, AKs, T9s, 98s, 87s, 76s, 65s
Vs MP 3-Bet IP	4.7%	AA-QQ, AJo, KQo, AKs, A5s-A4s,T8s, 97s
Vs MP 3-Bet SB	5.7%	AA-QQ, 66-44, AKo, AKs- AQs, JT _s , T9s, 98s, 87s, 76s
Vs MP 3-Bet BB	5.6%	AA-QQ, AKo, AKs-AQs, QT _s , J9s, T8s, 98s-97s, 87s, 76s, 65s, 54s
Vs CO 3-Bet IP	7.2%	AA*-JJ, AKo*, ATo, KJo, QJo, AKs, A7s-A2s
Vs CO 3-Bet SB	8.0%	AA-JJ, 55-44, AKo, AKs-AQs, KT _s , QT _s , JT _s -J9s, T9s-T8s, 98s-97s, 87s, 76s, 65s, 54s
Vs CO 3-Bet BB	8.6%	AA-JJ, 44-22, AKo, AKs-AQs, A5s-A4s, K9s, Q9s, T8s, 97s, 87s-86s, 76s-75s, 65s-64s, 54s
Vs Button 3-Bet SB	18.1%	AA-TT, 55-33, AKo-ATo, KQo-KJo, AKs-ATs, A7s-A2s, KQs-KJs, K8s-K4s, Q9s-Q8s, J9s-J8s, T8s, 98s-97s, 87s-86s, 76s-75s, 65s-64s, 54s

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Vs Button 3-Bet BB	17.5%	AA-TT, 22, AKo-ATo, KQo-KJo, AKs-A9s, KQs-KJs, K4s-K2s, Q6s-Q2s, J7s-J6s, T7s, 98s-96s, 87s-85s, 76s-75s, 65s-64s, 54s-53s, 43s
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Facing a 3-Bet in Position			
Position	Total Defending Range	3-Bet Flatting Range	4-Betting Range
UTG vs IP 3-Bet	5.1%	KK-TT*, AKo-AQo*, AKs-AQs, KQs	AA, 98s, 87s, 76s
MP vs IP 3-Bet	6.4%	QQ-TT, AKo-AQo*, AKs-AQs, KQs	AA-KK, AKs, 98s, 87s, 76s, 65s, 54s
CO vs IP 3-Bet	8.9%	AA, JJ-99, AKo*-AQo, KQo, AQs-AJs, KQs-KJs, QJs	KK-QQ, AKo*, AKs, T9s, 98s, 87s, 76s, 65s
Button vs 3-Bet	21.4%	AA, TT-77, AQo-ATo, KQo-KTo, QJo, AQs-A7s, A5s-A2s, KQs-K9s, QJs-Q9s, JTs-J9s, T9s-T8s, 98s-97s, 87s, 76s, 65s	KK-JJ, AKo, AKs, A6s, A4s-A2s, K8s-K4s, Q8s-Q7s
UTG vs OOP 3-Bet	5.1%	KK-TT*, AKo-AQo*, AKs-AQs, KQs	AA, AJs, ATs, 76s

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MP vs OOP 3-Bet	6.3%	AA*, QQ-TT, AKo-AQo, AKs-AJs, KQs, QJs,	AA*-KK, 98s, 87s, 76s, 65s
CO vs OOP 3-Bet	11.6%	JJ-99, AKo-AJo, KQo, AQs-ATs, KQs-KTs, QJs-QTs, JTs,T9s,98s	AA-QQ, AKs, A8s-A5s, 87s, 76s
SB vs BB 3-Bet	16%	AA, TT-77, AQo-ATo, KQo-KJo, AQs-A9s, KQs-KTs, QJs-QTs, JTs-J9s, T9s, 98s	KK-JJ, AKo, AKs, T9s-T8s, 98s-97s, 87s, 76s, 65s, 54s

Summary

1. When designing optimal preflop defending ranges, our main goal is to prevent the preflop raiser from being able to open wider than he should theoretically be able to.
2. We should be more likely to defend our hands by calling in position and re-raising out of position.
3. 3-bet bluffs need folds around 67 to 70 percent of the time to show an immediate profit, and a player should defend around 40 to 50 percent of his 3-bets when facing a 4-bet.
4. 4-bet bluffs need folds around 50 to 60 percent of the time to yield an immediate profit and should call between 50 to 60 percent of the time when facing a 5-bet jam.
5. 5-bet bluffs usually only need to succeed around 40 to 50 percent of the time to be profitable if they are randomized with the right bluffing hands. Usually, hands like ace-rag suited and low pocket pairs work best as 5-bet bluffs.
6. Three-bets on average punish the worst hands in our opponent's opening range more severely than calling does since calling allows him to see a flop.
7. The expected value of 3-betting and 4-betting strong but not super premium hands like ace-king and queens in position is probably much lower against an optimal opponent than players expect. With these hands, many players are making a mistake by re-raising when they should call instead.

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8. We must make sure we use calling ranges which can connect on many different flop textures so our range will not be transparent. However, it's also okay to use calling ranges which miss on low board textures since 8 high and lower boards are quite uncommon.
9. Hand values can change drastically based on what range they are facing. For example, king-nine offsuit may do well as a cold call in the big blind against a button open since the opening range includes many weaker king-x and nine-x hands. But it may work poorly as a 3-bet since 3-betting makes many dominated hands fold, and out of position, marginal pairs are tough to play for a large pot against a strong range.
10. A hand chart will not be perfect until the game of poker is actually solved. But they are certainly useful at identifying leaks and helping newer players. That is it's more important to understand why hands go into certain ranges than to memorize a hand chart.

Part Three

Post-flop Bet Sizing

Post-flop Bet Sizing

Introduction

Post-flop bet sizing is one of the most complex concepts in no-limit hold 'em, and as such it's often ignored since it's difficult to tell where to even begin. And while we're nowhere near ready to start discussing bet sizing in detail, it's crucial that the fundamentals are understood before moving forward.

This concept especially can be made as difficult and complex as one wishes, and it's important not to hold ourselves to an unrealistic standard when beginning to discuss bet sizing. However, what's most important now is to understand the general factors which help determine whether to bet large or small relative to the size of the pot.

Lastly, note that more precise bet sizing will usually be possible when there are fewer cards left to come. As will be explained in "Pinpointing the Optimal River Bet Size," starting on page 339, in "Part Eleven: River Play," it's often possible to make very precise bets on the river. But since decisions must be made quickly in practice without the help of computer software, it's important the fundamentals are understood first before more complex topics are approached.

Post-flop Bet Sizing at a Glance

Although bet sizing is too complex of a concept to confine to a single chapter, we should first make sure to understand the basic mathematics behind it before moving onto post-flop play. That's because bet sizing is extremely important in no-limit hold 'em, and what often separates a great player from merely a good one is how he uses different bet sizes in different situations to manipulate his opponent's range. Specifically, an excellent bet size can force our opponent to make tough decisions and maximizes the expected value of the bettor's hand.

In theory, if a player has a perfectly polarized range which includes hands of either 100 percent equity (the pure nuts) or 0 percent equity (pure air), he will choose his bet sizing so that he's betting an equal fraction of the pot on all three streets and is all in by the river. A formal proof of the mathematics behind this will not be shown here, but it was solved for in *The Mathematics of Poker* by Bill Chen and Jerrod Ankenman. So it's important to understand that a player with a completely polarized range will use this bet sizing structure to get all the money in by the river to maximize his earnings.

$$\text{Final pot-size} = (\text{Starting pot-size})(\text{Pot growth rate})^{(\text{Streets Remaining})}$$

Let's see how this formula works. Suppose it's blind versus blind and we'll assume on the flop that the small blind has a range which includes only hands with either 100 percent or 0 percent equity. For a 3.5 big blind open, the starting pot-size on the flop will be 7 big blinds, the final pot-size will be 200 big blinds, and there are three streets remaining. This reduces the following pot growth rate equation

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$$200 = (7)(R)^3$$

where

- 7 is the starting pot size,
- 200 is the final pot size, and
- R is the pot growth rate.

This implies that the pot growth rate is 3.06.

$$3.06 = \left(\frac{200}{7} \right)^{\frac{1}{3}}$$

Therefore, the pot should increase to 3.06 times its size with each passing street. This means we must bet 1.03 pot-sized bets on the flop, turn, and river to get all the money in by the river.

$$\begin{aligned} SPS + (2)(\text{Bet Size}) &= (3.06)(SPS) \Rightarrow \\ (2)(\text{Bet Size}) &= (2.06)(SPS) \Rightarrow \\ \text{Bet Size} &= (1.03)(SPS) \end{aligned}$$

where

SPS is the starting pot size.

And for this example, we should bet 7.2 big blinds on the flop, 22.0 big blinds on the turn, and 68.1 big blinds on the river to get all the money in.

Since these perfectly polarized ranges do exist, understanding optimal bet sizing for them is important, but the vast majority of the time a betting range will not be perfectly polarized. Usually, our opponent will have some hands in his range which either already beat our value hands or can outdraw us, and likewise, our bluffs will usually be capable of improving to a strong hand. So

when this is the case, betting an equal fraction of the pot on each street will not usually be ideal.

Stated another way, when our opponent has several hands in his range stronger than some of our value betting hands, we'll only occasionally want to get all the money in by the river. That's because our large bet sizing on each street will encourage our opponent to fold all but his strongest hands by the river. That is, whenever we value bet each street only to discover that our opponent has called us down with a better hand, we'll lose a large pot. This is one reason why in single raised pots with 100 big blind stacks, the majority of the time we will not bet big enough to try to get all the money in by the river.

However, there are other situations we may still want to bet even if our opponent has few medium strength hands in his range. This will frequently happen if, when in position, we call one of our opponent's bets and he checks to us on a later street that did not improve any hands in his range. We may want to bet in an attempt to win the hand right there.

To illustrate this concept, suppose our opponent opens in the cutoff and we call on the button. He continuation bets the



flop and then checks to us when the 2♦ comes on the turn. While our opponent may have some marginal hands in his range, such as tens and nines, the majority of his range should be weak. Therefore, a small bet should prevent him from seeing a free river card with his weak hands. And because it's small, it should also minimize the effectiveness of any potential check-raise whereas betting large makes a turn check-raise more effective and allows him to defend less of his turn checking range.

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When our strong hands are susceptible to being outdrawn on later streets, we may choose to use a descending bet sizing structure. That is, by betting bigger on earlier streets, we make sure our opponent puts more money into the pot when he's behind if he wants to try to outdraw us. Nevertheless, there are still limits on how big our bet sizing can be since very large bets are punished harshly when our opponent does have a hand which already is better than ours.

Here's an example. We open in the cutoff with the J♥T♥ and only the button calls. The flop is the T♣7♣4♠ and the turn is the 2♦. Since we have top pair, we may decide to bet a larger fraction of the pot on the flop than on the turn. Despite our hand not being especially strong, by betting larger on the flop, we make our opponent fold some overcard hands with over 25 percent equity. However, his implied odds and equity will have decreased on a low turn card, and by betting small, on the turn, we hopefully end the hand here, but if he does call, his range still should not be too strong on the river.

And when we go ahead and bet the river, our bet will often be small (after betting the turn). Our opponent has no additional implied odds and we're not worried about being outdrawn with his weak hands. In fact, as will be shown in future chapters, when out of position on the river, there is not much difference between betting small and checking.

So while deciding what bet size is best in a given situation will often be quite difficult, we should always remember the most important underlying concepts. Large bets, on average, require our opponent to defend less frequently and put more money into the pot while small bets require him to defend more. But small bets also require the bettor to be bluffing less since the defender is getting a better price. Therefore, the choice will often be between betting small and giving our opponent a good price when he'll call with a wide weak range or betting big so he gets a worse price and calls with a strong range.

Post-flop Bet Sizing at a Glance 95

A common misconception players have is the belief that they need to have one specific bet sizing with their entire range in each particular spot. This is not the case. It's possible to have several different bet sizings in the same spot where each range is balanced. Furthermore, a player who is capable of using multiple bet sizings will have a significant edge on someone who restricts himself to only a single sizing.

This idea of using multiple bet sizes in the same spot to manipulate our opponent's range is usually theoretically correct and extremely important in many spots. For instance, if, on the river, the pot is 80 big blinds and we have 100 big blinds remaining, our bet with one range could be for the whole 100 big blinds, 60 big blinds with another range, and 40 big blinds with a third range. Each of these ranges could be perfectly balanced and designed to manipulate our opponent's calling range in the way that best fits our purpose.

We should now have a strong enough understanding of the theory behind bet sizing to proceed to post-flop play. And as bet sizing is discussed in more detail, we'll learn how to recognize when certain bet sizings make sense. Thus, we'll be able to exploit weak opponents who use senseless bet sizings while preventing strong opponent's from exploiting us.

Summary

Although excellent bet sizing is one of the most difficult skills to master, it's critical for success against tough opponents. Specifically, betting the right size manipulates our opponent's calling range to get calls from weaker hands but still make some high equity hands fold. While we have only scratched the surface of this topic, by understanding who has the polarized range and what our bets are designed to accomplish, the foundation has been laid for developing precise bets in future chapters.

Here are some of the important points:

1. Betting equal fractions of the pot on all three streets in order to get all the money in on the river maximizes our winnings when our range consists of the pure nuts and pure air.
2. Small bets are often effective against polarized ranges. They prevent our opponent from getting to see free cards with his weak hands while minimizing the effectiveness of his raises.
3. A descending bet sizing structure is effective when we likely have the best hand and do not want to cheaply give our opponent additional cards.
4. Small bets keep our opponent's calling range wide and weak, while large bets make his calling range narrow and strong.
5. It's not true that we should only have one bet sizing in a given spot with our entire range.

Part Four

Facing a Flop Bet in Position

Facing a Flop Bet in Position

Introduction

We are now ready to move on to post-flop play. While it's certainly possible to play solid poker preflop simply by memorizing a hand chart, this is not possible for post-flop play since there are so many different flop combinations. But an excellent understanding of the math and theory will allow us to make sound decisions and win money from our opponents even in spots we've never encountered before.

So this is an important section of the book, and we'll start our post-flop analysis by examining how to defend against a flop bet when in position. In addition, by examining how to defend against a bet when in position, we'll also be able to see what types of hands our opponent should continuation bet and use this as a starting point for deciding whether to check or bet when positions are switched. And once we're confident with our flop play, the next step will be to move on to learning how to effectively play the turn and river.

Defending by Calling

When out of position, our opponent should only rarely be able to profitably bet the worst two cards in his range. That's because our in position calling range is designed to play effectively against our opponent's preflop raising range. While there may be some board textures on which he can profitably bet the worst hands in his range, more often than not our opponent will need to have a certain type of hand to be able to make a profitable bluff out of position.

So to start, let's first examine how often we would have to fold to a flop bet before our opponent can profitably bet two unwinnable cards. To help do this, the following equation shows, in terms of pot-sized bets, how often a bluff needs to succeed to assure that the overall bet is guaranteed a certain profit.

Minimum bluff success rate =
 $(\text{bet size in PSB}) / (\text{bet size in PSB} + 1)$

or

$$Y = \frac{X}{X + 1}$$

where

X is the bet size in terms of pot-sized bets, and
Y is the frequency the bluff must succeed to show an immediate profit.

For example, suppose our opponent bets 50 percent of the pot. This means bluff rate should be 33.3 percent of the time.

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$$0.333 = \frac{0.5}{0.5 + 1}$$

Similarly, the proper defending frequency can be solved for when expressed in terms of the opponent's flop bet sizing.

$$Y = \frac{1}{1 + X}$$

where

X is the bet size in terms of pot-sized bets.

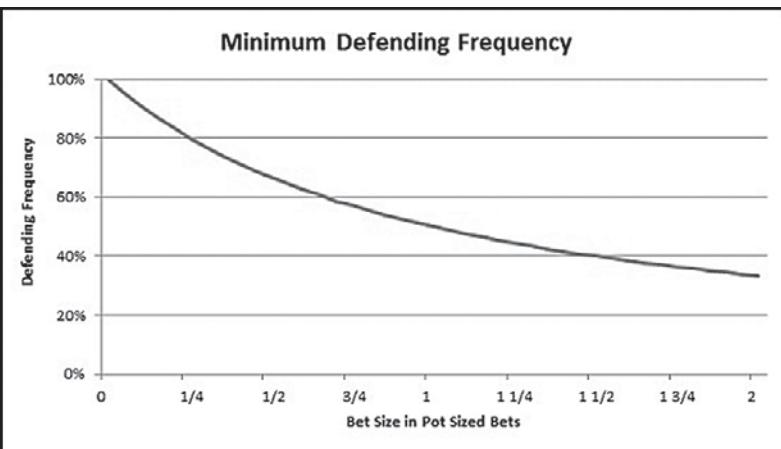
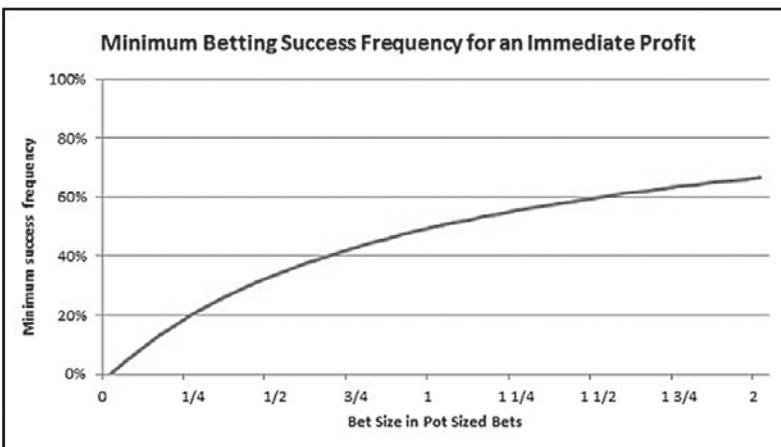
Y is the frequency the potential caller must defend to prevent his opponent from being able to profitably bluff with pure air, and

So in this example where X = 0.5 (pot sized bets) the potential caller needs to defend 66.7 percent of the time.

$$0.667 = \frac{1}{1 + 0.5}$$

With little effort, we can solve for how often our opponent's bluffs must succeed to show a guaranteed minimum profit for all other sizings as well. The graphs below show how frequently a bluff must succeed to show a profit with any two cards and how often we must defend against a bet to prevent our opponent from being able to profitably bluff any two cards.

Defending by Calling 101



We now want to ask how much better is it for our opponent when he bluffs the worst hand in his betting range (on the flop) and we defend by calling instead of raising?" This is what we did for preflop scenarios.

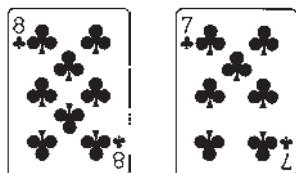
First, notice that our opponent will almost never be bluffing with hands which have no equity, so his bluffs should have an expected value of greater than 0 when they are called. However, the difference between post-flop and preflop is our opponent gets

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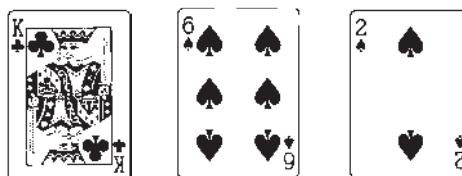
to see three more random cards when we call preflop, but only one more random card when we call post-flop. That is, on the flop, each player goes from having access to two cards to having access to five cards, and many hands greatly change in strength. On the turn, each player goes from five to six cards, and while many hands will change in strength, this effect is not usually as drastic as it was when we saw a flop.

In other words, while there was a significant difference between calling and raising against the weakest hands in our opponents preflop range, this difference is less significant post-flop. That is, many of the weakest hands in a preflop raising range which would fold to a 3-bet can make sets, two pairs, flush draws, and straight draws when allowed to see a flop. But on the flop, our opponent will often be bluffing with hands which can't immediately make a strong hand on any turn card.

Here's an example. Our opponent will often bluff with a hand like the



on the flop of the



despite the fact that he cannot make a strong hand on the turn. Notice that he will need to get lucky on both the turn and the river to make the best hand, and if he bets the turn and we raise, he'll

Defending by Calling 103

almost certainly fold no matter what the turn card is. So while a favorable turn which gives this player a straight or flush draw almost certainly will allow him to make a profitable bet, this spot is not nearly as profitable as simply making a strong hand on the flop.

There are flop textures where our opponent will be much more likely to outdraw us when his worst bluff is called. And in these cases there is a large difference in his expectation when he faces a call rather than a raise. So on these board textures, we must defend more aggressively.

Here's an example. The flop is the T♥8♥7♠ and our opponent bets. It should be clear there is a reasonable chance he outdraws us. That's because even his weakest bluffs can turn two pair, trips, straights, or a pair higher than tens. In addition, even if we call with the nut straight on the turn, our opponent may be betting the flop with a heart and catch running hearts on the turn and river. (Of course, this assumes we would only call with the nut straight on a heart turn so our opponent gets to realize his equity).

Consequently, we can conclude that since the expected value of our opponent's weakest bluff will change based on the board texture, there is no hard and fast rule for determining how much "extra" we should defend when we're calling instead of raising. For instance, against a normal 75 percent pot-sized continuation bet, we should defend at least 57.1 percent of our hands to stop our opponent from profitably betting the worst hand in his range. Nevertheless, we cannot solve for the exact frequency for defending against this bet.

So the conclusion is that defending anywhere between 60 to 70 percent of the time on most boards seems like a reasonable guess. This should stop our opponent from profitably betting any two cards on the flop. It also allows for enough folding that we give our opponent an incentive to bluff the hands which are theoretically correct bluffs, yet does not result in us folding so much that he can recklessly bluff any two cards. Likewise, we are

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not defending so aggressively that we give too much value to our opponent's strong hands. And throughout this book, the advice given will usually be to defend at least 60 percent of the time on the flop, but players who are more advanced should try to defend a bit more aggressively than this.

Usually, the board textures where our opponent's bluffs can likely outdraw us on the turn (such as the T♥8♥7♠ flop mentioned earlier) are the same ones where being in position is quite valuable. In addition, on these type of flops, we should have many hands which can improve on the turn. Therefore, good strategy implies to defend a wider range on these types of board textures. Likewise, we may also defend a bit wider on board textures where we're defending almost solely by calling since our opponent is virtually guaranteed to see the turn card.

Finally, while this methodology works well for making sure our opponent cannot profitably bet any two cards out of position, there may be some flops where he can still profitably bet any hand in his range. For example, if we call an under-the-gun open from the button and the flop comes the 2♥2♠2♣, we are not likely to have aces or kings in our range but our opponent is. Therefore, in this case, we may want to defend with less than 60 percent of our range and let him make money by bluffing any two cards. So while this is an undesirable outcome, folding to a flop bet at a high frequency with a very weak range is better than calling down aggressively and losing a large pot on the river.

Defending by Raising — The Value to Bluff Raising Ratio on the Flop

As discussed in “Part Three: Post-Flop Bet Sizing,” starting on page 89, there is no one size fits all bet sizing on the flop when betting or raising if our range isn’t perfectly polarized. Nevertheless, there are still some commonly used sizings which we should be familiar with. For instance, in a single raised pot, most players bet around 75 percent of the pot which will usually be close to 6 big blinds into an 8 big blind pot. Likewise, players who raise will usually raise this bet to between 16 and 18 big blinds in position — a reasonable sizing which allows the player in position to raise flops aggressively and requires the bettor to defend a large fraction of his flop bets by calling out of position.

So if we raise a 6 big blind bet into an 8 big blind pot to 16 big blinds, our opponent must defend at least 47 percent of the time if he wants to prevent us from making an immediate profit. Moreover, as is usually the case, a small change in raise sizing will not drastically impact this frequency. For instance, a slightly larger raise to 18 big blinds requires our opponent to defend 44 percent of the time to prevent our raise from yielding an immediate profit.

Our flop raising range will almost always be polarized with strong made hands and bluffs. But on some board textures, draws will be raised as well since they will usually become either very strong or very weak hands by the river, and can be value bet or bluffed accordingly. Also note that by raising, we make our opponent’s range much stronger on the turn, so it makes little sense to raise a hand for value unless it’s stronger than the vast majority of the hands in our opponent’s flop betting range. And

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since our raising range is polarized, many of the hands in our opponent's calling range should be bluff catchers which beat our bluff raises but lose to our value raises.

Now that we know what types of hands make sense in our raising range, let's figure out what our value raising to bluff raising ratio should be on the flop. For the sake of simplification, we'll also assume that our raising range is perfectly polarized meaning that our hands have either 100 percent or 0 percent equity.

So the first question is: "What is the end goal of our flop raising range?" Well, our goal on the river should be to bet with a range consisting of the right ratio of value bets and bluffs to make our opponent indifferent to calling with his mediocre strength hands. That is, a large fraction of our opponent's range on the river will be bluff catchers, and we want the expected value of both calling and folding with these hands to be zero.

Let's pause for a moment and look at a different example where the math is as simple as possible so the main ideas can be understood. Suppose our bet will always be the size of the pot. Furthermore, suppose our range on the flop consists of two types of hands, the nuts, which occur 20 percent of the time and will never lose, and bluffs, which occur 80 percent of the time and which can never win. This information can be used to determine what fraction of our hands should be bet on the flop, turn, and river.

When we bet the river, our opponent is getting offered 2-to-1 odds to call our bet, and this requires us to bluff one time for every two value bets, and in this example, since 20 percent of our range on the flop are the nuts (which are the value hands), we'll be betting (on the river) 30 percent of the total hands we had on the flop. Notice that this keeps our opponent indifferent to calling and folding since both calling and folding have an expected value of zero. In addition, notice our strategy is indifferent to what our opponent does with his bluff catcher — if he calls every time,

some of the time, or none of the time, the expected value of our betting range will be the same. This means we can look at our river bet from the perspective that our opponent always folds when we bet, and in this example, that will happen 30 percent of the time — 20 percent when we bet for value and 10 percent when we make a river bluff. But in a sense, since our opponent folds every time we bet, these are all winning bets.

In addition, also notice our opponent will always win after we check (on the river). That's because it also makes no sense for us to ever check the nuts if our range can include only the nuts or air as our opponent should never bet against this range. So in a way, we can say our opponent has effectively lost the hand whenever we bet the river with a balanced range of two-thirds value hands and one-third bluffs (since his expected value is zero whether he calls or folds), and it's also true our opponent wins the hand every time we check.

Now let's step back to the turn. If we make a pot size bet, our opponent will once again be offered 2-to-1 odds to call our bet, so he only needs to win one out of every three times to call. But also remember that all our river bluffs are in a sense winners, and since (in this example) we win 30 percent of the time on the river (when we bet), to offer 2-to-1 odds it now means that *on the turn* we must bluff another 15 percent of the time to balance the 30 percent we bet on the river. That is 30-to-15 is the same as 2-to-1.

So notice what we have done. We'll now be betting 45 percent of our flop range on the turn. It'll be made up of our 20 percent value bets, our 10 percent river bluffs, and an additional 15 percent turn bluffs. So now instead of having two-thirds of our bets, as we do on the river, be value bets, we'll actually have on the turn four-ninths value bets, and also notice that four-ninths is two-thirds squared.

$$\frac{4}{9} = \left(\frac{2}{3}\right)^2$$

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And when we go back to the flop, the same thing will happen again. Since we'll be making a pot size bet, and also will be betting 45 percent of our hands on the turn, to offer 2-to-1 odds, we now need to add in another 22.5 percent bluffs.

$$22.5 = \frac{45}{2}$$

Thus, on the flop, we'll be betting 20 percent value bets, 22.5 percent flop bluffs, 15 percent turn bluffs, and 10 percent river bluffs which comes to a total of 67.5 percent of our flop range. And similar to before, instead of having two-thirds of our bets, as we do on the river, be value bets, we'll actually have on the flop $\frac{8}{27}$ value bets, and also notice that this fraction is two-thirds cubed.

$$\frac{8}{27} = \left(\frac{2}{3}\right)^3$$

So let's repeat what we have actually done. The key here is once again making sure to understand that every time our opponent faces a bet from a balanced river betting range he has effectively lost the hand, and every time the river is checked, he will win. So when we bet the turn for one pot sized bet, the river must be bet with a balanced range (in this example) two-thirds of the time, and a balanced river betting range includes two-thirds value bets. These fractions can be multiplied to show that four-ninths

$$\frac{4}{9} = \left(\frac{2}{3}\right)\left(\frac{2}{3}\right)$$

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of our turn bets need to be value bets. In other words, since there is an additional street left to act, we can bluff more often on the turn, and five-ninths of our turn bets should be bluffs.

But we weren't quite done as we still had to figure out what fraction of our flop bets needed to be value bets. So once again, by betting one pot sized bet on the flop, our opponent is offered 2-to-1 odds on his call, so he only needs to win one-third of the time. And just as before, the odds our opponent is offered now determine how often the following street must be bet with a balanced range. Here, our opponent needs to win one-third of the time to be indifferent to calling, so the turn must be checked one-third of the time (in which case our opponent will always win) and bet two-thirds of the time (in which case he has effectively lost). So, if our flop betting range must be able to bet the turn two-thirds of the time, the river two-thirds of the time after betting the turn, and if two-thirds of our river bets must be value bets, then $\frac{8}{27}$ of our flop bets must be value bets

$$\frac{8}{27} = \left(\frac{2}{3}\right)^3$$

meaning that the remaining $\frac{19}{27}$, or *approximately 70 percent, of our flop bets should be bluffs.*

There's another interesting fact that should be pointed out. If you were to ask a typical poker player how he should bet, many will tell you to bet your good hands and then bluff a little. Of course there's more to it than this, but on the river this is roughly right. But it has now been shown that on the flop, approximately 70 percent of our bets should be bluffs,⁹ and this will be

⁹ In these cases where it seems likely that your opponent has a good hand rather than a great hand or a draw and will likely at most call hoping you won't bet again.

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counterintuitive to many people. But this is accurate since there are still two streets left. This concept is important to solid theoretical play, so it must be understood well before moving on. It may help to visualize this by examining what hands are in each betting range. So let's once again repeat some of what has already been covered.

On the flop, it's useful to imagine that our betting range consists of four types of hands — flop bluffs, turn bluffs, river bluffs, and value hands. A flop bluff is a hand which will bluff on the flop but will check-fold on the turn, while all of our turn bluffs, river bluffs, and value hands will keep betting. Since our opponent is being offered 2-to-1 odds on our pot size flop bet, only two-thirds of our flop betting range should continue betting on the turn. In other words, our turn bluffs, river bluffs, and value bets must make up two-thirds of our flop betting range while only one-third of our range should be flop bluffs which won't be bet on the next street if our opponent calls.

Our turn betting range is similar to our flop betting range except our flop bluffs are no longer in this range as they will be check-folded. In other words, the turn betting range consist of turn bluffs, river bluffs, and value hands, but only river bluffs and value hands will be bet on the river. Just as before, two-thirds of our turn betting range should be bet on the river, so river bluffs and value bets should make up two-thirds of our turn betting range while the remaining one-third should be turn bluffs.

Lastly, on the river, our betting range will consist of only two types of hands, river bluffs and value hands. As can clearly be seen, our betting range now includes much fewer hands than it did on the flop as all of our flop bluffs and turn bluffs have been check-folded. And since our betting range includes fewer bluffs but all of our value hands are still being bet, the ratio of value bets to bluffs is now significantly higher than it was on the flop or the turn. This concept of bluffing less aggressively on each following street consistently appears when analyzing theoretical play.

There's two more points that need to be made.

1. The size of the bet relative to the size of the pot determines how often you bluff. So in our 20 percent value bet example, if we were to make half-pot size bets instead of full pot size bets, our opponent would be getting offered odds of 3-to-1 instead of 2-to-1. This means the river should consist of 20 percent value bets and 6.67 percent river bluffs (for a total of 26.67 percent). The turn should be 20 percent value bets, 6.67 percent river bluffs, and 8.89 percent turn bluffs for a total of 35.56 percent. And the flop should be 20 percent value bets, 6.67 percent river bluffs, 8.89 percent turn bluffs, and 11.85 percent flop bluffs (for a total of 47.41 percent).
2. It's also possible to have such a strong range that there won't be enough bluffs on an earlier street. For instance, in our original example, suppose there were 40 percent value bets and we were again making pot-sized bets. Then the betting range on the river would be 60 percent, on the turn it would be 90 percent, and on the flop it would be 135 percent. But since it's impossible to bet 135 percent of all hands, it would just mean that all hands in the flop range would be bet on the flop.

Now let's return to the previous situation where a bet sizing of 57 percent of the pot is going to be utilized on the turn and river. In this situation, if we bet 57 percent of the pot on the river, our opponent will risk 0.57 pot sized bets to win 1.57 pot sized bets. This requires 73 percent of our river bets to be value bets.

$$(1.57)(1 - X) - (0.57)(X) = 0 \Rightarrow$$

$$X = 0.73$$

And when we bet the turn for 57 percent of the pot, our opponent once again risks 0.57 pot sized bets to win 1.57 pot sized

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bets. This means, when we bet, he must effectively lose 73 percent of the time to be indifferent to calling or folding, and this requires us to bet the river 73 percent of the time to make our opponent indifferent to calling on the turn. (Remember, when we bet the river, our opponent has effectively lost, but if we check, he will always win). Since we need to bet the river 73 percent of the time, and only 73 percent of our river bets need to be value bets, 53 percent of our turn bets must be for value.

$$\text{(River Betting Frequency)(Percent of River Bets Which Are Value Bets)} =$$

$$(0.73)(0.73) = 0.53$$

Lastly, we must make sure we're betting the turn at the right frequency to keep our opponent indifferent to calling our flop raise. If we raise a 6 big blind bet into an 8 big blind pot to 18 big blinds, our opponent risks an additional 12 big blinds by calling to win the 32 big blinds already in the pot. Again, since our opponent always effectively loses when we bet the following street but wins when we check, we must bet the turn 73 percent of the time after raising the flop. (Notice it's again 73 percent since our raise is approximately a 0.57 pot sized raise.)

In other words, since we're either raising or betting 57 percent of the pot on each street, we need to bet the turn 73 percent of the time, bet the river 73 percent of the time after betting the turn, and 73 percent of our river bets need to be value bets. We can multiply these frequencies together to figure out what percentage of our raises on the flop should be value raises. That is, the percentage of raises on the flop that need to be for value are determined by the following equation:

$$\text{(Turn Betting Frequency)(River Betting Frequency)(Percent of River Bets Which Are Value Bets)} = (0.73)(0.73)(0.73)$$

which is the same as:

$$(0.73)^3 = 0.389$$

While the numbers are a bit different from those in the previous example where we made pot size bets, notice the concept of raising or betting all our value hands on each street and removing some bluffs from our range on each additional street is still present. The majority of our flop bets are bluffs, around half our turn bets are bluffs, and just over a quarter of our river bets are bluffs. That's because some of our bluffs on the flop, i.e., flop bluffs, will drop out of our betting range and check-fold on the turn.

In reality, we'll never be raising the flop with a perfectly polarized range. Our bluff raises will sometimes get a lucky turn or river and improve to strong hands, and likewise our value raises will occasionally get an unlucky turn or river and become weak hands. Therefore, it's necessary to take into account the fact that we'll often have a different amount of strong hands on the river than what was started with when we raised on the flop.

In addition, sometimes a value or bluff raise will become a marginal hand on the turn or river. When this occurs, it may be best to check back, especially when in position, and attempt to win at showdown. Notice that we will not always be able to bet all three streets when our holding is best.

Lastly, if we fold to a turn bet, it might turn out that the folded hand would have improved to the best hand on the river, and if we bet the turn and make our opponent fold, he might be folding a hand which would have outdrawn us. Again, keep in mind that position is very valuable. That's because the player in position has a much easier time realizing the equity of his semi-bluffs than the player out of position. Specifically, while our opponent will often fold his weak hands when we bet the turn, if our holding is weak, we can check back the turn after raising the flop and occasionally get lucky on the river.

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Let's now imagine a case where our value hands have 80 percent equity and our semi-bluffs have 20 percent equity against our opponent's calling range. This looks like a more accurate distribution of equity for actual hands on the flop since gutshots and weak pairs often have around 20 percent equity. Furthermore, let's assume we'll always bet the best hand on the turn and the river. While we won't in reality have perfect information, we do have the advantage of position and will usually know if our hands are likely to win at showdown and can bet accordingly.

We now need to figure out what percentage of our raises on the flop should be value raises given these conditions, and it turns out that under the above condition, only 31.6 percent of our flop raising range needs to be a value hand.

$$(0.8)(X) + (0.2)(1 - X) = 0.389 \Rightarrow \\ X = 0.316$$

where

0.8 represents 80 percent equity,

0.2 represents 20 percent equity, and

X is the proportion of our flop raising range which can be value bet on the river

Notice we can now bluff significantly more on the flop, 68.4 to 61.1 percent than we could when we were raising a perfectly polarized range.

$$0.684 = 1 - 0.316 \text{ and} \\ 0.611 = 1 - 0.389$$

The equity of our bluffs has increased by 20 percent while the equity of our value hands has decreased by 20 percent, yet since we raise more bluffs than value hands on the flop, this caused the overall equity of our range to increase. Furthermore, if we didn't lower our value to bluff raising ratio on the flop, we would get to

the river with too many strong hands and our opponent could exploit us by folding all his bluff catchers.

In fact, as we change the equity of our value raises or bluff raises, we can see a very clear causation. If all else is equal, increasing the equity of either our value hands or semi-bluffs allow us to bluff more aggressively on the flop. In other words, the more equity our value raises and bluff raises have, the more weighted towards bluffs our raising range should be. This leads to the following rule:

While the exact ratio will change based on the board texture and cannot be solved for, a good rule of thumb is to have around 2 bluff raises for every 1 value raise on the flop when in position.

Players often get confused when talking about draws in polarized ranges since they are used to hands in polarized ranges either being clear value bets or clear bluffs. Yet a draw will function like a value bet when it improves to a strong hand and like a bluff when it misses. In fact, it's often useful to remind ourselves that "betting a draw on the flop is either a value bet or a bluff; we're just not sure which one."

We can also use the same equation used earlier to figure out how many bluff combos are needed to add to our raising range for each draw we raise. Furthermore, whether a draw allows us to bluff additional or fewer hands depends on how many streets are left, stack depth, and how much equity the specific draw has.

Here's an example. Sticking with our previous assumptions, we can solve for how many bluffs can be added to our flop raising range if we raise the nut flush draw which often has 47 percent equity against a typical bluff catcher.

$$(X)(0.47) + (1 - X)(0.2) = 0.389 \Rightarrow$$

$$X = 0.70$$

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That is, we need to raise 0.7 strong draws for every 0.3 bluff raises. This requires us to bluff approximately one hand combination for every 2.3 nut flush draws we raise in order to be balanced.

$$2.3 = \frac{0.7}{0.3}$$

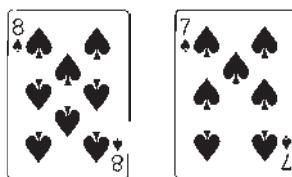
While each made hand on the flop that was raised for value required us to bluff raise multiple hands to be balanced, we need to raise multiple strong draws to bluff raise a single hand combination. This is due to the fact that even the strongest draws will have less equity than strong made hands. Nevertheless, raising strong draws on the flop can still be effective since it prevents our range from being too transparent and can make our opponent fold what would be the winning hand.

Increased Complications in the Bluffing to Value Raising Ratio

Since perfect information will not usually be available when playing against our opponent, we will now attempt to account for some of the simplifications made in the previous chapter. Even if a perfect value raising to bluff raising ratio cannot be solved for directly, we can analyze different board textures and make some key adjustments to ensure our raising range is reasonably balanced.

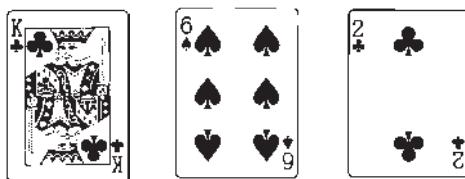
In the previous chapter, it was assumed that we would successfully bet all three streets with hands which will be the best hands on the river. In reality, we will not always bet both the turn and the river with the winning hand. Our value raises will sometimes get awful turn and river cards which will require a check even though our hand is still likely to win at showdown, and we won't always bet the turn with our bluffs which will improve on the river. In addition, some bluffs are much more effective at ensuring we bet all three streets when the bluff will improve to the best hand by the river.

Here's an example. We call on the button with the



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against a middle position open and the flop comes the



This hand has around 10 percent equity and works well as a bluff raise since the turn card “signals” to us how likely we are to improve on the river — a spade gives a flush draw, a nine or five gives an open ended straight draw, and any eight or seven gives us a pair with five outs against top pair. We’ll then bet when the turn comes one of these cards since there’s a good chance we’ll outdraw our opponent on the river. If the turn does not come one of these cards, we’ll check, and on a blank turn card it’s very unlikely our holding will become best on the river anyway.

Conversely, a pocket pair will be a much less effective bluff raise than the $8\spades 7\spades$ in the above example despite both hands having a similar amount of equity. That’s because the turn card does not tell us whether or not our pocket pair is likely to improve on the river. If it does improve to a set, we will have usually checked the turn, and this requires us to lower our value raising to bluff raising ratio on the flop.

In addition, sometimes our opponent will fold to our turn bet and other times we will fold to our opponent’s flop 3-bet or turn check-raise. While the net result of this is ambiguous, since we’re in position, it’s probably more likely our opponent will fold a hand which would have outdrawn us than vice versa. Notice that being in position is a significant advantage which the model in the previous section was unable to accurately describe. In addition, it was previously assumed we would always lose the hand once it was checked through the turn, but by being in position, we’re guaranteed to see the river after checking and may improve to the best hand.

Last, in some cases, our opponent will make us fold the best hand on the river. To illustrate this, imagine we raise a gutshot on the flop and decide to check the turn after making a weak pair. If our opponent has a missed draw on the river, he'll often bluff and make us fold the best hand. Normally, our opponent will fold the best hand to our bluffs since we have the polarized range as the flop raiser, but there are less common occurrences where he'll make us fold the best hand.

So while on most board textures a 2-to-1 bluffing to value raising ratio is likely a good starting point for designing raising ranges in position, poker is a complex and dynamic game. That is, it's important not to make the game out to be simpler than it actually is. Put another way, models can greatly increase our understanding of poker and provide us with estimations of what frequencies and ratios work in different spots, but they cannot take into account all the possible variables. And always remember that the best players are able to quickly adjust their flop raising range to take into account small details which the previous model was unable to incorporate.

Required Hand Strength to Value Raise a Made Hand

While the previous section addressed how to design a balanced flop raising range which consists of the proper ratio of value to bluff raises, we have not yet considered how strong a hand must be to effectively value raise the flop. To do this, we now must calculate what percentage of our opponent's flop betting range should go to showdown if we raise the flop and bet the turn and river. If we raise our opponent's 6 big blind flop bet to 18 big blinds, he must defend at least 43.8 percent of his flop betting range to prevent us from being able to profitably bluff any two cards.

$$(14)(1 - X) - (18)(X) = 0 \Rightarrow \\ X = 0.438$$

where

14 is the size of the pot after our opponent bets,

18 is the size of our bet, and

X is the percent of the flop betting range that our opponent must defend with.

On the turn we risk 25 big blinds to win the 44 big blinds in the pot. This requires our opponent to defend at least 63.8 percent of his turn range to prevent us from being able to profitably bluff with any two cards.

$$(44)(1 - X) - (25)(X) = 0 \Rightarrow \\ X = 0.638$$

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where

44 is the size of the pot,

25 is the size of our bet, and

X is the proportion of times our opponent needs to defend.

Finally, on the river we can go all in and risk 54 big blinds to win the 94 big blind pot. Our opponent must call our river bet exactly 63.5 percent of the time to keep us indifferent to bluffing.

$$(94)(1 - X) - (54)(X) = 0 \Rightarrow$$

$$X = 0.635$$

where

94 is the size of the pot,

54 is the size of our bet, and

X is the proportion of times our opponent needs to defend.

We can now multiply these frequencies together to find out the minimum amount of hands our opponent must feel to our flop raising range if he defends only by calling. This comes to 17.7 percent.

$$0.177 = (0.438)(0.638)(0.635)$$

So if our opponent intends to only defend against our flop raises by calling, he will need to defend more than 17.7 percent of his flop betting range since our bluffs will usually have some equity when called. Furthermore, if he only defends the minimum, we will always be able to profitably bluff raise the flop and will never fold to our opponent's bet or raise. That's because our flop bluff raises will immediately break even and then occasionally get lucky on the turn and river to beat our opponent.

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It's impossible to calculate exactly how much our opponent must defend on the flop and turn when he defends by sometimes calling (and sometimes raising). While it's possible to solve for the minimum amount he must defend, we can't solve for how much "extra" he needs to call on the flop and turn to make up for the fact that our bluffs will sometimes improve to the best hand. The more our opponent defends by calling and the more likely our bluffs are to become the best hand by the river, the wider his defending range must be on the flop and turn.

Furthermore, since our flop raising range is polarized, we know our opponent will usually defend by calling rather than 3-betting. While his exact defending frequencies are unsolvable and will depend on board texture, increasing our opponent's flop and turn defending frequencies each by a little bit seems reasonable. So if we assume he'll now defend 50 and 67 percent of his range on the flop and turn respectively, our opponent will need to felt around 21 percent of his flop betting range if he only defends by calling.

$$0.21 = (0.50)(0.67)(0.63)$$

Therefore, for our river jam to be profitable in position, our hand needs to win half the time when called down.¹⁰ ¹¹ So by assuming our opponent's calling range is static — his weak hands will never improve and strong hands will never weaken — we can

¹⁰ Since betting in position reopens up the betting, it does not make sense to value bet unless our hand wins at least half the time when called. If it loses more often than it wins, betting, relative to checking, will cost money and therefore the hand should just be checked to guarantee a showdown. However, as will be discussed later, this isn't necessarily true when we're out of position.

¹¹ Slightly more than half the time if our opponent will occasionally bluff raise.

solve for how strong a hand must be to value raise the flop. Specifically, if our opponent only defends by calling and his calling range is static, our value raises must not be beat by more than 10.5 percent of our opponent's flop betting range to be able to effectively value raise.

$$0.105 = (0.21)(0.5)$$

While the previous model gives us a good idea of how strong a hand needs to be to value raise on the flop and go all in on the river, there are a few other nuances we must be aware of when raising the flop. The first is our opponent's flop calling range is not static, so he won't simply call down with the top 10.5 percent of his flop betting range. The range he defends on the turn and river will be based on what the turn and river card is respectively. So while our opponent may choose to felt 10.5 percent of his flop betting range, neither he nor ourselves know what that range will be exactly until we see the turn and river cards.

The equity of the hands we are ahead of on the flop is also important. For example, suppose we have a hand which is only behind 10 percent of the hands in our opponent's flop betting range. If he has many high equity draws in his range as well, it may not be possible to value raise the flop and bet on many turn and river combinations. That's because too many hands in our opponent's range will have improved to beat us by the river and we will lose over half the time our river bet is called.

This is easiest to visualize by imagining an opponent whose flop betting range consists of 10 percent nutted hands with 100 percent equity and 20 percent combo draws with 45 percent equity. That is, when he has our value raises beat on the flop, we'll never outdraw him, yet many draws in his flop calling range will improve to beat us by the river. One consequence is that this opponent will be able to 3-bet the flop at a high frequency or call and get to the river with the best hand too often to make raising effective.

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Lastly, there are other times to value raise the flop even if we know it's not likely all our chips will be all-in on the river. This occurs when it's desirable to make many hands in our opponent's flop betting range fold before they are able to realize their equity. Specifically, making our opponent fold many hands whose equity is between 20 to 25 percent is very valuable and will encourage us to raise more aggressively.

Again, as is always the case when using models, every variable will not be taken into account and judgment must be used when creating ranges. For instance, there will be times to value raise the flop when we are beat by more than 10.5 percent of the hands in our opponent's betting range, but it's also important to be aware of our findings and not get reckless with our flop value raises.

Also, notice that our findings seem to suggest tight raising ranges, but it actually makes perfect sense with what we saw in the previous section. When the bluffing to value betting ratio is approximately 2-to1, we can still raise the flop aggressively even if the number of value raises seems small.

Delaying a Raise on a Dry Board

Since calling keeps our opponent's range wider than raising, when we have a very strong hand with near 100 percent equity, we'll usually want to call when facing a bet in position and delay our raise to a later street. Calling keeps all of our opponent's bluffs in his range, and we can still be all-in at showdown by raising the turn or river. The mathematics for this will be discussed in more detail throughout the book, but it's important to acknowledge two concepts now:

1. Since raising is much more expensive than calling, our opponent will fold a large part of his betting range to our raise. So when we raise he'll never get the chance to realize the equity of many of his bluffs.
2. Calling a flop bet and raising a later street will often require our opponent to put more money into the pot with his range by the river than raising the flop will.

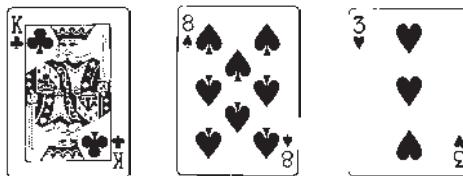
The fact that calling rather than raising on some flop textures results in the average final pot size being larger seems counter-intuitive and often confuses players. Nevertheless, if our hand has 100 percent equity and is facing a flop bet, we'll often be able to raise on the turn or river, and by delaying the raise, we expect to get more value from our opponent's bluffs.

This is one of the reasons we rarely want to raise our strongest hands on dry boards and will instead only defend by calling. Our opponent's bluffs don't have much equity in these spots and usually require multiple cards to outdraw us. Therefore, we can call with our strong hands on very dry boards and then

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either raise any turn card or call again and potentially raise the river.

Here's an example. Our opponent opens in middle position and we are the only caller on the button, it makes little sense to raise any hands if the



flops. There should be no hands in our range which are strong enough to raise but also concerned with letting our opponent's bluffs see additional cards. Specifically, the only hands strong enough to value raise on this flop are sets, and they are so strong that we can call with them and still comfortably raise any turn card.

When we do call with our entire defending range, many weak hands will be included. If our raising range does not include hands which would work well as bluff raises, then we should be mostly calling instead. That's because if these hands are not included in our calls, our range on the turn will be too strong and our opponent's bluffs will be very profitable (for him) on the flop.

Here's an example. On the previously mentioned K♣8♠3♥ flop, it becomes correct to call with hands like the T♦9♠ with the runner-runner flush draw. Then, if the turn does give us a flush draw, straight draw, and possibly even a pair, we can call again and hope to improve on the river and win a large pot. But if our opponent checks to us on the turn or river, our hand will almost always become an effective bluff.

In addition, our out of position opponent will often double barrel his turned flush or straight draw and give us the opportunity to raise him (with a balanced range which includes some draws). And when this occurs, he'll find himself in an awkward and

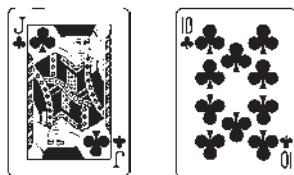
Delaying a Raise on a Dry Board 127

unprofitable position. Furthermore, if he folds to our raise, the equity of his holding will not get realized, and if he calls, the opportunity to bluff if his draw misses on the river will be gone. So as we already know, position is a powerful advantage and defending by only calling on some board textures is almost certainly theoretically correct.

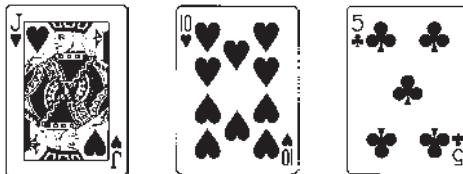
Delaying a Raise on a Wet Flop

We do not want to frequently delay our raises with strong hands which can be outdrawn by our opponent's bluffs when many turn cards will give him the best hand, and some which don't may still cause us to lose action. Therefore, when our opponent's bluffs have the potential to immediately outdraw us on the turn, it's usually best to raise the majority of our very strong hands on the flop.

Here's an example. Suppose our opponent opens in middle position and we call with the



as the only caller on the button. We will not likely want to slowplay if the



come on the flop since our hand is both strong enough to raise yet still vulnerable to his bluffs. And if we do just call, a raise on the turn would be ineffective on any ace, king, queen, nine, eight, or heart and probably should be made. Hence, this means the

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majority of the time we call our opponent's flop bet, he'll likely be able to see both the turn and river card and fully realize the equity of his bluffs. Since this is so risky, raising rather than calling on the flop will usually be the superior play.

The previous point warrants repeating one more time. We must keep in mind not only whether or not our opponent can outdraw us on the following street (the turn), but also if he can runner-runner the best hand. For example, if we slowplay a set on the 8♥6♥2♣ flop and the turn card comes a heart, our set will no longer be strong enough to raise. So if our opponent bets, we can only call giving him the opportunity to outdraw us (on the river) with a hand like A♥J♣.

Nevertheless, if slowplaying a strong hand on a wet board is not part of our strategy, we might find ourselves especially vulnerable to overbets on the turn. So when debating whether to slowplay a strong hand on this type of flop, it's a good idea to take into account how many turn cards will improve hands in our range. If most turn cards do put strong hands into our range, our opponent will not be able to overbet effectively.

Here's an example. If the flop is the Q♥T♣6♥ and we call our opponent's bet, nearly every turn card improves some hands in our range. Any ace, king, jack, or nine gives us either two pair or straight possibilities, and queens and tens can give us trips and have an important removal effects. In fact, the only cards which don't significantly improve some hands in our range (on the turn) are the offsuit six, five, four, trey, and deuce which only make up 15 cards for less than one-third of the deck. Therefore, since some hands in our range will improve on most turn cards, slowplaying becomes much less critical on this board.

Finally, keep in mind that the riskier slowplaying a big hand is, the greater the reward should be. That is, calling will often be worth the risk on boards where our opponent will overbet the following street frequently. And although he will sometimes draw out with his bluffs that would have folded to our raise, we'll also sometimes win his stack when he overbets a worse hand for value or overbet bluffs.

Facing a Flop 3-Bet

Sometimes our raised opponent will choose to defend his flop betting range by 3-betting rather than calling. He will tend to do this on board textures where his very strong hands are vulnerable to being outdrawn by our bluffs. Knowing this, if he never 3-bets the flop, we will get to realize the equity of our flop bluff raises too often. Nevertheless, our flop raising range is already quite polarized, so our opponent cannot effectively 3-bet us on the flop at a high frequency.

On the flop, if our opponent 3-bets us to 36 big blinds, he risks an additional 30 big blinds to win 32 big blinds. This requires his bluff to succeed 48 percent of the time to make an immediate profit.

$$(8 + 6 + 18)(X) - (30)(1 - X) = 0 \Rightarrow$$

$$X = 0.48$$

where

8 is the initial size of the pot,

6 is the size of the first bet,

18 is the call of 6 big blinds plus a raise of 12 more, and

30 is the call of the 12 big blinds plus a raise of 18 more.

Since our opponent's bluff must succeed 48 percent of the time to yield an immediate profit, we should defend at least 52 percent of our flop raising range. Also notice that our opponent's flop 3-betting range will be extremely polarized because he's raising against an already polarized range. And since his range is so polarized, we'll often defend by calling and utilizing our positional advantage on the turn.

When we call, the pot will be 80 big blinds and each player will have a 60 big blind stack remaining. How often we need to

Facing a Flop 3-Bet 131

call our opponent's turn jam will be determined by how much equity we expect his worse theoretically correct bluff to have. Just as was the case when calling 5-bet jams preflop, our opponent is guaranteed to realize the equity of his bluff once called. This requires us to defend a wider range than we otherwise would.

Consider the following equation:

$$(80)(X) - [60 - (200)(\text{equity of bluffs})](1 - X) = 0$$

where

X is the frequency our opponent's bluff must succeed to show a profit.

This formula can be used to solve for how often our opponent's bluff must succeed to make jamming profitable. If a 10 percent equity (this is around the equity of a gutshot) on his bluffs is assumed, we get that X is 33 percent.

$$\begin{aligned}(80)(X) - [60 - (200)(0.1)](1 - X) &\Rightarrow \\ (80)(X) - (40)(1 - X) &= 0 \Rightarrow \\ X &= 0.33\end{aligned}$$

Therefore, our opponent's bluff must succeed 33 percent of the time to make jamming a hand with 10 percent equity profitable, and this requires us to call with 67 percent of our turn range. And if he 3-bets the flop and bets a 10 percent equity hand on the turn, we must defend at least 35 percent of our flop raising range.

$$0.35 = (0.52)(0.67)$$

where

0.52 is the proportion of our flop raising range that we call our opponent's flop 3-bet, and

0.67 is the proportion of our turn range that we call with.

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If we are raising the flop with a ratio of around 2 bluffs for every 1 value raise, then at least 33 percent of our flop raises will be value raises or very strong draws. Since we only need to felt 35 percent of our flop raising range to our opponent's 3-bet, this will result in us felting only very strong hands.

Notice that when our opponent 3-bets the flop, he takes away our need to keep bluffing and makes our felting range much tighter. If he calls our flop raise, our turn and river bets should be done at a high frequency, and have a balanced river betting range which includes bluffs. However, in our original model, when our betting percentage for both the turn and the river was 73 percent, we end up felting 53 percent of our flop raising range.

$$0.53 = (0.73)(0.73)$$

Although we will not always bet the turn and river 73 percent of the time after raising our opponent on the flop — his flop 3-bet allows us to felt a much tighter range. It's often correct for our opponent to 3-bet us (on the flop) to prevent us from seeing a turn card with our raise-folding range, but this comes at a high price by allowing us to felt a very strong range with no bluffs.

A common leak many players have is they only want to raise the flop for value if the hand plays well against the opponent's flop 3-betting range. This of course makes sense if we raise on a specific flop texture where our opponent will only defend by 3-betting or folding. But on the majority of flop textures, he will mostly defend by calling. Remember, our flop raising range is polarized, and by raising we represent a very strong or very weak hand (and occasionally a draw). And if our opponent is value 3-betting against this range, his hand must be incredibly strong to beat hands in our value raising range.

Therefore, we should not be concerned if we value raise a hand which is beat by all of our opponent's value 3-bets. This is similar to the way we need to 3-bet aggressively against button opens when in the blinds with hands like ace-queen, ace-jack, and

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tens even if these holdings are never ahead of hands in our opponent's value 4-betting range. Our value raises do well when called, and if our opponent re-re-raises, we simply have to deal with it when it happens.

Defending by Both Calling and Raising

We now have all the necessary tools at our disposal to play well against a flop bet in position. While many more hand examples are included in the back of the book, we'll now consider some questions and answers related to defending against a flop bet.

Question No. 1: *How wide do we need to defend so that our opponent can't bet any two cards out of position profitably?*

Answer: The first step in our thought process is how aggressively to defend to keep our opponent from being able to profitably bet any two cards. This can be done quickly in our head for random bet sizings, but we should be especially comfortable with the normal bet sizes and have memorized the corresponding defending frequencies. We should also be comfortable with defending very wide on flops where our opponent bets small and folding more of our range when he bets large.

Question No. 2: *What hands do we want to raise for value?*

Answer: First, we need to figure out if our hand is strong enough to value raise and will later add enough bluffs so that our range is reasonably balanced. It's usually easier to figure out what hands to value raise first and then add in the right amount of bluffs. However, on some tricky board textures, it may be best to work backwards and first see what hands are appropriate to bluff raise and then balance the range with value raises.

Defending by Both Calling and Raising 135

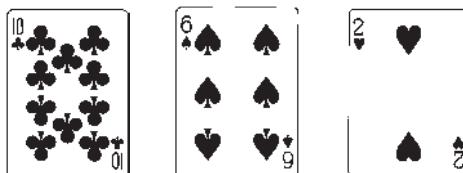
Question No. 3: *How many bluffs do I need to raise so my range will be balanced?*

Answer: In general, a good starting point is to assume two bluff raises for every value raise on the flop. This will usually get us close to the correct ratio and we can then adjust the frequency based on how much equity we think our value hands and bluff raises have. If it's our opinion that our bluff raises have significantly more than 20 percent equity, our bluffing frequency should probably be a bit more. Likewise, if we think our bluff raises have less than 20 percent equity, then bluff a bit less. Similar logic applies for raising our value hands.

It's also correct to bluff raise on the flop approximately two hands for every one strong hand we value raise. In addition, keep in mind that making sure our value to bluff raising ratio is balanced is much more important than making sure we've added enough bluffs to account for our draws — a few draws won't drastically impact how many bluffs are necessary to have in our raising range.

Question No. 4: *How many hands do we need to call in order to make a game theoretically optimal opponent unable to continuation bet more or less than the optimal amount?*

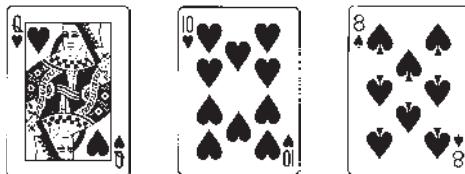
Answer: This is probably the hardest step since it's necessary to make sure we're calling around the right amount of hands and not folding too much or too little. If the board texture misses our range and our opponent's range, such as a flop of the



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then we must make sure to call aggressively enough despite not having many strong hands. That's because calling too little lets our opponent bet recklessly since his bluffs are so profitable.

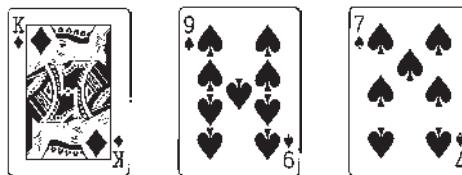
Conversely, if the flop hits both our ranges well, such as on a flop of the



then it's necessary to make sure we're not calling too many optimistic hands. That is, if our calling range is too wide, our opponent will not bluff many hands (on the flop) and his value bets will be too effective. So in this case, we'll want to defend between 65 to 70 percent of our flopping range against a 75 percent pot sized bet when in position (since our range is strong and position is valuable), but the exact frequency will depend on the board texture.

Example of Balancing a Defending Range on the Flop

Suppose we flat a middle position open on the button with the range listed in the hand chart (JJ-33, AKo-AQo, AQs-ATs, KQs-KTs, QJs-QTs, JTs-J9s, T9s, 98s, 87s, 76s, 65s, 54s) and the flop comes the



We can defend against a flop bet in the following manner:

- **Total Combos:** 125
- **Desired Combos Defended:** $(125)(0.60) = 75$
- **Value Raises:** 99(3), 77(3), Q♠J♣, Q♠T♣, J♠T♣ = 9
- **Bluff Raises:** A♦Qx(3), QTs (3), 87s(3), 76s(3), 6♦5♦, A♦T♦ = 14
- **Calls:** AKo(9), KQs(3), KJs(3), KTs(3), JJ-TT(12), A♠Q♣, A♠J♣, A♠T♣, 6♠5♣, 5♠4♣, JTs(3), J9s(3), T9s(3), 98s(3), A♦Q♦, A♦J♦, QJs(3) = 52

Total Combos Defended: 75

This is a basic example of how to balance a flop defending range. We did not slowplay any sets, but since our calling range includes all our ace-king combos and there are many turn cards which can improve some of the listed hands, it will be difficult for

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our opponent to overbet the turn effectively. In addition, since sets are such strong value raising hands, and we are in position, we can comfortably bluff raise two hand combinations for every set.

Notice how aggressively we're raising this flop even though no ace-king combo is included. So there are 23 raising combos on the flop which comes to 18.4 percent of the total hands played. And once we raise 23 combos, only another 52 combos are needed for calling, and this can be done quite easily. Furthermore, we need to bluff raise with hands, such as a gutshot with the A♦T♦, which can improve to beat hands in our opponent's strong bet-calling range. Plus, it's good strategy to call with top pair and middle pair hands which are likely the best hands on the flop but are unlikely to improve and beat very strong hands by the river.

And finally, it should now begin to be apparent how ineffective it is to recklessly bet the flop out of position against an optimal player. In addition, if it was clear our opponent was betting the flop recklessly, we could exploit him by widening our defending range and start value raising ace-king and also add in some additional bluff raises. While it's true that someone can still be a winning player if they continuation bet recklessly against bad players, this strategy will do poorly against strong players who know how to balance a raising range and defend against bets aggressively.

Summary

Although there are thousands of different possible flops, by understanding some general rules and frequencies, we can design balanced ranges in position. While quickness and precision can improve only with practice, it should now be apparent how to approach most flop textures when facing a bet. The process of raising our strong yet vulnerable hands and some bluffs which retain their equity occurs on every street, and by aggressively raising balanced ranges in position, our opponents will constantly sigh as we leave them with no desirable option.

1. On board textures where our opponent should not be able to profitably bet any two cards, we usually need to defend against a flop bet around 60 to 70 percent of the time. This will still give him an incentive to bluff with the right types of hands, but it will also limit the amount of value for his value betting hands. But the exact percentage needed to defend against a flop bet is unsolvable and will depend on how frequently we are raising and calling as well as the board texture.
2. Calling allows our opponent to see a turn card with his entire betting range whereas raising requires him to fold the majority of his bluffs. Since our opponent's bluffs can improve to beat hands in our calling range on the turn, it becomes necessary to defend with extra hand combinations if we are defending by calling rather than raising.
3. In our model with a perfectly polarized flop raising range, the proper betting frequency on both the turn and the river to make our opponent indifferent to calling our flop raise is 73 percent. In addition, 73 percent of our river bets need to be

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for value. This means that 39 percent of our flop raises need to be for value.

4. Our next model suggested we usually want approximately two bluff raises for every value raise on flops where our value raises and bluff raises have 80 and 20 percent equity, respectively.
5. Our opponent is usually required to felt at least 20 percent of his flop betting range. If he felts less than this, it will be profitable for us to recklessly bluff.
6. When our opponent 3-bets the flop, he takes away our ability to see the turn and river card cheaply with our bluff raises. But by doing this, our felting river range will be stronger with no bluffs.
7. Our calling range should be designed so some hands improve on the vast majority of turn cards. This prevents our opponent from being able to recklessly overbet the turn.
8. We usually want to delay raising until the latest possible street with very strong hands on dry boards. This keeps our opponent's range wide and we get additional value from his bluffs. While this works well on dry boards, it's usually best to raise the flop with strong hands on wet boards since allowing our opponent to see the turn card with his bluffs is risky.
9. Betting recklessly out of position on the flop is ineffective against good players. Optimal defending ranges usually are able to defend with a wide range on the flop yet felt strong and balanced ranges on the river.

Part Five

Whether to Bet or Check in Position

Whether to Bet or Check in Position

Introduction

This section is especially important because it's common to face a flop check when in position and the same concepts introduced now will also apply on the turn and the river. Furthermore, in this spot, due to the strength of position and the fact that our opponent's flop checking range is often weak, it's usually difficult to identify leaks since we'll likely win money even if our play is poor. However, the goal isn't to simply win money, but rather to maximize our winnings by taking the line with the greatest expectation with every hand in our range. And achieving this goal can best be accomplished by developing a strong fundamental understanding of the math and theory that goes along with this situation.

In "Part Four: Facing a Flop Bet in Position," starting on page 97, we examined how to defend against a bet when in position. Since we do not usually want to allow our opponent to profitably bet any two cards, it was possible to estimate how wide our flop defending range needed to be when facing a bet. However, if our opponent checks, although his flop checking range should be weaker than his betting range, we still do not have a clear starting point for how to proceed.

But this is not a problem as many of the same methodologies used in Part Four can be used again to help answer this question. Specifically, the same idea of creating a balanced betting range so our opponent is close to indifferent between calling and folding his marginal holdings will once again be used, and by betting with a balanced range which can improve on a variety of turn cards,

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our opponent will frequently call with the losing hand or fold the winning hand. In addition, by understanding how a flop bet or check determines our opponent's turn range, we can make sure that the right hands are being bet or checked on the flop.

The Value Betting to Bluffing Ratio for 3 Streets of Value

Recall that a player with a polarized range is able to bluff many more hand combinations on the flop than on the river when making pot sized bets. That's because the same value hands are bet on each street, but on the river a higher fraction of the betting range needs to be the value hands to keep the opponent indifferent to calling. We'll use the same approach here and make many of the same assumptions with the only difference being that the bet sizings which will be used are those more common than a pot sized bet.

Specifically, many players usually bet around 75 percent of the pot if they think their opponent can be strong and may be planning on check-raising. One of the reasons for this is that good players don't usually start overbetting until they're confident they can only rarely be beaten, and this usually doesn't occur until the river after their opponent has called twice.

Let's start with figuring out what fraction of our flop bets need to be value bets if we plan on betting 75 percent of the pot on each street with a perfectly polarized range. So by betting this amount on the river, our opponent will risk 0.75 pot sized bets to win 1.75 pot sized bets. This requires 70 percent of our river bets to be value bets.

$$(1.75)(1 - X) - (0.75)(X) = 0 \Rightarrow \\ X = 0.7$$

Although it's easy to figure out what fraction of our 75 percent pot sized river bets must be value bets, as shown in "Part

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Four: Facing a Flop Bet in Position," we must work backwards to find out what percentage of our flop bets should be for value.

The next step is to notice if we bet 75 percent of the pot on the turn, our opponent will once again be risking 0.75 pot sized bets to win 1.75 pot sized bets. And just as discussed before, if our turn betting range is perfectly polarized, this requires us to bet the river 70 percent of the time with a balanced range to keep our opponent indifferent to calling on the turn. That's once again because whenever we bet with a balanced range on the river, our opponent has effectively already lost (since calling and folding both have an expectation of zero), but whenever we check, he'll always win since we would never check a strong hand.

This same process occurs on the flop. That is, if we bet 75 percent of the pot on the flop, then the turn should be bet 70 percent of the time.

In other words, given the above conditions, 70 percent of our river bets need to be value bets, the river must be bet 70 percent of the time after betting the turn, and the turn must be bet 70 percent of the time after betting the flop. Multiplying these frequencies shows that 34.3 percent of our flop bets should be value bets.

$$\begin{aligned} & (\text{turn betting frequency})(\text{river betting frequency}) \\ & \quad (\text{fraction of river bets which are value bets}) = \end{aligned}$$

$$\begin{aligned} & (0.7)(0.7)(0.7) = \\ & \quad (0.7)^3 = 0.343 \end{aligned}$$

Again, this is no different than what we did previously, only now our bets are a bit smaller than pot sized bets. Furthermore, since we're betting slightly smaller than before, a bit more of our bets on each street need to be for value since our opponent is getting a better price to call.

Let's try another example where we figure out what fraction of our flop bets should be value bets, only now assume we're

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allowed to overbet the river and have 1.5 pot sized bets remaining. Remember, although it will be discussed in more detail in future chapters, overbets occur most frequently on the river because if our opponent has called twice, he's less likely to be strong. In other words, betting 1.5 pot sized bets on the river after making two smaller bets is often theoretically correct since it's not until the river that we can comfortably overbet.

Once again, we'll start on the river and work backwards. By betting 1.5 pot sized bets on the river, our opponent will risk 1.5 pot sized bets to win 2.5 pot sized bets. Consequently, since our bet is now larger and our opponent is getting worse odds to call, we are able to bluff more and need only 62.5 percent of our river bets to be value bets.

$$(2.5)(1 - X) - (1.5)(X) = 0 \Rightarrow \\ X = 0.625$$

Now, since we still bet the turn for 75 percent of the pot, our opponent risked 0.75 pot sized bets to win 1.75 pot sized bets. And just like in the previous example, this required us to bet the river 70 percent of the time with a balanced range to keep him indifferent to calling our turn bet. Likewise, our flop bet was also for 75 percent of the pot, and this required us to bet the turn with a balanced range 70 percent of the time.

Let's now determine what percentage of our flop bets need to be value bets if we're betting with a perfectly polarized range and allowed to overbet the river as described.

$$\begin{aligned} & (\text{turn betting frequency})(\text{river betting frequency}) \\ & (\text{fraction of river bets which are value bets}) = \end{aligned}$$

$$(0.7)(0.7)(0.625) = 0.306$$

Notice we're still using the same methodology as before when betting 75 percent of the pot on each street. That is, we've

worked backwards from the river to determine what percentage of our flop bets must be value bets. The only difference is since we're now overbetting the river, fewer of our river bets need to be value bets since our opponent is getting worse odds to call.

Thinking back to the flop raising example in Part Four, we needed to be able to bet the turn and river for value with 39 percent of our flop raising range if our opponent always won once we checked. In contrast, only 34.3 or 30.6 percent of our flop bets needed to be for value on the turn and river in the previous two examples. In other words, we're allowed to bluff more combinations of hands for each strong hand we value bet on the flop when compared to raising on the flop. And this makes sense since there is more effective stack depth when betting rather than raising, and bigger bets relative to the size of the pot allow us to bluff more. Put another way, when bets are larger our opponent gets a worse price to call, and this means a larger fraction of our betting range should be bluffs to keep him indifferent to calling with his bluff catchers.

Most if not all of the rules which apply to raising in position should also be applied to betting in position. For instance, we can bluff more aggressively if we can check back bluffs which improve to marginal hands that can win at showdown. Conversely, if we turn or river the best hand but our opponent can bluff and make us fold, we have to bluff less. Likewise, it's important to take into account how easy it is for each player to realize the equity of their weaker hands. We are once again in position and position is valuable, and this allows us to bluff aggressively on many flop textures.

Let's now estimate how often we need to be value betting the flop when our value bets and bluffs have 80 and 20 percent equity, respectively. If the turn and river must both be bet for value with 34.3 percent of our flop betting range, as was the case when only making 75 percent pot sized bets, then 23.9 percent of our flop bets must be for value if the winning hand is always bet on the turn and river.

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$$(0.8)(X) + (0.2)(1 - X) = 0.343 \Rightarrow \\ X = 0.239$$

Likewise, if we are able to overbet the river and thus only need to value bet the turn and river with 30.6 percent of our flop betting range, then only 17.7 percent of our flop bets must be value bets if the winning hand is always bet on the turn and river.

$$(0.8)(X) + (0.2)(1 - X) = 0.306 \Rightarrow \\ X = 0.177$$

While it intuitively makes sense to think we can bluff aggressively on the flop in position, having over four bluffs for every value bet on the flop seems extreme and counter-intuitive. This is largely due to the fact that in practice, we won't always be able to bet all three streets when we have the winning hand, and we certainly won't be able to overbet all winning hands on the river. And this brings us to our next rule:

As a general guideline, we'll probably want somewhere between 2.5 to 3 bluffs for every very strong hand value bet on the flop in position.

Again, notice that this is likely a much higher bluffing to value raising ratio than most players would expect, similar to the previous section where we learned that we can bluff raise the flop more aggressively than one would likely predict.

The Value Betting to Bluffing Ratio for Less than 3 Streets of Value

Another option on the flop is to bet with the intention of only betting two streets for value rather than all three. This is a useful line. It keeps the pot smaller and the opponent's range wider so weaker hands can be bet for value.

Once again, let's start with a simple example and assume we bet 75 percent of the pot on the flop and turn, and the river cannot be bet. Furthermore, let's assume our bluffs will never improve and our value hands will never be outdrawn. We can again work backwards to see what percentage of our flop bets need to be value bets.

Here, the last street we can bet will be the turn, so let's start there. If we make a 75 percent pot sized bet on the turn, our opponent will risk 0.75 pot sized bets to win 1.75 pot sized bets. And as we saw in the last chapter, this requires our opponent to win 30 percent of the time for his call to be profitable.

In the same manner, notice if we bet the flop for 75 percent of the pot, our opponent once again risks 0.75 pot sized bets to win 1.75 pot sized bets. Since he always effectively loses when we bet the turn with a balanced range, and effectively wins when we check, this requires us to bet the turn 70 percent of the time to keep our opponent indifferent to calling on the flop.

In order to find out what percentage of our flop bets should be value bets, we can now multiply our turn betting frequency by what percentage of our turn bets need to be for value. When this is done, it shows 49 percent of our flop bets should be value bets given the above conditions.

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(turn betting frequency)(fraction of turn bets are value bets) =

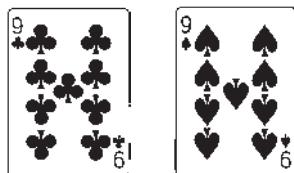
$$(0.7)(0.7) = 0.49$$

It should come as no surprise that since one less round of betting is utilized, a higher value betting to bluffing ratio on the flop is required. That's because we have one less street to allow some of our previous bluffs to check-fold while continuing to value bet all our strong hands. In other words, when value betting hands on the flop which aren't particularly strong, it's crucial we have fewer bluffs in our range. And this brings us to our next rule.

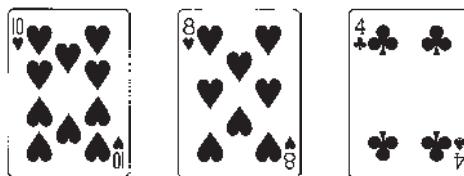
A good rule of thumb is to have around one value bet for every one bluff on the flop when planning on only betting two streets for value.

Nevertheless, betting the flop in position with the intention of betting the turn and checking the river is an extremely common and useful line. By using this strategy when there are additional cards to come, our opponent will not be able to cheaply realize the equity of his weak and marginal hands. In addition, by having the advantage of position, as soon as we show weakness by checking on the river, the hand immediately goes to showdown and our opponent won't get the chance to turn our hand into a bluff catcher after we check.

Here's an example. We open on the button with the



the big blind calls, and the flop is the



This is a great spot to bet the flop with the intention of betting on many turn cards and checking the river. Betting the flop and turn will likely be effective since we will get value when our opponent has a pair of eights as well as make him fold some hands, such as overcards, which could outdraw us. Yet betting the river will likely be a losing play. Our opponent will often fold eights and call or raise his pairs of tens and better.

Another option is to bet the flop for value with the intention of checking back both the turn and the river and hoping to win at showdown. This allows us to make high equity hands fold when we have a vulnerable made hand — hands with two overcards often have around 28 percent equity against lower pairs on the flop. In addition, we may be able to get one street of value from weaker hands.

Here's another example. Suppose we open on the button with the 4♦4♣, and the flop comes the 8♥5♣3♦. In this situation, nearly every hand with two overcards in the opponent's range has at least 24 percent equity, and getting our opponent to fold such high equity hands is useful. In addition, our flop bet may get value from weaker hands that check-call, as is the case when our opponent check-calls ace-ten or king-trey suited and is also happy to check it down.

Unlike if we bet the flop and turn and check the river, betting only the flop for value gives our opponent the opportunity to bet the river knowing we're unlikely to have a strong hand. And when he does this, most of the hands in our range will at best be bluff catchers since it's unlikely we'd check back a strong hand on the turn. While this line is still useful, it does lead to more difficult decisions on later streets when compared to other possible lines.

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In other words, since value betting only the flop gives our opponent the opportunity to bluff on the river as well as cheaply see additional cards, this situation does not model well. However, rather than worry about a frequency or ratio for this line, simply understand how it can make sense when we have a vulnerable made hand which wants to make high equity hands fold on the flop.

However, as will be explained in greater detail in future chapters, it's often useful to bet the flop with the intention of checking the turn and betting the river if our opponent checks. This line works especially well when giving free cards on the flop is risky, but our hand isn't so strong that we can comfortably bet another street until our opponent has shown additional weakness. Moreover, this line gives our opponent a clear opportunity to bluff on the river after we check the turn, which often results in getting more value from his weakest hands.

Required Hand Strength to Value Bet the Flop

When our opponent checks to us on the flop, he'll have a relatively weak range (his betting range is of course stronger) as well as be at a disadvantage from being out of position. Because of this, on many board textures, he'll not want to defend 60 percent or more of his flop checks against a 0.75 pot-sized bet. In other words, our opponent is better off to check-fold the flop when the pot is small rather than calling down with weak holdings. How aggressively he should defend his checks will depend both on the strength of each player's range as well as how valuable position is on the given flop texture.

In "Part Six: Out of Position Flop Play," starting on page 179, we'll analyze how aggressively the player out of position should defend his flop checks. For now, let's start with a simple example and assume our opponent defends by check-calling 50 percent of the time on the flop against a 75 percent pot sized bet. In addition, let's assume that once he check-calls the flop, he will check-call the turn and river aggressively enough to prevent us from being able to profitably bet any two cards. Again, this should intuitively make sense since he would rather fold at a higher frequency on the flop when the pot is smallest than on the turn or river.

As is usually the case, we'll need to work backwards to figure what percentage of our opponent's flop checking range will call down when facing a bet on each street. Let's start by noticing if we bet 75 percent of the pot on the river, we'll be risking 0.75 pot sized bets to win 1 pot sized bet, and our opponent will need to call 57.1 percent of the time to make us indifferent to bluffing.

$$(1)(1 - X) - (0.75)(X) = 0 \Rightarrow$$

$$X = 0.571$$

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So, since our opponent will not allow us to profitably bluff the river with any two cards, he'll need to check-call 57.1 percent of the time. Let's continue to work backwards and notice if we bet the turn for 75 percent of the pot, we'll once again be risking 0.75 pot sized bets to win 1 pot sized bet, and our opponent must again defend 57.1 percent of his checking range. Lastly, we must look to see how often he defends against our flop bet, and as already discussed, he'll probably fold a bit more on the flop, so we assumed he defends 50 percent of the time.

Therefore, if our opponent check-calls 57.1 percent of the time on the river, 57.1 percent of the time on the turn, and 50 percent of the time on the flop, these frequencies can be multiplied together to show that his flop checking range will call down all the way to the river 16.3 percent of the time when facing a bet on all three streets.

$$\begin{aligned} & (\text{flop check-calling frequency})(\text{turn check-calling frequency})(\text{river check-calling frequency}) \\ & = (0.5)(0.571)(0.571) = 0.163 \end{aligned}$$

While our opponent ends up calling down with only a small part of his checking range when he faces a bet on each street, his felting range is also likely weaker than it would at first seem. That's because if he bets most of his strong hands on the flop, then his initial flop checking range will be quite weak. Consequently, the majority of our opponent's check-calling range will consist of bluff catchers. Lastly, he may decide to call a bit more than 57.1 percent of the time on the turn since our bluffs can improve on the river, and if he does, his felting range will be even weaker.

Likewise, if sticking with our previous assumptions, we plan on betting only the flop and turn, then our opponent ends up going to showdown with 28.6 percent of his flop checking range.

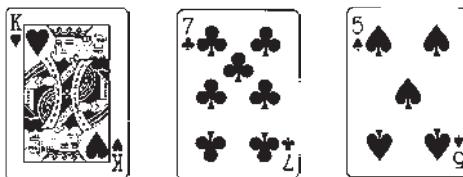
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(Flop Check-Calling Frequency)(Turn Check-Calling Frequency)

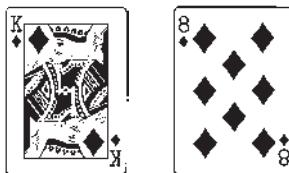
$$(0.5)(0.571) = 0.2855$$

Although these frequencies are estimates, and they will change based on board texture (and get more complicated since the opponent can check-raise), they are still useful to remember when trying to figure out how strong a hand needs to be to effectively value bet. (Keeping in mind that we should not bet the river in position for value unless we win over half the time when called.)

Here's an example. We open on the button, the big blind calls, and the flop comes the



On this board, the big blind flops top pair or better approximately 20 percent of the time, as well as any weaker pair another 15 percent of the time. Since he will likely check most of his range on this flop and defend by check-calling when he does defend, we can quickly determine our marginal top pair hands, such as the



are not strong enough to value bet all three streets. More specifically, although our opponent can call all three bets with a hand we beat, such as king-six suited, we will lose the majority of the time our river bet is called as well as sometimes face a check-

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raise. Consequently, unless our hand improves, we should only bet the king-eight suited on this board texture for a maximum of two streets of value. However, when betting only two streets for value, we shouldn't always bet the same streets. For example, sometimes, we may choose to bet the turn and river, and other times bet the flop and the river.

Likewise, if our hand is the 6♦6♣ on the same K♥7♣5♠ flop, we can quickly see that this hand is not strong enough to bet even two streets for value. That's because betting twice causes our opponent to defend around 28.5 percent of his flop checking range, and sixes will lose to nearly any hand in that range. So while there is no clear answer, either checking back sixes on the flop or betting the flop and checking back on most turn cards are likely the two best available lines.

In general, problems like these are best analyzed with the help of computer software. Many programs can quickly calculate how often a given range will have certain hands on a specific board texture, and this makes analyzing post-flop play much quicker than manually counting combinations of hands.

Lastly, although the impact of potential flop check-raises will be discussed in much more detail throughout this section and the following section, we should begin to analyze the importance of it now. Let's once again start with an easy example and assume our opponent decides to defend 50 percent of his flop checking range, only now rather than just check-calling 50 percent of the time, his strategy will be to check-call 40 percent of the time and check-raise 10 percent of the time.

The first thing we should notice is the majority of our flop value betting range will be turned into a bluff catcher 10 percent of the time when our opponent check-raises. Remember, the opponent's flop check-raising range is very polarized, and few hands in our flop value betting range will be stronger than his value check-raises. Having a strong hand turned into a bluff catcher is undesirable, and this encourages us to bet the flop less aggressively.

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In addition, our opponent is now also check-calling fewer hands, and this makes it harder for us to get value when betting non-nutted hands. In other words, many of the weak hands our opponent was previously check-calling on the flop are now being used as check-raise bluffs. This makes value betting more difficult and encourages us to bet fewer streets for value.

The net result is we should bet less aggressively when our opponent is defending by sometimes check-raising rather than always check-calling, as well as consider altering our bet sizing. Again, these concepts will be discussed in much more detail in future sections.

Deciding Which Streets to Value Bet

Now that we have a sense of how strong a hand needs to be to bet two or three streets for value in position, we must next determine which streets are best to bet when we do not want to bet all of them. In other words, rather than bet the flop and turn and check the river, we may decide instead to check the flop and bet the turn and river, and it's important to understand the significance of each line.

Betting the flop with a marginal strength hand has several disadvantages when compared to checking. First, it makes our opponent's range much stronger on the turn. If he's check-folding the flop between 40 to 50 percent of the time, all of his weakest hands which often had little chance to improve will fold on the flop. Additionally, our marginal strength made hands usually do quite well against hands in our opponent's check-folding range, but do poorly against his check-calling range which consists of many better pairs.

As previously discussed, betting also gives our opponent the opportunity to check-raise, and when he does, any hand which we planned to only bet for two streets of value will become a bluff catcher. To make matters worse, these bluff catching hands are often medium pair type hands which are unlikely to improve and beat our opponent's value check-raises, but will occasionally be outdrawn by his check-raise bluffs. So betting with marginal hands on board textures where our opponent will likely check-raise is quite risky.

While there are significant drawbacks to betting the flop with a hand that will only be able to bet two streets for value, betting the flop is useful for preventing our opponent from realizing the equity of the weakest hands in his range. Players usually

Deciding Which Streets to Value Bet 159

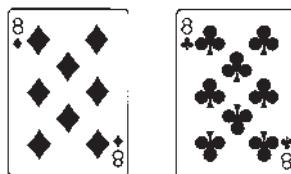
underestimate how significant it is to allow their opponent to see free cards, and as previously mentioned, even if he has just two overcards, that's often around 28 percent equity against a pair.

So although there are advantages to both checking and betting with a marginal strength made hand on the flop in position, we can make a general guideline for determining which line is superior.

As a general rule of thumb, a marginal strength made hand should be bet on the flop if it is vulnerable to being outdrawn by hands in the opponent's check-folding range. If the hand is not likely to be outdrawn by the opponent's check-folding range, the hand should instead be checked on the flop and value bet on the turn and/or river if checked to again.

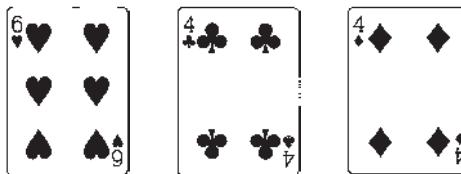
In addition, by checking some marginal strength hands on the flop, it's more difficult for our opponent to recklessly bluff the turn after showing weakness. One leak many new players have is they bet all of their strong hands on the flop and only check their weakest ones, and a player who plays this way can be easily exploited.

Let's consider an example where betting the flop with a marginal strength hand will be effective. Suppose we open in the cutoff with the



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the big blind calls, and the flop comes the



This is a great spot to bet the flop since many high equity hands, such as the T♥9♥ and the Q♠J♠ in our opponent's check-folding range, should fold to our flop bet. In addition, since the only strong hands in our opponent's range are pocket sixes and pocket fours, it's unlikely we'll ever face a check-raise on this flop and have our hand turned into a bluff catcher. And since he will not likely check-raise on this flop texture, it's best to bet the earlier streets so our opponent is unable to realize the equity of his weaker holdings.

Now let's try an example where checking on the flop with a marginal strength hand is the best strategy. Suppose we open in middle position with kings, and once again the big blind is the only caller. If the flop comes the A♦9♦6♠, there's little reason to bet after our opponent checks. While it's true we can bet to get value from our opponent's jacks, tens, and flush draws, these holdings will likely produce value for us on later streets when he check-calls or bets. Furthermore, the hands most likely to draw out on the turn are the flush draws, but he won't fold his flush draws to a flop bet anyway. Lastly, by betting, we also allow our opponent to successfully check-raise us with his sets and bluffs.

One of the more interesting aspects of these general guidelines is they showcase how sometimes a weaker hand will be bet for value on the flop while a stronger hand is checked. For our final example, suppose we open on the button, the big blind calls, and the flop comes the K♠7♣3♣. Here, it makes little sense to bet queens since queens don't fear giving free cards to most hands in our opponent's check-folding range. Yet eights can make sense to

Deciding Which Streets to Value Bet 161

bet since we can likely get two streets of value from our opponent's pairs of sevens, as well as make hands which can improve to beat us on the turn, such as the Q♦J♠, fold. And making the Q♦J♠ fold when we hold eights is useful as this hand has over 26 percent equity against us, but when we hold queens, it's ideal to let our opponent see the turn and hope he improves since he's nearly drawing dead.¹²

Again, the previous example is especially significant because it showcases how stronger hands will sometimes be checked and weaker hands value bet. Furthermore, a hand can be bet for more than one reason, and often we'll bet a hand not just to get value from weaker hands, but also to make high equity hands fold.

¹² Of course, these concepts are already well known to anyone who has read Two Plus Two books on limit hold 'em.

Bluffing with the Right Hands on the Flop

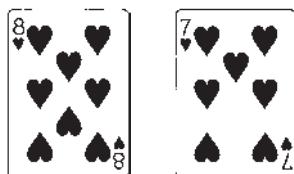
One of the trickier aspects of playing the flop in position is it can be tempting to recklessly bluff in situations where betting with any two cards is profitable. This, however, is problematic, as we need to check back some weak hands on the flop that can be used as bluffs on later streets. In addition, if we never check back a weak hand, our range will be quite transparent on the turn since our flop checking range will consist of almost entirely marginal made hands.

Let's start with analyzing which hands usually make for good bluffing hands on the flop. First, when we bet the flop, our opponent will fold his worst hands in his checking range, and this results in his range being stronger on the turn. In addition, we'll often have the opportunity to continue betting the turn and river, which will result in the final pot being large and our opponent's felting range being strong.

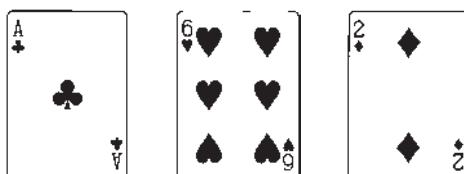
Since betting the flop makes our opponent's range on the turn stronger, we want to bluff with hands which retain their equity well against a strong range. For instance, it matters little if a gutshot is facing a strong or weak range, as it will have around the same amount of equity either way. More specifically, the gutshot usually needs to improve to a straight to make the best hand, and once it does, it will usually be the nuts and win at showdown no matter how strong our opponent's range is.

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Here's an example of a great flop bluffing spot. We open on the button with the



the big blind calls, and the flop comes the



Although it's unlikely our holding will improve to the best hand on the next card, we'll bet again if we turn a flush or straight draw and can potentially make a very strong hand on the river. In addition, our hand has no showdown value if it does not improve, so whenever our opponent folds, he'll almost always be folding the best hand.

As mentioned before, a flop bet in position will usually make our opponent fold the weakest 40 to 50 percent of his flop checking range. Since these hands fold to a bet, we should be less likely to bluff with hands that do well against this part of our opponent's range. In other words, if our holding does particularly well against hands in our opponent's check-folding range, we should be more likely to check back the flop and keep these hands in his range. In addition, since betting the flop makes our opponent's range stronger on the turn, we do not want to bluff with hands which don't have the potential to make strong hands by the river.

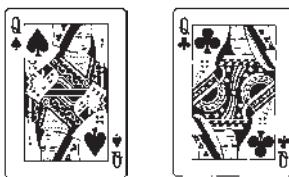
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Let's return to the example where we opened on the button, the big blind called, and the flop was the A♣6♥2♦, only now let's imagine our hand is the K♦Q♣. While betting king-queen is likely profitable since our opponent may not defend enough to prevent us from profitably betting any two cards, it does not retain equity well as his range gets stronger. In addition, the hands our opponent will fold to a flop bet, such as king-ten or queen-jack, are hands we currently beat which will also improve on many of the same turn cards that improve our holding. So in particular, if we check the K♦Q♣ on this flop and the turn comes a queen, we'll likely get value when our opponent holds a queen-jack or a queen-ten. Therefore, in this spot, checking is likely superior to betting even if our hand will sometimes need to be bluffed on a later street.

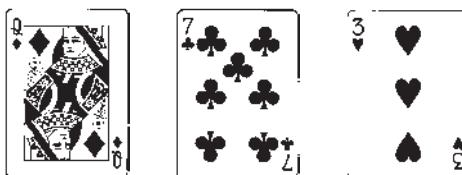
Checking Back with a Strong Hand

Since checking back in position effectively removes a street from the game, it's rarely desirable to do this with a strong hand. Nevertheless, checking back with a strong hand is ideal when there is not much value in betting and giving free cards to the opponent's checking range isn't risky.

Here's an example. We open in middle position with the



and the big blind calls. It would make sense to check if the flop is the



That's because our opponent will not call a bet on all three streets unless he has top pair or better, yet when we hold top set we block two thirds of his possible top pair combinations. In addition, he will also not likely have a check-raising range on this flop, so we don't need to worry about losing value from his check-raise bluffs. So in this situation, the likely most profitable play is to check the flop and hope he starts bluffing on the turn.

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Checking back strong hands also may make sense if there are many turn and river cards which put almost no strong hands in our range. That's because our opponent should sometimes overbet on the turn and river when we cannot be strong. While checking back is risky on board textures where many turn and river cards can improve our opponent's hand, it may be worth it if we are sufficiently rewarded when he overbets weaker hands on later streets.

For instance, suppose we open on the button and the big blind calls. If the flop comes the T♠9♠5♣ and we never check back any strong hands, our opponent should make large bets with hands like ace-ten and king-ten if the turn card comes the 2♦. That is, our opponent should not be afraid to overbet these holdings when there are almost no stronger hands in our range.

In reality, checking back strong hands on wet boards such as the one above will only be justifiable against excellent opponents who are capable of frequently overbetting. Against more typical players who are not capable of this tactic on blank turn cards, we're better off value betting the flop and hoping he check-calls or check-raises. In other words, it's important to understand why in theory it likely makes sense to occasionally check back strong hands on wet board textures, but exploitatively it's going to be a bad play against most opponents.

Facing a Flop Check-Raise

We also need to make sure we're defending aggressively enough against our opponent's flop check-raises, turn bets, and river bets so he cannot profitably raise or bet with any two cards. The math for this is nearly exactly the same as described in the chapter "Required Hand Strength to Value Raise a Made Hand," starting on page 120, in "Part Four: Facing a Flop Bet in Position." In this chapter, we saw how often our opponent needed to defend against our flop raises, turn bets, and river bets to prevent us from profitably raising or betting with any two cards. The exact same concept is present here, only now we're the player defending against a raise or bet.

As we saw previously, if our opponent check-raises a 6 big blind bet into an 8 big blind pot to 18 big blinds, we'll probably want to defend around half of our flop betting range. That's because even though his flop check-raise is expensive, his bluffs will also sometimes improve on the turn or river after we call. Likewise, since our opponent's turn and river bets will be around 64 percent of the pot, we'll probably want to call approximately 67 and 63 percent of the time on the turn and river, respectively.

If we call our opponent's flop bet 50 percent of the time, his turn bet 67 percent of the time, and his river bet 63 percent of the time, then 21 percent of our flop betting range must call all three streets.

$$0.21 = (0.50)(0.67)(0.63)$$

Although there are no new concepts here, we should notice a few of the important aspects of calling down against a flop check-raise. First, we will not need to call down with every hand in our flop value betting range although it depends on how strong our value bets on the flop are — it's likely that 30 to 40 percent of

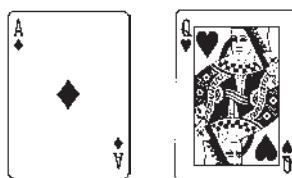
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our flop bets were value hands. Furthermore, in this example, we'll only call down to the river with 21 percent of our flop betting range, so many of our flop value bets will be folded on the turn or river.

Nevertheless, despite the fact that calling on all three streets with many of our flop value hands is not necessary, we'll usually have to call our opponent's flop check-raise with some bluffs in addition to all our value hands. That's because we need to defend 50 percent of our flop betting range against a check-raise, but it's unlikely half of our betting range consists of value hands or draws. Therefore, some of the hands that should be used for defending will be unusually weak. Players often refer to defending with these hands by calling, a "float." And if we never float on the flop, our opponent will be able to check-raise bluff any two cards profitably.

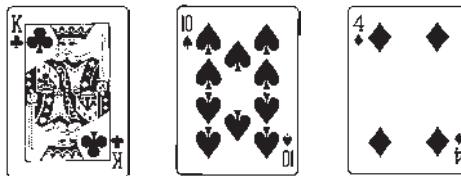
Floating with some hands on the flop against our opponent's check-raise is not usually problematic for two main reasons. The first is there are still two streets left, so we'll have the opportunity to bluff our hand again on the turn and/or river if our opponent checks and we do not improve. Second, many bluffs on the flop also have some showdown value, especially against the opponent's check-raise bluffs.

Here's an example. The



is ahead of most of our opponent's bluffs on a flop of the

Facing a Flop Check-Raise 169



Therefore, if we call the check-raise on the flop and the turn and river are both blanks, checking ace-queen to try to win at showdown is a reasonable option.

We should also accept that some bluff catchers will need to be called on all three streets against an optimal opponent. Although it's admittedly undesirable to be placed in a break even spot on the river after having already invested so much money into the pot, this is unfortunately unavoidable.¹³ However, it's important to remember that even if the majority of our range are bluff catchers after our opponent check-raises and bets multiple streets, he cannot take this line often and remain balanced. In other words, our opponent will not have many hands strong enough to check-raise for value on the flop, and if he check-raises too frequently, his range will include too many bluffs.

Furthermore, it's best to emphasize calling with draws which can improve against our opponent's value betting range even if they have less equity against our opponent's entire check-raising range. Remember, simply having more equity does not make a hand better, and hands which are able to make the nuts on the turn and river are particularly useful to have in our calling range.

However, some mediocre strength hands must still be called so we can check back and win at showdown if our opponent checks. If too many draws and not enough made hands are called, it often won't be possible to bluff all missed draws on the turn and/or river if our opponent checks. Therefore, calling with too

¹³ In good games you can get away with avoiding these situations for the sake of reducing volatility. Just remember that you are costing yourself some EV.

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many speculative hands and not enough marginal made hands will cause problems for our entire range.

Another strategy to occasionally consider is 3-betting the flop. Flat calling the check-raise requires us to risk 12 additional big blinds to win the 32 big blinds already in the pot, which is a great price and requires our opponent to keep betting at a high frequency. Plus, we are in position and our opponent's flop check-raising range is very polarized. So we should defend the majority of our flop betting range by simply calling when facing a check-raise.

Nevertheless, we should usually 3-bet the flop with very strong hands which are vulnerable to being outdrawn by our opponent's bluffs. For instance, it makes sense to 3-bet a hand like the $\text{T}\heartsuit\text{T}\clubsuit$ on a flop of the $\text{J}\spadesuit\text{T}\spadesuit\text{6}\clubsuit$ since our opponent's check-raise bluffing range includes many gutshots and hands which can runner-runner a flush. Additionally, if we do have a 3-betting range, it of course needs to be balanced with both value raises and bluffs.

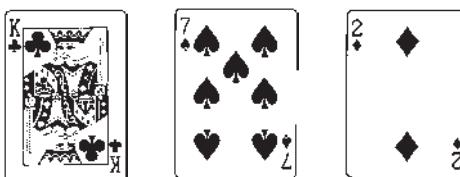
Thought Process for Deciding Whether to Bet or Check in Position

Let's now consider a solid thought process for deciding whether to bet or check after our opponent has checked. While this unfortunately involves a longer and more difficult thought process than when facing a bet, it will quickly improve with practice.

Question No. 1: *What will our opponent's calling range look like when we bet all three streets?*

Answer: Our opponent will typically call down with at least 16 percent of his flop checking range if he faces three bets and usually defends by calling rather than raising (though the exact percentage will change based on the board texture). This can be used to determine how strong a hand needs to be to value bet on all three streets.

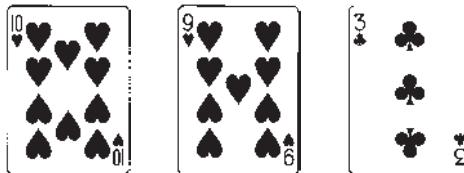
On dry flops with at least one high card, such as the



this question will usually be quite easy to answer since it's not likely many hands will change in strength on the turn and

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river. But on wet flop textures where hands will change in strength on many turn and river cards, such as the



this question will frequently be more difficult to answer. Nevertheless, we'll usually start with betting our strong hands and continue betting on favorable turn and river cards.

Question No. 2: Which streets should we bet with hands which want to bet only one or two streets for value?

Answer: As previously discussed, we should follow the general rule that a marginal strength made hand should be bet on the flop if it's vulnerable to being outdrawn by hands in the opponent's check-folding range. But if the hand is not likely to be outdrawn by our opponent's check-folding range, the best strategy is to check the flop and then to value bet on the turn and/or river if checked to again.

In general, on boards with at least one high card, it's usually easy to check back the flop with marginal strength hands since giving a free card isn't especially risky. For instance, when we have a marginal strength made hand on the K♣8♠3♥ flop, such as a weak pair of kings, queens, or jacks, it's likely best to check.

In contrast, on lower and more coordinated board textures, such as on the 9♥7♥3♣ flop, the hands which are usually able to bet only one or two streets for value should likely start with betting the flop. That's because many hands in our opponent's check-folding range usually have a significant amount of equity against marginal strength made hands. However, we must be aware that betting too many

marginal strength hands on the flop will make us vulnerable to check-raises, so even wet boards should not be recklessly bet in position.

Question No. 3: *Around how many hands do we need to bluff so our betting range is balanced? Which hands work best as bluffs?*

Answer: In general, we should bet between 2.5 and 3 bluffs for every very strong hand value bet on the flop, and bet 1 bluff for every marginally strong hand value bet. That's because marginally strong hands will not likely be able to value bet all three streets, so our bluffing to value betting ratio on the flop must decrease. These estimates are useful for trying to add the right amount of bluffs to our betting range so our opponent is close to indifferent to calling with many marginal strength made hands.

While wide ranges, such as the button opening range, can be difficult to balance quickly when playing, by practicing away from the tables we can get a feel for how aggressively to bet in different situations. After all, even if our ranges aren't perfect (and they won't be), if our game is closer to game theoretically optimal than our opponent's, we'll still make money in the long run.

It's also usually quite easy to identify which hands work best as bluffs, as these are the hands which have little showdown value but retain their equity well as the opponent's range gets stronger. In addition, since our flop betting range usually has many strong hands and bluffs which can improve on a variety of turn cards, it's frequently not difficult to continue betting aggressively after our opponent calls our flop bet.

Example of Balancing a Flop Bet in Position

We are now ready to balance a betting range on the flop after our opponent checks to us in position. Let's assume middle position opens and we flat on the button with a range of JJ-33, AKo-AQo, AQs-ATs, KQs-KTs, QJs-QTs, JTs-J9s, T9s, 98s, 87s, 76s, 65s, 54s, and let's also assume our bet sizing will always be 75 percent of the pot.

Flop: Q♥8♣6♠

Total Combos: 125

Value Bet: AQ(12), 88(3), 66(3) = 18

Bluff Bet: 77(6), 55-44(12), 76s(3), 65s(3), JTs(4), J9s(4), T9s(4), KJs(4), AJs(4), ATs(4), KTs(4) = 52

Total Hands Bet: 70

Betting Frequency: 56%

Notice that we are checking several hands on the flop, such as king-queen and queen-jack suited, which would make highly profitable bets. That's because these hands are likely more profitable as checks than bets, and we want some hands in our checking range which can call turn bets from our opponent or value bet if he checks. In addition, getting check-raised with a top pair, good kicker hand is terrible, and checking avoids that.

Also notice the flop is not being recklessly bet as it often is by players who bet all hands other than medium strength pairs. More specifically, betting all hands except QJs, QTs, and JJ-99 results in a flop betting frequency of around 80 percent. Consequently, this makes it easy for our opponent to exploit us by check-raising at a high frequency. Moreover, if we bet all our weak hands on the flop, there will be no hands for us to bluff with

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on the turn when we would start value betting king-queen and queen-jack suited. So instead, we value bet the flop with hands strong enough to bet multiple streets for value and emphasize bluffing with hands which retain their equity against our opponent's calling range.

With the above ranges, we're betting, on the flop, 56 percent of the time once our middle position opponent checks. In this spot, this is likely a reasonable betting frequency since our button flatting range hits this board texture well and we have the advantage of position. So betting just over half the time prevents our opponent's check-raises from being too effective, plus betting at this frequency does not allow him to constantly see free cards with his checking range.

Since our flop value bets are so strong and we're in position, we should probably use just under a 3-to-1 bluffing to value betting ratio. This is true despite having many bluffs in our flop betting range. If our opponent decides to call down, our betting range will be balanced on the river since many of our bluffs will either improve or check-fold on the turn or river. Additionally, if our opponent check-raises the flop and bets the turn and river, the worst hand we'll need to call down is ace-queen which is quite strong.

Lastly, we should acknowledge that although this betting range looks quite good and balanced, this is not a theoretically optimal range. After all, in theory we would not use just one bet sizing on the flop, and betting smaller with a range that includes many weaker value hands, such as king-queen, may be better than checking all of them. Nevertheless, the ratios and frequencies we've previously discussed still prove quite useful.

Summary

Facing a flop check in position can be difficult since there is no clear starting point. Therefore, it's crucial to understand what a value betting hand is designed to accomplish, whether it makes high equity hands fold, gets value from worse hands, or both. Moreover, recklessly betting hands simply because they can be called by worse hands will result in our opponent's check-raises being too effective and our checking range being too weak.

Consequently, it's important to not always bluff on the flop just because betting any two cards is profitable. In other words, some weak hands must be checked and used as bluffs on later streets. More specifically, bluffs which retain their equity well should be bluffed on earlier streets, while checks should be considered with hands which have some showdown value.

And to finish this chapter, here are a few points summarizing the important ideas in "Part Five" Whether to Bet or Check in Position."

1. In position, our flop value bets should usually be able to bet two or three streets for value. This prevents our opponent from getting the opportunity to bet knowing we're unlikely to be strong.
2. We usually want to bluff with hands which have little showdown value but retain their equity against our opponent's calling range.
3. In position, it's often profitable to bet with any two cards on the flop. However, recklessly betting a hand simply because it has a positive expectation is not necessarily the most profitable way to play.

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4. Betting between 2.5 to 3 bluffs on the flop for every strong value bet in position is likely a good rule of thumb.
5. Betting only the flop for value in position is often an undesirable line since it allows our opponent to bet a balanced range on the river and turns most of our hands into bluff catchers.
6. Betting the flop with the intention of betting the turn and checking the river is a strong positional play. This is especially true if our hand is vulnerable to being outdrawn by hands in our opponent's check-folding range. But if our hand is not vulnerable to being outdrawn, it's frequently best to check the flop and bet later streets.
7. A reasonable opponent will usually call down at least 16 percent of his flop checking range if he faces a 75 percent pot sized bet on each street and only defends by calling. And if we only bet two streets for value, he'll usually defend at least 29 percent of his flop checking range.
8. We are able to fold around 50 percent of the time to our opponent's flop check-raise. Defending by calling is usually most effective since this keeps his range wide and requires him to frequently bet the turn.

Part Six

Out of Position Flop Play

Out of Position Flop Play

Introduction

Out of position flop play is an intimidating topic for players of nearly all skill levels. Since ranges are wide on the flop, beginners especially struggle to quickly take into account all the different hands in each player's range and to determine whose range is stronger. This makes even scratching the surface of out of position flop play feel overwhelming.

Conversely, expert players know how difficult it is to analyze and model flop situations since there are still additional cards to come. This is true for preflop play as well, but since there are no community cards, generic preflop strategies can be memorized and applied with little thought. But on the flop, since there is no excellent starting point for determining whether to bet or check when out of position, it's easy to bet or check an unbalanced range without realizing it, and this is especially problematic when out of position. That's because an astute opponent will frequently bet or raise to make it difficult to realize the equity of a hand in an unbalanced range.

Therefore, it's important to understand the underlying theoretical concepts behind out of position flop play even though simply understanding them won't automatically make you a great player. Like most competitive games, poker requires decisions to be made within a limited amount of time and the underlying factors which determine the best decision can be quite complex. So while it's important to understand the theory behind out of position flop play, much practice is necessary to become an excellent player.

The Mental Block of Betting as the Preflop Raiser

When discussing positional flop play, I intentionally refrained from stating whether we were the preflop raiser or the cold caller. Perhaps one of the biggest and most common leaks even successful players have is they nearly always bet as the preflop raiser, and when out of position check as the cold caller. This is often done with little regard to which player actually has the stronger range or how valuable position is. In fact, taking the initiative by betting out of position after cold calling preflop is even called a “donk bet,” which in itself implies it’s a line not often taken by strong players.

As we’ll see, a strong player should not bet at a high frequency simply because he’s the preflop raiser and has the initiative. Likewise, the out of position cold caller should not be afraid to donk bet on flop textures which favor his range. Nevertheless, since these leaks are so prevalent, let’s briefly discuss why this is the case before we attempt to fix them.

One reason why these leaks exist is that many players realizing it was frequently correct to bet the flop if they were the preflop raiser overdid it. And since the preflop raiser would usually bet the flop, it made little sense for the preflop caller to donk bet a strong hand out of position because a check-raise would likely be successful.

So why did always betting seem to work? Imagine playing in a ten handed game and there are three other tight players, three loose players, and three average players. After raising first in from under the gun, we’re more likely to be called by a loose player with a weak range than a tight player with a strong range. Therefore, it makes sense for us to usually bet the flop since our range is likely stronger than our opponent’s.

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While this is far from theoretically correct poker, it's likely a reasonable representation of how the game was played several years ago (and still largely is played in a live poker setting). The strategy to constantly continuation bet the flop in heads up pots probably showed a profit, especially against weak players. In other words, this advice most likely did beat the games of the past.¹⁴ But rules like this are bad from a theoretical perspective and will cause us to lose against strong opponents and not win as much as we should against weak ones.

Another reason players often won't lead as the preflop cold caller is that it's hard to balance both a flop betting and checking range when out of position. In fact, balancing multiple ranges when out of position is probably the second hardest aspect of no limit hold 'em to master (with bet sizing being the most difficult), and many players aren't willing to put in the time necessary to develop this skill.

Lastly, it should also come as no surprise that the players who are able to donk bet as well as effectively defend their checks as the preflop raiser are often unwilling to discuss it. That's because mastering this skill is such a valuable weapon that it makes little sense to encourage other players to develop it as well. And by the time a player has mastered this skill, he's probably already at the stage in his poker career where most of his learning comes from analyzing his own game rather than learning directly from others.

So let's begin taking an analytical approach to improving our play when out of position. To start, let's analyze the relative hand strengths of both the preflop raiser and the cold caller on a few board textures using the ranges from the "Recommended Hand Chart," starting on page 80, in "Part Two: Preflop Play."

¹⁴ Keep in mind that when I say games of the past that no-limit was hardly ever played as a cash game before 2004. But no-limit tournaments, which began to be shown on television with the original World Poker Tour shows in 2003, rekindled interest in an otherwise dead game.

Flop Range Analysis

MP Open on the K♣T♣4♦ flop: Overpair+ 8.6%; top pair, top kicker+ 14.3%; flush draw 7.6%

Button Flat vs MP open: Overpair+ 7.2%; top pair top kicker+ 14.4%; flush draw 7.2%

Total Equity on the flop: MP = 49.9%, Button = 50.1%

MP Open on the A♥6♣3♠ flop: Top pair, top kicker+ 10.2%; top pair 33.5%; middle pair+ 58.3%

Button flat vs MP open: Top pair, top kicker+ 12.0%; top pair 26.4%; middle pair+ 55.2%

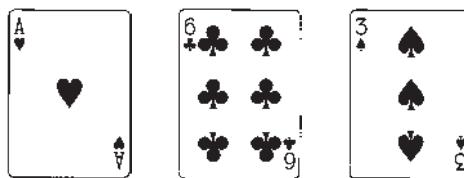
Total Equity on the flop: MP = 52.5%, Button = 47.5%

MP Open on the T♣8♦4♦ flop: Overpair+ 16.4%; top pair+ 27.6%; flush draw 8.9%

Button flat vs MP open: Overpair+ 12.0%; Top pair+ 24.0%; flushdraw 10.4%

Total Equity on the flop: MP = 49.0%, Button: 51.0%

As can be seen, the strength of both the preflop raising and cold calling range are comparable on all the above flop textures. In fact, in the middle position versus button example on the



flop, the button's range has the better top pair hands and is arguably the stronger range despite having less equity. Yet many winning players would probably agree they're used to almost always betting when they are the preflop raiser, especially on a dry board with one high card such as the A♥6♣3♠.

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So the conclusion is that optimal poker does not care who raised preflop and has the initiative, and against strong opponents neither should we. All that matters is the current state of the game. This includes what each player's range is, who is in position, and how much stack depth is remaining relative to the size of the pot.

Assessing How Valuable Position is on the Flop

Although the exact value of position on the flop is impossible to quantify, there are some board textures where being in position is extremely valuable and others where it's not nearly as important. This concept can best be illustrated by first imagining an extreme example.

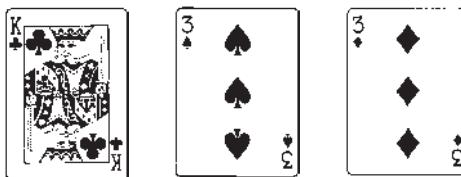
When trying to figure out what fraction of our flop bets in position should be for value, we started out with a simple example where we assumed our range was perfectly polarized. In this situation, we would always bet the flop, turn, and river with the right ratio of value bets and bluffs on each street to make our opponent indifferent to calling. Since our range was perfectly polarized, our opponent could never prevent us from realizing our equity, and because of this, it made no sense for him to ever bet with his bluff catchers.

In other words, since our opponent will always check when we have a perfectly polarized range (giving us no new information) and neither player can improve on free cards, it does not matter who is in position when one player has a perfectly polarized range. *More specifically, when a player's range is perfectly polarized, position has no value.* That is, with a perfectly polarized range, we should bluff the same amount of hands on the flop, turn, and river regardless of who is in position.

In reality, no player will ever have a perfectly polarized range on the flop, but there are situations where the betting range functions more similarly to a perfectly polarized range than others. This occurs when value betting hands are very unlikely to be outdrawn by weaker hands and bluffs are very unlikely to improve.

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Here's an example. When a player bets on the



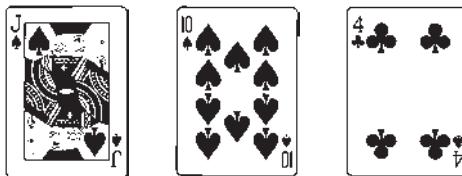
flop, he will usually be betting a very polarized range. In addition, players rarely bet hands with the intention of only betting one or two streets for value on this board texture (though it does happen), and it's unlikely the best hand on the flop will be outdrawn by a weaker hand on the turn or river. Consequently, if a player check-calls on the flop, he will almost always check on the turn since the bettor's range will remain polarized.

Since additional cards are unlikely to result in the better hand being outdrawn, most players probably feel reasonably comfortable playing out of position on the K♣3♠3♦ flop. More specifically, it's easy to check-call with weak top pair hands and strong middle pairs since few overcards can come on the turn or river. In addition, since a player who check-calls on the flop will almost always check on the turn, the flop bettor gains no additional information about his opponent's range.

On the other hand, position is more valuable on board textures where weaker hands can outdraw stronger hands on the turn and river. That's because the player in position always gets the first opportunity to end the action and see an additional card. This allows him to more effectively manipulate the size of the pot and realize the equity of his hands. In other words, position is more valuable on flop textures where the turn will likely change the strength of many hands in each player's range.

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Many board textures, such as when the flop comes the



which greatly favor the player in position, are well known by weak and strong players alike. On this flop texture, nearly every bluff has at least one overcard and some sort of straight draw. This means even the strongest hands on the flop are vulnerable to being outdrawn on the turn. Therefore, the player in position will have a much easier time realizing the equity of his medium strength made hands and draws than the player out of position.

Other board textures where position is especially valuable are not nearly as well known since additional cards do not at first appear as threatening. A common mistake players make is they assume a dry board texture — a board texture with few or no possible draws — means allowing the opponent's bluffs to see free cards is not risky. The fact that there are usually a few strong hands, such as sets, on dry board textures which do not fear giving free cards encourages players to think this way.

In reality, low board textures tend to greatly favor the player in position since nearly every bluff has overcards, and making top pair on the turn or river will often be good enough to win at showdown. In other words, it's almost as if hands with two overcards are draws with 6 outs on low board textures. Consequently, low board textures function similarly to wet board textures since the weakest hands in both the betting and calling range have a considerable amount of equity.

To illustrate this, imagine we open in the cutoff and the button calls. If the flop comes the $7\spades 5\clubs 2\hearts$, nearly every turn card will improve some weak hands in our range and our opponent's range. That is, around 57 percent of the turn cards will be

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overcards, and there are no hands on the flop which won't have a reasonable amount of equity.

In addition, position is particularly valuable on the **7♠5♣2♥** flop because it's difficult for us to bet the flop and turn for value with a marginal strength hand when out of position. That's because our opponent will have the opportunity to bluff after the river is checked and our marginal strength hands will become bluff catchers. This makes playing medium strength hands such as nines, eights, and pairs of sevens difficult. However, check-calling with medium strength hands also isn't ideal as they will frequently be outdrawn by our opponent's bluffs on the turn and river.

This brings us to the following rule:

The more difficult it is to check-call on a flop texture when out of position, the more valuable position will usually be.

Notice that these are the board textures where giving a free card is risky, and the marginal strength hands which typically want to be check-called will often be outdrawn on the turn or river.

Below are a few examples of flop textures along with a quick description for why position is or isn't usually particularly valuable. In order to better visualize some hands in each player's range, assume we open in the cutoff and only the button calls.

Flop No. 1: Q♣6♥2♥. Position is not particularly valuable on this board texture as there are many hands in our range and our opponent's range with little equity. This makes it easy to check-call with top and medium pair hands since so few overcards can come on the turn. While our strong pairs will sometimes be outdrawn by flush draws, most hands which have a reasonable chance of making a flush by the river will not fold to a flop bet anyway.

Flop No. 2: 9♥5♥3♣. This board texture is both low and wet, so position is extremely valuable. It's also difficult to check-call on

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this flop texture, as the hands which want to get to showdown without betting all three streets, such as nines and eights, are also the same hands which are extremely vulnerable to being outdrawn by overcards.

Flop No. 3: Q♣J♦6♠. Contrary to what many players believe, position is not particularly important on this flop texture. It's easy to check-call with pairs of queens and jacks since our opponent will often be betting hands with little equity which are unlikely to improve. In addition, the flop can be check-raised occasionally to prevent our opponent from recklessly betting.

Flop No. 4: 7♣2♦2♠. As previously discussed, position is more valuable on low and dry board textures than most players think. Check-calling with marginal strength made hands is difficult since they will so frequently be outdrawn on the turn and the river, but in this spot strong hands can be slowplayed and check-raised on a later street.

Flop No. 5: 7♥6♥4♣. This flop texture is an absolute nightmare to play out of position. It's difficult to develop a check-calling range since check-calling even a nut type hand (such as a set) is risky. However, if we never check-call a strong hand, our opponent can aggressively overbet on many turn and river cards.

Furthermore, the marginal strength hands which are check-called on the flop will frequently be outdrawn on later streets. In addition, if our opponent is overbetting, he'll be able bet at a high frequency and still remain balanced. So boards like this require us to check-raise and check-fold the flop at a high frequency.

The Out of Position Value Betting to Bluffing Ratio

Previously, we found that betting the flop with a perfectly polarized range required 34.3 percent of our flop bets to be value bets if we only bet 75 percent of the pot on all three streets. In addition, if we could overbet the river, only 30.6 percent of our flop bets needed to be for value. As previously discussed, since position has no value when a player has a perfectly polarized range, the exact same math will apply regardless of who is in position as long as we assume our range is perfectly polarized.

Yet when modeling situations where our betting range was not perfectly polarized, we had to make several assumptions which were not true in general. For instance, even if we're only value betting very strong hands on the flop, the winning hand won't always be bet on all three streets. In addition, our opponent may fold to our turn bet (or make us fold if he raises), and this prevents us from always realizing the equity of our bluffs. Again, the model was not able to accurately take this into account.

On the other hand, when ranges are not perfectly polarized, position becomes quite valuable and our assumptions from previous chapters become more problematic. Specifically, it's more difficult to realize the equity of our weak hands when out of position than when in position since a turn check does not guarantee we'll see a river card. In addition, we won't have the ability to bet the river if our opponent shows weakness by checking, so getting thin value with strong but not amazing hands will often be difficult.

In other words, while the exact value of position cannot be quantified, it's safe to say that if we wanted to bet between 2.5 to 3 bluffs for every very strong hand value bet when in position on

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the flop, we should be bluffing less when out of position. And this brings us to our next rule.

Although position will be more valuable on some flop textures than others, betting between 2 and 2.5 bluffs for every 1 very strong hand value bet out of position seems reasonable for most flop textures.

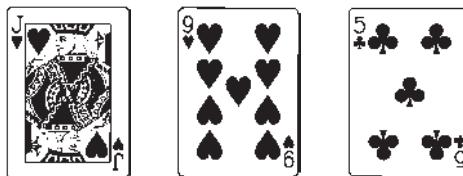
As always, be aware of what assumptions are being made when applying this general rule of thumb since this ratio will not work nearly as well if stack sizes are shallow or the pot is multiway.

Furthermore, as previously discussed, we'll sometimes bet hands on the flop with the intention of only betting one or two streets for value. This is done when betting the flop will make some high equity hands fold. Unlike when in position, it's difficult to bet only two streets for value when out of position since our opponent will have an opportunity to bet after the river is checked. This situation is difficult to model, but despite its drawbacks, betting only one or two streets for value when out of position will sometimes still be the best line.

When Should Betting with Any Two Cards be Profitable?

Up until now, we've assumed our opponent should not be able to profitably bluff with any two cards preflop or when out of position on the flop. This should intuitively make sense for preflop play since if our opponent could profitably bluff with any two cards, he would never fold. Likewise, since being out of position on the flop is a disadvantage, in raised pots it made sense to assume our opponent should not be able to profitably lead with any two cards on the vast majority of flop textures.

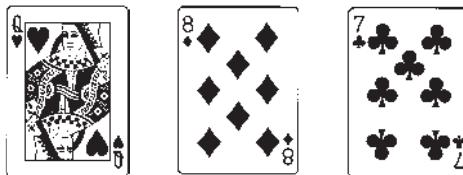
While even a hand as weak as deuces has a positive expected value when it's checked out of position on a flop of the



the expected value of the check should be small and close to zero. If we could profitably bet deuces out of position on this board texture, then even a bet which is only slightly profitable would be better than checking. However, most players learn from trial and error that betting a weak hand when out of position has a negative expected value on most board textures even if it cannot be proven directly.

However, there are situations where a player should be able to make a profitable bluff even if his hand has no equity. More specifically, these situations usually occur after someone had to risk money to maybe get the opportunity to make a profitable bluff.

Here's an example. The cutoff opens, we 3-bet in the small blind to 12 big blinds total, and the cutoff calls. The flop comes the



and we bet 13 big blinds, the turn comes the 4♦ and we bet 25 big blinds, and the river comes the 2♥ and we check. Notice that after we check, our opponent has the opportunity to go all in for 50 big blinds to win a 100 big blind pot. This requires us to call 66.7 percent of the time in order to prevent him from being able to profitably bluff with any two cards.

Yet since we 3-bet preflop, bet the flop, and bet the turn, our range is very polarized by the river, and few if any hands will work best as check-calls. In fact, if we had a marginally strong hand on the flop, such as the Q♦9♦ or a pair of jacks, we would have likely check-called the flop since allowing our opponent too see additional cards with his weakest hands isn't particularly risky. In other words, once we check this river, we'll be check-calling much less than 66.7 percent of the time.

While allowing our opponent to profitably bluff with any two cards may at first seem confusing, it's conceptually similar to when we were betting with a perfectly polarized range. More specifically, whenever we bet with a perfectly polarized range, our opponent always effectively lost, yet whenever we checked, he effectively won. The same process occurs when we bet the turn with a very polarized range in a 3-bet pot since if we check the river our opponent will almost always win. That is, he'll either check back and win at showdown, or he'll bluff knowing we're almost always folding.

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Put differently, even if our opponent can make a profitable river bet after we check, this is not a problem if he had to risk money on the turn to maybe get this opportunity. For example, if our opponent calls with a weak speculative hand on the turn, such as a gutshot, he'll usually lose the money he's invested when his draw misses and we bet the river. He'll only occasionally improve to the best hand or get the opportunity to make a profitable bluff, and this will not make his turn call overly profitable.

This brings us to our next rule:

The more profitable our opponent's bluff will be, the more money he should be required to risk and/or the rarer it should be for him to get the opportunity to bluff.

Stated another way, if our opponent's bluff on a later street will only be slightly profitable, then it's not problematic if he often gets that opportunity after only risking little. Yet if our opponent's bluff will be highly profitable, he must risk more money to only occasionally get that bluffing opportunity. More specifically, we are only being exploited if our opponent is risking little money to consistently find himself in a highly profitable bluffing situation.

How Profitable Should Our Opponent's Bluffs Be in Position on the Flop?

When our opponent bets after facing a check in a heads up raised pot, he'll usually risk 6 big blinds to win 8 big blinds. As previously discussed, we must defend at least 57 percent of the time to prevent him from being able to make an immediate profit by betting any two cards.

Nevertheless, letting our opponent show an immediate profit with any two cards after we check on the flop is not likely problematic. Assuming he's not in the blinds, when he calls preflop he risks 3.5 big blinds to usually get the opportunity to see the flop in position. (He'll sometimes get squeezed and have to fold his weaker hands preflop.) Since he took a risk by calling, our opponent may sometimes be able to profitably bluff any two cards post-flop, especially if most of his bluffs are only slightly profitable.

Here's an example. We open in middle position and our opponent calls on the button. If we then check the flop, his bet should be successful often enough that a reasonable estimate for the EV of his worst bluff is 1.5 big blinds. Notice that even though the worst hand in our opponent's range can profitably bluff after we check, he still loses on average 2 big blinds when he flops a weak hand.

$$\begin{aligned} \text{overall EV for the hand} &= \\ \text{EV of flop bet} - \text{dead money already invested} & \end{aligned}$$

$$- 2 = 1.5 - 3.5$$

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This showcases how our opponent will still lose money overall by cold calling too weak of hands preflop even if he can often make a profitable bluff post-flop. More specifically, in order for a hand to be a profitable cold call preflop, it must be able to flop strong hands or draws at a reasonable frequency. In other words, if our opponent's hand is so weak that he constantly has to fold to our flop bet and will usually only be able to make a slightly profitable bluff if we check, then calling preflop with such a weak hand clearly has negative expectation.

Betting less frequently out of position on the flop and defending more of our checks has several other key implications. Our opponent will more often have a profitable bluffing opportunity. But if we are defending more of our checks by check-calling and check-raising, then the expected value of our opponent's bluffs will decrease. In other words, while he'll get many opportunities to make profitable bluffs, those bluffs will only be slightly profitable.

In addition, our opponent will most likely make less money when he flops a strong hand since we will frequently check and keep the pot smaller. Many players rely on almost always winning at least a continuation bet when they flop a strong hand after cold-calling in position. But if we're not recklessly betting the flop, our opponent will frequently only win a small pot.

Nevertheless, we'll usually need to bet the flop reasonably often ourselves, as well as defend our flop checks aggressively enough so that their flop bets aren't overly profitable.

That is, on the flop, we can either give our opponent a few opportunities to make highly profitable bluffs, many opportunities to make slightly profitable bluffs, or be somewhere in between. More specifically, if we're constantly check-folding on the flop, then something is probably wrong. We're either check-folding hands that belong in another range on the flop, or our preflop range is too weak. (The exception to this occurs when calling in the big blind since it often makes sense to call getting a great price even if the flop must often be check-folded.)

How Profitable Should Our Opponent's Bluffs ... 197

We can calculate the minimum expected value of the worst hand in our opponent's range on the flop based on how aggressively we're betting and defending our checks. This is accomplished by calculating how often our opponent gets the opportunity to bluff and how profitable those bluffs are.

Let's start with a simple example. The pot is 8 big blinds and when a player bets, he'll always bet 6 big blinds. Furthermore, let's assume we're checking the flop 60 percent of the time and defending 45 percent of our flop checks. Lastly, let's also assume our opponent has a weak hand which will always fold if we bet the flop, but will bluff if we check since he knows bluffing with any two cards is profitable. This produces an expectation of at least 1.02 big blinds for our opponent's weakest hand.

$$\begin{aligned} \text{minimum EV of opponent's hand} = \\ (\text{flop checking frequency})[(\text{pot size})(\text{folding frequency}) \\ - (\text{bet size})(\text{defending frequency})] \end{aligned}$$

$$1.02 = (0.6)[(8)(1 - 0.45) - (6)(0.45)]$$

As can be seen, with the above assumptions, the weakest hand in our opponent's range on the flop has an expected value of at least 1.02 big blinds. That's because we won't always bet the flop, and once we check, our opponent can profitably bet since we defend less than 57 percent of the time. Furthermore, notice this is the minimum expected value of our opponent's hand rather than its actual expected value since we'll often defend by check-calling and our opponent's weakest bluffs have equity.

In addition, be sure to understand that the expected value of our opponent's weakest hand was calculated on the flop before we bet or checked, not the expected value of his bluff. Notice that if we bet, the expected value of our opponent's weakest hand is zero (since he'll always fold), and if we check, his expected value will be greater than 1.02 big blinds (since he'll always get the

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opportunity to bluff). Here, the minimum expected value of our opponent's bluff is 1.7 big blinds.

$$\text{minimum EV of opponent's bluff} = \\ (\text{pot size})(\text{folding frequency}) - (\text{bet size})(\text{defending frequency})$$

$$1.7 = (8)(1 - 0.45) - (6)(0.45)$$

And if we assume players always bet 6 big blinds into an 8 big blind pot, the following formula can be used to find the minimum expected value of the opponent's hand on the flop.

$$(X)[(8)(1-Y) - (6)(Y)] = \text{minimum EV of opponent's hand}$$

where

X is our flop checking frequency, and

Y is our defending frequency after we check.

Although it's difficult to estimate what the expected value of our opponent's very weak hands on the flop should be, it undoubtedly depends on each player's range and the flop texture. Furthermore, a common sense approach should be used to determine if the expected value of our opponent's weakest hands on the flop seems reasonable.

Here's an example. We open in the cutoff, the button calls, and the blinds both fold. If we're checking and folding to our opponent's flop bets often enough that the expected value of his weakest hands is 2 big blinds or greater, does this seem reasonable? While the situation is far too complex to be proven directly, it probably does not for several reasons. They are discussed below.

1. Since the button only risked 3.5 big blinds by calling preflop, he'll expect to win back a large portion of his preflop call if the expected value of his weakest hands on the flop is at least

2 big blinds. Since he often gets the opportunity to make a profitable bluff even if he flops a hand with nearly no equity, this effectively makes his preflop call much cheaper than it would otherwise be.

2. All the hands in the button's preflop calling range have the potential to make strong made hands or draws on the flop. In other words, it's a worst case scenario for our opponent to have to fold to our flop bet or bluff if we check. Sometimes his weakest preflop calling hands are going to flop the nuts or a hand which can make an excellent bluff raise.
3. Even our opponent's weakest bluffs on the flop will usually have a reasonable amount of equity against our check-calling range. For instance, despite pocket pairs usually being among the worst possible bluffing hands on the flop, they still have around 10 percent equity against better pairs. This increases the expectation of even the weakest bluffs in our opponent's range.

Again, it's difficult to say what the expected value of our opponent's weakest hands on the flop should be, so no general rule will be given. Nevertheless, if we find ourselves constantly check-folding on the flop to the point where our opponent is effectively getting a significant discount on his preflop calls, we should look to either change our preflop or flop strategy. In particular, if we're check-folding so often that our opponent is encouraged to recklessly bet the flop, many hands which are currently being bet should likely be check-raised instead.

Whether to Bet or Check Very Strong Hands on the Flop When Out of Position

Although an optimal player will always take the line with the greatest expected value, what line is most profitable with a given hand will depend on each player's range. And one of the easiest starting points for figuring out how to play our range is to determine the most profitable line with our very strong hands.

For instance, if check-calling with these holdings on a given flop texture is more profitable than check-raising, then we'll usually have no check-raising range. That's because check-raising a strong hand becomes an inferior strategy if check-calling has a greater expected value, and check-raising a range of only bluffs would certainly not be optimal. In other words, what we do with the strongest hands in our range largely determines how many other hands in our range should be played.

As for our opponent, he should be able to make highly profitable flop bets on board textures where position is particularly valuable and/or his range is much stronger than ours. In addition, on flop textures where he can make highly profitable bets with any two cards, we should expect him to frequently bet. That's because he should check only if checking is more profitable than betting, and this is less likely to be the case if his flop bets are highly profitable. This is especially true if letting hands in our check-folding range see a free card is risky.

Here's an example. On the flop, we're again checking and folding 55 percent of the time to our opponent's bet. And when he bets, it's 6 big blinds into an 8 big blind pot. In addition, let's assume he knows how often we're folding to a bet after we check.

Whether to Bet or Check Very Strong Hands on ... 201

And as before, the minimum expected value of our opponent's flop bet is 1.7 big blinds.

$$1.7 = (8)(0.55) - (6)(1 - 0.55)$$

Since our opponent can bet any hand in his range for an expected value of at least 1.7 big blinds, it does not make sense for him to check back a hand that will have an expected value of less than 1.7 big blinds after checking. In other words, any hand in our opponent's flop checking range should have an expected value of at least 1.7 big blinds, otherwise, he makes a mistake by not betting the flop.

Next, let's continue with the same assumptions from the previous example except we'll fold 70 percent of the time to our opponent's flop bet instead of only 55 percent. This increases his expectation to at least 3.8 big blinds.

$$3.8 = (8)(0.7) - (6)(1 - 0.7)$$

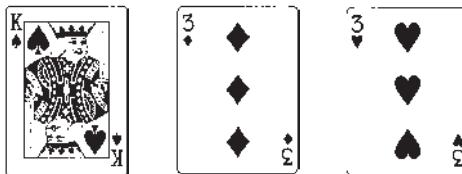
Since we're now defending 15 percent less of our flop checks, our opponent's bluffs will succeed more often, and consequently the minimum expected value of his flop bets have increased. More specifically, whereas before our opponent would always bet with hands that didn't have an expected value of at least 1.7 big blinds when checked back, he'll now bet all hands which have an expected value of less than 3.8 big blinds when checked back.

In other words, the more often we're check-folding after checking on the flop, the harder it will be for our opponent to justify checking back rather than just betting. That's because betting on the flop now is so profitable, and few hands will have a greater expected value as checks than bets. More specifically, the more likely we are to fold to our opponent's bet after checking on the flop, the higher his flop betting frequency should be. And

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again, this is especially true on board textures where giving our check-folding range a free card is risky.

Here's another example. We open in the cutoff, only the button calls, and once again our strategy on the flop is to fold 55 percent of the time after checking. If the flop comes the



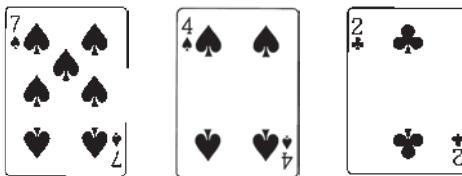
and we check, our opponent will likely still check back hands like king-jack, king-ten, and tens despite the fact that betting with any two cards on the flop has an expected value of at least 1.7 big blinds. That's because his medium strength hands will not likely be outdrawn by hands in our check-folding range, and these holdings can comfortably be bet on later.

Let's try another example assuming we're once again folding 55 percent of the time, only this time the flop is the 9♠6♠4♣. If we check to our opponent on this flop texture, it's hard to imagine many hands in his range will want to check back. That is, all his marginal strength hands are vulnerable to being outdrawn by hands in our check-folding range, and because of this, he'll be tempted to bet these hands now. Remember, this is a great board texture for the player in position to bet the flop with the intention of only betting one or two streets for value. That's because giving free cards with a hand like the 9♦8♦ or the 8♦8♣ is so risky.

In other words, there are two main factors for determining how aggressively our opponent will bet the flop in position. The first is how frequently we're folding to a flop bet, and the second is how risky it is to give our check-folding range free cards. If we'll often fold to his flop bet and giving our check-folding range free cards is risky, then he'll usually bet. This means our strongest hands should be check-raised. But in contrast, if we'll rarely fold

to our opponent's flop bet and giving free cards to our check-folding range isn't risky, then he should not often bet the flop and our strongest hands should instead be bet.

Now let's discuss an example where our attempted flop check-raise will almost always succeed. Imagine when in the big blind we call a button open and the flop comes the



Notice that position is very valuable on this flop texture as it allows our opponent to more comfortably bet only one or two streets for value. In addition, since our checking range includes many hands with two overcards, he will not feel comfortable giving us free cards with marginal strength hands. Lastly, our opponent's bluffs retain their equity quite well against our check-calling range since his overcards frequently improve to beat our marginal pairs. Consequently, these reasons encourage him to frequently bet the flop which then encourages us to check-call or check-raise our sets rather than bet out.

Now let's try an example where an attempted flop check-raise would often fail. Suppose we open in the cutoff and the button calls, only this time the flop is the K♠J♣4♦. Since our opponent would likely 3-bet the majority of his aces and ace-king hands preflop, he will not have many strong hands which want to bet the flop with the intention of betting all three streets. In addition, hands such as king-ten, ace-jack, and queen-jack will be frequently checked back since these holdings are not vulnerable to being outdrawn by hands in our check-folding range. In other words, since we have the superior range on the flop and position is not particularly valuable, our opponent will not frequently bet this flop after our check. Therefore, we should bet the majority of

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our strong hands and only occasionally check-raise or check-call a very strong hand.

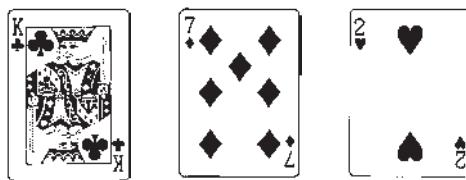
Lastly, on board textures where both players have comparable ranges, a balance will usually need to be struck by betting some very strong hands and checking others. More specially, if we always bet our strong hands on the flop our checking range will be too weak, and our opponent can then exploit us by betting aggressively. Yet if we never bet our strong hands, then our checking range will be too strong, and our opponent can again exploit us by only betting his very strong made hands and draws.

Deciding Whether to Check-Call or Check-Raise

Once we've decided not to bet our very strong hands out of position, usually because our checking range is weak and our opponent will frequently bet the flop, we must determine whether check-calling or check-raising is the superior line.

Check-calling should be emphasized on board textures where our opponent is unlikely to be betting a single street for value and his bluffs are unlikely to improve to beat us on the turn. This allows him to continue bluffing with his weak hands. Then we usually check-raise the turn so he'll be unable to outdraw us cheaply on the river.

Here's an example. We open in middle position, the button is the only caller, and the flop is the

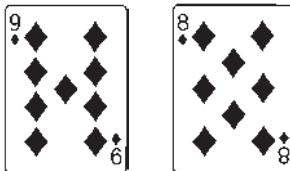


While our opponent might value bet some hands on the flop with the intention of only betting a single street for value, the majority of the hands he'll value bet will most likely be bet on multiple streets. That's because holdings like top pair and medium pair are not vulnerable to being outdrawn by hands in our check-folding range. In other words, since the hands we'll fold to a flop bet are not likely to outdraw our opponent's medium strength hands anyway, he has little reason to bet them on the flop.

However, since our opponent, on the flop, is not likely to just bet a single street for value with his medium strength hands, it's

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easier for us to confidently check-call with nut type hands expecting to get the opportunity to check-raise on a later street. Remember, although some hands in his range, such as the



can outdraw our sets on the river, by making a runner-runner flush or straight, if our opponent picks up a draw on the turn, he'll almost always bet and we can check-raise. That's because flush draws and straight draws will usually make the perfect bluffing hands on the turn, as they have little showdown value but retain their equity well against our check-calling range. Thus, the hands which are capable of outdrawing our sets on the river will almost always be draws which he'll bet on the turn, and this makes check-calling the flop with the intention to check-raise the turn less risky than it would otherwise be.

Check-raising is usually the superior line on board textures where our opponent is more likely to bet a single street for value and there are many bluffs in his flop betting range which can improve to the best hand on the turn. This usually occurs on the low and coordinated board textures which typically favor the player in position. So check-raising the flop allows us to get value from our opponent's strong hands now, as well as prevents him from cheaply outdrawing us on the turn or river.

Here's an example. We open in the cutoff, our opponent calls on the button, and the flop is the T♦6♠5♦. Many of the hands our opponent will likely bet on this flop, such as sevens and eights, won't be able to bet again on almost any turn card. In addition, even stronger hands in our opponent's value betting range, such as ace-ten, won't be able to keep value betting on many turn cards, such as the K♣. Therefore, check-raising a set on this flop

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ensures we get value from our opponent's strong hands before he gets scared on the turn or river. In addition, as we saw in "Part Five: Whether to Bet or Check in Position," starting on page 141, our opponent will probably even have to float with some bluffs against our flop check-raises.

Nevertheless, perhaps the biggest risk with check-calling strong hands on very wet board textures is we'll often get outdrawn or be unable to check-raise on the turn even if we still have the best hand. For instance, if we check-call a set on the $T\spades 6\spades 5\clubsuit$ flop, if the turn card brings the third spade, our hand is usually not strong enough to value check-raise. Consequently, this forces us to check-call again, and our opponent now gets the opportunity to outdraw us on the river with his semi-bluffs (likely by hitting his runner-runner flush). These reasons usually make check-raising the flop with our strong hands superior to check-calling, especially if our opponent is not capable of overbetting the turn.

Here is a quick list of different flop textures and how frequently I prefer to check-raise on them. Keep in mind this is just meant to give a general idea of what types of board textures should be aggressively check-raised compared to check-called. The exact frequencies are unsolvable and will depend on each player's range.

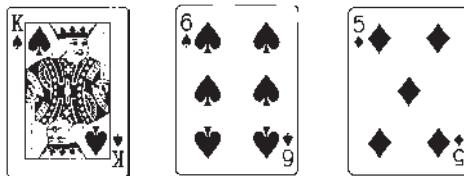
Boards we should rarely check-raise: $A\clubsuit 4\spades 4\clubsuit$, $K\spades K\spades 4\clubsuit$, $Q\clubsuit 3\spades 2\clubsuit$, and $A\spades K\hearts 5\clubsuit$. Notice all of these flop textures have at least one high card. This allows us to comfortably check-call with our weaker top pair hands as well as our medium pairs. In addition, since there are usually few or no hands, on the turn, in our opponent's range which can improve to straights or flushes, any strong hand we check-call on the flop will most likely be able to check-raise if he bets again on the turn. Therefore, our strategy on these flop textures should be to defend against our opponent's bets almost entirely by calling.

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Boards we should check-raise occasionally: 7♣4♥2♠, 9♣9♠7♦, Q♠T♥5♣, and K♠6♦5♦. These flop textures are either more coordinated than the previous ones or do not have at least one high card. This makes check-calling medium strength hands more difficult since our opponent is more likely to improve with his bluffs. In addition, if we check-call with a strong hand when there are possible straight or flush draws, we may have to check-call rather than check-raise on the turn if the draw completes.

Since both check-calling and check-raising our strongest hands on these board textures is reasonable, we'll often want to do a combination of both. In addition, we should pay extra attention to removal effects when value check-raising.

More specifically, we do not usually want to check-raise with very strong hands that remove value hands from our opponent's flop betting range. Here's an example. We check a set of kings on the



flop and our opponent bets. Notice it's unlikely he has a top pair hand since there is only one possible king remaining. This makes check-raising less effective since he's unlikely to have a top pair hand which can call our check-raise and subsequent bets. But check-raising other sets, such as sixes and fives, will be more effective since our opponent is more likely to be value betting a king on the flop.

Boards we should check-raise frequently: 7♠4♦2♦, 8♦7♦6♣, 7♥3♥3♣ and 9♥8♦6♦. It's often wrong to check-call on the above flop textures. That's because any hand in our check-calling range will often be outdrawn by our opponent's bluffs on the turn. In

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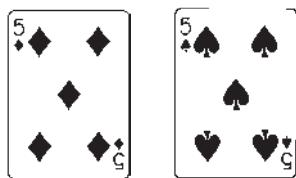
addition, he often won't bet the turn when we have the best hand, and even if he does, we frequently won't be able to check-raise if many hands in his range improve on the turn to straights or flushes.

These flops are the most difficult ones to play out of position against a strong opponent, but by check-raising (the flop) aggressively, we make it difficult for him to cheaply realize the equity of his weakest hands. Remember, in the same way check-calling with marginal hands on these flop is difficult since we'll often get outdrawn, our opponent also doesn't like letting us see free cards with his marginal holdings. That is, he'll often bet medium strength hands as well as many draws, and by check-raising, we maximize our chance of making these hands fold before their equity is realized.

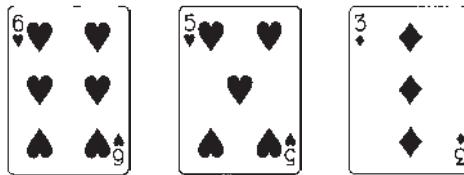
The Difficulties of Check-Raising Certain Flop Textures

Some flop textures are difficult to check-raise using our usual bet sizing since the turn is so likely to improve many hands in our opponent's range. These are the same board textures where position is extremely valuable and we'll frequently be unsure of whether we hold the best hand on many turn and river cards.

Here's an example. We flat the



in the big blind against a button open and the flop comes the



On this flop, we should ask, "If we value check-raise our set, how many turn cards either kill our action or put us behind many hands in our opponent's range?" The answer is: Any heart, seven, four, or deuce will put many flushes or straights in our opponent's range, and make it difficult to know how to continue.

Since position is so valuable on this board texture, we should consider check-raising to a larger size than usual. That's because large check.raises give our opponent a worse price on his call, and

this makes it difficult for him to call with a wide range and abuse his power of position on the turn. More specifically, if we raise a 4 big blind bet into a 6 big blind pot to only 12 or 14 big blinds — the pot will likely be smaller than usual because many players open the button to only 2.5 big blinds — our opponent will likely call with a wide range so he gets to play the turn in position.

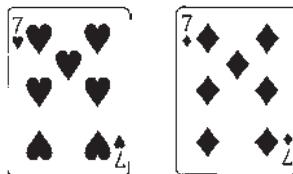
Lastly, it's important to understand and accept that some board textures are much better for our opponent's range than ours. Although eight high or lower flops are uncommon, when they do occur, it's important to simply acknowledge that the flop is unfavorable for our big blind flatting range. This requires us to check-fold to our opponent's flop bets at a high frequency. Excellent blind play requires us to both be able to assess the value of position as well as recognize which player's range is favored on a given board texture.

The Difficulties of Check-Calling Vulnerable Hands

As has already been discussed, since check-calling guarantees our opponent will see the turn with his entire flopping range, it's usually difficult to check-call with marginal hands which are vulnerable to being outdrawn. Yet the same holdings which are risky to check-call will often function poorly as bets because betting makes our opponent's range stronger and weak pairs do not retain their equity well as his range improves.

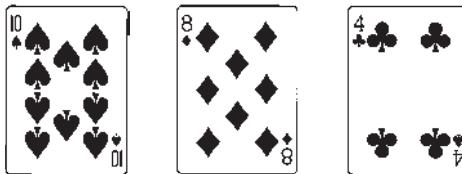
This will come as no surprise to veteran players. One of the most frustrating commonly occurring spots is to hold a marginal pair out of position on the flop against an opponent who likes to aggressively bet. Every line will feel bad as betting often accomplishes little (and may not even make sense in context of our entire range), yet check-calling forces us to play a guessing game on the streets that follow.

Here's an example. We call a cutoff open in the small blind with the



and the flop comes the

The Difficulties of Check-Calling Vulnerable ... 213



If our opponent bets his entire range for 6 big blinds into an 8 big blind pot, as many opponents will, our hand will have 54.4 percent equity against a typical opening range. Hence, if we are getting such a good price and our hand has so much equity, why does check-calling on this flop feel so miserable?

The reason lies in the fact that our hand will almost always remain a bluff catcher, and when we are ahead on the flop our opponent will outdraw us on the turn or river a fair amount of time. In addition, since it's usually impossible for us to know if our hand is best, we'll often call with the losing hand or fold the winning hand. But our opponent will rarely if ever be confused as to whether he's bluffing or value betting against our specific hand, and this allows him to play effectively against us.

We can model this situation using the same formula we used to estimate our value betting to bluffing ratio on the flop. Whereas before, we assumed the bettor's value bets and bluffs had 80 and 20 percent equity respectively, these estimates are not accurate for this situation. Sevens have significantly less than 20 percent equity when behind, and less than 80 percent equity when ahead.

When our opponent has two overcards, such as the K♦Q♦, his bluff will have around 28 percent equity. Likewise, when he bets a pair of tens or better, he'll usually have around 88 percent equity. Although he'll have a few very weak and very strong hands in his range on the flop, most of the hands in his betting range will have around either 28 or 88 percent equity. Using the same assumptions from "Part Five: Whether to Bet or Check in Position," starting on page 141, which required 34.3 percent of our flop bets to be able to value bet the turn and the river, we can

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estimate what fraction of our opponent's bets on the flop need to be value bets.

$$(0.88)(X) + (0.28)(1 - X) = 0.343 \Rightarrow$$

$$(0.6)(X) = 0.063 \Rightarrow$$

$$X = 0.105$$

The model suggests that since our opponent's value bets and bluffs both have so much equity, he needs only 10.5 percent of his flop bets to be value bets! (And even if he never checks his value bets will easily surpass that percentage.) While our previous assumptions are not perfect, especially since our opponent won't always bet the winning hand on the turn and river, he also has the advantage of position which we were unable to take into account (but which is significant on this flop texture).

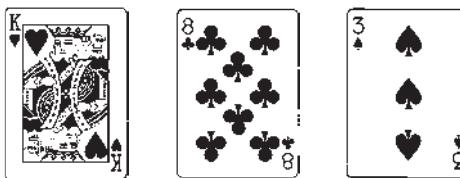
This model showcases why check-calling a vulnerable pocket pair on the flop is often a weak play despite the hand having so much equity. That is, a pocket pair will almost never improve to beat hands in our opponent's value betting range, but will be outdrawn frequently by his bluffs. In addition, since there are still multiple streets left to act, our opponent has several opportunities to strengthen his range by giving up some of his bluffs while continuing to value bet all of his strong hands. Remember, just because a hand has a lot of equity does not imply it has a high expected value, and we must be able to fold high equity hands on the flop when the situation calls for it.

Weak players often get confused with this concept, and can't fathom how it's possible to need to fold a hand with over 50 percent equity when getting such a good price. But consistently calling with weak made hands on the flop is often an especially problematic leak because these holdings continue to be difficult to play on the turn and river. In other words, check-calling with too weak of a made hand on the flop is a great example of a spot where a small mistake will often be compounded to a larger and more expensive mistake on the turn and river.

Donk Betting from the Blinds

Since the big blind preflop cold calling range is condensed and position is valuable, we'll often have to check our entire range on the flop. This is true even if our range has more equity than our opponent's.

Here's an example. Our opponent opens on the button and we call in the big blind using the preflop ranges from "Part Two: Preflop Play." If the flop comes the



our range will have 53.9 percent equity against a typical player. However, despite our range having more equity and position not being particularly valuable on this board texture, we'll still likely want to check our entire range.

The reason why donk betting isn't effective here is that we have few hands in our range stronger than king-jack, and as such, the majority of our range is unable to effectively get more than two streets of value by betting. In addition, check-calling is not risky since our opponent is unlikely to outdraw us when we hold a hand like the K♦7♦.

In other words, just because our range has more equity than our opponent's, it does not imply we should have a flop donk betting range. That is, we must pay attention to how our equity is distributed among hands in our range, and unless some of them are very strong, donk betting will not be effective. More specifically, if our value bets on the flop are too weak, our opponent will be able to frequently raise and turn our value hands

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into bluff catchers. In addition, even if he does defend by flat calling against our weak flop bets, it's unlikely we'll win at showdown. That's because he won't need to call down very often because he can defend so aggressively by raising.

In general, donk betting from the blinds will often be effective on board textures where we have offsuit two pair combinations and our range has more equity. That's because the possibility of two pair hands add a significant amount of equity to our range and are strong enough to bet on the flop with the intention of betting all three streets for value. In addition, if we check our entire range on these board textures, our checking range will likely be too strong and our opponent can exploit us by rarely betting the flop.

Here's an example. We flat in the small blind against a cutoff open and the flop comes the K♠Q♠8♦. Our range now has 59.6 percent equity, but in addition to having more equity, we now have 9 combinations of two pair since we would call preflop with king-queen offsuit. Furthermore, if our opponent raises our donk bet, we can 3-bet some of our very strong hands as well as some draws and bluffs, so we don't always have to defend by calling. Lastly, if we never donk bet, a skilled opponent will be reluctant to bet the flop as he'll know there are many hands in our range strong enough to value check-raise.

Understanding the Major Parameters of Flop Play

We've covered a lot of ground so far, so it'd be wise to quickly review the major parameters, or guidelines, previously discussed for flop play. Although this is all review, seeing the most important formulas on the same few pages should help with visualizing exactly what the models are suggesting.

Parameter No. 1: Minimum Required Defending Frequency

Example Formula:

$$\text{minimum defending frequency} = \text{pot-size} / (\text{bet-size} + \text{pot-size})$$

Application: This formula should be used whenever we desire to prevent our opponent from being able to profitably bet or raise with any two cards. If however he has already taken a risk to maybe get the chance to bluff, allowing him to profitably bet any two cards is not usually a problem.

For instance, if we bet the flop and our opponent calls in position, then this formula should not usually be applied after we check the turn. Our opponent risked money on the flop and will not always get this opportunity to make a profitable bluff.

But our opponent should never be able to profitably bluff with any two cards when facing a bet or raise since if he can he'll never fold. As such, this formula always must be applied when betting or raising.

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Parameter No. 2: Required Felting Range When Facing a Bet on All Three Streets

Example Formula: If we are out of position and bet 75 percent of the pot on the flop, turn, and river, our opponent should defend at minimum 18.7 percent of his range if he only defends by calling.

(flop calling frequency)(turn calling frequency)(river calling frequency) =

$$0.187 = (0.57)(0.57)(0.57)$$

Application: This formula determines how strong our opponent's river calling range will be if he faces a bet on all three streets and calls enough to prevent us from being able to profitably bluff with any two cards. A near identical formula can be used as well when facing a flop raise, turn bet, and river bet.

Although hands not strong enough to value bet all three streets can still be value bet on the flop, rather than other streets, this is usually only justified if betting makes high equity hands fold. Also, it's especially difficult to bet only a single street for value on the flop or bet only two streets for value when out of position since both these lines give our opponent the opportunity to bet on the river against a weak range.

Parameter No. 3: The Bluffing to Value Betting Ratio

Example Formula: If we have a perfectly polarized range on the flop and can only bet 75 percent of the pot on each street, we should bet the turn 70 percent of the time after betting the flop, the river 70 percent of the time after betting the turn, and 70 percent

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of our river bets should be value bets. From these frequencies, we can derive what percentage of our flop bets must be value bets.

(turn betting frequency)(river betting frequency)(percent of river bets which are value bets)

$$(0.70)(0.70)(0.70) = 0.343$$

In addition, we can estimate what percentage of our flop bets should be value bets if our value bets and bluffs have 80 and 20 percent equity respectively. Given the assumptions discussed previously in “Part Five: Whether to Bet or Check in Position,” only 23.9 percent of our flop bets need to be value bets.

$$(0.8)(X) + (0.2)(1 - X) = 0.343 \Rightarrow \\ X = 0.239$$

Application: These formulas can be used to determine our bluffing to value betting ratio based on our bet size, the number of streets remaining, and the equity of our bluffs and value bets. In addition, there are other important factors, such as the value of position, each player’s ability to realize their equity, and how likely the best hand is to be bet on all three streets, which must be kept in mind as well even if our model cannot directly take them into account.

Parameter No. 4: Required Out of Position Betting and Check-Defending Frequencies

Example Formula: The following formula can be used to determine the minimum expected value of our opponent’s weakest hand on the flop.

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minimum EV of opponent's hand =

$$(\text{flop checking frequency})[(\text{pot size})(\text{folding frequency}) - (\text{bet size})(\text{defending frequency})]$$

For example, suppose the pot is 8 big blinds and whenever a player bets they will bet 6 big blinds. If we check the flop 60 percent of the time and defend 45 percent of our checks, the minimum expected value of the opponent's weakest hand will be 1.02 big blinds.

$$1.02 = (0.6)[(8)(1 - 0.45) - (6)(0.45)]$$

Application: This formula illustrates how we must use some combination of betting, check-calling, and check-raising to keep the expected value of our opponent's air hands reasonably low on the flop. If the expected value is too high, he will be able to profitably call preflop with hands which otherwise should be folded.

This is perhaps the hardest and most delicate parameter to apply since balancing multiple ranges out of position on the flop is difficult. Furthermore, on board textures where our range is weak, we should emphasize check-calling and check-raising with our strong hands. However, if our range is strong, betting should be emphasized.

Example of Balancing a Range Out of Position on the Flop

Here's an example of how to play a middle position opening range—AA-22, AKo-ATo, KQo, AKs-A7s, A5s, KQs-KTs, QJs-QTs, JTs-J9s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s, 54s—against a button caller when the



flops. Since we already saw how the button should defend against a continuation bet in "Part Four: Facing a Flop Bet in Position," this gives us a great starting point for determining how to play our range when out of position.

Total combos on the flop: 209

Value bet: AA(6), AK(12), 97s(2), TT(6) = 26

Draw bet: A♠J♠, A♠T♠, A♠8♠, A♠5♠, Q♠J♠, Q♠T♠, 8♠6♠, 6♠5♠, 5♠4♠, JTs(3), T8s(3), 86s(3) = 18

Bluff bet: A♠Qx(3), AxQ♠(3), A♦Q♦, A♠Jx(3), AxJ♠(3), A♦J♦, A♠Tx(3), A♦T♦, QJs(3), QTs(3), 65s(3), 98s(2), A♦8♦, 88(6), A7s(3) = 39

Total combos bet: 83

Betting frequency: 39.7%

Total combos checked: 126

Checking frequency: 60.3%

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Check-call: KK(3), A♦Q♠, J♦9♠, T♦9♠, 9♦8♠, A9s(3) KQ(12),
KJs(3), KTs(3), QQ-JJ(12) = 40

Value check-raise: 77(3), 99(3), J♦T♠, T♦8♠ = 8

Bluff check-raise: 87s(3), 76s(3), 75s(3), J9s(2), T9s(2) = 13

Total checks defended: 61

Percentage of checks defended: 48.4%

Opponent's EV of flopped air:

$$(0.603)[(8)(1 - 0.484) - (6)(0.484)] = 0.74$$

Analysis: Despite check-raising aggressively with many sets, straight-flush draws, and bluffs, we still are only defending 48.4 percent of our checks. Because of this, the expected value of our opponent's weakest hands on the flop is at least 0.74 big blinds. If this seems too profitable, aces as well as some additional bluffs can be check-raised instead of bet. This will lower the expected value of our opponent's weakest hands since his bluffs will fail more frequently.

In addition, notice there are 3 bluffs in our betting range for every 2 value bets. This seems reasonable, especially since tens were counted as value bets despite the fact that they clearly cannot be bet for value on all three streets. Also, position is reasonably valuable on this flop texture, so although bluffing a bit more aggressively may be possible, it's unlikely we can bluff much more frequently than we currently are and still remain reasonably balanced.

Lastly, by now it should be apparent that ranges are complex and dynamic enough on the flop that hands cannot always be easily classified as value bets, bluffs, or draws. That's because there are still two additional cards to come, and hands are often bet on the flop for multiple reasons — to make high equity hands fold and get value from worse hands. Nevertheless, it's still important to have some idea of what ratio of value bets to bluffs is being used on the flop.

Summary

Playing well when out of position on the flop is tough, but ultimately that's a good thing. Difficult flop situations occur constantly, and by putting in the necessary work to really understand flop play we can gain a significant edge on our opponents.

It's especially demanding to play out of position because betting the flop with the intention of only betting one or two streets for value is often ineffective. That is, if we check on the river after betting the flop and turn, our opponent has the opportunity to bet and convert many of our hands into bluff catchers.

We also discussed why our opponent must not be able to make profitable bluffs with any two cards without having previously taken a risk. Although allowing him to frequently make a slightly profitable flop bet in position is not likely a problem, we should still check-call and check-raise aggressively on certain board textures. More specifically, check-raising and check-calling are significantly more effective at lowering the expectation of our opponent's weak hands on the flop than betting is.

Lastly, board textures where check-calling is difficult will usually favor the player in position, and it's important to check-raise these boards aggressively. In addition, it's unlikely our opponent will check back on the flop, but he'll often plan on checking the turn and/or river after betting on the flop. Also, large check.raises are more effective if several turn cards will greatly improve many hands in our opponent's range.

Here's a few specific points which were addressed in this section of the book:

1. Optimal poker only cares about the current game state. The previous action is only necessary for assigning hand ranges.

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2. It's acceptable for our opponent to make profitable bluffs with the worst hands in his range provided he previously took a risk and isn't always guaranteed to get a profitable bluffing opportunity.
3. Check-raising punishes our opponent for betting the flop with a weak or marginal hand, but greatly increases the pot size as well as the strength of our opponent's range.
4. Making our opponent fold hands which have 20 to 25 percent equity against our hand on the flop is significant. If betting makes him fold many high equity hands, then betting the flop with the intention of only betting one or two streets for value may be the best line (even when out of position).
5. Our opponent will likely bet frequently on the flop when betting with any two cards is highly profitable. This encourages us to emphasize check-calling and check-raising with our strongest hands. If his flop bets are not very profitable, he'll likely bet at a lower frequency, and when this happens, it encourages us to bet our stronger hands for value.
6. Some flop textures are difficult to check-raise because so many turn cards will either make it difficult to keep betting for value or put many stronger hands in our opponent's range. This requires us to use a bigger check-raise sizing.
7. Figuring out which hands work best as check-raises, check-calls, and bets is often difficult and requires much practice both at and away from the tables. Understanding how each line affects our opponent's range is the first step to developing these skills.

Part Seven

3-Bet Pots on the Flop

3-Bet Pots on the Flop

Introduction

Almost all players at some point in their poker career think one of the weakest aspects of their game is 3-bet pots. This is due to several reasons. First, 3-bet pots occur less often than single raised pots so players are less experienced with them. In addition, most players who don't emphasize learning poker theory use a trial and error approach to improving their play, and because of this their play suffers in spots which occur less frequently. But this won't be a problem for us as nearly every concept previously discussed will also apply to 3-bet pots.

Next, players are more likely to remember their misplays in 3-bet pots since the pot is larger and mistakes are so costly. Thus they are more likely to steam. However, for most players, it's easier to accept losing a large pot if they feel they played the hand well and simply got unlucky. Hence, our focus will be on the theoretical aspect of 3-bet pots rather than tilt control because one advantage of playing well is we're less likely to make a large mistake and then go on tilt.

Lastly, 3-bet pots are often difficult to play because the 3-bettor is usually out of position with a polarized range while the 3-bet caller is in position with a condensed range. If we're the 3-bettor, our range will be the easier one to play since very strong and very weak hands are typically easier to play than marginal strength hands. Yet playing out of position will often be tough even if our range is polarized. Likewise, although we'll usually have the advantage of position if we're the 3-bet caller, our range will include many medium strength hands, and it's often difficult to tell whether calling or folding with these hands when facing multiple bets is the best strategy.

In spite of this, it's important not to approach 3-bet pots with any sort of fear. Although more money than usual is at stake, this shouldn't be used as justification for poor play. Optimal poker is aggressive, and it often requires us to make a large bluff or call down with a bluff catcher in a 3-bet pot. We simply must accept the fact that there is a lot of money at stake and be willing to play large pots with far from nutted hands.

Bet Sizing as the 3-Bettor

If we 3-bet to 12 big blinds preflop and the original raiser calls, the pot, on the flop, will be around 25 big blinds. If our range is perfectly polarized, the optimal bet sizing equation shows we should bet enough so that the pot doubles on each street.

$$(\text{starting pot-size})(\text{pot growth rate})^{(\text{streets remaining})} = \text{final pot-size}$$

$$\begin{aligned} 25R^3 &= 200 \Rightarrow \\ R &= 2.00 \end{aligned}$$

where

25 is the starting pot size,
200 is the final pot size, and
R is the growth rate.

Therefore, if the pot should increase to 2.00 times its size on each street, we should bet 0.5 pot-sized bets on the flop, turn, and river, to get all-in on the river.

$$\begin{aligned} (2.00)(\text{SPS}) &= \text{SPS} + (2)(\text{bet size}) \Rightarrow \\ \text{SPS} &= (2)(\text{bet size}) \Rightarrow \\ \text{bet size} &= (0.5)(\text{SPS}) \end{aligned}$$

where

SPS = starting pot size.

If the pot, on the flop, is larger than 25 big blinds, which will often be the case in squeezed pots, then betting a bit less than 0.5 pot-sized bets on each street will get all the money in by the river. Likewise, the pot will usually be smaller than 25 big blinds when the button opens and we 3-bet from the blinds. When this occurs,

our bets need to be slightly larger on each street to get us all-in by the river. Nevertheless, while it's important to make small bet sizing adjustments based on the flop pot size, betting around half the pot will usually get us close to all-in by the river.

Therefore, we can once again work backwards to figure out what fraction of our flop bets need to be value bets if we bet the flop with a perfectly polarized range. So if we bet a 0.5 pot sized bet on the river, our opponent will risk 0.5 pot sized bets to win 1.5 pot sized bets. This requires 75 percent of our river bets to be value bets to keep our opponent indifferent to calling with his bluff catchers.

$$(1.5)(1 - X) - (0.5)(X) = 0 \Rightarrow \\ X = 0.75$$

And as previously explained, when we bet the river with a balanced range, our opponent has effectively lost, but if we check, since our range is perfectly polarized, he'll always win. Thus, if we bet 0.5 pot sized bets on the turn, our opponent once again risks 0.5 pot sized bets to win 1.5 pot sized bets, and therefore the river must be bet with a balanced range 75 percent of the time after betting the turn. Likewise, if we bet the flop for 0.5 pot sized bets, the turn must be bet with a balanced range 75 percent of the time. We thus should bet the turn 75 percent of the time after betting the flop, the river 75 percent of the time after betting the turn, and 75 percent of our river bets need to be value bets. This results in 42.2 percent of our flop bets needing to be value bets.

$$0.422 = (0.75)(0.75)(0.75)$$

where

the first 0.75 is the turn betting frequency,
the second 0.75 is the river betting frequency, and
the third 0.75 is the percent of river bets which are value bets.

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Furthermore, if we continue using assumptions from previous chapters and assume our value bets have 85 percent equity and our bluffs 15 percent equity, approximately 38.9 percent of our flop bets should be value bets. The reason why our value bets and bluffs have 85 and 15 percent equity respectively, as opposed to 80 and 20 respectively which was used earlier in the book, is because our 3-betting range is quite polarized which makes it more difficult for stronger hands to be outdrawn.

$$(0.85)(X) + (0.15)(1 - X) = 0.422 \Rightarrow \\ X = 0.389$$

It should come as no surprise that in 3-bet pots a greater fraction of our flop betting range needs to consist of value hands when compared to raised pots. That's because our bets are smaller in 3-bet pots relative to the size of the pot, and our opponent thus gets a better price to call on each street. And for this reason, we come to our next general rule:

Our flop betting range in 3-bet pots should include around 3 bluffs for every 2 very strong value bets.

Although it may at first seem difficult to balance a flop betting range in a 3-bet pot since more of our bets need to be value bets, this can be taken into account preflop when designing 3-betting ranges. More specifically, by 3-betting our strong overpairs and ace-king hands preflop, we're guaranteed to have several hands strong enough to value bet on nearly any board texture. Furthermore, we should not often bet our entire range on the flop. Many 3-bet bluffing hands with one high card, such as the A♥5♥ and the K♦9♦, can flop weak top pairs hands which make excellent check-calling hands.

Defending Against Flop Bets in 3-Bet Pots by Calling

When facing a half pot-sized bet as the cold caller, we'll need to defend at least 66.7 percent of the time on each street to prevent our opponent from making an immediate profit with his bluffs. If we wish to do this, we're required to call down with 29.7 percent of our flopping range when facing a bet on all three streets.

$$0.297 = (0.667)(0.667)(0.667)$$

where

the first 0.667 is the flop calling frequency,
the second 0.667 is the turn calling frequency, and
the third 0.667 is the river calling frequency.

Whether or not our opponent should be able to profitably continuation bet any two cards on the flop will depend on each player's range and the flop texture. Remember, when analyzing preflop play, we saw that the out of position 3-bettor pays on average 6 to 7 big blinds to see a flop with his bluffs, and since our opponent risked money preflop, it's not necessarily a problem if he frequently gets the opportunity to make a slightly profitable bluff post-flop. For instance, our opponent's bet with any two cards may have a minimum expected value of 2 big blinds on a certain flop. Yet if he risked on average 8 big blinds to get that opportunity, then nothing suggests we are being exploited.

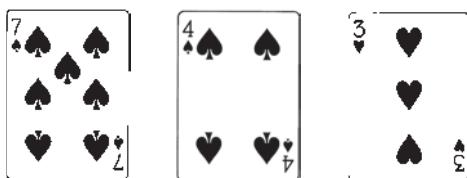
While the above cannot be proven directly, this is likely the outcome which results from optimal preflop play. The 3-bet cold caller cannot defend enough on many flop textures to prevent the 3-bettor from profitably betting any two cards, but the 3-bettor risked enough money preflop that this is not a problem. Also, if a

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player 3-bets a hand which is too weak preflop, he'll flop poorly with a high probability and his expectation for the hand will be negative.

In general, our 3-bet calling range does quite well on boards which are jack high or higher. That's because our range usually includes many high card hands such as ace-queen, ace-jack, and king-queen. Flops which are king high are a bit tougher when ace-king isn't in our range, but we'll still usually have a good amount of top pair hands even if our kicker isn't amazing. In addition, our opponent probably shouldn't be able to profitably bet any two cards on many high board textures since our range is so strong and we have position.

However, it's usually tough to defend on low board textures. Here's an example. We open on the button and call the big blind's 3-bet to see a flop of the



This is a great flop for our opponent's 3-betting range. It should produce a 57.3 percent equity for a typical player. That's because his range should include many more strong overpairs than ours, and they'll rarely be outdrawn and can almost always continue to be value bet on the turn and river.

In addition, this flop strongly connects with our opponent's 3-bet bluffing range. Low suited connectors and gappers make excellent 3-bet bluffs, and nearly all these hands flopped either a pair, draw, or both. Furthermore, overcard hands such as ace-king and ace-queen can bluff on the flop and will usually improve to the best hand if they make top pair on the turn. As a result, nearly every bluff in our opponent's flop betting range will have

considerable equity (much more than 15 percent) and our opponent is thus able to bluff quite aggressively.

Also note that this may be backwards from what you've read elsewhere and may even seem counterintuitive. New players often associate flops with a high card as better for the 3-betting range since this range often makes many top pair, top kicker hands. And while true, holdings such as kings, queens, and jacks are just mediocre when the board has a higher card on it, whereas they are usually strong value hands when the board comes all undercards. In addition, as previously mentioned, low boards hit hands in the 3-bet bluffing range. Yet hands which work well as 3-bet bluffs and improve on low board textures, such as the 8♠6♠ and the 5♥4♥, are often too weak to call a 3-bet. The result is low board textures tend to strongly favor the 3-bettor.

Defending Against Flop Bets in 3-Bet Pots by Raising

Raising is also an option in 3-bet pots. If we call our opponent's 12.5 big blind bet into a 25 big blind pot, the pot will be 50 big blinds. As previously explained, we can solve for how much the pot needs to grow on each street to get all the money in by the river, assuming we raise or bet an equal fraction of the pot on each street.

$$50R^3 = 200 \Rightarrow \\ R = 1.59$$

where

50 is the starting pot size,
200 is the final pot size, and
R is the growth rate.

Therefore, by our estimate, the pot would increase to 1.59 times its size with each passing street. The same methodology shown previously in this section can be used to show we must raise or bet approximately 0.30 pot-sized bets on each street to get all-in on the river. This requires us to raise the flop to 27.3 big blinds, bet the turn for 23.4 big blinds, and bet the river for 36.8 big blinds.

However, these bet sizings are not important to remember and will rarely if ever be used. The reason for this is it will be difficult, if not impossible, to bet the turn after raising the flop and then fold to a check-raise all-in. More specifically, once we bet the turn, we'll have only 36.8 big blinds remaining. As such, we'll almost always be getting odds to call our opponent's all-in check-

raise. In fact, if our opponent check-raises all-in on the turn, we'll need only 18.4 percent equity for calling to be profitable.

$$(163.2)(X) - (36.8)(1 - X) = 0 \Rightarrow$$

$$X = 0.184$$

where

36.8 is the price of the call,

163.2 is the size of the pot, and

X is the equity required for calling to be profitable.

Furthermore, there are few situations where we'll be bluffing the turn in a 3-bet pot with a hand that has less than 18.4 percent equity against our opponent's check-raise all-in. This is true because our opponent will often have some draws in his check-raising range, especially if he knows we'll sometimes fold and let him take down a massive pot without a showdown. In addition, if we're never or almost never folding to his turn check-raises, jamming the turn ourselves will be superior as this takes away his option to only call our bet. For these reasons, making a small turn bet in a 3-bet pot after raising the flop is ineffective.

Another option is to raise the flop with the intention of only utilizing the flop and turn to get stacks all-in. This means there are effectively two streets left to act and once again the bet sizing formula can be used to estimate what our bet and raise sizing may look like.

$$50R^2 = 200 \Rightarrow$$

$$R = 2.00$$

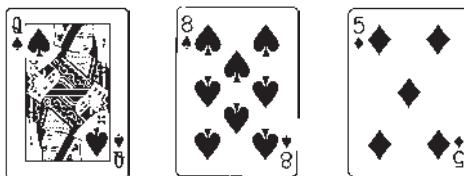
As we've already seen, if the pot must double on each street, we're required to make a 0.5 pot sized raise on the flop and a 0.5 pot sized bet on the turn. This requires us to raise the flop to 37.5 big blinds and to bet 50 big blinds on the turn.

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Nevertheless, there are many problems with raising to 37.5 big blinds. Specifically, our flop raise size is now so big that our opponent will often be tempted to just go all-in and destroy our positional advantage. Moreover, when his flop jam succeeds, he'll win a large pot, and even when it does not, he's guaranteed to realize the equity of his hand since he's all-in. Lastly, after raising to 37.5 big blinds, we'll need only 25 percent equity to call our opponent's flop jam, which makes it awkward to even raise and fold a gutshot with an overcard.

It's best to pick a flop raise sizing which is small enough so that our opponent can't easily go all-in and destroy our positional advantage. Yet since we don't need to raise in 3-bet pots to get all the money in by the river, it rarely, if ever, makes sense to raise unless we have a strong but vulnerable hand. This will usually only occur on wet flops, but many players are often afraid to make small raises on these board textures because they fear giving their opponent odds to call with a draw. However, allowing our opponent to make profitable calls with his draws is not necessarily a problem.

Here's an example. We open in the cutoff and call the small blind's 3-bet. If the flop comes the



our the opponent will likely have many gutshots in his range. If he continuation bets 12.5 big blinds into a 25 big blind pot, and if we raise to only 25 big blinds (the minimum) he may be able to profitably call with some or all of his gutshots. Therefore, some players often think this means our raise sizing must be bad since we didn't make our opponent fold many high equity hands which can outdraw us on the turn.

Moving on, let's simplify things a bit and assume that if we call our opponent's flop bet when he has a gutshot then his expected value is 9 big blinds. This seems reasonable since he'll make a straight on the turn 8.5 percent of the time, the pot is already large, and there are implied odds. Yet if we raise the minimum on the flop, even if he can profitably call with a gutshot, he's likely only barely getting the price he needs to call. In other words, it would not be surprising if calling a raise with a gutshot here has an expected value as low as only 1 big blind.

So in this example, despite the fact that our opponent can profitably call our raise with all of his gutshots, by raising instead of calling, we greatly decrease his expectation. By the way, this feeling of just barely getting odds to call and hating it should be familiar to even novice players. While oftentimes our bet or raise sizing will be designed to make the expected value of many of our opponent's hands zero, such as is the case when we bet on the river or bet with a perfectly polarized range, sometimes the best we can do is just decrease the expected value of many of our opponent's hands. And in 3-bet pots, it's likely best to usually make a small raise and allow our opponent to profitably call with some of his draws and force him to play the turn out of position. This results in his range being weak on the turn and allows many of our turn bluffs to be highly profitable.

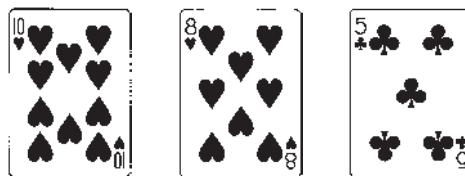
As such, making small raises to around 25 to 28 big blinds on the flop is likely ideal. This forces our opponent to still defend aggressively against our flop raises since he must defend significantly more than half of his range, as well as forces him to constantly play the turn out of position. Furthermore, when he does call, we have the option to comfortably go all in on the turn for around a 75 percent pot sized bet. And lastly, even if he can call on the flop with many of his draws, their expectation will likely be significantly lower when we raise and force him to either jam or call than if we simply called ourselves.

Facing a Flop Check as the Cold Caller in Position

When we call a 3-bet in position, it's reasonable to expect our opponent to frequently bet the flop since the preflop 3-betting range is polarized while the 3-bet calling range is condensed. However, our opponent will sometimes check to us in a 3-bet pot and when he does, we'll play similarly to how we would when facing a check in a raised pot. In other words, we'll bet primarily a polarized range of value bets and bluffs, and only bet marginally strong hands if many high equity hands will fold.

Although it's advantageous to be in position, we'll still want to have around 3 bluffs in our betting range for every 2 value bets. In addition, on board textures which are difficult for our opponent to check-call, we should consider using a smaller bet sizing on the flop. This makes our bluff cheaper and causes our opponent to defend a wider range by either check-calling or check-raising, as well as results in his winning less money when his check-raise succeeds.

Here's an example. We open in middle position and call the big blind's 3-bet. If the flop comes the



our opponent will probably have a difficult time check-calling with marginal strength hands since they will frequently be outdrawn on the turn. This encourages him to defend his flop checks by check-raising more aggressively, and by us betting

smaller we'll have less money invested if our hand gets turned into a bluff-catcher. So small bets are often effective when our opponent will have trouble check-calling, and this is especially true on the flop in 3-bet pots.

Just like in single raised pots, it's common to be able to profitably bet any two cards on the flop once our opponent checks. More specifically, he'll need to defend at least 67 percent of the time to make our half pot-sized flop bets unprofitable, and this isn't something he's usually able to do. However, as previously discussed, this is not a problem for him since we risked up to an additional 8 to 9 big blinds by calling preflop to maybe get the chance to bluff post-flop. Calling 3-bets with weak hands will still be a losing play unless our opponent check-folds at an unreasonably high frequency.

Summary

3-bet pots on the flop are not much different from single raised pots other than more money is at stake and no raise is required to get all-in by the river. Although losing a 3-bet pot is costly, optimal poker requires us to play aggressively and frequently put our stack at risk. In other words, we must defend aggressively against our opponent's flop bets and not let the fear of him holding a monster hinder us from playing well.

Since the pot is already large on the flop in 3-bet pots, bets will usually be smaller relative to the size of the pot when compared to raised pots. This requires a higher fraction of the flop betting range to be value bets since our opponent is getting a better price on his call. However, this is not usually a problem in 3-bet pots, especially since the preflop 3-bettor will often have many premium hands in his range.

Raises should occur less frequently on the flop in 3-bet pots since no raise is required to get all-in by the river. However, raising with a strong but vulnerable hand is often the correct play. The flop should usually be raised to around 25 to 28 big blinds, and if the turn is bet it's best to go all-in since bet-folding will not usually be an option.

Here are a few final points.

1. Playing in 3-bet pots is similar to playing in raised pots. We usually want to bet strong hands for value, check medium strength hands, and bluff hands with little showdown value and some equity.
2. If a 3-bet is called preflop, the 3-bettor will frequently be out of position with a polarized range and the 3-bet-caller will frequently be in position with a condensed range. It's

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expected that the 3-bettor will often be betting on the flop and the 3-bet-caller will usually defend by calling.

3. Since both players had to take a risk to see the flop, it's reasonable for players to often be able to make profitable flop bets with any two cards.
4. We usually want around 3 bluffs for every 2 value bets on the flop in 3-bet pots.
5. Raising is less effective in 3-bet pots since it allows our opponent to felt a strong range and we do not need to put in a raise to get all the money in by the river.
6. When we do raise the flop for value, it will usually be with a strong but vulnerable hand which can be outdrawn by hands in our opponent's bet-folding range. Hands which do not fear giving additional cards to this range will usually be calling with the intention of often raising the turn.
7. It's not necessarily a problem that our opponent can make profitable calls with weak draws on the flop on some board textures.
8. Small flop bets are effective in position on flop textures where our opponent will have difficulty check-calling.

Part Eight

Playing the Turn in Position

Playing the Turn in Position

Introduction

Before moving on to turn play, you should stop for a moment and congratulate yourself for making it over halfway through the theory section of this book and think about all that has already been covered. Although we've only discussed preflop and flop play in detail, solid flop play is not possible without having some knowledge of the frequencies and ratios necessary for turn play. Likewise, concepts such as equity, bet sizing, and when bluffing any two cards should be profitable, will apply on the turn in the same manner as they did on the flop. In fact, even though little effort has been put in specifically trying to improve our turn play, we should already have an idea of what to do in most spots simply by applying the concepts previously discussed.

In other words, most of the theoretical concepts necessary for excellent turn play have already been introduced. And while some repetition will be useful, our primary focus when analyzing this street will be to learn new frequencies and ratios and focus on the aspects of turn strategy which differ from what was necessary for the flop. This is especially important because the pot won't always be the same size on the turn, and it's common for ranges to now be more defined.

Lastly, it's important to note that despite what many people think, the turn is not an especially troublesome street. Many players often think this because their strategy is poor on the flop, and thus their turn range will include many hands which are difficult and awkward to play. So good flop strategy should ensure our turn range will be reasonably balanced on the majority of turn cards, and this makes taking the correct line much easier to determine and execute.

Raising a Turn Bet After Calling the Flop

We'll start our discussion of turn play by estimating the correct bluffing to value raising ratio on the turn when facing a bet. However, unlike on the flop in single raised pots where no post-flop betting has yet occurred, when our opponent bets on the turn, the pot will not always be the same size. In addition, each player is likely to have a different range on the turn, with the flop caller having a mostly condensed range and the flop bettor having primarily a polarized range. Nevertheless, when we do face a turn bet in position, our bluffing to value raising ratio will change based on whether our opponent is betting 15 big blinds into a 20 big blind pot or 6 big blinds into an 8 big blind pot.

That is, on the turn, the pot will be around 8 big blinds if the flop checked through and around 20 big blinds if a flop bet was called. And as was shown when analyzing flop play, we'll need to call or raise at least 57.1 percent of the time to prevent our opponent's 75 percent pot-sized bets from showing an immediate profit.

On the turn, our opponent should not likely be able to profitably bet any two cards after we call his flop bet. This is especially true if we didn't defend the flop unreasonably aggressively and mostly defended by calling. In this case, his flop bluff sometimes succeeded, and even when it didn't, he usually got the opportunity to improve on the turn and continue bluffing. In other words, if we fold at a reasonable frequency to our opponent's flop bets, he'll effectively pay very little money on average to see the turn, and since he gets to see the turn so cheaply, we cannot allow him to profitably bluff with any two cards or he'll never check-fold the flop.

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We've already discussed how to defend against our opponent's turn bets if he bets 15 big blinds into a 20 big blind pot and we want to defend by calling, so now let's consider raising. Once again, we can begin by analyzing what sizing we'd need to use if we wanted to raise and bet equal fractions of the pot on the turn and river. Note the starting pot size is 50 big blinds since that's the size the pot would be if we just called our opponent's turn bet.

$$50R^2 = 200 \Rightarrow \\ R = 2.00$$

That is, the pot needs to grow to double its previous size with each additional round of raising or betting, and if the pot doubles from 50 to 100 big blinds on the turn, we need to raise our opponent's turn bet of 15 big blinds to 40 big blinds and follow through with around a 50 big blind river jam.

However, the problem with raising our opponent's turn bet to 40 big blinds is we leave, relative to the size of the pot, little money behind. In particular, if our opponent goes all-in on the turn after our raise, the pot will be 150 big blinds and we'll have only 50 big blinds remaining. This means we'll get 3-to-1 odds to call and need only 25 percent equity for calling to be profitable. Thus, it becomes very difficult for us to raise the turn and fold to our opponent's turn jam, especially since he's guaranteed to realize the equity of his bluffs and will win a massive pot if we fold.

Notice that this is no different than what occurs in 3-bet pots when we raise on the flop and bet the turn without going all-in. That is, it's simply not effective to raise or bet on the turn in position and leave such little money behind as our opponent can then go all-in to destroy our positional advantage and we'll almost always be priced into calling.

As such, a small turn raise is usually more effective than a large one since this forces our opponent to defend a wider range

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and encourages him to call. This also allows us to more frequently play the river in position. However, there are times when large raises are appropriate and we must not get into the habit of thinking only one sizing works in this spot.

So let's instead suppose we raise our opponent's 15 big blind turn bet to 33 big blinds and plan to bet all-in for 57.5 big blinds if we do bet the river. This bet sizing makes it more difficult for our opponent to defend by only jamming or folding against our turn raise, as well as results in him winning less money when we do fold.

Just as before, it's easiest to visualize the situation by working backwards. If we raise our opponent's turn bet to 33 big blinds and he calls, the pot will be 86 big blinds on the river. If we then bet 57.5 big blinds, 71.4 percent of our river bets must be value bets to make him indifferent to calling.

$$(143.5)(1 - X) - (57.5)(X) = 0 \Rightarrow \\ X = 0.714$$

where

143.5 is the pot size,

57.5 is our bet size, and

X is the percentage of our river bets which must be value bets

Yet, when we raise the turn to 33 big blinds, our opponent risks only 18 big blinds to call and potentially win a 68 big blind pot. If we use this raise sizing on the turn, he needs to effectively lose 79.1 percent of the time on the river for his turn call to be break even.

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$$(68)(1 - X) - (18)(X) = 0 \Rightarrow$$

$$X = 0.791$$

where

68 is the pot size after we raise the turn,

18 is the price to call, and

X is the frequency at which our opponent must effectively lose to be indifferent to calling.

Also notice that our opponent can lose on the river in either of two ways. First, he'll effectively lose when facing a river bet against a balanced range since the expected value of calling and folding will both be zero. Second, he'll also lose whenever we check back the best hand. Remember, in reality, we won't always value bet the best hand on the river because sometimes the winning hand will be weak. For instance, we'll sometimes bluff raise a gutshot on the turn and river a pair, and this hand can win at showdown after checking if our opponent holds a missed draw.

However, we won't often check back the winning hand on the river. That is, if our strategy has us frequently checking the winning hand, we won't be able to bet the river with a balanced range the nearly 79.1 percent of the time that's required to make our opponent indifferent to calling on the turn. Notice that this is likely a much higher river betting frequency than most players would expect — betting nearly 4 out of every 5 times — and that's because our opponent got an amazing price on his turn call.

These frequencies can also be multiplied to determine what percentage of our turn raises need to be able to value bet the river if we never check back the winning hand. If we bet the river 79.1 percent of the time after betting the turn and if 71.4 percent of our river bets are value bets, then 56.5 percent of our turn raises should be able to value bet the river.

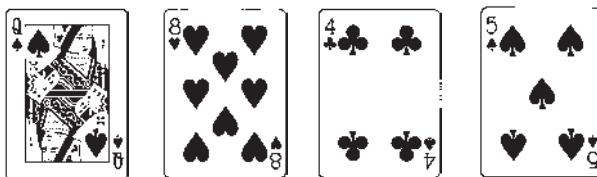
$$0.565 = (0.791)(0.714)$$

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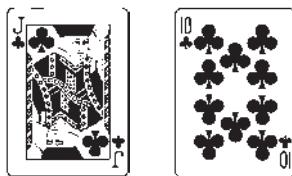
where

0.791 is the river betting frequency, and
0.714 is the percentage of river bets which are value bets

In reality, we'll usually have at least a few bluffs in our turn raising range that can river a marginal pair and potentially win if checked back and this allows us to bluff a bit more aggressively. Here's an example. The board is the



and we raise with the



If our opponent calls, we can comfortably check back if the river comes a jack or a ten and win if our opponent has a missed draw.

This leads to our next rule:

Since our turn bluffs will sometimes become marginal hands on the river which can be checked and win at showdown, we should have approximately 1 bluff for every value raise in our turn raising range when facing a double barrel.

Also notice that our turn raising range must include a higher percentage of value hands than our flop raising range since the pot to stack size ratio is greater and there is one less street to go. In

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addition, since raising makes our opponent's range much stronger on the river than calling does, it usually only makes sense to value raise hands which are ahead of the majority of his turn value bets.

Raising a Turn Bet After the Flop was Checked Through

When our opponent checks the flop and we check back, it's often reasonable to think he should be able to profitably bet any two cards in his range on the turn. More specifically, our opponent may have checked a very strong hand planning to check-raise, but it's unlikely we checked back the flop with a strong hand. This means his range on the turn will often be stronger than ours, but since he was not guaranteed the opportunity to bluff the turn when he checked the flop (as we will often bet the flop ourselves) this is not a problem.

If our opponent bets 6 big blinds into an 8 big blind pot on the turn, we can solve for what bet sizing allows us to bet and raise equal fractions of the pot on the two remaining streets. Note the starting pot size is 20 big blinds, as this is the size the pot would be if we were to only call our opponent's turn bet.

$$20R^2 = 200 \Rightarrow$$

$$R = 3.16$$

where

20 is the starting pot size,

200 is the final pot size, and

R is the growth rate of the pot.

If the pot is to grow to be 3.16 times its previous size with each additional round of betting or raising, then we need to make approximately 1.08 pot-sized raises or bets on each street. With

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this raise and bet sizing, the pot will grow to 63.2 big blinds on the turn and 200 big blinds on the river¹⁵

$$63.2 = (20)(3.16)$$

where

20 is the turn starting pot size, and
3.16 is the growth rate.

$$200 = (63.2)(3.16)$$

where

63.2 is the river starting pot size, and
3.16 is the growth rate.

Put differently, we need to raise and bet slightly larger than the pot on the turn and the river to get all-in by showdown. This requires a huge raise on the turn since growing the pot to 63.2 big blinds means we'll need to raise a 6 big blind bet to 27.6 big blinds!

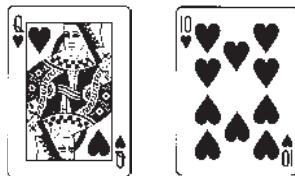
However, raises this large are unlikely to occur in practice. That's because our opponent will usually have many nut-type hands in his range which unsuccessfully attempted to value check-raise the flop in addition to any strong hands he made on the turn. As such, we'll want to raise a bit less. For this reason, a more reasonable raise size to around 18 to 20 big blinds is usually preferred.

Therefore, overbetting the river will often be the best option if our turn raise is called. The reason for this is we're more likely to raise on coordinated board textures so our opponent doesn't get to cheaply see additional cards, and these are the same board textures where he'll often be afraid and will only call our raise

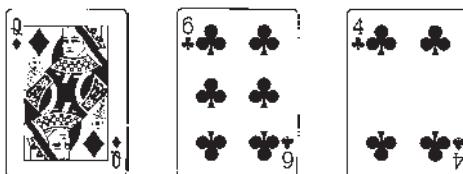
¹⁵ Note there is a slight difference due to rounding.

with his strongest hands. In other words, if our opponent merely calls our turn raise and gives us the opportunity to outdraw him, it's usually safe to assume he won't have a strong hand on a blank river.

Here's an example. Our opponent opens in the cutoff and we call with the



on the button. The flop comes the



and the flop checks through. If the turn comes the T♦ and we raise our opponent's bet, he'll likely be tempted to 3-bet if he has two-pair or better. That's because there are many possible straight and flush draws on this board texture, and calling risks him being outdrawn by our bluffs or losing value if the river card scares us into checking back.

In contrast, we should be less likely to raise on board textures where our opponent will feel comfortable calling with his strong hands. That is, the board textures where he feels comfortable letting our bluff raises see an additional card are usually the same board textures where we feel comfortable slowplaying until the river.

For instance, if our opponent checked to us on the K♣2♠2♦ flop and we checked back, it's unlikely the 8♥ turn would make

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us want to raise. That is any hand strong enough to raise for value on the turn, such as a set of eights, does not fear giving free cards. As such, calling on the turn with the intention to raise the river will be the superior play. Consequently, our opponent will usually only face a raise on the board textures where he'll find the river difficult to play out of position.

In addition, we should note that many players think it cannot be correct to overbet the river and leave only a little bit of money behind. Yet there's nothing theoretically wrong with this bet sizing. Players often get frustrated when they have to fold and are getting great odds to call, but it's important to remember that it's the price of our opponent's bluff that determines our calling frequency. The fact our odds to call are so good simply means our opponent can only rarely be bluffing (or else he can be exploited since calling with bluff catchers will be profitable).

Let's suppose we decide to raise our opponent's 6 big blind turn bet to 20 big blinds (making the pot 48 big blinds after he calls) and will sometimes bet 55 big blinds on the river. Again, we can work backwards to figure out what percentage of our turn raises should be able to value bet the river in order to keep our opponent indifferent to calling on the turn.

If he calls our turn raise to 20 big blinds, the pot size will be 48 big blinds on the river before any betting takes place. And when we bet 55 big blinds into a 48 big blind pot on the river, 65.2 percent of our bets should be value bets.

$$(103)(1 - X) - (55)(X) \Rightarrow \\ X = 0.652$$

where

103 is the pot size,

55 is our bet size, and

X is the percentage of our river bets which must be value bets.

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And on the turn, when we raise a 6 big blind bet to 20 big blinds, our opponent can call and risk 14 big blinds to win 34 big blinds. This requires him to effectively lose 70.8 percent of the time on the river to be indifferent to calling on the turn.

$$(34)(1 - X) - (14)(X) = 0 \Rightarrow \\ X = 0.708$$

where

- 34 is the pot size,
- 14 is the price of the call, and
- X is the frequency our opponent must lose to be indifferent to calling.

Again, our opponent effectively loses on the river when we bet a balanced range or check back the winning hand. If we never check back the best hand on the river, then the river should be bet 70.8 percent of the time after betting the turn and 65.2 percent of our river bets should be value bets. This requires 46.2 percent of our turn raises to be able to value bet the river.

$$0.462 = (0.708)(0.652)$$

where

- 0.708 is the river betting frequency, and
- 0.652 is the percentage of river bets which are value bets

Again, while this model does give us a good approximation for what percentage of our turn raises should be value raises, it doesn't take into account that we have position and will sometimes river a marginal strength hand which can check back. Because of this, it's likely safe to bluff a bit more aggressively on the turn.

It's hard to say what percentage of our turn raises should be able to value bet the river, especially since we won't always use

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the same river bet sizing. For instance, it's not unusual to go all-in for around 1.5 pot sized bets on some river cards, whereas in other spots, making smaller bets will be the best strategy. Nevertheless, it's probably reasonable to assume we'll usually want around 40 to 50 percent of our turn raises to be value raises after the flop checks through.

Finally, it's important to remember we'll greatly strengthen our opponent's felting range by raising the turn. In particular, since our turn raise and river bet are both usually large relative to the size of the pot, our opponent can fold much of his range without fear of being exploited. This results in him usually felting only around 25 to 35 percent of his turn betting range when facing a turn raise and river bet. As such, our turn value raises should usually be very strong hands. However, there are exceptions, and sometimes a weaker hand should be value raised if it will make him fold many high equity hands which could outdraw us on the river.

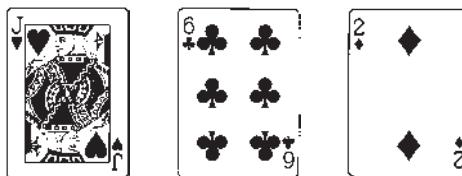
Putting Hands in the Right Ranges on the Turn in Position

We now need to visualize each player's range on the turn based on the flop action. Doing this allows us to take the line with the greatest expected value and pick a bet sizing which makes sense.

Facing a Turn Bet After Calling the Flop

If our opponent bets both the flop and the turn, he's representing a polarized range. Although he may have bet both streets for value with the intention of checking the river, (as is common practice on wet boards where giving free cards is a fear), the majority of our opponent's value bets on the turn will usually be hands he plans to bet on the river.

So what are the types of hands our turn range consists of that will change drastically based on the flop texture? For instance, if the texture is dry, such as on the



flop, we probably have many sets in our range since slowplaying the flop isn't risky. But if the turn puts many draws in each player's range, such as if the 7♣ comes, we can now raise using around a 1-to-1 value raise to bluff raise ratio. This puts our

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opponent in a difficult spot with all of his pairs and draws and allows us to play the river effectively in position. And if we don't raise, our strategy will be to continue to call with our marginal strength hands and most of our draws.

If we called our opponent's flop bet on a wet board texture, the turn will sometimes improve many hands in our range and allow us to develop a raising range. Here's an example. We flat on the button against a cutoff open and the flop comes the T♠9♠7♣ and the turn comes the 4♦. We can raise some of our flushes as well as some bluffs. Since our opponent knows our strategy will be to sometimes raise on this turn card, he won't likely overbet and will instead make medium sized bets of around 60 percent of the pot.

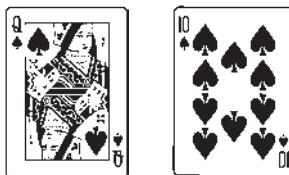
On other occasions, the turn card may come a blank after calling a flop bet on a wet board. When this happens, there will usually be few or no strong hands in our range. Since we'll never or almost never raise our opponent's turn bet in this situation, he should consider overbetting. This maximizes the value he gets with his strong hands as well as prevents us from being able to cheaply see the river card and improve to the best hand.

To illustrate this, imagine the same T♠9♠7♣ flop except the turn card now comes the 4♦ instead of the 4♠ (putting no flushes in our range). When this occurs, there will be no hands in our range which can effectively raise our opponent's turn bet, and although he should use multiple bet sizes on the turn, he should also, at the very least, have some overbetting range. And as undesirable as it is for us to sometimes face very large bets on the turn, we simply must acknowledge the turn card was bad for our range and call with our best bluff catchers and draws.

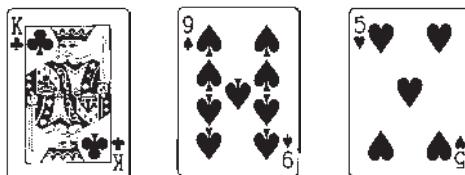
Facing a Turn Check After Calling the Flop

There are a few possible types of hands our opponent can have if he checks the turn after betting the flop. The most common is a bluff he's planning to check-fold. Remember, our opponent's value betting to bluffing ratio should increase on the turn, and the most obvious way to do this is to give up some bluffs that were bet on the flop which now have little chance of improving on the river.

Our opponent may also have a medium strength hand which he plans on check-calling. This commonly occurs when his flop bluff improves to a medium strength hand on the turn, such as when he bluffed with the



on the



flop, and the turn comes the T♣. In addition, on the flop, he may have bet a marginal strength made hand to make high equity hands fold and is now check-calling on the turn.

Lastly, our opponent can be planning to check-raise using around a 1-to-1 ratio of value check-raises to bluff check-raises.

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As we saw when analyzing out of position flop play, check-raising is extremely effective at punishing players who value bet too often or bet too big. That's because every strong hand our opponent value check-raises allows him to check-raise bluff additional hands in a balanced range. Also, he's more likely to check-raise on turn board textures where he has a difficult time check-calling and giving free cards is risky.

A substantial leak most players have is that they do not adjust their turn bet sizing based on the strength of their opponent's checking range. More specifically, bigger bets are more effective on board textures where our opponent has many medium strength hands which want to check-call, and smaller bets are more effective on board textures where he'll not likely check-call but often check-raises.

Here's an example. Middle position opens and we flat on the button. If the flop comes the K♥7♥3♣ and our opponent bets, what hands in his range will want to check-call on the 2♠ turn? While there are some medium strength hands, such as tens or nines, that he may want to bet on the flop and check-call on the turn, this is not a flop texture where he's likely to bet with the intention of only betting a single street for value. As a result, betting smaller on the turn makes his turn check-raises less effective and forces him to widen his turn check-calling range, and this further allows us to utilize the value of position on the river.

In other situations, we'll want to bet a bit larger. Suppose the same action and the same K♥7♥3♣ flop as before, only now assume the turn comes the Q♠ instead of the 2♠. This turn card puts many marginal strength hands into our opponent's range, as pairs of queens are not strong enough to bet but can easily be check-called. Therefore, it's reasonable to bet larger here with some strong hands and bluffs since this bet sizing is more effective against marginal strength hands.

In general, most players are currently betting the turn too large when their opponent checks to them after betting the flop.

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That's because their opponent can still have strong hands in his range he's planning to check-raise, and if he has few marginal strength hands in his range, he'll often not want to check-call to begin with.

In fact, small bets are particularly effective against players who have few medium strength hands in their checking range for three main reasons:

1. Betting the turn requires our opponent to pay to see an additional card so he does not get a free chance to outdraw us. Also, many of the hands he'll check-fold have some equity against our bet, and making him constantly fold hands with 10 or 15 percent equity is significant.
2. Betting both the turn and the river allows us to bluff more hands while remaining balanced. In other words, we can bluff more if two rounds of betting are utilized rather than just one.
3. Small bets force our opponent to defend his checks wider on the turn by check-calling. This allows us to more frequently play the river in position.

We know we are at a Nash Equilibrium when neither player has an incentive to change their strategy. Specifically, we must figure out if either player has an incentive to change if we make small bets at a high frequency on the turn when our opponent cannot have many medium strength hands.

First notice that our opponent's attempted check-raises will succeed at a high frequency if the turn is often bet. But if our bet is small relative to the size of the pot, he won't win much more money than if he had just bet the turn himself. Yet it's quite bad for him when his check-raise fails since a round of betting is removed from the game and weak hands which would have folded to a bet (such as gutshots) get a chance improve. As a result, our opponent will not have an incentive to check-raise recklessly.

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When his check-raise succeeds, he receives only a small reward, but when it fails, he's much worse off than he would be if his strategy was to lead with a bet.

Since most hands our opponent plans to check-fold will be quite weak, a small bet is all that is needed in order to force him to fold or make a close to break even call. And if he rarely check-raises (the turn) and we bet small at a high frequency once he checks, it appears neither player has an incentive to change. This makes much more sense than for us to bet big since if we bet big at a high frequency, our opponent can exploit us by always check-raising his strong hands. So betting small allows us to deny him free cards without getting exploited by his check-raises.

Players often get in the habit of betting 65 to 75 percent of the pot (or checking) in most situations without stopping to ask themselves "Does this bet sizing make the most sense with the hand I have against my opponent's range?" We must not make this mistake, and need to be willing to bet all sorts of different sizings based on our range, our opponent's range, and the board texture. There is nothing wrong with betting 25 percent of the pot on the turn if the situation calls for it.

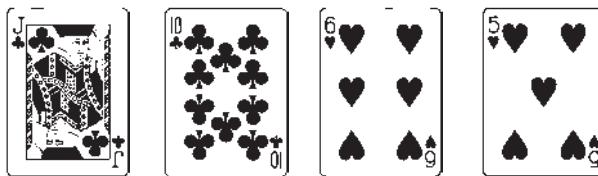
Facing a Turn Check as the Flop Bettor

If our opponent checks to us on the turn after we bet the flop, our range should be polarized while his will be condensed. Although we'll sometimes check back a marginal strength hand on the turn, we'll usually be checking back weak hands which will fold to our opponent's river bet.

As shown previously, we'll want to use around a 1-to-1 bluffing to value betting ratio on the turn if our value bets are strong. Since we intentionally bet hands on the flop for value that would be able to bet two or three streets and bluffed with hands

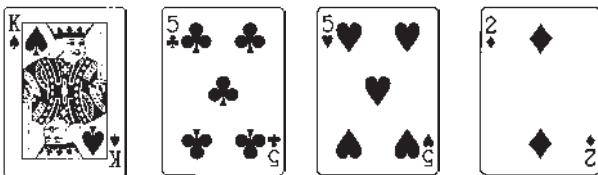
which retain their equity well, it's usually quite clear which hands should be bluffed or value bet on the turn.

Nevertheless, there are some board textures where it's easy to get carried away and bluff too often. Here's an example. If the board is the



it's easy to recklessly bet since our range has so many flush draws, open ended straight draws, and gutshots (many of which also have overcards). So if we bet all of our gutshots, our betting range will likely include too many bluffs and our opponent can exploit us by calling or check-raising aggressively. This is a common mistake players make when they follow a rule such as "bluff gutshots, pairs with five outs, and strong draws on the turn."

In contrast, on a board like the



there aren't many hands which make excellent bluffs. In other words, there are few or no hands in our range which have little showdown equity yet retain their equity well when bet. Yet, if we plan to value bet many top pair hands on the turn, it's crucial that bluffs are included in our betting range as well. Here, which hand we bluff with matters little since the majority of our potential bluffing hands are likely drawing dead to our opponent's pair of kings.

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It's important to always be aware of the board texture and not let ourselves bluff too few or too many hands. In general, new players will often bluff recklessly on wet boards since there are so many hands in their range which have little showdown value but can, on the river, improve to the best hand.

Likewise, they won't bluff enough on board textures where there are few gutshots and flush draws since they aren't used to having to bluff with hands which have so little equity when called. We shouldn't make this mistake against strong opponents and must analyze each board texture to ensure our betting range is balanced.

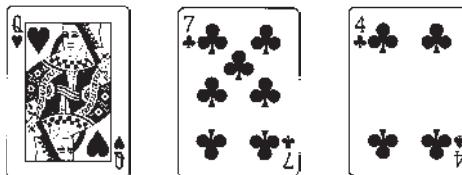
Facing a Turn Check After Checking Back the Flop

If our opponent has checked both the flop and the turn, he's twice shown weakness. As a result, it will usually be profitable to bet any two cards. However, just because it's profitable to bet does not mean we should bet our entire range, and betting a polarized range consisting of our strongest made hands and bluffs will be best.

It's also important to note that it's often more profitable to pass up a profitable bluffing opportunity on the flop with the intention to bet the turn if our opponent checks again. This is an important concept that's often overlooked. Players who refuse to pass up profitable bluffing opportunities with weak hands often have a transparent range on the turn and can easily be exploited.

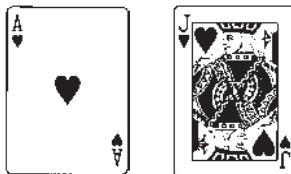
Putting Hands in the Right Ranges on the Turn ... 265

Here's a great example. We call on the button against a middle position open and our opponent checks to us on the



flop. Most players will automatically bet all of their weak holdings since betting any two cards is likely profitable. But this is a mistake against strong opponents since if we bet all of our weak hands on the flop, his check-raises will be too effective. Moreover, our opponent will know that if we check, our holding will almost always be a medium strength hand (on the turn), and this makes it impossible to bet a balanced range.

Imagine on the above flop we decide to instead check back the



rather than bet it. Although we declined to bet in a profitable bluffing spot, our opponent should, on the turn, check again with many weak hands intending to check-fold. This makes sense since he'll likely figure we checked the flop with a marginal pair like the Q♦J♣ or the T♠T♦ to avoid potentially getting check-raised. Yet if our opponent is strong on the turn, he'll likely bet hoping we call with these hands. So when this happens, we can fold if the turn did not improve us, as any heart, ace, or jack will.

It's often tricky to tell whether a hand should be bluffed on the flop or checked back with the intention to bluff a later street.

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As previously mentioned, we should emphasize checking with hands which will improve on the same turn cards as hands in our opponent's check-folding range. This is often true even if betting the flop would make some better hands fold. That's because a bet on a later street will likely make these holdings fold anyway.

Here's an example. We call a middle position open on the button with the A♦K♣ and the flop comes the J♥8♥6♣. Checking back ace-king on this flop is likely best since our opponent may have an ace-queen or king-queen hand he's planning on check-folding to a bet. Notice that checking allows us to make top pair on the turn and get value from our opponent when he makes the same pair with a worse kicker. Additionally, if he checked a weak pocket pair on the flop, he'll likely check the hand again on the turn and the river. This gives us the opportunity to bluff on a later street and make him fold the best hand.

In contrast, betting is best if we have a hand like the K♣T♣ on the J♥8♥6♣ flop. Our hand retains its equity very well as a bet since it has the potential to runner-runner a straight or flush. Furthermore, it's now desirable to bet the flop and make our opponent fold something like king-queen.

Lastly, it's important to note our range will often be capped on the turn when we bet after checking the flop. This means whenever our opponent check-raises, our hand at best will be a bluff catcher. However, this is not a problem. Our opponent can check-raise only so often and remain balanced, and it's risky for him to check the turn with a strong hand. And when he does check-raise, we simply must call down often enough so he cannot bluff too aggressively. This is true even if the expectation of calling is zero with every bluff catcher in our range.

Facing a Turn Bet After Calling a Flop Check-Raise

After a flop check-raise, our opponent will usually bet around 25 big blinds on the turn into a 44 big blind pot. This needs to succeed 36.2 percent of the time for him to make an immediate profit, so on the turn, we must defend at least 63.8 percent of our range to prevent him from being able to profitably bet any two cards. Nevertheless, whether calling or raising is best depends on how risky it is to give additional cards to hands in our opponent's bet-folding range.

Since the price to call on the turn is 25 big blinds to win 69 big blinds, our opponent must bet the river at a high frequency to make us indifferent to calling with our bluff catchers. This makes calling with our strong hands tempting as his range should be very polarized and he'll likely bet all of his strong hands on the river in addition to some bluffs.

However, after our opponent bets the turn, because stack sizes are shallow relative to the size of the pot, going all-in is also a reasonable option. This is true even though his range should be polarized and we have position. When we go all-in, we're guaranteed to realize our hand's equity, and jamming prevents our opponent from getting to see the river and realize the equity of his bluffs. This is especially significant since a skilled player will check-raise bluff on the flop with hands, such as gutshots or hands with three to a flush and three to a straight, which retain their equity well. Many of these bluffs will have several outs to the nuts on the river. So jamming the turn usually makes our opponent fold his weaker draws and make only slightly profitable calls with his stronger draws.

As previously shown, whenever our bluff jam is called, we expect to, on average, get 2 big blinds back for every percent of equity our hand has. This is the same concept as discussed when making 5-bet bluffs preflop and jamming turns in 3-bet pots, and

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it makes our bluffs much cheaper in the long run than they would otherwise be.

For instance, suppose the weakest bluff in our range on a given board texture has 20 percent equity against our opponent's calling range. This is around, on the turn, how much equity flush draws and open-ended straight draws have against most calling ranges. So if we go all-in for a 79 big blind bet, we'll only lose on average 38.7 big blinds when called.

$$-38.7 = (0.20)(201.5) - 79$$

where

201.5 is the pot size, and

79 is the size of the turn raise.

Because we only lose on average 38.7 big blinds when called, that's what we're effectively risking when jamming the turn. And risking 38.7 big blinds to win 69 big blinds requires our opponent to call 64.1 percent of the time to keep us indifferent to jamming and folding.

$$(69)(1 - X) - (38.7)(X) = 0 \Rightarrow$$

$$X = 0.641$$

where

69 is the pot size,

38.7 is the effective price of our bluff, and

X is our opponent's calling frequency.

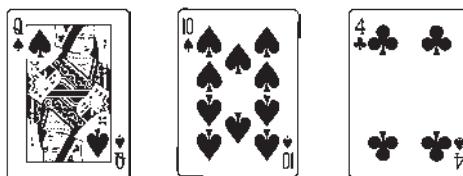
So if our opponent wants to make us indifferent to jamming the turn with flush draws and straight draws, he'll need to call with approximately 64.1 percent of his turn betting range. This usually is not a problem so long as he's willing to call with some draws (provided these draws can sometimes win unimproved), as 64.1 percent of his turn betting range won't be value bets.

Furthermore, it may simply be the case that in some spots it's possible for us to profitably jam the turn with open ended straight draws and flush draws because our opponent can't quite defend 64.1 percent of the time. Nevertheless, these hands are not bluff catchers, and being able to make a slightly profitable bluff with a draw after taking a risk does not necessarily mean our opponent made a mistake or is being exploited.

It's also difficult to say whether or not jamming or calling the turn ultimately requires our opponent to felt a wider range. That's because his turn betting range won't be perfectly polarized, and since he can river a marginal strength hand, we can't conclude exactly how often he should bet the river. In addition, the more equity our bluffs have on the turn, the more frequently our opponent needs to call our turn jam. That is, high equity bluffs don't need to succeed very often to be profitable, so if our bluffs have a lot of equity, our opponent must frequently call to keep us indifferent to jamming and folding.

But perhaps the most important factor for determining whether to jam or call the turn with a strong hand is if jamming makes our opponent fold many high equity hands. For example, in the previous example we assumed he called 64.1 percent of the time and folded 35.9 percent of the time. If we hold a strong hand which is vulnerable to being outdrawn by hands in the bottom 35.9 percent of our opponent's turn betting range, then jamming will almost certainly be better than calling. This is true despite the fact that jamming prevents us from getting to play the river in position.

Here's an example. Suppose we bet a set of tens on the

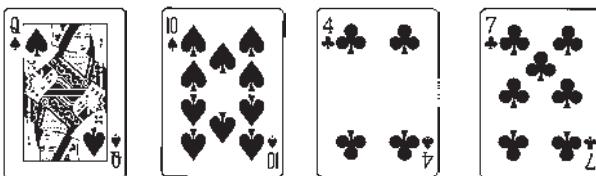


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flop and call our opponent's check-raise. If the turn comes the 7♣, we'll likely want to jam when facing a bet since many hands in our opponent's bet-folding range can make straights or flushes on the river. Therefore, it's best to require him to either fold or commit his entire stack with his draw, and by raising now we also ensure we get value from our opponent's smaller sets and two pairs.

Lastly, it's important to note having a capped range rarely matters when there are few streets left to act and little stack depth. (In the above example, this will happen when we only call the turn bet.) Capped ranges are usually problematic because our opponent can overbet knowing his value hands are never beat. Yet if we call his flop check-raise and turn bet, there's such little stack depth on the river that this isn't an issue. In fact, since he'll only be able to make a moderate sized bet, it's fine if he's able to value bet some hands knowing he'll never be beat.

To illustrate, let's continue with our previous example where the board is the



and we jam the turn with all of our sets and two pairs (as well as some bluffs, of course). If the river comes the 2♦, and we only called on the turn, although our range will be capped at overpairs, our opponent can only go all-in for 0.57 pot sized bets. Since he can't overbet the river, calling with a strong hand on the turn will likely be less profitable than raising. This often results in the best hand in our river range being a bluff catcher, and when this happens, we should call often enough to keep him indifferent to bluffing (even if the expectation for our call is zero).

Facing a Turn Check After Calling a Flop Check-Raise

Facing a check after calling a flop check-raise is very similar to facing a check after calling a bet since in both cases our opponent represented a polarized range on the flop. As such, what frequency to bet the turn and what bet sizing to use will depend largely on if our opponent's range is still polarized.

Our flop bet-calling range will not be polarized on the turn and instead consist of three types of hands — hands which are ahead of some value check-raises, bluff catchers, and hands with little showdown value. Also notice that since the majority of our calling range will be behind our opponent's value check-raises, he should bet the turn at a high frequency to prevent us from getting to freely realize the equity of our draws or get to showdown cheaply with our bluff catchers.

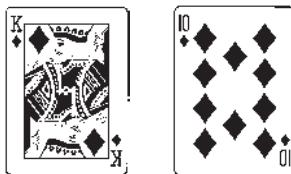
Specifically, when the turn card does not change the strength of either player's range, our opponent's range should remain polarized on the turn. For instance, suppose we're check-raised on the



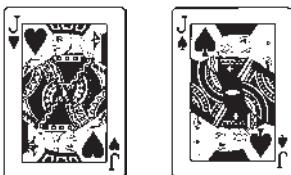
flop and the turn comes the $2\spadesuit$. There will, on this board texture, likely be no medium strength in our opponent's range since he

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would not have check-raised with a hand like the



or the



on the flop.

As previously discussed, we should make small turn bets in spots where there are few or no medium strength hands in our opponent's range. Betting small at a high frequency prevents him from getting to see a free river card with his weak hands, and by betting on both streets it's easier to bluff most or all our weak hands in a balanced range by the river.

In addition, contrary to what the vast majority of winning players believe, in this situation it's not usually necessary to size our bets so we're all-in on the river. Remember, we're betting to prevent our opponent's bluffs from getting to freely realize their equity, not to get value from medium strength made hands (since those hands are not likely to be in our opponent's range). So a small bet effectively puts less dead money in the pot in case he does check-raise and turn our hand into a bluff catcher.

Furthermore, if our opponent does have a strong hand on the turn, he'll usually check-raise again no matter what size we bet. Thus, our nut type hands will not lose value by betting small against his strong hands anyway. After all, if our opponent didn't

want to get all-in with a strong but non-nutted hand, he would not have likely check-raised the flop to begin with.

When thinking about new concepts, it's often useful to imagine playing the hand from the opponent's perspective. Visualize for a moment you call a button open from the big blind and the flop comes the K♥8♦4♦. If you check-raise the flop and check on the 2♠ turn, what hands would you check-call with if your opponent bets 25 percent of the pot? My guess is you'll fold much more often than not to this bet, and after the hand feel a bit frustrated that your opponent got to make such a cheap and profitable bet. In other words, you'd notice he was able to effectively float your flop check-raise and bluff on the turn. That's a good indicator that something significant is happening that you don't yet understand.

If we call our opponent's flop check-raise and the turn puts more marginal strength hands into his range, then betting a bit larger will be more effective. By increasing our bet sizing, we'll be able to bluff more hand combinations, get more value with our strong hands, and make our opponent pay more to see the river if he has a reasonable chance to outdraw us.

Example of Balancing a Defending Range on the Turn

Let's take the flop calling range from "Part Four: Example of Balancing A Defending Range on the Flop," starting on page 137, and defend against another 75 percent pot sized bet on the turn.

Flop: K♦9♠7♠

Flop Calls: AKo(9), KQs(3), KJs(3), KTs(3), JJ-TT(12), A♠Q♠, A♠J♠, A♠T♠, 6♠5♠, 5♠4♠, JT(3), J9s(3), T9s(3), 98s(3), A♦Q♦, A♦J♦. QJs(4) = 53

Turn: 8♥

Total Combos: 52 (9♥8♥ was removed from our range)

Desired Combos Defended: (52)(0.6) = 31

Value Raises: JT(3), 6♠5♠ = 4

Bluff Raises: TT(3), 5♠4♠(1) = 4

Calls: AKo(9), KQs(3), KJs(3), KTs(3), TT(3), 98s(2), A♠Q♠, Q♠J♠, A♠J♠, A♠T♠ = 27

Total Combos Defended: 35

Percentage of Range Defended: 67%

Since the turn card put some nut type hands in our range which are vulnerable to being outdrawn on the river, we can raise using a 1-to-1 bluffing to value raising ratio. Notice we're bluff-

raising with half of our pair of ten combinations and calling with the other half. If we were to bluff raise them all, our raising range would be unbalanced and include too many bluffs. So it theoretically makes sense to take both lines as long as we believe the expected value of raising and calling with tens is approximately the same. If one line has a higher expected value, then that line should always be taken. However, taking multiple lines with the same hand is quite common in theory and it likely happens here.

It should also come as no surprise that since the turn card put many strong hands in both player's range that our bluff raises should be reasonably strong. Here, we're bluff raising open ended straight draws and a lone flush draw. Although it will be unfortunate when our opponent goes all-in and forces us to either commit our stack or fold a pretty good hand, he will not frequently want to jam against our turn raising range. After all, half of this raising range is a straight, and 37.5 percent is the nuts.

Furthermore, although middle pair hands with some sort of draw are often clear calls, in this situation our opponent's turn betting range is quite strong. If we call with jacks or tens, it will be difficult to get value when the draw completes on the river, and it's possible our opponent already has the nut straight on the turn. This encourages us to consider folding hands like jacks and jack-nine suited even though they may currently be the best hand or become the best hand on the river.

Lastly, recall that although defending 60 percent of our range against a 75 percent pot sized bet will prevent our opponent from making an immediate profit, more advanced players should attempt to defend more aggressively. This is especially true if our opponent's bluffs are reasonably likely to river the best hand and position is valuable, as is the case here. Defending 67 percent of our range may seem overly aggressive at first, but since we have position and our range is strong, it's reasonable.

Summary

Excellent positional turn play requires us to understand who has the polarized range and how valuable seeing an additional card is for each player. More specifically, we must not get in the habit of always using the same bet size on the turn and need to consider large or small bets. If our opponent's range is condensed, large bets will usually be effective since they are best against medium strength hands. But when his range is polarized, small bets are best since they reduce the effectiveness of his check-raises and prevent him from seeing free cards on the river.

Just because it's profitable to bet any two cards does not mean our entire range should be bet, and it's common to check a weak hand on the flop with the intention of bluffing on the turn. Our opponent will likely check planning to check-fold weak made hands such as pocket pairs on multiple streets, which means we'll get several chances to bluff with overcards and make him fold the better hand.

Since position is so valuable, it's important not to bet too large in spots where our opponent will be tempted to check-raise all-in and destroy our positional advantage. Therefore, it's usually fine if he can make slightly profitable calls with his strong draws.

Here's a few more important points.

1. Since there are fewer streets left to act on the turn, a higher frequency of our turn bets and raises need to be for value. If the pot is large due to a bet being placed on the flop, we'll want close to a 1-to-1 bluff to value raising ratio.
2. If our opponent checks the turn after checking the flop, we can now value bet with many hands which were not strong enough to bet the flop as well as hands which improved on the turn.

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3. It's hard to get all-in by showdown if the pot is small on the turn. It will usually require us to overbet the turn and the river, but this is risky since our opponent may have checked a very strong hand on the flop or made one on the turn.
4. We should approach facing turn bets in the same manner as we approached facing flop bets. In other words, it's common to raise our strongest hands for value, call our medium strength hands, bluff raise some hands, and fold the rest. Very strong hands can also be slow played, especially if we fear few river cards or think our opponent will likely overbet the next round.
5. If our opponent checks the turn after betting the flop, we usually want to check back our medium strength hands and instead bet our strong hands and some bluffs. More specifically, just because a hand can be profitably bet doesn't mean betting is more profitable than checking. As such, it's usually more profitable to check back most medium strength hands and bet a polarized range.
6. After our opponent check-calls our 75 percent pot sized turn bet, we should usually either bet the river or check back with a marginal hand which can win at showdown 70 percent of the total time. This keeps our opponent close to indifferent to check-calling the turn with a bluff catcher.
7. If the flop is checked through, it's not necessarily a problem if the majority of our turn value bets become only bluff catchers when facing a check-raise. Our opponent still does not have an incentive to recklessly check-raise the turn since he loses value and risks being outdrawn if we check back.
8. Small bets are usually best on board textures where our opponent will not have many medium strength hands in his

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range which can easily check-call — his range is still polarized. This allows us to prevent him from getting to see free river cards while still minimizing the effectiveness of his successful turn check-raises.

Part Nine

Playing the Turn Out of Position

Playing the Turn Out of Position

Introduction

In the previous section, we analyzed new bet sizings and ratios for turn play and discussed what types of hands each player's range should consist of given the board texture and previous action. While there are many similarities between in position and out of position turn play, there are also several key differences which we must become familiar with.

One main focus of this section will be how our flop action influences the decisions we make on the turn. That's because, on the turn, the price our opponent pays to call our flop bet determines what betting, check-calling, and check-raising frequencies are reasonable. In addition, certain lines may or may not make sense in context of our range, and it's important to be aware of this or else our opponent can exploit us for having unbalanced ranges.

In addition, playing the turn out of position on certain board textures will be quite difficult, especially if there are many draws but few strong hands in our range. Position is often extremely valuable, and an optimal opponent will know what hands are in our range and constantly pick bet sizings which make them difficult to play. Yet, even if no ideal solution to this problem presents itself, by understanding the theory behind out of position turn play, we'll minimize our frustration and maximize our winrate.

Playing the Turn as the Flop Bettor

Previously, we focused on combating our opponent's flop calls by betting the turn and the river. This was done because situations where the bettor has a perfectly polarized range are easy to model allowing for new concepts to be explained clearly. But in reality, we'll also need to defend against our opponent's flop calls by check-calling and check-raising on the turn rather than just betting.

Here's a simple example. We bet 6 big blinds into an 8 big blind pot on the flop and our opponent calls with a hand with no equity. Furthermore, let's assume he will always bet 15 big blinds on the turn if we check since his hand never has any showdown value (so the only way for him to win is by bluffing). When he does this, what line we take on the turn will determine how much money he'll win or lose overall from calling on the flop.

1. Check-folding the turn results in our opponent's flop call and turn bet winning 14 big blinds — the original 8 big blinds in the pot as well as our 6 big blind flop bet.
2. Assuming our opponent will fold his zero equity hand when we bet the turn, betting causes him to lose the 6 big blinds he risked on the flop.
3. Check-calling and check-raising cause our opponent to lose both the 6 big blinds he risked from calling the flop as well as his 15 big blind turn bet, a total of 21 big blinds in all.

Therefore, we must not check-fold the turn at such a high frequency that our opponent can profitably call on the flop with

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any two cards intending to bluff the following street. Furthermore, the previously mentioned values can be used in the inequality below to show some combination of betting, check-raising, and check-calling on the turn is necessary to make our opponent unable to profitably call with the worst hand in his flopping range.

$$\begin{aligned} & (\text{Turn check-folding frequency})(14) + (\text{turn betting frequency})(-6) \\ & \quad + (\text{turn check-defending frequency})(-21) \leq 0 \end{aligned}$$

Notice this is an inequality rather than an equation. That's because the expected value (for our opponent) of calling the worst hand in his flopping range must be less than or equal to zero or else he'll never fold on the flop. In other words, although we don't know the expected value for calling the worst hand in our opponent's flopping range, it must be less than or equal to zero or else he should never fold.

In addition, our example assumes our opponent loses on average the maximum amount possible when we bet the turn, check-call, or check-raise. In reality, he won't, on average, lose 6 big blinds when our flop bet is called and we bet the turn since sometimes he'll improve on the turn and be able to profitably raise or call.

Likewise, when we check-call on the turn, our opponent's hand will usually have some equity or may get the opportunity to profitably bluff on the river. This further stresses why our opponent should, if we are playing correctly, expect to lose money if he ever calls the flop with a hand with no equity. Our turn frequencies should be designed to make the worst theoretically correct call in his range close to break even, and since these hands have equity, if he calls with a hand with no equity, it should clearly be a losing play.

Additionally, although our turn frequencies should change for different flop textures, if we bet properly, our opponent probably should fold the weakest hands in his range to a bet. Put differently, if our flop betting range is so weak relative to our opponent's

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range that he should never fold, then we almost certainly shouldn't have bet the flop to begin with.

Although this inequality cannot be used to find the theoretically correct turn betting, check-calling, and check-raising frequencies, it can be used to tell if a combination of frequencies is wrong. For instance, suppose we bet the turn 50 percent of the time, check-call and check-raise 5 percent of the time combined, and check-fold the remaining 45 percent. When using these frequencies, the expected value of our opponent's flop call with the worst hand in his flopping range is at least 2.25 big blinds.

$$2.25 = (0.45)(14) + (0.50)(-6) + (0.05)(-21)$$

where

0.45 is the turn check-folding frequency,

0.50 is the turn betting frequency, and

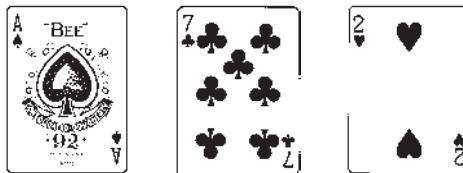
0.05 is the turn check-defending frequency

It's important to remember that 2.25 big blinds is the minimum amount our opponent expects to win on average with his flop call since even the worst hand in his flopping range will have some equity. And in this example, our opponent should never fold on the flop since every hand can be profitably called.

Also notice that betting the turn only 50 percent of the time and rarely check-calling or check-raising is easily exploitable, and these frequencies aren't as unrealistic as they may at first seem. This is especially true on certain flop textures. That's because many players recklessly bet the flop, and as a result have a weak turn range. And since their turn range is weak, they end up check-folding at a high frequency which is especially problematic if they aren't frequently check-calling or check-raising the turn (and many players aren't). In fact, there are many winning players who bet the flop so often that it's profitable to call with any two cards on certain flop textures hoping for the opportunity to bluff the turn.

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Here's an example. A poor player will usually continuation bet on the



flop. He'll usually value bet with all his strong hands and bluff all his weak ones, and medium strength made hands such as weak aces and strong middle pairs are check-called. When he does this, his range will be very unbalanced on the turn. He'll have trouble betting and defending his checks aggressively enough to prevent his opponent from profitably calling on the flop with any two cards.

Even if a player who recklessly bets on the flop also bets all of his premium hands, these holdings are very limited in quantity. There simply won't be many strong hands on the turn relative to the amount of weak hands bluffed on the flop. Additionally, since the flop is so dry, there will usually be few possible straight or flush draws on the turn, and there will never be any overcards. So for these reasons, players who bet too frequently on the flop will often find betting the turn aggressively on dry boards especially troublesome.

Additionally, if a player bets the flop aggressively but check calls all of his medium strength hands, he'll often struggle to defend enough of his turn checks. That's because there will be few or no hands in his range on the turn which work well as check-calls. This results in him check-folding the turn at a high frequency, and because of this, floating on the flop against such a player is exceptionally effective.

Consequently, when using computer software to analyze your play, it's a good idea to be aware of your turn betting frequency, check-calling frequency, and check-raising frequency after betting

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the flop. If your opponent can on average profitably call on the flop with any two cards, this is a massive leak that an astute player can easily exploit. In addition, even if your opponent will on average lose a small amount of money if he floats the flop with a zero equity hand, this still suggests our turn frequencies are not nearly aggressive enough. Therefore, if you find you have this leak, and many players do, make an effort to bet less frequently on the flop and play more aggressively on the turn. Also, look for specific board textures where you think you may be playing poorly.

It's also worth repeating once more that while we can prove certain combinations of turn betting, check-calling, and check-raising frequencies are easily exploitable, we can't solve for the optimal frequencies. Furthermore, we should note that check-calling and check-raising the turn are significantly more effective than betting at lowering the expected value of our opponent's flop floats. That's because check-calling and check-raising, on the turn, allow him to bet and invest more money into the pot which he'll then lose when we check-call or check-raise. In other words, if we're concerned the expected value of our opponent's flop calls with weak hands is too high, one way to lower this value is to more aggressively check-call or check-raise the turn.

Lastly, notice it's riskier for our opponent to call our flop bet with a hand which has no showdown value than a bluff catcher. That's because bluff catchers can check back the turn and the river to win at showdown without risking any more money. But if our opponent has a hand which has no showdown value, he'll have to bluff at some point if he wants to win unimproved. For this reason, calling on the flop with hands that have no showdown value is ineffective unless they have the ability to improve to strong holdings on the turn or river (as gutshots, open ended straight draws, and flush draws do).

Playing Draws Out of Position on the Turn

On the turn, one of the biggest disadvantages to being out of position is that draws play quite poorly as check-calls. This is largely due to the fact that after check-calling on the turn, we won't get the opportunity to see if our opponent checks before deciding whether to bluff on the river if our draw misses. Consequently, this often makes it difficult, if not impossible, to profitably check-call with weak draws on the turn.

So the real question will often not be whether check-calling with a draw is profitable, but rather if check-calling is more profitable than either check-raising or betting. Remember, hands with little showdown value which retain their equity well as bets or raises usually make the best bluffing hands,¹⁶ and draws with 8 to 11 outs on the turn often fit this description perfectly. The fact that draws work so well as bluffs is another reason why they're usually bet on the turn rather than check-called.

Nevertheless, on the turn, it will not always make sense for us to have a betting range when out of position. That's because if we check-called on the flop, our range will be condensed and our opponent's polarized. Hence, for this reason, we'll not always have the option of betting our draws (on the turn) in a balanced range, and will instead have to check-call, check-raise, or check-fold.

For analyzing the profitability of check-calling the turn with a draw, let's assume it has 20 percent equity and all our outs are clean — nine out flush draws usually have around 20 percent equity and eight out open ended straight draws have around 18

¹⁶ First written about 35 years ago by David Sklansky when he coined the term “semi-bluff.”

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percent equity. If our opponent bets 15 big blinds into a 20 big blind pot, by calling we risk 15 big blinds to win the 35 big blinds already in the pot plus any additional implied odds.¹⁷ Since we'll lose 15 big blinds 80 percent of the time and win 20 percent of the time, an equation can be used to solve for how many big blinds we'll need to win on average when our draw hits to justify calling.

$$(-15)(0.8) + (X)(0.2) \Rightarrow \\ X = 60$$

where

- 15 is the amount lost when our draw misses, and
- X is the amount we must win when our draw hits to be indifferent to calling.

Small offhand calculations like this are useful to make while playing, especially when trying to figure out if calling with a draw is profitable. And with our above assumptions, we must win on average at least 60 big blinds to justify check-calling. Another way to look at this is since the pot size after our opponent bets is already 35 big blinds, we need to win on the river, on average, an extra 25 big blinds for our turn call to have positive expectation.

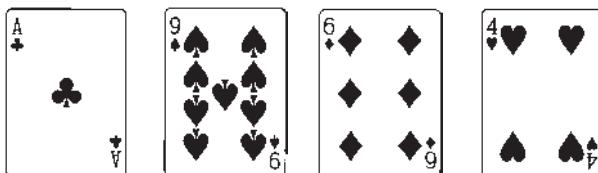
However, this information cannot be used directly to figure out how often our opponent will bet the river or what bet sizing he'll use. That's because board textures where we can have draws in our check-calling range are the same spots where the river card is likely to change the strength of many hands in each player's range, and they model poorly. That is, in these situations, our opponent will often bet the turn for value with the intention of checking back the river. Additionally, he'll often check back when he rivers a marginal strength hand with his bluffs, and this makes

¹⁷ And of course “implied odds” is another term first appearing in *Hold 'em Poker* by David Sklansky.

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it even more difficult for us to get value when our draw hits on the river.

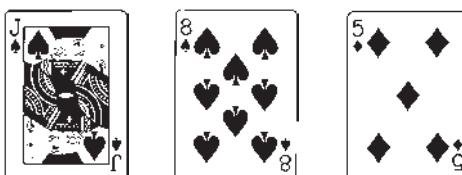
Here's an example. The board on the turn is the



Since our opponent does not fear giving our check-folding range free cards on this board texture, it makes little sense for him to bet for value with the intention of checking back the river. In addition, nearly every hand we check-call with will be a bluff catcher. Furthermore, because our check-calling range consists almost entirely of bluff catchers, it's almost as if our opponent is betting the turn with a perfectly polarized range. As we've already seen, it's easy to figure out how often he needs to bet the following street with a balanced range to keep us indifferent to calling with a bluff catcher.

Also notice that the same board textures where our opponent's turn betting range functions similarly to a perfectly polarized range are the ones where we can't have many or any draws. And when his range does not function in this way, the situation becomes much more complex making it difficult to predict our opponent's river betting frequency and bet sizing when we hold a draw.

To illustrate, imagine our opponent opens on the button and we call in the big blind. If we check-call on the



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flop and the turn comes the 9♦, he'll likely value bet many hands he does not plan to bet on the river such as weak pairs of jacks, tens, and ace-nine. And since the river card will greatly change the strength of many hands in both player's ranges, and our opponent will likely value bet the turn with the intention of checking back the river, it's hard to predict how often he'll bet on different river cards.

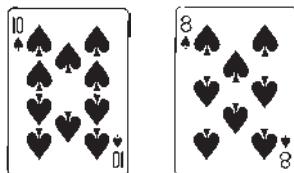
However, the previous situation is where we're most likely to find ourselves holding a draw on the turn. Although there's no formula for figuring out our opponent's river betting frequency, we can still use our understanding of theory to make good estimates for how often we should expect him to bet the river.

When the river hits many draws which are potentially in our check-calling range, our opponent will usually not bet at a high frequency. Here's an example. We call a button open in the big blind and check-call on the T♦4♦3♠ flop and the 8♣ turn. If the river card is the 9♦ and completes the flush, our opponent will often check back. This is partly because he was likely value betting many hands on the turn which aren't particularly strong to make us fold high equity hands, and these holdings won't be able to effectively bet the river unimproved.

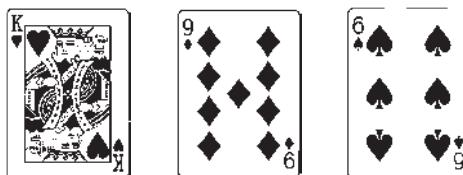
However, our opponent should be even more likely to check back when the flush completes since he knows there are many flushes in our range. That's because we likely check-called most of our flush draws on the flop, and on the T♦4♦3♠8♣ board all of these flush draws were also pairs, gutshots, or had overcards. In other words, all of our flush draws on the turn likely have additional outs, and some may have even been the best hand. Thus, on the turn, this encouraged us to check-call again which results in our range being too weighted towards flushes on the river. Consequently, it's more difficult for us to get value on this river card than it would otherwise be since our opponent knows we're likely strong.

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Let's contrast this with an example where we'll have few draws which improve on the river. In the big blind, we call a button open with the



If we check-call on the



flop and $2\spadesuit$ turn, our opponent will likely bet the river if we make a straight or flush. That's because there were no possible flush draws on the flop, so it's less likely for us to have a flush draw in our range on the turn. In addition, if the river card comes the $7\heartsuit$ and gives us the straight, our opponent will likely keep betting aggressively as that river did not hit our range particularly well. So calling with our draw (on the turn) should be very profitable since our opponent will likely bet aggressively when we hit, and he may even overbet when we make a straight.

In other words, draws are much better when the draw hits on river cards which aren't particularly good for our range. Most players are experienced with hitting a draw only to then ask themselves "How can I possibly get value now? My range is strong and my opponent knows it, so he won't often bet and is unlikely to think I'm bluffing if I bet." This must be taken into account ahead of time when deciding whether to call with a draw.

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For check-calling draws on the turn to be profitable, our turn check-calling range needs to be balanced so our opponent has the incentive to bet the river fairly often if our draw hits. If we check-call too many flush draws, he'll not likely bluff when a flush card comes on the river, but if we never check-call flush draws, he should frequently overbet the river when the draw hits. Straight draws are often a bit easier to call with since they'll usually be less obvious when completed on the river.

At equilibrium, we'll likely be check-calling some but not all of our flush draws. This gives our opponent an incentive to still bet the river aggressively when the flush comes, but he won't bet so aggressively that our worst flush draws will be profitable calls. In addition, if he makes a small turn bet, we'll usually be able to call with most if not all of our flush draws, but unfortunately our opponent will not usually bet small when there are many draws in our range. Put differently, he'll likely size his bet on the turn so that we're close to indifferent to calling with many of our straight and flush draws. And when this happens, our better draws will be profitable calls while calling with our weaker ones will be a losing play.

Playing the Turn After Betting the Flop

We now need to make sure that hands are being put into the right ranges on the turn after betting the flop. Recall tough decisions on the turn can never be avoided completely, though with excellent flop play they'll likely only occur on particularly difficult turn cards. By betting and checking balanced ranges on the flop, we maximize our chances of being able to play the turn effectively.

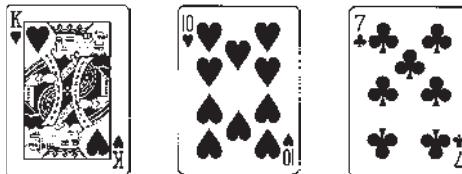
Following a Flop Bet by Betting the Turn

If our flop bet was called, we'll usually have a polarized range on the turn. What types of hands our opponent's range should consist of depends on the board texture and whether he slowplayed many strong hands on the flop. If he has few strong hands in his range, we should consider overbetting with some of our strongest hands since our opponent will not likely raise our turn bet.

Remember, it's theoretically correct to use multiple bet sizings in the same spot and have each bet sizing range be balanced. So even if overbetting makes sense, we'll overbet with some hands and bet smaller with others. Of course, this is difficult to implement in practice, but the right bet sizing can have a huge impact on the expected value of our hand.

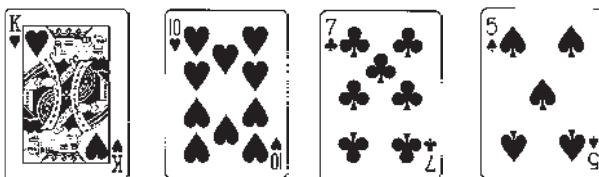
Here's an example. We open in the cutoff, our opponent calls on the button, and the flop comes the

Playing the Turn After Betting the Flop 293



If our opponent calls our flop bet and the turn comes the 5♠, it's not likely he'll raise our turn bet. This means overbetting a range of some very strong hands which can almost never be beat (ace-king and better) and bluffs is extremely effective. Notice that our opponent got unlucky to get a turn card which put no strong hands in his range, and overbetting maximizes the expected value of our strongest hands and allows us to bluff more hands in balanced ranges.

Also, it's important to note in a spot like this that many players are often afraid to overbet with non-nutted hands like top pair, top kicker. Yet if our opponent has better than ace-king on the



board, he'll likely win most if not all of our stack regardless of our turn bet sizing. Remember, stacks are only 100 big blinds deep in these examples, so even if our opponent does have a very strong holding, he's still limited on how much he can win.

Yet even when we have an overbetting range, strong hands which may be beat or splitting should bet smaller. For instance, it would not make sense to overbet jacks on the K♦T♦7♣5♠ board. More specifically, betting smaller requires our opponent to keep calling with weaker hands, such as a pair of tens or a weak draw, that would fold to a large bet. In addition, if he has us beat, we'll

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usually lose less money since he'll be unlikely to raise with a capped range. However, it's crucial we also bet small with some nut type hands so our opponent cannot recklessly raise knowing we can't be strong. Therefore, it's often effective to bet larger relative to the size of the pot on the flop than the turn with a strong but vulnerable hand.

For instance, imagine we open in middle position with the T♠9♠, the button calls, and the flop is the T♥6♥3♣. Notice that ten-nine suited is not usually strong enough to win at showdown after betting multiple streets for medium sized bets, but we also don't like giving free cards to our opponent's flopping range since our hand is vulnerable. What should we do?

One option is to make a medium sized bet on the flop and then to bet smaller on favorable turn and river cards. Betting the flop a bit larger is ideal because we want to encourage our opponent to fold some high equity hands such as the A♦J♣ and the K♣J♣, which he'll likely fold because they have tainted outs against our betting range. Yet we can bet smaller on a favorable turn card, such as the 3♠, since some of our opponent's overcard hands already folded on the flop and those which didn't now have less equity. In addition, a small bet ensures we get additional value from any nines and eights which will likely be checked if given the opportunity.

Betting smaller on the turn is probably more effective than checking since betting prevents our opponent from getting to see the river with his entire range. Additionally, a small bet is better than a big one because a large bet likely makes our opponent fold his weakest bluff catchers which we beat. Lastly, if he is unlikely to raise our turn bets aggressively with his strong hands, we'll lose less by betting small than if were to check-call and our opponent bet larger.

While you might think betting small on blank turns makes our opponent's flop calls effective as well as makes it difficult for us to bluff, remember we'll also often have an overbetting range on the same board texture. Even if overbetting with the T♠9♠ on

a T♥6♥3♣3♠ board is ineffective, overbetting a pair of queens may be an excellent play. That's because effectively betting the right size with the right hands maximizes their expected value, and constantly puts our opponent in a tough spot.

Conversely, if the flop board texture was dry, it's unlikely we'll want to overbet any turn cards since our opponent probably wouldn't have raised with any of his very strong hands on the flop. For instance, we open in the cutoff and our opponent calls on the button. If our bet is also called on the K♣8♣5♦ flop and the turn comes the 9♠, this is not a good spot to have an overbetting range.

Overbetting will not be effective because our opponent likely just called with sets on the flop and also may have turned a set of nines. Since he can be strong on the turn, he'll sometimes raise with a polarized range consisting of straights, sets, and bluffs. This is significant because if we have a straight on the turn and our opponent has a set, he'll likely end up raising and committing his stack no matter what our bet sizing is. This encourages us to bet smaller with our nutted hands since a large bet isn't needed to get all-in by the river when our opponent is very strong.

In theory, we'll want to use multiple bet sizings on just about every board texture. But balancing multiple ranges is hard, and it's most important to do this when our opponent can't be strong and will rarely raise our bet. More specifically, it's best to make sure we're at least utilizing large overbets on blank turns or rivers after our opponent called our bet on a wet board. Other spots are usually less important and more difficult, and will be discussed in more detail later in the book.

Following a Flop Bet by Check-Calling the Turn

Although check-calling the turn allows our opponent to bluff with weak hands which called on the flop, it does not punish him as severely as check-raising does. That's because on the river he'll

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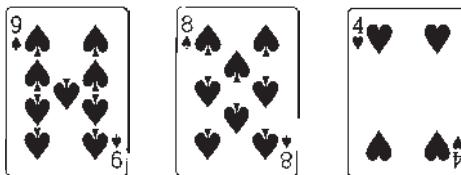
sometimes make the best hand or find himself in a profitable bluffing spot. Nevertheless, the expected value of our opponent's turn bluff will depend on the quality of his hand and the board texture, as check-calling on some board textures is much riskier than others.

Since our opponent's turn betting range is polarized, it of course makes sense for our check-calling range to consist primarily of medium strength hands when possible. Since our flop betting range was polarized, the medium strength hands in our range on the turn will often be hands which were strong on the flop but got a bad turn card. Additionally, we may have value bet vulnerable hands on the flop intending to check-call on many turn cards.

We may also decide to check-call on the turn with flop bluffs which did not improve if our opponent bets small. Here's an example. We bet the



on the



flop since we may turn the nut flush draw or top pair. If the turn comes the 2♦ and we check, our opponent may make a small bet figuring it'll be difficult for us to check-call and play the river out of position. But calling a small bet with the A♠Q♣ will likely be

profitable since our hand has showdown value and may make a strong pair on the river. So check-calling the turn with overcards which have showdown value will often be necessary, if our opponent bets small, to avoid being easily exploited by small bets.

Following a Flop Bet by Check-Raising the Turn

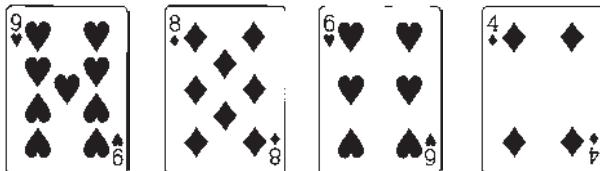
Our turn check-raising range should be polarized just like our turn positional raising range. However, since we're out of position, it's often best to raise a bit more money. The reason for this is now if our opponent decides to go all-in, he'll forfeit his positional advantage, whereas before, when we raised in position, he could go all-in and destroy our positional advantage. Consequently, this allows us to raise a bit larger and still expect our opponent to mostly defend by calling. And since our turn check-raises are slightly larger than our positional raises and we don't have the advantage of position, we'll usually want 50 to 60 percent of our check-raises to be for value.

Despite the similarities between raising in position and out of position, there are several key differences which should be taken into account. The first key difference is when out of position, we're not guaranteed a showdown after checking the river. This makes raising the turn (out of position) more difficult since our opponent gets the opportunity to bet with a balanced range when we hold a bluff catcher on the river. This also decreases on the river the expected value of our bluff catchers and will be discussed in more detail later in the book.

Second, it's hard to find an ideal sizing when check-raising the turn. On one hand, a small check-raise gives our opponent a great price to call and lets him frequently play the river in position. Yet on the other hand, a large check-raise makes it difficult for us to fold if our opponent jams since we're getting good odds.

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Here's an example. We want to check-raise a range of primarily sets and bluffs on the



board since there are so many possible straight and flush draws. But check-raising small is difficult since our opponent will get good immediate odds to call as well as have implied odds and position on the river. Furthermore, it's also difficult for us to tell if the river improved our opponent's hand and he'll often be able to profitably bluff any two cards if we check.

Continuing on, if we check-raise to 40 big blinds or less on the turn, our opponent gets 3-to-1 immediate odds or better in addition to any implied odds he'll have when holding a draw. This makes check-raising small difficult since he'll likely be able to profitably call with a large portion of his range. However, we must remember that just because he can profitably call with his draws does not mean our check-raise sizing was ineffective. If our opponent bets the turn with a flush draw and is called, the expected value of his hand will almost certainly be higher than if we had check-raised because our raise requires him to put additional money in the pot when he's behind.

Large check.raises are tempting because they give our opponent a worse price to call with his draws. Yet on wet board textures, it's hard to check-raise bluff the turn and then fold to a jam since we need such little equity to call.

Notice that a check-raise to 40 big blinds leaves us with only 50.5 big blinds remaining, and if our opponent jams, this requires us to have only 25.3 percent equity for calling to be profitable.

$$(-50.5)(1 - X) + (149.5)(X) = 0 \Rightarrow \\ X = 0.253$$

where

149.5 is the amount in the pot,

50.5 is the price to call, and

X is the equity needed for calling to be profitable.

This forces us to make either slightly profitable calls or questionable folds after making a large investment in the pot. Moreover, on board textures with a reasonable amount of coordination, there are not many hands being strong enough to check-raise bluff which don't have around 25.3 percent equity.

It's also worth noting that since our opponent is guaranteed to realize the equity of his bluff when he goes all-in, we'll have to call his turn jam at a high frequency to make him indifferent to bluffing with his draws. While the exact frequency will depend on our turn bet sizing and the equity of our opponent's bluffs, if we fold more than one-third of the time, his jam will usually be profitable. This means if only 50 to 60 percent of our turn check-raises are value check-raises, our opponent will likely be able to profitably jam his draws. Again, this may not be a problem, but it also likely encourages us to check-raise a bit more value hands when the board is very wet. We also should consider check-raising and calling with some strong draws which dominate our opponent's weaker draws.

We should usually check-raise all-in ourselves if our check raise sizing is so big that it's impossible for us to fold if our opponent jams. This takes away his option to only call our check-raise without going all-in, and since we'll never fold to his jam anyway, this simply leaves him with one less option.

While check-raising all-in on the turn is an option, check-raising a 15 big blind bet to 90.5 big blinds is a massive raise and far from ideal. Ultimately, there does not appear to be an ideal solution to this problem. Wet boards, on the turn, are simply tough to play out of position when our opponent uses any reasonable bet sizing, as both check-calling and check-raising frequently put us in tough spots.

Playing the Turn After Check-Calling the Flop

Although we'll often slowplay strong hands on dry flop textures, for the most part our range on the turn will be condensed after we check-call the flop. Whether or not it's possible to have nut type hands in our range will depend on both the flop board texture and the turn card, and this has a significant impact on how hands in our range should be played.

Following a Flop Check-Call by Check-Calling the Turn

If we check-called on the flop, the majority of our turn defending range should be check-called again since our opponent has the polarized range. Again, one of the key differences between in position and out of position play is how difficult it is to check-call draws. This further concentrates our check-calling range on the turn into a range composed of mostly medium strength made hands, as calling with weak draws will often be a losing play.

In situations where we check-called and check-raised aggressively on the flop, it may be reasonable to allow our opponent to profitably bet any two cards on the turn. That's because his flop bet had a low success frequency, so he still won't have an incentive to recklessly bet just because he'll likely get the opportunity to make a slightly profitably bluff on the turn. In other words, in this situation, our opponent had to, on average, invest a substantial amount of money into the pot for the opportunity to bluff the turn, so allowing him to make slightly profitable bluffs is not likely problematic.

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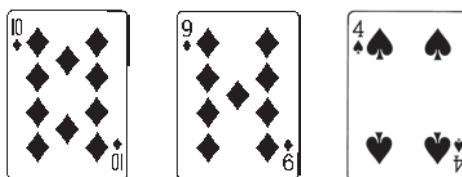
When we don't defend our flop checking range particularly aggressively, our opponent will often win immediately or have the opportunity to bluff on the turn. This encourages us to defend the turn aggressively enough so he cannot profitably bet any two cards. There are exceptions, especially when the turn card is particularly bad for our range and our opponent can overbet.

However, we'll usually determine our check-calling frequency based on our opponent's bet sizing. If he bets big, check-calling with a tight range is best, but if he bets small, it's necessary to check-call with a wide range to prevent him from profitably betting any two cards.

Following a Flop Check-Call by Check-Raising the Turn

Our turn check-raising frequency will be determined by the flop texture and the turn card. As already discussed, it's not often possible to effectively check-raise after check-calling on a wet flop texture when the turn is a blank. Yet if we check-called on a dry board texture or if the turn card put some very strong hands into our range, a balanced check-raising range can be used to prevent our opponent from cheaply realizing the equity of his bluffs.

Here's an example. We check-call on the



flop. First notice that it's difficult to check-raise if the turn card is not a diamond, queen, jack, or eight. That's because it's ineffective to slowplay strong hands on this flop unless our

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opponent will frequently overbet the turn, and even then the risk may still not be justified. However, when the turn card does put straights or flushes into our range, we'll have little trouble in balancing a check-raising range.¹⁸

If the flop texture was dry, we'll usually be able to check-raise on any turn card. That's because check-calling our strongest hands on the flop was more profitable than check-raising, largely because there was little risk in our opponent outdrawing us on the turn or getting scared with a strong hand and checking back.

For instance, we'll be able to check-raise (if he bets) on every single turn card after check-calling a set of eights on the A♥8♣4♠ flop. Check-calling allows us to keep our opponent's range wide and punish him when he double barrels his turned draws. Furthermore, we can balance our value check-raises by check-raising bluffs, such as some straight draws, flush draws, and pairs with 5 outs which have a reasonable chance to improve but little showdown value.

Following a Flop Check-Call by Donk Betting the Turn

As previously discussed, unlike the flop where both players often have similar ranges, on the turn, ranges will usually be more asymmetric after one player bet the flop and another called. Consequently, donk betting the turn is usually ineffective since our flop check-calling range is condensed, and betting with a condensed range when our opponent has a polarized range is a losing play. More specifically, our opponent can comfortably fold the weakest hands in his range and raise with his strong as well as his good bluffing hands. Therefore, although the inability to donk bet the flop is a considerable leak many players have, never donk

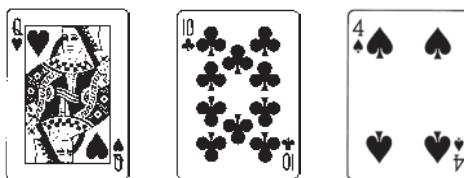
¹⁸ An optimal opponent will know all of this and adjust his bet sizing and betting frequencies accordingly.

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betting the turn is a much smaller leak since appropriate spots occur less frequently.

However, donk betting the turn is a strong play when the turn card significantly strengthens our range relative to our opponent's. This often happens when the middle card pairs, but it can occur in other spots as well. Therefore, it's important to be able to quickly recognize when the turn card disproportionately favors our range and consider donk betting when this occurs.

Here's an example. We call a button open in the big blind and check-call on the



flop. If the turn comes the T♥, this is a great spot to donk bet since our check-calling range likely has many more tens in it than our opponent's betting range. That's because he likely checked back many of his tens on the flop since they aren't usually strong enough to bet multiple streets for value and do poorly when check-raised. However, since we'd check-call with nearly all the tens in our range, it's more likely for us to have trips on the turn than our opponent.

If we check the turn in this situation, our opponent should check back at a high frequency since his pairs of queens are no longer strong enough to effectively keep value betting and will become only bluff catchers when check-raised. Put another way, our checking range will be too strong if we never donk bet any of our trips, and this encourages us to donk bet our strong hands. Remember, theoretically optimal poker does not care about who has initiative, and if our range is better than our opponent's due to a favorable turn card, we should frequently bet.

Summary

Playing well on the turn when out of position is difficult, but with careful planning our opponent's positional advantage can be minimized. It's important to bet, check-call, and check-raise at reasonable frequencies otherwise our opponent will be able to recklessly call us on the flop and take the pot on the turn. More specifically, check-raises (on the turn) are an excellent tool for punishing an opponent who calls too much on the flop, and overbets on blank turn cards are useful for combating condensed ranges.

It's also crucial to keep in mind who has the polarized range as well as how many marginal strength hands we possess. For instance, if check-calling is difficult, check-raises must be made more aggressively to prevent our opponent from recklessly betting. Although there will unfortunately be some board textures which are difficult to play, especially with draws, when out of position, with careful planning the expected value of our range can be maximized against strong opponents.

Here's a few important points.

1. Even if it's impossible to figure out optimal turn betting, check-calling, and check-raising frequencies, it still can be shown some combinations of these frequencies are clearly wrong and easily exploitable.
2. Check-calling or check-raising the turn punishes our opponent for calling the flop with a weak hand much more severely than betting does.
3. Our turn check-calling range should consist of mostly medium strength hands regardless of whether we bet or check-called the flop.

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4. When out of position, it's more difficult to check-call with draws than in position since we'll rarely get the opportunity to bluff missed draws on the river.
5. We'll mostly defend by check-calling the turn after check-calling the flop since our range is condensed.
6. On the turn, there's often no ideal check-raise sizing when the board is wet. That's because check-raising too small gives our opponent good odds to call with his draws, but check-raising large makes it difficult to fold if he jams.
7. Donk betting the turn is uncommon since we have often already signaled we have a medium strength hand by check-calling the flop. Nevertheless, donking the turn makes sense if the turn card improves our range more than our opponent's.

Part Ten

3-Bet Pots on the Turn

3-Bet Pots on the Turn

Introduction

While turn decisions in 3-bet pots are undoubtedly important since so much money is at stake, it's important to remember the pot will often usually be quite large before any turn betting takes place. That is, since the pot is so large relative to remaining stack sizes, our options are often quite limited. However, it's worthwhile to spend at least a few pages focusing on these situations since mistakes are so costly.

Furthermore, new players would probably be surprised to know how often turn decisions in 3-bet pots occur between two game theoretically optimal players. As was discussed in "Part 2: Pre Flop Play," starting on page 31, the blinds should 3-bet aggressively against cutoff and button opens who should then mostly defend by calling. While weak players may not 3-bet aggressively enough which allows the cutoff and button to exploitatively fold to 3-bets, this isn't a reasonable option against aggressive opponents. Likewise, flop bets should frequently be called in 3-bet pots, and this results in playing the turn for a large pot being a relatively common occurrence.

We'll once again assume the 3-bettor is out of position and the 3-bet-caller is in position as is the case for the majority of 3-bet pots. Yet, even if this isn't true, it's important to remember the 3-bettor should have a polarized range and is thus expected to do most of the betting on the flop. Additionally, nearly all the theoretical concepts we've discussed previously for single raised pots will apply as well.

While we've only discussed 100 big blind starting stack play up until this point, it should be noted that this stack depth is especially relevant for this section. More specifically, as stack

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depth changes, much of the math shown in the following pages will change significantly. Therefore, it's important not to mistakenly think the frequencies and ratios discussed in this section will work equally well for different stack sizes.

Double Barreling in a 3-Bet Pot

Let's begin with analyzing how to play the turn when out of position in a 3-bet pot after betting the flop. While it of course makes sense to follow the usual practice of betting with a polarized range, it serves little purpose to repeat all the math and frequencies which have already been discussed. (That said, it's important to keep in mind we usually want a bit more than half of our double barrels in 3-bet pots to be for value.) Rather, our focus will be on taking the right lines with the right types of hands and picking bet sizings which make sense.

As previously shown, if, on the flop, the starting pot size is 25 big blinds and we bet 12.5 big blinds, then the pot will be 50 big blinds before any betting takes place on the turn. If we then bet 25 big blinds on the turn and our opponent goes all-in for 75 big blinds total, our call will risk 50 big blinds to win 150 big blinds, and this requires only 25 percent equity for calling to be profitable. And since our hand requires exactly 25 percent equity to be indifferent to calling, any hand with less equity than this should be folded to our opponent's turn jam.

Unfortunately, most open ended straight draws and flush draws have slightly less than 25 percent equity against our opponent's turn jamming range. In other words, draws have nearly the maximum amount of equity possible that still require us to fold once we face a turn jam after betting 50 percent of the pot. Few outcomes in poker are worse than putting in half of our stack with a high equity draw only to have to fold, so special precautions should be taken to try to prevent this from happening.

There are several ways to avoid bet-folding a high equity draw on the turn. The first is to simply check. This way we'll

Double Barreling in a 3-Bet Pot 311

either get to see a free river card if our opponent checks or can check-call or check-raise all-in if he bets.

An optimal opponent will be aware of how undesirable it is to have to bet-fold the turn in a 3-bet pot with a draw, as well as how difficult it is to check-call on many board textures after betting the flop (since our range for the most part should be polarized). This encourages our opponent to make small bets on the turn, and when he does, check-calling with a flush draw is likely to be highly profitable (compared to folding) since we're getting such great odds. In reality, most players are currently betting too big when facing a turn check in a 3-bet pot, and this often makes our check-calls less effective and our check-raises more effective than they should be. (Our check-raises are more effective since the pot is bigger when our opponent folds.)

Another option is to simply overbet the turn all-in. Our opponent will often fold to such a large bet and when he doesn't, we'll get to realize the equity of our hand since we're all in. For instance, if the pot is 50 big blinds on the turn, our turn jam will be for 75 big blinds or 1.5 pot sized bets. However, this large overbet may be best as it's quite easy to develop a balanced jamming range which consists of strong hands and high equity bluffs in this spot. This is especially true since many of our 3-bet bluffs were suited connectors and gappers which frequently make straight or flush draws on the turn and are excellent bluffs.

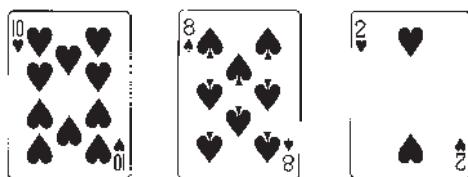
It's also important to note that keeping our opponent's range wide is usually a desirable outcome as this means he'll ultimately feel weaker hands. However, if we know our hand has so much equity that we cannot fold to our opponent's turn jam, large bets are often best because they maximize our fold equity.

Additionally, it'll be easier to go all-in on the turn after making a larger bet on the flop. That is, betting larger on the flop with a range that consists of many hands which will want to overbet jam on the turn is usually best. This allows us to win a bigger pot when our opponent folds and requires us to risk less money on the turn relative to the size of the pot.

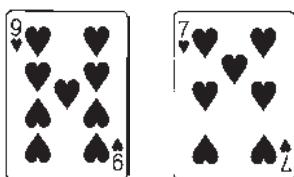
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Here's an example. Rather than betting 12.5 big blinds on the flop and 75 big blinds on the turn, we can instead bet more on the flop so our overbet on the turn isn't so massive relative to the pot-size. More specifically, the pot will be 61 big blinds following an 18 big blind flop bet and our turn jam will be for 69.5 big blinds or 1.14 pot sized bets. While this is still quite a large bet, it's significantly less than betting 75 big blinds into a 50 big blind pot for a 1.5 pot sized bet.

Keep in mind it's theoretically correct to utilize many different bet sizings in the same spot since this maximizes the expected value of each hand. So we'll regularly bet different sizings based on our plan for the turn. For instance, if the flop comes the



making a large flop bet with hands which will often want to jam on the turn, such as the



can be quite effective. Draws will of course need to be balanced with value hands, and in this spot overbetting strong but vulnerable hands such as queens on many turn cards seems reasonable.

However, betting 50 percent of the pot on the flop and turn is better with hands which will not likely be outdrawn on the river

Double Barreling in a 3-Bet Pot 313

by our opponent's weaker holdings. That's because it's more efficient to utilize 3 rounds of betting instead of 2 when giving additional cards isn't particularly risky.

Here's an example. If the flop is the T♥8♠2♥, value betting large on the flop and jamming the turn with the A♥A♣ is unnecessary. That's because this hand will not often be outdrawn on the river by any hands a turn overbet would make fold. Likewise, a large flop bet is unnecessary with the 7♣6♣ since a gutshot can be comfortably bet-folded on the turn. Therefore, as long as our betting range includes the proper ratio of value bets and bluffs and can improve on most turn cards, our range will be balanced and there'll be no way for our opponent to easily exploit us.

In conclusion, balancing two or more bet sizing ranges is difficult and it's important not to get overwhelmed trying to implement too many new concepts at once. However, understanding theory before we can comfortably implement it will allow us to learn quicker and prevent us from developing bad habits. In addition, nearly all theoretical concepts can be used exploitatively, so even if we're unable to balance multiple betting ranges especially well, that doesn't mean overbetting won't be useful exploitatively. And finally, using multiple bet sizings in 3-bet pots seems particularly important since having to fold a strong draw after betting the turn is so undesirable.

Playing the Turn Out of Position After the Flop Checks Through

Before discussing turn bet sizing, careful attention must be paid to what each player's turn range looks like after the flop checks through. Our out of position flop checking range likely consisted of some marginal strength hands which we intended to check-call, as well as some very strong hands which were going to either be check-called or check-raised. In addition, some weak hands were checked intending to be check-folded and these holdings can be used as bluffs on later streets if the flop is not bet.

Likewise, on the flop, the 3-bet-caller also checked back most of his medium strength hands as well as some weak hands which likely would have made profitable bluffs. While it's also possible on the flop that he checked back a very strong hand in position, these hands should only make up a small fraction of his checking range, especially on wet board textures.

Once the flop checks through, some of the hands in each player's range which were not strong enough to effectively value bet (on the flop) will be able to value bet the turn. In addition, the turn will usually improve some weak holdings in each player's range so they can be bet, and since the pot is already around 25 big blinds, a variety of different turn bet sizings can be utilized to manipulate the pot size and our opponent's range.

Betting close to an equal fraction of the pot will be best when using a range that is very polarized and designed to win the maximum amount possible from our opponent's bluff catchers. Since there are two streets left to act and the pot is already 25 big blinds, assuming the effective stack was 100 big blinds, the pot

will need to grow to be 2.83 times its original size with each round of betting.

$$25R^2 = 200 \Rightarrow$$

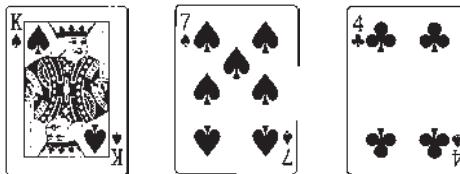
$$R = 2.83$$

where

R is the growth rate of the pot.

So if the pot must grow to be 2.83 times its previous size on each street, we'll need to bet around 0.92 pot sized bets, or slightly smaller than a pot-sized bet on each street. Also notice that since our bet is larger than a typical double barrel in a 3-bet pot, a bit more than half of our turn betting range can be bluffs. (Remember, bigger bets allow us to bluff more.)

In other situations, we may choose to bet a bit less on the turn if we don't want to be all-in by the river. Here's an example. We check queens on the



flop and our opponent checks back. Here, it's unlikely we'll want to be all-in on the river since our hand isn't strong enough to consistently win at showdown after making large bets. So betting smaller on the turn and the river is likely best because it should allow our hand to win more frequently if there is a showdown. Although it depends on our bet-sizing, since we're betting smaller, we'll want more of our turn bets to be for value.

Lastly, if we fear our opponent may be strong on the turn either because the turn card could have improved him or because he may have checked back a strong hand on the flop, it's probably

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best to bet smaller on the turn and then consider overbetting the river if he's unlikely to be strong. And when our opponent calls our turn bet on a wet board and the river is a blank, he's unlikely to be strong, so an overbet may be the best strategy.

Facing a Turn Bet in Position After Calling a Flop Bet

When our opponent bets 25 big blinds on the turn into a 50 big blind pot, we're required to defend at least 66.7 percent of the time to prevent him from being able to profitably bet any two cards. Since we'll defend against the majority of our opponent's flop bets by calling, he'll frequently get the opportunity to bluff on the turn and thus it makes sense for us to defend against these turn bets aggressively. That said, it's not likely a problem if his bet shows a small profit since he risked quite a bit of money to get this bluffing opportunity.

Since we risk 25 big blinds to win 75 big blinds on the turn, he'll need to bet the river with a balanced range (or check the winning hand) 75 percent of the time to make us indifferent to calling. Nevertheless, since our opponent is out of position and his range is polarized, he'll likely have few if any marginal strength hands which he can check on the river. This requires him to bet close to 75 percent of the time and we can compare how much of our opponent's turn betting range he felts based on whether we raised or called the turn.

In order to calculate this, we must figure out how often he needs to call based on the equity of our worst theoretically correct bluff. Although our worst bluff may show a slight profit, it's reasonable to assume it'll be only slightly profitable if not exactly break even. So let's assume our opponent bets 25 big blinds into a 50 big blind pot on the turn and our jam will be for 75 big blinds total. Since every 1 percent of equity our bluff has essentially makes it two 2 big blinds cheaper, the following equation can be used to show how frequently our opponent must call based on the equity of our bluff for it to break even.

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$$(75)(1 - X) - (75 - 200Y)(X) = 0$$

where

X is our opponent's calling frequency, and
Y is the equity of our bluff.

1. If our bluff has no equity when called, we are effectively risking 75 big blinds to win 75 big blinds. Our jam needs to be successful greater than 50 percent of the time to show a profit.
2. If our bluff has 15 percent equity when called, we are effectively risking 45 big blinds to win 75 big blinds. Our jam needs to be successful greater than 37.5 percent of the time to show a profit.
3. If our bluff has 25 percent equity when called, we are effectively risking 25 big blinds to win 75 big blinds. Our jam needs to be successful greater than 25 percent of the time to show a profit.
4. If our bluff has 37.5 percent equity when called, we are effectively risking 0 big blinds to win 75 big blinds. If our opponent ever folds, jamming will be profitable.

It's important to note that if our opponent plans to jam the river 75 percent of the time after his turn bet is called, then jamming the turn with a range where the worst bluff has greater than 25 percent equity makes him feel a wider range than calling does. That's because jamming a hand with 25 percent equity forces our opponent to call 75 percent of the time to prevent our weakest bluff jam from being profitable, but if we call, he'll only jam the river 75 percent of the time to make us indifferent to calling the turn with a bluff catcher. However, while it's possible some of our bluffs will have 25 percent or more equity when

called, the weakest bluffs will almost certainly not. This means calling the turn usually forces our opponent to felt a wider range.

Although calling the turn likely makes our opponent felt a wider range than raising does, this is a small change proportionally compared to other spots. For instance, jamming a range where the worst bluff has 15 percent equity on the turn in a 3-bet pot will require our opponent to felt 62.5 percent of his betting range. If we call instead, he will have to bet at most 75 percent of his turn betting range by going all-in on the river. This change isn't significant compared to those in other spots.

In contrast, when we raise a flop bet in a single raised pot our opponent is able to fold over half of his flop betting range without our flop raise being immediately profitable (since our flop raise is to 18 big blinds to win 14 big blinds). This results in him felting a much stronger range on the river for a much larger pot when compared to just calling. Yet unlike when we raise the flop or turn in a raised pot, jamming the turn in a 3-bet pot allows us to put the last bet in so we are guaranteed to realize our equity which makes our opponent defend much more aggressively. Additionally, since there is little money left relative to the size of the pot after our opponent bets the turn in a 3-bet pot, stacks will likely get all-in by the river regardless if we call or fold.

We now need to decide whether we should raise or flat when facing a bet on the turn with a draw. Again, the board textures where we have draws in our range are the same board textures where the opponent is likely to value bet the turn with the intention of checking the river since giving free cards is risky. Yet this is less of an issue in 3-bet pots since his 3-betting range is already polarized and betting only the flop and turn for value is especially difficult when out of position.

Let's suppose our draw will only river the nuts, and when our opponent bets the turn for 25 big blinds into a 50 big blind pot he plans to bet the river 75 percent of the time. When our draw hits, we'll win not only the 75 big blinds in the pot but also an

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additional 37.5 big blinds from implied odds for 112.5 big blinds total.

$$112.5 = 75 + (50)(0.75)$$

where

75 is the pot size,

50 is the river bet size, and

0.75 is the river betting frequency.

Since we'll win 112.5 big blinds when our draw hits on the river, calling the turn must be profitable if our hand has at least 18.2 percent equity.

$$(112.5)(X) - (25)(1 - X) \Rightarrow \\ X = 0.182$$

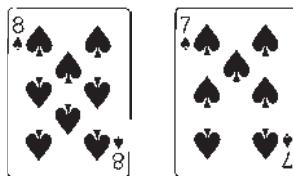
Although calling will always be profitable if our draw has 18.2 percent or more equity, calling with a hand with less equity will still be profitable if we're able to make a profitable river bluff after our opponent checks. Remember, he needs to check-call at least 66.7 percent of the time to make our river bluff jams unprofitable and this is not usually possible. This, of course, makes sense theoretically. We risked 25 big blinds by calling the turn to only occasionally get the opportunity to profitably bluff the river. Furthermore, we may call with draws which have less than 18.2 percent equity (which is around how much equity an open ended straight draw has vs. an overpair) and only the worst hand in our turn calling range should be approximately break even.

In reality, whether calling, jamming, or occasionally even folding on the turn with a draw in a 3-bet pot is best will be close. Moreover, if we have many draws in our range, our opponent may not bet 75 percent of the time when our draw hits on the river. It's also possible our outs are tainted if we have the non-nut flush draw, and this will sometimes result in us getting stacked when

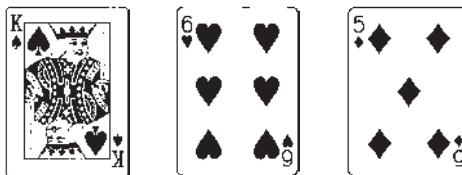
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we hit our draw. Just as was the case in single raised pots, it's important to be aware of how many draws in our range improve on the same river cards since this influences our opponent's river betting frequency and sizing.

Here's an example. We open on the button with the



our opponent 3-bets from the big blind, and we call. Additionally, we call a half pot sized bet on the



flop as well as on the 2♣ turn. Since there aren't many draws in our range, our opponent's betting range will function similarly to a perfectly polarized range. That is, if the river comes the 5♥ and he checks, it's unlikely he'll want to check-call since they'll be few or no medium strength hands in his range. This means our opponent must bet the river at a high frequency to prevent us from being able to call him profitably with bluff catchers on the turn, and once he does check the river, we can profitably bet any two cards.

In this spot, calling our opponent with an open ended straight draw on the turn will be a very profitable play. We'll stack him often enough to justify the price of our call on the turn since we'll river the nuts 17.4 percent of the time, and when our opponent

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does check the river, he'll almost always fold to our bet. So calling will almost certainly be superior to raising.

But here's an example where calling will likely be less profitable. We open on the button with the 8♠7♠ and call our opponent's 3-bet from the big blind. Additionally, suppose we call his half pot sized bet on the K♠9♣2♠ flop and the 3♦ turn. While calling his turn bet will still likely be profitable, he may not bet the river as aggressively when the river card brings the flush. That's because he may think there are many flushes in our range as well as having bet the turn with a medium strength hand, such as pocket tens, which feared giving a free card. (Some players may choose to bet a medium strength hand on the flop and the turn, but then check-call on blank rivers.)

In other words, it's not reasonable to assume our opponent will bet the river 75 percent of the time when our hand makes the flush or he'll always check-fold once he checks. Lastly, we're not drawing to the nuts, so we'll sometimes be beat after making the flush. Put simply, it will often occur that small straight draws in 3-bet pots do better than flush draws despite having one less out.

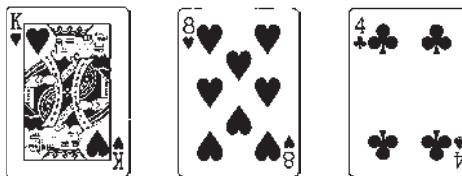
Although it can be difficult to tell if it's best to call, raise, or fold a draw on the turn (and we'll usually need to do some combination of at least two), the hands which make the best value raises on this street are usually quite easy to identify. In particular, we want to value raise hands which are strong yet still vulnerable to being outdrawn by hands in our opponent's bet-folding range.

For instance, it's easy to see we should jam a set of eights when facing a double barrel in a 3-bet pot on the K♥T♠8♥6♥ board. Almost any hand in our opponent's bet-folding range can outdraw us on the river, and by raising now he may fold a high equity hand like the 9♦8♦ or the A♣J♥. In addition, raising ensures all the money gets in on the turn and our opponent doesn't get scared with a hand like the A♥K♦ or the K♦T♦ on the river. Lastly, since stack sizes are so small after our opponent bets the turn, he can't overbet the river if we just call, so slowplaying will be ineffective.

Facing a Turn Check in Position After Calling a Flop Bet

When our opponent checks to us on the turn after betting the flop in a 3-bet pot, it usually makes little sense to make a large turn bet. That's because he'll usually be tempted to defend, when he has a defensible hand, by check-raising all-in against a large bet since there is so little money remaining relative to the size of the pot. In other words, betting small forces him to call wider and makes it more difficult for him to destroy our positional advantage.

Here's an example. Our opponent bets 12.5 big blinds into a 25 big blind pot on the



flop before checking on a $2\clubsuit$ turn. While our gut reaction might be to bet 50 percent of the pot on the turn and the river since this allows us to get all-in after betting an equal fraction of the pot on each street, our opponent will often check-raise all-in against this bet sizing. That is, he'll likely try to balance a check-raising range of strong hands and draws in order to ensure he gets to put in the last bet with his flush draws and straight draws.

But by betting less on the turn, our opponent is forced to defend a wider range since our bluffs are cheaper. This also reduces the amount he wins when his check-raises are not called.

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Furthermore, it'll be difficult for him to slowplay by check-calling the turn with a very strong hand since we can easily hit a straight or flush on the river. Lastly, although our opponent can likely profitably check-call with his draws, we'll bet the river less often when the river card hits many draws in his range. While there is no one size fits all bet sizing here, betting one-third or less pot sized bets on the turn is likely fine on wet boards.

Summary

Playing the turn when out of position in 3-bet pots can be tricky since bet-folding draws is so difficult. In addition, our bets will often be a bit bigger out of position than in position because our opponent will be less likely to go all-in and destroy his positional advantage, but we should be extra careful to avoid bet-folding high equity draws when possible. In general, small bets are effective in position since this forces our opponent to call wider and play the river out of position.

If both players check on the flop, it's important to bet according to how strong our hand is relative to our opponent's range. Consequently, betting big on the turn will often be effective with a range of strong value hands and bluffs, but if our value bets are relatively weak, betting smaller should be best since this requires our opponent to call with a wider range on the turn and the river. Plus it allows us to win more frequently at showdown.

In addition, it's important to remember that raising the turn in 3-bet pots does not greatly strengthen our opponent's felting range relative to raising in single raised pots. That's because raising the turn all-in ensures we're able to realize the equity of our hand. This also encourages us to raise when we have a strong hand, such as a set or weak flush, which is vulnerable to being outdrawn by hands in our opponent's bet-folding range and there are many draws in his range. Here are a few more important points:

1. After the flop checks through in a 3-bet pot, a variety of different bet sizings are possible on the turn and the river. In general, around a 1-to-1 bluffing to value betting ratio should be used.

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2. We should try to avoid facing a break even call with a strong draw against our opponent's turn jam. More specifically, betting 50 percent of the pot on the flop and turn with hands which have approximately 25 percent equity is risky if our opponent will often move all-in.
3. For each 1 percent of equity our hand has when called after going all-in on the turn, our bluff is effectively 2 big blinds cheaper. Since our worst bluffs usually have around 15 percent equity, our opponent must call with the majority of his turn betting range.
4. Calling our opponent's turn double barrel in a 3-bet pot will usually result in him being all-in by the river at a slightly higher frequency than jamming the turn will, yet this allows him to see a river card with his entire turn betting range. In addition, strong hands which are vulnerable to being outdrawn by our opponent's bet-folding range should raise all-in on the turn.
5. It's theoretically correct to use many different bet sizings in most spots, and this is especially important in 3-bet pots. Overbetting all-in on the turn with a range of vulnerable value hands and high equity draws is often a strong play.

Part Eleven

River Play

River Play

Introduction

We've now come to the final street, and it may surprise you to see there is only one chapter on river play. That's because nearly every relevant concept for river play has already been discussed in detail in previous sections. Consequently, we'll focus our attention on the aspects of playing the final street which differ from flop and turn play.

Most importantly, since there are no additional cards to come, more precise ranges and bet sizings can be made. On the earlier rounds, we were never able to convert equity into expected value since there were additional cards to come, but this is possible in some river situations. As such, river play usually requires the smallest amount of guesswork when applying theory.

Unfortunately, precise solutions often require a lot of math and can be extremely time consuming. Specifically, some spots would take a highly skilled player hours to get close to what could be called a "solution" even with the help of advanced computer software. So for this reason, models are still needed to showcase important theory concepts. This is especially true since we only have a limited amount of time to make a decision when playing.

Comparing In Position and Out of Position River Jams

Many players don't truly understand how river value bets work and this causes them to develop leaks in other aspects of their game. In fact, the term "value bet" is often misleading and confusing since value bets on the river don't always work the same way as they do on other streets. More specifically, how strong our hand needs to be to value bet on the river will depend on whether we're in or out of position.

When in position, our river bet needs to win at least half the time when called to make betting more profitable than checking. This should be quite intuitive since betting against our opponent's check-folding range accomplishes nothing as there are no more cards to come and we'll win the pot either way. So all we care about is how our hand does against his calling and check-raising raise and betting will always have a negative expected value relative to checking if our opponent wins more often than we do once he calls (or raises).

This concept often confuses players since a value bet on the river does not imply we want our opponent to call. Keep in mind this was true for other streets as well, but it's more difficult to visualize on other streets since there are additional cards to come.

Here's an example. On the river, our opponent who is first to act checks and we have a pot sized bet remaining. Going all-in for one pot sized bet requires our opponent to call half the time to keep us indifferent to bluffing and because we're all-in, he won't have the opportunity to raise. Furthermore, let's assume he has us beat 20 percent of the time. This means when we bet the river, our opponent will fold 50 percent of the time, call with the worse hand 30 percent of the time, and call with the better hand 20 percent of

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the time. Therefore, the expected value of betting is 0.9 pot sized bets.

$$0.9 = (0.50)(1) + (0.3)(2) - (0.2)(1)$$

where

0.50 is our opponent's folding frequency,

0.30 is the proportion of times our opponent calls and loses, and

0.20 is the proportion of times our opponent calls and wins.

Let's compare this expected value to that of checking. And since our opponent has us beat 20 percent of the time, we'll win 80 percent of the time. Therefore, the expected value of checking is 0.8 pot sized bets.

$$0.8 = (0.80)(1) + (0.20)(0)$$

where

0.80 is our winning frequency,

0.20 is our losing frequency, and

1 is the size of the pot.

Since value betting has a higher expected value than checking, it's the superior play. Nevertheless, after value betting, we're still hoping our opponent folds. That's because we'll lose 40 percent of the time once he calls since 40 percent of our opponent's calling range beats us.

We can solve for our expected value after our opponent calls and before he shows us whether he has the best hand. Since we win 60 percent of the time and lose 40 percent of the time once called, our expected value is 0.8 pot sized bets.

$$0.8 = (0.60)(2) - (0.40)(1)$$

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where

0.60 is our winning frequency,

0.40 is our losing frequency,

2 is the size of the pot when we win, and

1 is how much we lose when we lose.

Notice if we bet and our opponent folds, we'll always win a single pot sized bet. But if he calls, our average win will be only 0.8 pot sized bets. So despite us winning the majority of the time when called and betting being the superior play, we still hope he folds to our river bet.

This concept should be fairly obvious to advanced players, but it often confuses new players and results in them not value betting the river aggressively enough — it just feels awkward to bet the river for value in position while rooting for our opponent to fold when checking back is so easy and profitable.

Although value betting the river in position and hoping our opponent folds may at first seem counterintuitive, it's always more profitable to jam than check as long as we win over half the time when called.¹⁹ Remember though, that a river betting range will almost always be polarized and include only strong and weak hands. Therefore, medium strength hands should be checked since betting them mostly just causes worse hands to fold and better hands to call. Stated another way, a value bet simply means the hand is favored if called. It does not imply we're hoping our opponent calls or that we'll call if our opponent raises.

Now let's discuss value betting the river when out of position. The key difference is it's often superior to bet with a hand which will lose over half the time when called rather than check. Again, this should be a concept most advanced players are already

¹⁹ When our opponent can raise it's a bit more complicated, and this will be discussed in the following chapter.

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familiar with.²⁰ But weaker players who don't understand this idea often think highly skilled players are playing overly aggressively when in reality they're playing much closer to game theoretically optimal than they'd expect.

Here's an example. We once again find ourselves on the river with a pot sized bet left, only now we're out of position and our opponent has us beat 30 percent instead of 20 percent of the time. In this situation, if we go all-in for a single pot sized bet and he calls 50 percent of the time, our expected value will be 0.6 pot sized bets.

$$0.6 = (0.50)(1) + (0.20)(2) - (0.30)(1)$$

where

- 0.50 is our opponent's folding frequency,
- 0.20 is the proportion of times our opponent calls and loses,
- 0.30 is the proportion of times our opponent calls and wins,
- 1 is the size of the pot or the size of our bet, and
- 2 is the number of bets we win when our opponent calls and loses.

In position, it would clearly not make sense to bet with our hand since we would lose over half the time when called — checking in position has an expected value of 0.7 pot sized bets. However, when out of position, our opponent has the opportunity to bet after we check and can bet with a balanced range of value bets and bluffs on the river. This makes checking out of position less profitable than checking in position.

Let's assume once we check on the river our opponent will always value bet the 30 percent of his range which beats us in a

²⁰ Because David Sklansky explained it in detail thirty-five years ago.

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balanced range for a single pot sized bet. Since we'll get 2-to-1 odds on our call, a balanced betting range should have 1 bluff for every 2 value bets. In other words, if he value bets 30 percent of the time he also should bluff 15 percent of the time to keep us indifferent to calling. This results in him betting the river 45 percent of the time, and as already explained, whenever our opponent bets with a balanced range, we have effectively lost the hand and the expected value of our call will be zero. Therefore, the expected value of checking the river will be 0.55 pot sized bets.

$$0.55 = (0.55)(1) + (0.45)(0)$$

where

0.55 is the proportion of times our opponent checks the river and loses,

0.45 is the proportion of times our opponent bets,

1 is the size of the pot, and

0 is our expectation when our opponent bets.

Since the expected value of jamming the river is 0.6 pot sized bets while the expected value of check-calling is only 0.55 pot sized bets, we should value bet this river when out of position despite expecting to lose over half the time when called. This further showcases why the term value bet is misleading — when out of position, it's often best to bet the river with a strong hand expecting to lose more often than win when called! (The obvious exceptions occur when your opponent bluffs far too frequently or infrequently when you check.)

That's because when we check out of position, we'll not only lose to all the hands which beat us, but also effectively lose to all the hands our opponent bluffs in a balanced betting range. This reduces the expected value of checking a hand with showdown value, and encourages us to value bet aggressively in some spots even if we expect to lose more often than win when called. It's

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especially common, when out of position, that going all-in is the best strategy despite expecting to lose more often than win when called if stack sizes are shallow relative to the pot size.

Value Betting When Raises are Possible

Since we won't often be going all-in when we bet the river, our opponent will usually have the opportunity to raise us. In addition, his raising range should be designed to turn the majority of our value betting hands into bluff catchers, so we must take into account how often he'll make us face a break even call when deciding whether or not it's more profitable to bet or check.

When betting out of position, we don't need to worry about reopening up the betting. Put differently, if our opponent is in position, he'll always have the opportunity to bet or raise with his strong hands and will never check back a very strong hand since checking goes to showdown — he can't check hoping to check-raise. This, in a sense, makes out of position value betting on the river less risky. Sure it's true that if we bet and our opponent raises a balanced range we'll have invested more dead money into the pot and usually be faced with a break even call, but hands which are strong enough to value raise are of course strong enough to bet as well when facing a check. In other words, although betting the river when out of position makes the pot bigger, it doesn't really give our opponent an opportunity to bet or raise that he wouldn't otherwise have.

But when we bet the river in position, it reopens the betting and gives our opponent the opportunity to check-raise with a balanced range of value hands and bluffs. And when he does this, both calling and folding with most of the hands in our range will have an expected value of zero meaning we'll have effectively lost the hand. So notice that by bet-folding the river in position, we'll not only lose our bet to hands which beat us, but our bet and the pot will also effectively be lost to hands which our opponent bluffs in a balanced check-raising range.

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Let's illustrate this with an example. On the river, we're in position and have 80 big blinds remaining and the pot is 40 big blinds. If we bet 20 big blinds, our opponent has the opportunity to go all-in for 80 big blinds total, and for us to be indifferent to calling, 70 percent of our opponent's check-raises must be value raises.

$$(140)(1 - X) - (60)(X) = 0 \Rightarrow \\ X = 0.7$$

where

140 is the size of the pot,

60 is the size of the raise,

X is the frequency of our opponent's value raises, and

1 – X is the frequency of our opponent's raise bluffs.

Since our opponent needs 70 percent of his river check-raises to be value raises, if 5 percent of his range on the river is strong enough to value check raise, then he can also check-raise bluff 2.1 percent of the time and remain balanced.

$$0.071 = \frac{0.05}{0.70}$$

$$0.021 = 0.071 - 0.05$$

Let's assume we always fold once our opponent check-raises since calling and folding both have an expected value of zero. When we bet-fold a hand after our opponent value check-raised, we'll have lost 20 more big blinds than we would have by checking. Yet if our opponent was bluff check-raising, we'll have effectively lost 60 blinds. That's because we would have won the 40 big blind pot had we simply checked back, but by bet-folding, we lost both the original 40 big blind pot and our 20 big blind bet.

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This makes value bet-folding riskier in position than out of position since we'll lose to our opponents check-raise bluffs whereas checking guaranteed showdown.

Nevertheless, bet-folding on the river in position will still frequently be the best option and the following equation can be used to determine the expected value of betting relative to checking.

EV of betting relative to checking = (bet size)(frequency opponent calls with the worst hand) – (bet size)(frequency opponent calls or check-raises the better hand) – (bet size + pot size)(frequency opponent check-raise bluffs)

This equation shows that in order for in position value betting to be superior to checking, our opponent must call with the losing hand frequently enough to overcome the fact that we'll sometimes fold the best hand to our opponent's check-raise bluffs. Notice that simply solving for the expected value of our river bet won't tell us if betting or checking is superior since checking has a positive expectation as well. So our goal isn't to bet if betting has a positive expected value, but rather if betting has a greater expected value than checking. Therefore, if the expectation of betting relative to checking is positive, betting is our best strategy.

Furthermore, on the river, make sure to note our opponent will not usually be able to check-raise all of his hands which beat our value betting hand. He has to make sure his value check-raises beat over half the hands in our check-raise calling range or else calling will be more profitable than check-raising. As such, there are many different variables in this equation, and this requires us to estimate several of our opponent's frequencies.

Let's stick with our previous example and suppose we're in position on the river and bet 20 big blinds into a 40 big blind pot with the intention of bet-folding. In addition, let's suppose our opponent will call the river frequently enough to make us indifferent to bluffing which requires him to call 66.7 percent of

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the time. Moreover, assume 5 percent of his hands will be strong enough to value check raise and he'll check-raise bluff an additional 2.1 percent of hands so his range is balanced. Lastly, assume he calls with the best hand 10 percent of the time. These values can be plugged into the previous formula to determine the expected value of betting relative to checking. And in this case the answer is 5.66 big blinds.

$$(20)(0.667 - 0.10 - 0.05 - 0.021) - (20)(0.1 + 0.05) \\ - (60)(0.021) =$$

$$9.92 - 3 - 1.26 = 5.66$$

where

- 20 is the size of the bet,
- 0.667 is our opponent's calling frequency,
- 0.10 is how often our opponent calls with the best hand,
- 0.05 is how often our opponent value check-raises.
- 0.021 is how often our opponent check-raise bluffs, and
- 60 is the size of the pot after we bet.

So here, the expected value of betting is 5.66 big blinds greater than that of checking. And despite the fact that we effectively lose both our bet and the pot for 60 big blinds total every time our opponent check-raise bluffs, this does not occur often enough to deter us from betting.

Another way to get this answer would be to solve for the expected value of betting and the expected value of checking and then subtract. Both methods are valid, but this method is a bit faster and showcases why it's so risky to bet-fold when our opponent plans to aggressively check-raise with a balanced range.

Pinpointing the Optimal River Bet Size

One of the most exciting aspects of applying theory to river play is in many cases it allows us to actually solve for the theoretically perfect bet size. But before this formula is introduced and explained, it's best to first discuss river bet sizing using some easier to visualize examples.

Even when exact answers can be solved for, it's usually a good idea to begin with predicting the correct answer then seeing how accurate our prediction was. For example, we learned previously that as a general rule of thumb it's good to use around a 2-to-1 bluffing to value raising ratio when raising the flop in position. Yet if we were to ask a player who doesn't understand theory well to guess how many bluff raises he should have in his flop raising range, he'll almost always guess he should be bluffing much less. That's because he doesn't understand how it's possible to bluff so much when there are many streets left to act.

This information is useful because it gives us an idea of how players of a given skill level actually think and play. Those who are playing low limits online almost certainly don't bluff raise enough on the flop. This encourages us to exploitatively fold our bluff catchers when facing a raise even if in theory we should be defending much more aggressively.²¹ Again, this is one of the main reasons why being a theoretically strong player is so useful. It allows us to make less mistakes against strong opponents as well as better exploit weak ones.

So let's start with making a few predictions before actually getting to the formula. Assume we are on the river with unlimited

²¹ The point Mason Malmuth and David Sklansky made much earlier in the text warning about bluff catching.

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stack depth and our opponent will never raise our bet. In addition, assume he'll call often enough so our bluffs break even. Due to these two assumptions, position will not matter, so it's fine to assume we're either in or out of position.

So on the river, given the above assumptions, how much would you bet (in terms of pot sized bets) with a hand your opponent has beaten 15 percent of the time? Stop and actually think of a bet size because if you bet too much or too little there's a good chance other players around your skill level are also making the same mistake. And after you've made your best guess, it's a good idea to go and solve for the expected value of that bet sizing. How often does your opponent call this bet? How often do you win when you're called? Getting good at poker requires work, and these are the types of questions you'll often need to be able to answer as you continue to improve.

The optimal bet sizing in this situation is 0.83 pot sized bets, and how this value was calculated will be explained later in this chapter. When we bet 0.83 pot sized bets, our opponent will need to call 54.7 percent of the time to keep us indifferent to bluffing.

$$(1)(1 - X) - (0.83)(X) = 0 \Rightarrow \\ X = 0.547$$

This information can be used to determine our expected value after betting. Our opponent will call 54.7 percent of the time but he only has us beat 15 percent of the time. This means 39.7 percent of the time he'll call and lose. Therefore, our expectation after betting is 1.06.

$$1.06 = (0.453)(1) + (0.397)(1.83) - (0.15)(0.83)$$

where

0.453 is the frequency at which our opponent folds,
0.397 is the frequency at which our opponent calls and loses,

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- 0.15 is the frequency at which our opponent calls and wins,
- 1 is the size of the pot,
- 1.83 is how much we win when our opponent calls and loses, and
- 0.83 is how much we lose when our opponent calls and wins.

This can be compared to the expected value of checking which will be 0.85 pot sized bets since we'll win the pot 85 percent of the time.

$$0.85 = (0.85)(1) + (0.15)(0)$$

So by betting the perfect amount on the river we increase our expected value by 0.21 pot sized bets relative to checking.

$$0.21 = 1.06 - 0.85$$

It's also important to understand our mistake if we bet too much or too little. Betting too much causes us to lose more money to hands which beat us and causes our opponent to fold more hands we beat. Although our bet will be profitable as long as we win over half the time when called, winning just over half the time causes our bet to be only slightly better than checking. An optimal bet sizing results in us winning the majority of the time when called for reasonable sized bets.

Betting too small results in us getting too little value from the hands we do beat. Here we're already winning 72.6 percent of the time when called, so betting smaller causes us to lose too much value from the hands we beat and decreases our expected value.

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$$0.726 = \frac{0.397}{0.547}$$

where

0.397 is the frequency our opponent calls and loses, and
0.547 is our opponent's calling frequency.

Again, these types of exercises are useful for identifying general leaks. Understanding a formula on paper isn't nearly as important as being able to recognize the mistakes you're currently making and fixing them in a methodical way.

Here is the formula for the expected value of betting on the river. Notice this is the total expected value of the bet and not the expected value of betting relative to checking. Also keep in mind the expected value of checking will change based on whether we're in or out of position, so the following formula won't automatically tell us if betting is better than checking.

$$\begin{aligned} \text{EV of betting} = & (\text{opponent's folding frequency})(\text{pot-size}) + \\ & (\text{frequency we're called and win})(\text{pot-size} + \text{bet size}) - \\ & (\text{frequency we effectively lose})(\text{bet size}) \end{aligned}$$

This formula can be expressed using only two variables when playing against an optimal opponent who wants to keep us indifferent to bluffing.

$$\text{EV of betting} = \left[1 - \frac{1}{1+X} \right] (1) + \left[\frac{1}{1+X} - Y \right] (1+X) - (Y)(X)$$

where

X is our bet size in terms of pot sized bets, and
Y is how often we effectively lose.

Since the variable Y represents how often we effectively lose, this formula is able to take into account our opponent's ability to

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bluff raise. Remember, when he bluff raises with a balanced range, we'll have effectively lost the hand. So if our opponent never raises on the river, then Y will simply be how often he has us beat. But in cases where he'll sometimes raise with a balanced range, Y will also include bluff raises.

We can consider the derivative of this formula with respect to X to obtain the river bet sizing which yields the highest expected value. Basic calculus tells us that the value of X for which the derivative equals zero corresponds to a local maximum or minimum, in this case the bet size for which the value of the formula is maximized. In reality, Y will change slightly based on our bet sizing, stack depth, and the removal effects of our hand. That is, if we check or bet small, our opponent will usually bet or raise more aggressively and have more stack depth to utilize. However, Y will often change only a small amount based on our bet sizing assuming stacks are adequately deep, so it's worthwhile to treat it as a constant rather than get sidetracked with details.

This is the only formula in this book which requires calculus to derive, and if you're not comfortable with calculus, you shouldn't worry about its derivation. You can still test the formula by plugging in values yourself and seeing that it's correct. But if you are comfortable with calculus, you should be able to derive it yourself, and more mathematically intensive explanations are given in *The Mathematics of Poker* by Bill Chen and Jerrod Ankenman.

$$\text{Derivative: } 0 = \frac{1}{(1+X)^2} - 2Y \text{ or } Y = \left(\frac{1}{2}\right)(1+X)^2$$

where

X is our bet size in terms of pot sized bets, and
Y is how often we effectively lose.

This formula probably seems confusing at first. But luckily after some rearrangement it can be expressed in the following way

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and can then be used in a quadratic solver (which are available for free online) to solve for close to the perfect bet sizing.

$$0 = 1 - (2Y)(1 + 2X + X^2)$$

This is such an important formula that it's worth carefully doing a few examples to make sure we're comfortable using it. Let's start with an example where we think we're effectively beaten on the river 22 percent of the time. This requires us to plug in 0.22 for Y and solve for X.

$$\begin{aligned} 0 &= 1 - (2Y)(1 + 2X + X^2) \Rightarrow \\ 0 &= 1 - (2)(0.22)(1 + 2X + X^2) \Rightarrow \\ 0 &= 1 - (0.44)(1 + 2X + X^2) \Rightarrow \\ 0 &= 1 - 0.44 - 0.88X - 0.44X^2 \Rightarrow \\ 0 &= 0.56 - 0.88X - 0.44X^2 \end{aligned}$$

We're almost done. Now all we need to do is google search “quadratic solver” online and click on one of the many links. After plugging in each of the terms, the following answers should appear.

$$X = -2.51 \text{ or } 0.51$$

Since we're using a quadratic equation, we'll usually get two answers. Normally, one will be nonsensical in the context of poker — a negative pot sized bet — and only one will be the correct answer. And in this example, since it's impossible to bet -2.51 pot sized bets, betting 0.51 pot sized bets is clearly the answer. That's the sizing which maximizes our expected value. It results in us winning the majority of the time when called while still winning a reasonable sized bet.

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Let's try one more example. Only this time assume we're beat on the river 40 percent of the time. Again, it's a good idea to guess at what this number is before solving for the answer so you can estimate if you're regularly betting too big or too small.

$$\begin{aligned}0 &= 1 - (2Y)(1 + 2X + X^2) \Rightarrow \\0 &= 1 - (2)(0.4)(1 + 2X + X^2) \Rightarrow \\0 &= 1 - (0.8)(1 + 2X + X^2) \Rightarrow \\0 &= 1 - 0.8 - 1.6X - 0.8X^2 \Rightarrow \\0 &= 0.2 - 1.6X - 0.8X^2\end{aligned}$$

Plugging these values into a quadratic equation solver, the two possible values for X are -2.11 or 0.12 pot sized bets. Clearly, the optimal bet sizing here must be 0.12 pot sized bets.

Although it may at first seem as if we should always bet 0.12 pot sized bets when our opponent has us effectively beat 40 percent of the time, this isn't true. This would be true if he could only defend by calling, but we have to be extra careful when check-raises are possible. That's because as previously discussed, this formula will not tell us whether it's more profitable to check or bet in position since betting reopens up the action and allows our opponent to raise.

And if our opponent is able to aggressively check-raise, then betting 0.12 pot sized bets will probably be inferior to checking. Again, that's because whenever our opponent check raise bluffs with a balanced range we'll have effectively lost the pot (in addition to our bet) which would have been won by checking. So getting check-raise bluffed effectively causes us to lose 1.12 pot sized bets. However, when our opponent calls we can only win an additional 0.12 pot sized bets (and we'll still sometimes lose when called) which is usually too small to justify reopening up the betting when in position.

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This brings us to an interesting and important point regarding bet sizing. In general, very small bets often make sense theoretically when out of position since they do not reopen the betting. Yet the same small bets in position will rarely be best when our opponent has a check-raising range. That's because winning such little additional money when he calls with a worse hand does not justify the risk of getting raised. Put another way, the more aggressively our opponent will check-raise, the more likely we should be to check back. That's because betting causes us to effectively lose the pot at a higher frequency.

Another important point to mention is when stack sizes are shallow and going all-in is an option this formula won't work very well for determining whether or not to bet when out of position. The reason for this is that our opponent has no opportunity to raise after we go all-in, and by going all-in for a small amount, we force him to call with a wide range. In fact, it's sometimes correct to go all-in when out of position even if we're beat by over half the hands in our opponent's range (before he calls). So this formula is not accurate for bet sizing when stacks are shallow, and it's important to understand the concepts at play as already discussed in "Part 11: Comparing In Position and Out of Position River Jams" starting on page 329.

Lastly, as we'll see in the next chapter, this formula does not take into account removal effects. The cards our hand removes from the deck will impact our opponent's calling, raising, and folding frequencies. In other words, it's impossible for him to always call at the same frequency based on our bet sizing regardless of what hand we have. This effect ranges from nearly irrelevant to extremely important based on our hand and the board texture.

Utilizing Removal Effects

Since cards in our hand cannot be in our opponent's range, our holdings will almost always influence what hands he can have. Although this effect is present on every street, it's especially important to properly utilize removal effects on the river. For instance, when bluffing, our hands removal effect is often the sole determinant for whether our bluff has a positive or negative expected value.

Since there are no additional cards to come, all of our river bluffs will have zero equity when called. This was not the case for preflop, flop, and turn play since even our weakest bluffs had some equity. As such, we always emphasized bluffing with hands which retained their equity well since they had a chance to outdraw our opponent. And although removal effects were still present on previous streets, they were usually much less significant than the concept of simply bluffing with hands which best retain their equity. So it made sense to largely ignore this effect and concentrate on more significant concepts.

Furthermore, ranges are usually quite wide on previous streets so removal effects often have a limited impact on our opponent's range. While it's true holding a top pair hand on the flop means he'll have one-third fewer top pair combinations, there are usually so many strong and weak hands in his range that removal effects rarely significantly alter it. But this isn't always the case on the river since ranges are usually more defined with fewer combinations of hands. It's thus common for our holding to significantly change our opponent's betting or calling frequency because we remove a large fraction of hands from his range.

Here's a simple example. On the river, our opponent checks to us and we bet a single pot sized bet. Since we risk one pot sized bet to win one pot sized bet, he must call exactly 50 percent of the time to keep us indifferent to bluffing.

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Moreover, let's suppose our opponent's river checking range includes 100 hand combinations if our hand has no removal effect. He thus should check-call with 50 of these combinations to keep us indifferent to bluffing with a hand with no removal effects.

Now let's suppose we bluff with a hand on the river that blocks 6 value hands in our opponent's check-calling range but no hands in his check-folding range. This means he'll have six less hand combinations in his checking range and check-calling range (since his checking range includes his check-calling range). He'll thus call only 46.8 percent of the time.

$$0.468 = \frac{50 - 6}{100 - 6}$$

And since our opponent's calling frequency has decreased, we'll both win the pot more frequently as well as lose our bet less often. The expected value of betting this hand is now 0.064 pot sized bets.

$$0.064 = (1 - 0.468)(1) - (0.468)(1)$$

where

1 is either the size of the pot or the size of the bet,

0.468 is our opponent's calling frequency, and

1 – 0.468 is our opponent's folding frequency.

This may seem insignificant at first, but keep in mind this value represents pot sized bets. And if the pot is 100 big blinds on the river, bluffing with this hand will have an expected value of 6.4 big blinds. That's a substantial gain and constantly bluffing with the right hands on the river will add up in the long run.

Likewise, our bluff will have a negative expected value when our hand has an undesirable removal effect. That's because hands with bad removal effects block hands in our opponent's check-folding range. For example, suppose our hand blocks 8 hands in

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our opponent's check-folding range but only 1 hand in his check-calling range. This results in our opponent check-calling 53.8 percent of the time.

$$0.538 = \frac{50 - 1}{100 - 8 - 1}$$

And if he check-calls 53.8 percent of the time then the expected value of our bluff will be negative 0.076 pot sized bets.

$$- 0.076 = (1 - 0.538)(1) - (0.538)(1)$$

where

1 is either the pot size or the bet size,

0.538 is our opponent's calling frequency, and

1 – 0.538 is our opponent's folding frequency.

As can be seen, the expected value of a bluff can change quite significantly based on removal effects. Bluffs with good removal effects have a positive expectation while bluffs with bad removal effects have a negative expectation. So picking the right bluff randomizers is often quite significant as the expected value of our first bluff with a beneficial removal effect was 0.14 pot sized bets greater than our second bluff with a detrimental removal effect.

In reality, almost every bluff in our betting or raising range should have a beneficial removal effect. That's because we'll only be able to make a few bluffs and remain balanced on the river since our value hands are limited. However, there are usually many hands in our range with beneficial removal effects. As such, our opponent will have to make sure he's calling aggressively enough that we're required to bluff with the right hands to show a profit. In other words, we should lose money in most spots unless we bluff with a hand with a beneficial removal effect.

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Let's examine a couple board textures and discuss the type of hands which will have beneficial and detrimental removal effects when bluffed. For each of these boards, assume we called a cutoff open on the button, our opponent bet the flop, turn, and river, and we're debating if we should bluff raise.

Hand No. 1: Flop: Q♥8♥4♦; Turn: J♣; River: K♣. Here we should not likely bluff raise with missed flush draws since these hands likely block many hands in our opponent's bet-folding range. This may seem counterintuitive at first, especially because, on the river, players are often used to bluffing with the worst hands in their range. But if we have a hand like the 7♥6♥, then our opponent can't be bet-folding the river with any missed flush draw with the 7♥ or 6♥, and this means he's more likely to be bet-calling.

If our opponent is betting the river with many sets, two pairs, straights, and bluffs, then bluff raising a hand like the T♣T♦ will likely be best. That's because tens block half of his ace-ten and ten-nine combinations. Additionally, he'll likely fold most if not all of his two pairs to our raise. When bluffing in a spot like this, it's important to see how many combinations we block in both our opponent's value betting and bluffing range as well since calling with our bluff catcher may also be profitable. But if calling isn't particularly profitable, then bluffing with a hand which blocks many hands in his bet-calling range will be best.

Hand No. 2: Flop: Q♥J♣5♣; Turn: 8♦; River: 2♣. On the river, much of our opponent's bet-calling range will be flushes. So, in order for bluff raising here to be profitable, our hand should block as many flush combinations as possible while minimizing how many hands we block in his bet-folding range.

It's not usually possible to block some of our opponent's value hands without also blocking some bluffs. Here's an example. We decide to bluff raise on the river with the A♣J♣. Notice this hand is only a bluff catcher when we call yet it blocks

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all of our opponent's nut flush hands when raised. But doing this also blocks some hands in his bet-folding range since he could be bet-folding the river with a hand like the A♣T♠. Nevertheless, blocking a few of our opponent's bet-folding hands likely isn't enough to stop A♣J♣ from being an excellent bluff raise.

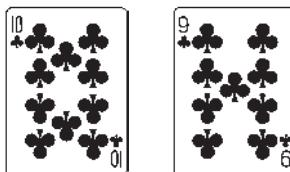
Lastly, we should avoid bluff raising with hands which only block hands in our opponent's bet-folding range. For instance, since he's likely bet-folding all his pairs of queens which bet the river, bluff raising with a queen which blocks no flush combinations will have a negative expected value. So even if calling with top pair will not be profitable, we shouldn't raise since our hand has a detrimental removal effect.

Turning Made Hands Into Bluffs in Position

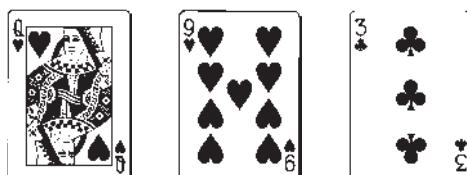
Removal effects aside, on the river, weak made hands should be turned into bluffs when they are our weakest holdings and we want to bet with a balanced range. This occurs when the river completed most or all of the possible draws in our range so we don't have many or any missed draws. This will usually only occur on the river since ranges are both weaker and wider on earlier streets.

It's important to remember that just because checking a made hand on the river is profitable doesn't mean checking is superior to betting. That's because bluffing can have an even greater expected value.

Here's an example. Suppose we open with the



in the cutoff, the big blind 3-bets, and we call. Assume the flop is the



Turning Made Hands Into Bluffs in Position 353

and our opponent bets one half the pot and we call. Likewise, assume we do the same on the 7♠ turn. If the river comes the J♥ and our opponent checks, then a pair of nines with no kicker is probably the worst hand in our range. All of our draws which called on the turn will have made either a straight, flush, or pair of jacks, and all of our made hands will be at least as strong as a pair of tens.

Without any more analysis, it's safe to conclude we'll likely want to bluff with the T♣9♣ since it's the weakest hand in our range. While removal effects are of course relevant, here it's probably most important to check with hands that are more likely to win at showdown and bluff with hands which win less often. Furthermore, removal effects won't likely matter enough to encourage us to bluff with a hand which will frequently win after checking.

Whether or not bluff jamming is best will depend on how often our hand wins after checking back the river as well as how often our opponent calls our river bet. Remember, since bluffing any two cards on the river will be profitable, he's not calling enough to prevent us from profitably bluffing any two cards. The formulas for the expected value of bluff jamming and checking will be as follows.²²

$$\text{EV of jamming} = (\text{pot-size})(\text{opponent's folding frequency}) - (\text{bet size})(\text{opponent's calling frequency})$$

$$\text{EV of checking} = (\text{pot-size})(\text{frequency we win after checking})$$

It's best to solve both of these equations separately and then take whichever line has a higher expected value, and this is quite

²² The formula for our expected value is slightly more complicated if we're not all-in and the opponent can check raise as shown previously in "Part 11: Value Betting When Raises are Possible," starting on page 335.

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easy to do. But let's do a quick example just to make sure we're comfortable doing it.

On the river, the pot is 80 big blinds and we have 60 big blinds remaining. Furthermore, suppose our hand wins 20 percent of the time when checked back and our opponent only defends against our river jam 40 percent of the time. To determine which line is more profitable, let's start with determining the expected value of jamming.

$$24 = (0.60)(80) - (0.40)(60)$$

where

80 is the size of the pot,

60 is the size of the bet,

0.60 is the probability that our opponent folds, and

0.40 is the probability that our opponent defends.

So, the expected value of betting all-in is 24 big blinds. Let's compare this with the expected value of checking.

$$16 = (0.20)(80) + (0.80)(0)$$

where

80 is the size of the pot,

0.20 is the probability our hand is best,

0.80 is the probability our opponent's hand is best, and

0 is our return when our opponent's hand is best.

Checking has an expected value of only 16 big blinds, so the expected value of betting is 8 big blinds greater than checking. Despite having showdown value, our hand is weak enough that it should be bet as a bluff.

One final note. Players often try to make turning a made hand into a bluff seem more complex or impressive than it is. In reality, all we're doing on the river is bluffing with the worst hand in our

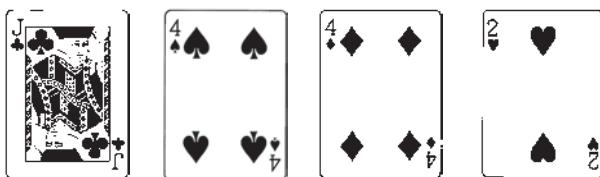
Turning Made Hands Into Bluffs in Position 355

range as is common in many other spots. It just so happens that the hand we're bluffing with also makes a profitable check, but ultimately, all we care about is if betting is more profitable than checking.

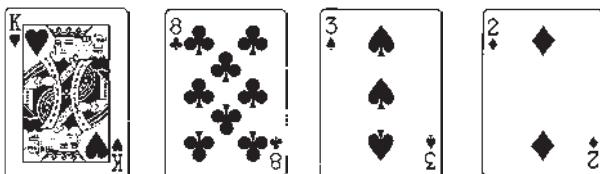
Overbetting the River

Although overbetting has already been addressed in previous sections, it's worth discussing specifically with regards to the river. That's because overbets work best when our opponent called on a wet board texture and the next community card was a blank. Furthermore, since there are no streets left to act on the river, we have only one round of betting left to get all-in. (Remember, when betting with a perfectly polarized range it's always best to get all-in by showdown.) This usually requires us to make a very large river bet when our opponent cannot be strong.

Since there are four community cards on the turn, there will usually be many draws in each player's range. After all, even if the flop came rainbow, the turn will bring a flush draw just under three-fourths of the time and some straight draws will almost always be possible. So while there are some dry turn boards where few or no draws are possible, such as the



or



they're relatively uncommon.

In addition, recall our betting range gets stronger on each street as we bluff less. Usually, we'll check-fold our weakest hands on the turn and continue to bluff with our better bluffs. As a result, many of our turn bluffs will often be flush draws or straight draws. This wasn't the case on the flop since we usually needed many bluffs in our range that we regularly bet overcards or hands with 3 to the flush and 3 to the straight. But on the turn, bluffs usually have more equity and are more likely to make a very strong hand on the following street when compared to flop bluffs.

When our opponent calls our turn bet, it's important to assess how many draws are in our range which can outdraw any strong hands our opponent might have slowplayed. If our range includes many draws which can improve to beat his best hands, then he won't usually be strong if the river card blanks. This makes large overbets with nut type hands on the river effective. When slowplaying is less risky, he'll be more likely to just call with a very strong hand and we should consider betting smaller.

Here are some board textures and a quick description of why our opponent should or shouldn't be likely to slowplay a very strong hand when facing a bet. To better visualize the hand, assume we are in the cutoff against a button cold caller and have bet the flop and turn. And when he calls our turn bet and the river card blanks, we should be willing to overbet accordingly on these boards.

Boards which should often be slowplayed: Q♥Q♠7♣2♦, A♠A♦J♣4♣, and K♣9♥5♠2♦. Slowplaying is easy on these boards because there are either few or no flush and straight draws possible or our opponent can have a full house. In the case of the Q♥Q♠7♣2♦ board, no straight draws or flush draws are possible, so our opponent should call with his strong hands to encourage us to keep bluffing. Likewise, although many gutshots are possible on the K♣9♥5♠2♦ board, it still isn't very risky for our opponent

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to call with a set and encourage us to keep bluffing. And since we won't frequently outdraw him with hands in our bet-folding range, he's better off waiting until the river to raise his very strong hands.

In the case of the A♦A♦J♦4♦ board, there will often be six combinations of ace-jack in our opponent's range on the flop and turn which he can comfortably slowplay. These hands are not vulnerable to being outdrawn by our gutshots and flush draws, so our opponent will call with these hands and hope we make a straight or flush and lose a large pot.

Boards which should sometimes be slowplayed: Q♥T♠7♣4♦, K♣8♣2♦4♣, and T♥9♣9♥5♦. There are more possible straight draws and flush draws on these boards so our opponent will be more reluctant to slowplay a strong hand. Many straight draws are possible on the Q♥T♠7♣4♦ board and flush draws on the K♣8♣2♦4♣ board. As such, slowplaying will likely be justified only if our opponent expects us to occasionally overbet the river. This prevents him from having a capped range on blank river cards and allows him to win a very large pot when we overbet a worse hand.

Although there are many straight and flush draws on the T♥9♣9♥5♦ board, our opponent flopped 6 combinations of full houses or four of a kind — 3 combinations of TT, 2 combinations of T9s, and 1 combination of 99. He should call with these hands on the flop and turn to encourage us to keep bluffing and keep draws in our range.

Boards which should rarely be slowplayed: J♥T♥6♣5♣, T♣6♣3♦K♦, and Q♣7♣5♣6♥. There are so many possible draws on each of these board textures that our opponent takes a huge risk whenever he calls with a strong hand. Not only is there a good chance he'll likely get outdrawn on the river, he may also lose value by calling. This means that raising on the turn will almost certainly be more profitable than calling. Furthermore, since there

Overbetting the River 359

are so many possible draws, most river cards will usually put some strong hands in his range.

Here's an example. Our opponent will not likely want to slowplay a strong hand on a J♥T♥6♣5♣ board since there are so few possible river blanks. Additionally, if we're betting a strong hand such as the J♠T♠ on the turn and our opponent has a set of sixes, when he slowplays, he may lose action if the river card completes many draws. This discourages him from slowplaying even if he knows he'll sometimes face a very large river bet on a few river cards.

Summary

Applying theory to river play is especially exciting since little guesswork is often required. With no more additional cards to come, it's often possible to calculate the expected value of our hand based on how much equity it has. Although models are still important for visualizing situations, much more precise bet sizings and frequencies can usually be found.

In order to consider value betting a hand in position, our holding must win at showdown once called over 50 percent of the time. It's also common to value bet a hand hoping our opponent will fold, but we should be careful not to bet too aggressively with weaker holdings since betting allows our opponent to check-raise. Conversely, since checking out of position does not guarantee a showdown, it's often best to value bet a hand even if it will lose over half the time when called.

A formula can be used to solve for the theoretically correct bet sizing if our opponent never bets or raises and calls aggressively enough to prevent us from being able to profitably bluff. When these assumptions are relaxed, the formula still usually provides a good estimate for the best bet sizing provided there is adequate stack depth. In addition, betting the right size on the river can often have a large impact on the expected value of our hand.

Since all bluffs have zero equity when called on the river, hands with beneficial removal effects should be emphasized. The difference between bluffing a hand with beneficial and detrimental removal effects is often substantial and shouldn't be ignored. If our opponent doesn't want to allow us to be able to profitably bet with any two cards, he should call aggressively enough that only bluffs with the best removal effects are profitable.

Summary 361

It's common to overbet on a blank river because the turn board texture will usually be coordinated enough to deter our opponent from slowplaying a strong hand. Furthermore, our turn betting range should include fewer bluffs than our flop betting range so the quality of our bluffs should be better — the worst hands are check-folded. This discourages our opponent from slowplaying on many boards and allows us to overbet strong hands with little fear of losing when the river is a blank.

Here are a few brief descriptions of the most important points:

1. When in position, we should only bet a hand for value if we expect to win at least 50 percent of the time when called. If our opponent can check-raise, we'll need to win more than this to make up for the fact that he can check-raise bluff and make us fold (or call as an underdog).
2. When out of position, we'll often be “value jamming” the river even though we expect to lose the majority of the time when called. Whether or not we should jam will depend on the frequency our opponent has us beat and the pot to stack size ratio.
3. When it's theoretically correct to play the same hand two different ways, the expected value of both lines should be the same. This occurs quite frequently, and a player who never slowplays a very strong hand will often find he's vulnerable to overbets and an equilibrium point must be reached.
4. In theory, we should have many bet sizings with balanced ranges in most spots. This is extremely difficult to do in practice, but a necessary concept to work on for becoming a great player. The optimal river bet sizing formula allows us to bet near the perfect size in many situations.

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5. River bluffs should be made by hands with excellent removal effects, whereas bluffs on earlier streets should be made with hands which retain their equity.
6. A made hand should only be turned into a bluff if it's profitable since checking will usually have a positive expected value as well. This usually occurs when a draw came on the turn or the river and now the weakest hands in our range would be made hands.
7. Since ranges are often highly polarized by the river, this will frequently be a street where players have overbetting ranges. We should overbet when our opponent cannot have very many strong hands in his range which beat our value overbetting hands, and this can be solved for by the optimal river bet sizing formula.

Part Twelve

Multiway Pots

Multiway Pots

Introduction

Similar to the way 3-bet pots aren't more difficult to play than single raised pots, multiway pots aren't more difficult to play than heads up pots. Players often find them more troublesome only because they learn through a trial and error approach and in online games most hands are played heads up to the flop. Nevertheless, since we now have a strong understanding of theoretical poker, it's unnecessary to play millions of hands before feeling comfortable with how to play against multiple opponents.

In many ways, multiway pots are actually easier to play than heads up pots since players need to defend a smaller fraction of their range when facing a bet. More specifically, we won't usually need to defend weak hands which are often difficult to play as was often the case for heads up pots. However, it's worth briefly discussing multiway pots since they occur reasonably often and the pot size is larger, so mistakes are costly.

Although we'll focus on the theory of multiway pots, it's important to note that when several players see a flop, a weak player will commonly be involved. That's because weak players usually like to call preflop and see many flops and good players will play more loosely to try to stack the fish. So while we'll mostly focus on how to play in multiway pots against strong opponents, always remember theory is also a useful tool for exploiting weak players and taking their stack before someone else can.

Hand Strength on the Flop

Just as was the case for heads up single raised pots, an out of position bettor should not usually be allowed to profitably bet any two cards. However, since there is more than one player who can defend against a bet, each active player needs to defend only a fraction of his range to prevent the bettor from making an immediate profit on his bluffs. This ultimately results in players seeing the turn with stronger ranges than they otherwise would.

How much each player should defend depends on their range and position. Put differently, each player won't defend the same percentage of hands when facing a bet. However, we can get a general idea of how aggressively each player must defend by assuming they each defend the same percentage of hands in a combined effort to prevent the bettor from profitably betting any two cards.

Let's suppose the player out of position bets 75 percent of the pot on the flop and the remaining players combined will defend aggressively enough so this flop bet only succeeds 40 percent of the time. In other words, the remaining players must defend 60 percent of the time combined against the flop bet. Remember, when figuring out how often each player needs to defend in a situation like this, it's not as simple as taking the total defending frequency (in this case 60 percent) and dividing by the number of players remaining. That's because sometimes multiple players will have a hand strong enough to defend. Instead, we must calculate how often each player must fold so the bettor wins 40 percent of the time and from there figure out how often each player needs to defend.

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Given the previous assumptions, if there are three players on the flop (so two players can defend against the bet), then each player would fold 63.2 percent of their flopping range.

$$X^2 = 0.4 \Rightarrow$$

$$X = 0.632$$

Since each player can fold 63.2 percent of the time, they must defend at least 36.8 percent of the time.

$$0.386 = 1 - 0.632$$

This same methodology can be used to determine how often each player must defend given how many players saw the flop. Again, this method assumes every player defends the same percentage of hands and believes all players combined should defend 60 percent of the time.

Players On The Flop	Folding Frequency (%)	Defending Frequency (%)
2	40	60
3	63.2	36.8
4	73.7	26.3
5	79.6	20.4
6	83.2	16.7

Notice how drastically each player's range changes as more players see the flop. If the flop is heads up, the defending player should defend 60 percent of his range. But if there are four players on the flop, each player should defend only 26.3 percent of the time. So given the above assumptions, if four players see the flop,

Hand Strength on the Flop 367

they'll defend less than half as many hands as they would when heads up.

In general, most players significantly underestimate how much stronger a hand should be to bet, call, or raise when multiway. Top pair hands and even overpairs will regularly not be strong enough to bet or raise on many board textures where three or more players see the flop. Furthermore, weak players often use close to the same range regardless of how many opponents they are facing. This is a huge leak which results in them going to showdown with hands that are too weak.

It's worth noting that although it's unlikely flops will be seen by five or more theoretically sound players, in a live setting it's a more common occurrence that pots will include many players. That's because live play is usually full ring where more players have the option to see the flop and live players are often too loose preflop. One reason why otherwise overly tight players, (assuming the rake isn't too high relative to the stakes), can still do well in games against soft opponents even if they have a very limited understanding of poker. And this also means that calling with speculative hands hoping to flop either a set or draw is a strong play against weak opponents who will regularly invest too much money in the pot with top pair.

Bluff Catchers in Multiway Pots

Since players are required to defend less frequently in multiway pots, it's important to emphasize calling with hands which have the potential to make nut type hands by the river. Marginal hands still need to sometimes be called, but they should usually either have some chance to improve on the turn and river (such as a top or medium pair hand with 3 to a flush and 3 to a straight) or be quite strong and not particularly vulnerable to our opponent's bluffs.

Calling with a marginal made hand is less desirable in a multiway pot for a few reasons. First, if there are still players left to act, one of these can put in a raise after we call. This happens both preflop and post-flop, and when it does occur, we'll usually have to fold or make close to a break even call. Putting more money into the pot only to later be faced with a close to break-even call is an undesirable outcome which should be avoided when possible.

Additionally, made hands usually have a significant amount of equity against a single draw, but do poorly against multiple draws. For instance, if we have an overpair and are facing only a straight draw on the flop, then our opponent will usually have 8 outs. But if we're up against two opponents and one has a straight draw while the other has a flush draw with an overcard, then our opponents can have as many as 18 outs combined, and it's much easier to dodge 8 outs than 18 outs. Furthermore, since we'll likely have to fold to additional bets on the turn and river even when the draws miss, it's unlikely we'll win a large pot. This encourages us to try to avoid calling with medium strength hands when multiple players may have draws.

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Lastly, notice that since we'll need to defend fewer hands multiway, our strong draws will usually make up a larger fraction of our defending range. It's thus not necessary to call with as many bluff catchers to prevent our opponent from being able to show an immediate profit on his bluffs. We'll of course still need to call with some medium strength hands since only calling with draws will result in us having too many bluffs on later streets, but it's less crucial to defend many bluff catchers on the flop to prevent our opponent from recklessly betting. In addition, our opponent will know our defending range is stronger and adjust his betting range accordingly.

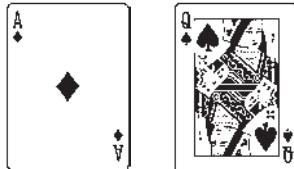
Holdings which usually flop only marginal strength hands should often be avoided in multiway pots. For instance, if the cutoff opens and the button calls, calling with the



in the small blind may be a losing play. This hand plays poorly out of position, and it will almost never beat a non-bluff when facing bets on multiple streets unless it makes at least two pair. Remember, applying theory to preflop play requires more guesswork than river play since there are so many cards left to come, so it's impossible to solve for what line is best. However, while calling with a hand which will mostly flop only mediocre made hands may still be profitable, we should at least consider folding or squeezing even if calling is our standard line.

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Conversely, if the under-the-gun player opens and the cutoff calls, squeezing with the



on the button rather than calling is a reasonable option. That's because ace-queen will almost always be a bluff catcher (with the potential to split) when facing a bet on the flop, and by 3-betting we may make one of our opponents fold either preflop or post-flop. In addition, our hand still has a significant amount of equity when called even if we'll rarely make an exceptional hand.

Speculative Preflop Hands

Most players intuitively understand that the ability to make nut type hands becomes more important in multiway pots. However, this causes them to overrate speculative hands, especially preflop. Suited connectors and gappers are regularly called when they should be 3-bet bluffed or folded preflop and it's important to understand why.

1. Suited connectors often make three to a flush and three to a straight type hands as well as gutshots. These holdings can bluff raise and float profitably when facing a bet in heads up pots, but they usually must be folded in multiway pots.
2. Since ranges get strong quickly in multiway pots, it's often difficult to get value with weak flushes. It's obvious when the flush is possible and ranges are now so strong that sometimes players won't even need to feel all of their set combos (much less two pairs or overpairs) when facing bets or raises. This often makes it difficult to get action with a weak flush unless the opponent has us beat.
3. The pot-size and our opponent's bet size on the flop will be large relative to the remaining stack sizes. This decreases the implied odds of our draw relative to the pot size and makes it difficult to profitably call with weak draws.

Here's an example. It's usually quite profitable to call with a draw when our opponent bets 4 big blinds into a 6 big blind pot since there is so much stack depth remaining. This is especially true if we're drawing to the nuts since a small investment can potentially win our opponent's stack. But if he bets 10 big blinds into a 15 big blind pot, we'll have to risk a much larger fraction of

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our stack in an attempt to get all-in with the nuts by the river. This makes it more difficult to call on the flop with a good but not amazing draw.

This is not meant to deter you from ever playing suited connectors in single raised multiway pots. They're often profitable hands, especially against weak opponents who will call down with marginal holdings if we make a big hand or who are easily bluffed. But it's important to realize they should not be played recklessly and to recognize just how strong hands need to be for us to be able to confidently go to showdown in multiway pots. Additionally, position is of course especially important when multiway since it's so undesirable to get raised behind us after calling with a mediocre made hand or draw.

And finally, the best speculative hands in multiway pots are usually pocket pairs. They will almost always make profitable calls preflop. Unlike suited connectors and gappers, pocket pairs immediately tell us on the flop whether we're likely to have the best hand by the river. When a set is flopped, we can confidently raise and build the pot, and if the set is missed, we can simply fold to any aggression from our opponents. In other words, calling or raising on the flop will usually either be highly profitable or a clearly losing play. This isn't the case with suited connectors since we'll usually only improve to the best hand on the turn or river.

Deciding Who is Responsible for Defending

In reality, all players won't defend an equal fraction of their range against a bet. However, there's no way to calculate exactly how much each player should defend. It all comes down to positions and how strong each player's range is. If a player is out of position, has checked, and has shown weakness, then it's unlikely this person will defend much against a bet. Conversely, if a player on the flop is last to act in position and has a strong range, then he should be expected to defend more aggressively than everyone else.

To illustrate, suppose the cutoff opens and the button and big blind both call. Since the big blind received a 1 big blind discount on his preflop call due to having posted the big blind, he will call as long as he expects to lose less than 1 big blind overall for the hand. This results in his range being weaker than it would otherwise be. Furthermore, since he's also out of position, he'll defend less on boards where position is particularly valuable.

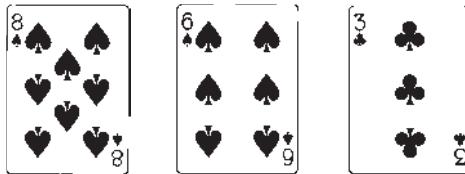
In contrast, the button will likely defend aggressively if the cutoff bets. After all, he called preflop with a range that does well against the cutoff's opening range and always has the advantage of position. So even though we can't calculate exactly how much each player should defend against a bet, it's safe to assume the button will be defending more aggressively than the big blind on most flops.

Additionally, it's important to note whether each player will likely defend by check-calling or check-raising. That's because how frequently the bettor is check-raised will determine how often he gets to see a turn card with his bet-folding hands, as well as what bet sizing is best. Recall that small bets are better when

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players are unlikely to defend by check-calling and will usually defend by check-raising.

Here's an example. The cutoff opens and the button and big blind call. It's now likely the big blind will defend by mostly check-raising on the



flop. His range has few or no hands which can comfortably check-call, so he'll defend by aggressively check-raising his sets and some bluffs, while the button will most likely defend by calling since he's in position. And if both ranges combined are not defending enough to prevent the cutoff from being able to profitably bet any two cards, then they're not likely defending aggressively enough.

Summary

The same theory which applies to single raised pots will also apply to multiway pots. However, it's important to stop and think about how strong each player's range needs to be to continue when playing against multiple opponents. Weak players regularly end up betting or calling with hands which are too weak for this situation.

It's important to emphasize playing hands which have the potential to make near nut type hands when the pot is multiway. In particular, some hands which make slightly profitable calls preflop if the pot will likely be heads-up will be slightly losing calls in multiway pots. On the flop, we'll usually need to defend fewer bluff catchers as they'll be more strong made hands and draws in our range. We'll still need to call with enough bluff catchers so our opponent can't recklessly bet and our calling range is balanced, but when possible, it's best to call with hands which can more easily improve.

Weak draws are commonly overrated in multiway pots. Strong players won't always commit their stack with two-pair or a set if many possible draws improved. Moreover, it's more common for a low flush to lose to a better flush when many players are involved. While weak draws will often make profitable calls post-flop, it's often not worth calling with a suited connector or gapper preflop hoping to flop a draw which will be only marginally profitable.

It's impossible to determine exactly how much each remaining player should defend when facing a bet. So we must pay extra careful attention to each player's range and how valuable position is for a given board texture. Usually the big blind will defend less frequently than other positions post-flop since he got a discount on his call preflop and thus called with a weaker range.

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Here's a few of the more crucial points:

1. Players need to defend against bets much less often in multiway pots than in heads up pots. Most players underestimate how strong this effect is.
2. Hands often need to be very strong to win at showdown in multiway pots. So starting hands which consistently make marginally strong hands such as ace-jack offsuit are often less useful. Likewise, hands which have the potential to become very strong, such as pocket pairs preflop and draws to the nuts on the flop, become more valuable.
3. In multiway pots, since bets on the flop are bigger relative to remaining stack sizes and felting ranges are stronger, players often end up overrating suited connectors since they can't call or bluff raise as effectively as they often can in heads up pots.
4. How frequently each player must defend against a bet depends on each player's range and their position.

Part Thirteen

Shallow and Deep Stack Play

Shallow and Deep Stack Play

Introduction

So far, throughout the book, we've always assumed starting stack sizes are 100 big blinds. That's both because it's the most common stack size used in cash games and it provides enough stack depth to allow us to explore and discuss the most important theoretical concepts. However, starting stack sizes will not always be 100 big blinds deep, and it's important to understand how ranges should change for shallow and deep stack play.

Tournament players need to know how to apply different theory concepts based on stack depth since players often start out quite deep before effective stack sizes become shallow. As we'll see, failing to adjust your range to take into account stack depth becomes especially problematic when stack sizes are shallow. Additionally, this is an important skill to master for cash game players as well since it's quite common for at least one player at the table to be short stacked.

Ultimately, all of the theoretical concepts we've previously discussed for 100 big blind stack play will apply to deeper stack play as well. Once again, the biggest advantage of understanding theory is we can figure out what to do in a situation without using a trial and error approach. Maybe one day we'll be 400 big blinds deep against another strong player. And it shouldn't be overly difficult for us to figure out what to do if we understand the math and theory behind our decisions.

Flop Value

Betting Frequencies with a Perfectly Polarized Range

As stacks get deeper, it's possible to bluff more aggressively with a perfectly polarized range and remain balanced. The reason for this is deep stacks let us bet bigger and give our opponent a worse price to call. This was already shown when comparing raised pots to 3-bet pots since our flop betting and raising range in 3-bet pots needed to contain a higher fraction of value hands.

Recall that when analyzing flop play, we saw the following street must be bet two-thirds of the time after betting the pot with a perfectly polarized range. That's because our opponent was getting 2-to-1 odds on his call and effectively won whenever we checked but lost whenever we bet. The same methodology can be used to determine what fraction of our flop bets should be value bets if we make larger or smaller bets on each street.

Here's an example where stack sizes are shallow. Suppose starting stacks are 40 big blinds, it's heads up, and the pot is 7 big blinds on the flop. This information can be used to determine how much the pot must grow on each street to get all-in on the river.

$$7R^3 = 80 \Rightarrow \\ R = 2.25$$

So, if the pot must grow to be 2.25 times its previous size after each round of betting to get stacks all-in by the river, then approximately 0.62 pot sized bets should be made on each street. This requires us to us to bet the turn 72 percent of the time after betting the flop, the river 72 percent of the time after betting the turn, and 72 percent of our river bets to be value bets.

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$$(1.62)(1 - X) - (0.62)(X) = 0 \Rightarrow \\ X = 0.72$$

Since we plan to bet the turn 72 percent of the time after betting the flop, the river 72 percent of the time after betting the turn, and 72 percent of our river bets will be value bets, then 37.3 percent of our flop bets should be value bets.

$$0.373 = (0.72)(0.72)(0.72)$$

A chart can be created to show what percentage of our flop bets need to be value bets based on our stack depth in terms of pot sized bets using the same methodology just shown. To do this, we'll once again need to assume our range is perfectly polarized on the flop and composed of hands which have either 100 or 0 percent equity. Furthermore, assume the pot is heads up and the turn and river are always bet at the perfect frequency with balanced ranges to make our opponent indifferent to calling.

Stack Depth (PSB remaining for each player on the flop)	Bet Size on Each Street (PSB)	Turn and River Betting Frequency (%)	Percentage of River Bets which are Value	Percentage of Flop Bets which Should be Value
2	0.35	84.4	84.4	60.1
3	0.46	76.3	76.3	44.3
5	0.61	72.5	72.5	38.1
10	0.88	68.1	68.1	31.6
17	1.14	65.3	65.3	27.8
25	1.35	63.5	63.5	25.6
100	2.43	58.6	58.6	20.1

None of the above chart needs to be memorized, but it's worth noting a few important trends. If remaining stack sizes are small, then even a small change in stack depth can greatly change what fraction of our flop bets should be for value. For instance, if there are 2 pot sized bets remaining, then 60.1 percent of our flop bets need to be for value. But if there are 3 pot sized bets remaining, only 44.3 percent of our flop bets need to be for value. This is a substantial change for stacks getting only slightly deeper.

However, once stacks are already adequately deep, increasing stack depth won't greatly change what frequency of our flop bets should be for value. Notice when we have 10 pot sized bets remaining on the flop, 31.6 percent of our flop bets must be for value. Yet when 25 bets remain, only 25.6 percent of our flop bets must be for value. This is a relatively small change for stacks being substantially deeper.

This helps showcase an important point. In general, if stacks are very shallow, optimal ranges and frequencies should change drastically with a small change in stack depth. Furthermore, when stacks are very shallow, it's often possible to model situations quite accurately and find close to the optimal solution. Expert sit-and-go and tournament players are comfortable with how frequencies and ranges change based on only a slight difference in stack depth for this precise reason. So in general, it's safe to assume most players who haven't studied the math underestimate just how significantly ranges should change as stacks get very shallow.

Yet as stacks get deeper, a substantial change in stack depth is much less significant. For instance, suppose we open in the cutoff and only the button calls. If the pot is 7 big blinds on the flop, neither player's strategy will likely change much based on whether we're 300 big blinds or 1,000 big blinds deep. Granted, there will be some change, but the change is likely much less significant than most players would expect. This is especially true since it's rare for theoretically strong players to get all-in with 300

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big blind stacks much less 1,000 big blind stacks, so the extra stack depth rarely comes into play.

So for these reasons, players who wish to improve their game with different effective stack sizes should likely focus on shallow stack play rather than deep stack play, and a player who has studied shallow stack play should have a substantial advantage over someone who has not. And since ranges will not change too much as stacks get deeper, studying deep stack play for stack sizes over 200 big blinds is likely only worthwhile for an expert player who frequently plays very deep.

Shallow Stack Play at a Glance

As previously discussed, there is no way to calculate the expected value of a hand simply based on its equity when there are additional cards to come. This is an extremely important point, as hands with less equity are often more profitable than hands with greater equity. Thus it's crucial to be able to realize our equity and ideally our hand should have the potential to beat hands in our opponent's value betting range and win a very large pot. As such, holdings which have the potential to make the nuts and continue to get value after being raised have a higher expected value than their equity alone would indicate.

Nevertheless, as stacks get shallow, the ability to make nut type hands becomes less important and the overall equity of the hand becomes more important. This leads us to the general rule of shallow stack play.

As stack sizes get smaller relative to the size of the pot, more emphasis should be placed on high equity hands and less emphasis should be placed on hands which have the potential to make nut type hands.

This is due to several reasons:

1. When we make a nut type hand, we do not have enough stack depth remaining to raise and win a very large pot. In other words, when we make the nuts and our opponent makes the second nuts, it's still impossible for us to gather a lot of chips.

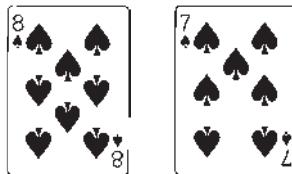
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2. Our opponent cannot make large bets to prevent us from being able to profitably call with marginal strength hands. Put differently, having a capped range is much less significant since our opponent cannot make large bets to begin with.
3. Since bets are small relative to the size of the pot, weaker holdings can be bet for value. Additionally, more marginal strength hands will need to be called down. This allows medium strength hands to be played more effectively.
4. Position is usually less valuable, largely because draws are less prevalent and we're more likely get all-in on the flop or turn.

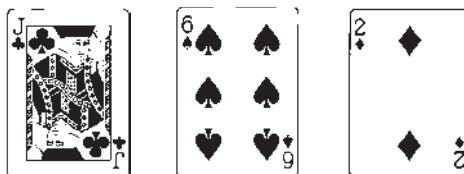
The above reasons encourage us to change our preflop strategy significantly. Hands which have little equity but have the ability to make nut type hands, such as suited connectors and gappers, become much less profitable (and often unplayable) as stacks get shallow. That's because making a hand which beats most of the hands in our opponent's value betting range, such as a straight or flush, still can't win a very large pot. However, holdings which have more equity preflop but can rarely make strong hands, such as the A♣T♥ or the K♣T♥, are now more profitable. The reason for this is we no longer have to worry about facing multiple large bets, and if we bet, our opponent won't be able to make a large raise.

Our post-flop strategy should change as well when stacks are shallow. Again, we'll emphasize playing hands with more equity rather than hands which have the potential to make nut type hands. For instance, hands with three to a flush and three to a straight, such as the

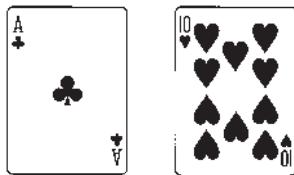
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on the



flop will no longer have the potential to win a very large pot. This decreases the expected value of this hand. In contrast, a holding like the



on the same board texture may make a profitable call since we can comfortably call down or bet if we turn an ace or a ten.

In addition, since having a capped range is not problematic when stacks are shallow, ranges where our strongest value betting hand is still quite weak will work best in spots. This can easily be seen preflop since players can often 3-bet all-in with a capped range and their opponent will be unable to raise.

Here's an example. It's often quite effective to 3-bet all-in with a range consisting primarily of many pocket pairs and high card hands such as AK, AQ, and AJ. That's because these hands have a reasonable amount of equity when called, yet since they are

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vulnerable to being outdrawn on the flop, we still want to encourage our opponent to fold preflop. In other words, hands in our opponent's folding range almost always have a significant amount of equity, and making these holdings fold to a 3-bet is very useful. And having no premium pairs in this range isn't problematic since our opponent cannot raise anyway.

While it's trickier to visualize, this same concept of betting with a capped range when stacks are shallow can apply post-flop as well. For instance, it may be best to donk bet on the flop or turn with a capped range in some spots since our opponent will not be able to make a large raise (or any raise at all if we're all-in). This allows us to consider flop and turn donk betting ranges in some spots which would clearly be bad with more stack depth. While detailed short stack play is beyond the scope of this book, hopefully, you'll now understand why donk betting can make sense with a capped range when shallow.

Ultimately, it's hard to give general rules for how to play shallow stacks since there's such a huge difference between being 10, 20, or 35 big blinds deep. The same calculations as those previously shown would have to be applied to get new frequencies and ratios for a specific stack depth. In addition, bet-folding the flop or the turn often becomes impractical as stacks get very shallow, (any hand which bets will have enough equity to bet-call), so calculations often need to be made planning on only utilizing one or two rounds of betting. There's really no substitute for putting in the time and studying ranges, and whether or not this justifies your time will depend on your skill level and the types of games you're playing.

Deep Stack Play at a Glance

Unsurprisingly, deep stack play requires us to make the opposite of the adjustments made for shallow stack play. This brings us to our general rule for deep stack play.

As stack sizes get larger relative to the size of the pot, more emphasis should be placed on hands that have ability to make the nuts and less emphasis should be placed on the absolute equity of the hand.

In other words, we want to play hands that have the ability to beat hands in our opponent's value betting and calling ranges. This is due to several reasons:

1. Since very large bets are possible, a balanced flop betting range can include many bluffs for each value bet. This makes strong hands and good bluffing hands more important.
2. It's important we have some very strong hands in our range or our opponent can recklessly raise or overbet. In other words, he can punish us severely for having a capped range.
3. When our opponent makes large bets, it's not necessary to defend as much of our range as we would have to if he bet smaller. This allows us to stress defending strong made hands and draws and requires us to put less emphasis on calling with many bluff catchers.
4. Our opponent will frequently raise on many board textures, and when he does, we'll usually have the option to re-raise

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him. This allows us to win a massive pot when we have the nuts and he has the second nuts.

5. Position is usually more valuable, largely because draws will be prevalent in both player's ranges and we'll rarely be all-in before the river. This is also true for 3-bet and even 4-bet pots.

Our preflop strategy when deep should be designed to increase our chances of making nut type hands. In particular, holdings which can make sets, straights, and flushes are more valuable because these hands can win very large pots. The nut flush is particularly valuable since it's possible to win a massive pot when our opponent holds a king or queen high flush.

Position also is more valuable when deep because 3-bet and 4-bet pots are played with significant stack depth remaining. However, one leak many players have is they think 3-betting when deep and out of position is a poor play. That's because they dislike the idea of having to play a large pot when out of position. This, however, is a not correct for several reasons.

To illustrate, suppose the button opens and both the small blind and big blind decide to defend mostly by calling rather than 3-betting. When this occurs, the button is nearly guaranteed to see a flop or win preflop. Because the button will rarely face a 3-bet, the blinds must defend with extremely wide ranges to prevent the button from being able to profitably open on any two cards. (In fact, it may be possible for the button to profitably open with any two cards if the blinds almost never 3-bet). This results in the button being able to profitably open with nearly any two cards and constantly getting to play the flop in position.

So if the button is rarely 3-bet, he'll open nearly any two cards in his range. This now gives the blinds an incentive to 3-bet aggressively since in order to prevent the blinds from being able to profitably 3-bet any two cards the button must call with a wide range. This results in the button's calling range, despite the

advantage of position, consisting of hands too weak to effectively play in 3-bet pots. There simply aren't enough strong hands and worthwhile speculative hands in the button's opening range to defend at a reasonable frequency when he's opening wide.

Consequently, it's quite easy to show that if the blinds are not aggressively 3-betting a button open, then the button will have an incentive to open very wide, which then gives the blinds an incentive to start aggressively 3-betting (since the button's calling range is so weak).²³ Although, as was already shown in the preflop section, it's impossible to figure out exactly how wide the button should open based on stack depth. For instance, if the button opens over 50 percent of the time, he'll have to call 3-bets with some relatively weak hands. In other words, while the button will open a bit wider since position is more valuable in 3-bet pots when stacks are deep, he won't open too wide or else he'll have to defend too weak of range to a 3-bet.

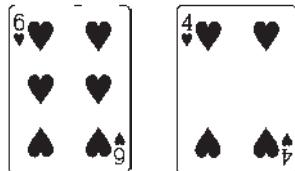
While it's impossible to solve preflop play for 100 big blind stack depth, much less when stacks are deeper, as a general rule of thumb, preflop ranges will not change drastically when playing with large stacks. The player likely to be in position, such as the cutoff or the button, should call a bit wider or open a bit more aggressively. Likewise, the blinds will likely try to emphasize calling a bit more and 3-betting a bit less since they are out of position. Yet it's still critical that the blinds don't over adjust and continue to 3-bet aggressively since if they do not, the button especially can open with an extremely wide range (and will thus be vulnerable to aggressive 3-betting, which encourages the blinds to change their strategy).

Additionally, be sure to keep in mind that just because our opponent can profitably call our 3-bet with a speculative hand

²³ As stakes get deep, positional advantage goes up. Thus, when stacks are large, 3-betting out of position probably should not be done as often as indicated here.

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does not imply our bet sizing was bad. Here's an example. If we're deep and the button opens with the



he may be able to profitably call if we 3-bet from the big blind (using our standard 3-bet sizing). But the expected value of his hand should be significantly lower than if we were to have just called his open. In other words, when our opponent calls our 3-bet, it may be only slightly profitable, so he'll still expect to lose money overall for the hand. (Just less than he would have if he folded.) Also, it's crucial not to make massive 3-bets when out of position just because our opponent will be able to profitably call smaller 3-bets with speculative hands which play particularly well when deep and in position. After all, he only has so many of these hands in his preflop opening range.

Lastly, as we'll see when discussing bet sizing in more detail in the following section, it's important to adjust our bet sizing when deep and out of position in a 3-bet pot. Once this is understood, playing a 3-bet pot out of position becomes much less intimidating.

Summary

In general, when stack sizes are shallow, even a small change in stack depth will cause ranges and frequencies to change drastically. Therefore, a player who has studied the math behind shallow stack play should have a significant advantage over someone who has not. But when stacks are deep, the changes will be much less severe.

In general, the absolute equity of a hand becomes more important as stacks are shallow whereas the ability to make nut type hands is more important for deep stack play. When betting large, many bluffs can be in our flop betting range for each very strong value bet. Yet when stacks are shallow and bets are smaller, our opponent gets a better price to his call so more of our bets need to be value bets to keep him indifferent to calling with a bluff catcher.

Preflop play will change significantly when stacks are shallow but less drastically for deep stacks. One leak many players have is they fear playing 3-bet pots out of position when deep, and this causes them to play a weak preflop strategy and only rarely 3-bet. If the button opens a wider range than usual, he'll have to call 3-bets with weaker hands, and 3-betting aggressively prevents him from being able to open too wide.

Here's a few of the more important points:

1. The absolute equity of a hand matters more when stacks are shallow since our opponent is unable to overbet.
2. As stacks get deeper, the ability to make nut type hands becomes more important since these holdings have the potential to win a massive pot.

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3. Capped ranges are less disadvantageous when stacks are shallow. This allows players to consider using capped betting and raising ranges.
4. Although position is especially valuable when stacks are deep in 3-bet pots, players must still 3-bet aggressively when out of position since the button should be opening a wider range which forces him to call 3-bets with a weaker range.

Part Fourteen

Advanced Bet Sizing

Advanced Bet Sizing

Introduction

As already discussed, since betting multiple sizes in the same spot is best, optimal play requires us to balance countless ranges at once. Furthermore, while it's sometimes possible to figure out close to the perfect bet sizing for our specific hand on the river, this is not possible on the flop or turn. That's because there are still cards left to come and our betting range will never be perfectly polarized.

Nevertheless, we can employ the theory we've already discussed to greatly improve our bet sizing. As is often the case when applying theory to complex spots, while it may be impossible to tell if our sizing is correct, it's often possible to tell if our sizing is wrong. Perhaps most importantly, we can make sure our bet sizing is consistent with our theoretical knowledge and there is no contradiction in our thought process.

Furthermore, although our bet sizing will never be perfect, there are many common spots where nearly all players currently size their bets incorrectly and fixing this leak will give us a significant edge. These spots occur surprisingly frequently, and using the right bet size both increases our expectation and constantly puts our opponent in a tough spot.

Using Bet Sizing to Check for Contradicting Thoughts

Perhaps the most useful aspect of exploring multiple bet sizes is that it allows us to check for contradictions in our thought process. This can be accomplished by making assumptions regarding our opponent's calling range and then making sure our bet size makes sense in context of those assumptions.

Note that one assumption we'll commonly make on the river is our opponent should defend at a frequency that makes us indifferent to bluffing. That's because if he defends too often, our bluffs will have a negative expected value and we'll stop bluffing. And if he doesn't defend enough, we'll never check-fold or check back in position with a hand which has no showdown value. While there are spots where bluffing any two cards on the river should be profitable, this usually is not the case. Thus, this assumption is very useful for allowing us to determine what bet sizes and frequencies make sense.

Here's an example. On the river, the pot is 50 big blinds, we have 75 big blinds remaining, and believe our opponent will call at a frequency which keeps us indifferent to bluffing. If we're in position and go all-in, our opponent should call 40 percent of the time.

$$(50)(1 - X) - (75)(X) = 0 \Rightarrow$$

$$X = 0.4$$

Since he will call our jam 40 percent of the time, going all-in on the river with the nuts has an expected value of 30 big blinds greater than the current pot size (ignore removal effects).

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$$30 = (0.4)(75) + (0.6)(0)$$

where

0.4 is the calling frequency,

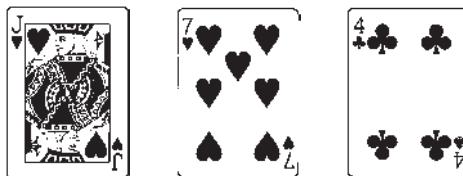
75 is the bet size,

0.6 is the folding frequency, and

0 is the amount won relative to checking when our opponent folds.

This tells us that in order for betting any bet size other than all-in to be correct with the nuts, our opponent must call and raise enough so that our expected value is at least 30 big blinds greater than the pot size. Remember, while it's always correct to take the line with the greatest expected value, players often get confused and think it acceptable to take a line with a lower expected value "for balancing purposes." But this is never theoretically correct. So in this case, if a smaller bet doesn't have an expected value of at least 30 big blinds, always jam.

Let's continue to develop this example. Suppose we open in the cutoff and the button is the only caller who calls our 75 percent pot sized bet on the



flop and the 6♦ turn. When the river comes the 2♦, no hands should have improved in our opponent's range, and because the turn board texture was risky to slowplay since his betting range included so many draws, he's unlikely to have a hand stronger than ace-jack.

When first beginning to explore different bet sizes, it's easy to begin recklessly overbetting in spots like this with bluffs since

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our opponent's range is capped. While it's true he should hate facing an overbet from us if we bet the river with a balanced range (since he'll always have at best a bluff catcher and will be indifferent to calling), there aren't enough strong hands in our range to allow us to bet all our bluffs and remain balanced. In other words, bluffing too aggressively on the river allows our opponent to profitably call with his bluff catchers.

Stated another way, our opponent should not often let us profitably bluff on the river with any two cards even if overbets are effective. That's because our turn betting range was designed to check-fold some missed bluffs on the river, and because of this, it's usually safe to assume our opponent should call at a frequency that keeps us indifferent to bluffing.

It's tempting to use the river bet sizing formula and calculate our bet sizing based on how often we're beat on the river, which results in us overbetting all our hands better than king-jack and betting smaller with hands our opponent sometimes has beat. However, doing this causes our range to be transparent and allows him to aggressively raise since our range is capped.

For instance, suppose we use the river bet sizing equation and believe it's best to bet 40 percent of the pot with king-jack and balance it with the proper amount of bluffs. Yet if the only value hand in our range is king-jack, our opponent will check-raise all-in with all of his ace-jack and king-jack hands since these holdings cannot be beat. (He'll also raise bluffs of course.) Put differently, if we ever bet the river with a range where our strongest value bet is king-jack or weaker, then he'll be able to raise aggressively since our range is capped.

So we can clearly see it is problematic to bet with a range where the strongest value hand is weaker than king-jack since our opponent can raise us knowing he can't be beat. Furthermore, if he were to always raise our small bets when he has ace-jack or king-jack, then betting small with our nut type hands would be more profitable than going all-in. And in order for this to make sense theoretically, on the river we must sometimes make small

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bets with our nut type hands so our opponent is indifferent to calling or raising our bet with his strongest hands. This results in him sometimes raising and other times calling.

Consequently, if we should occasionally value bet small with the nuts and go all-in other times, then the expected value of both lines must be equal. And since we already know the expected value of jamming the nuts for 75 big blinds into a 50 big blind pot is 30 big blinds greater than the size of the pot, that's what our expected value must also be if both sizes should be used. Again, if our opponent doesn't defend aggressively enough against our small bets, then we should never bet small with the nuts. In contrast, if he defends too aggressively, we should always bet small since betting this size is more profitable than overbetting.

Continuing on, let's stick with assuming, on the river with the nuts, we sometimes want to bet 40 percent of the pot since this will balance a betting range which consists primarily of king-jack and bluffs. And if the pot is 50 big blinds, a 40 percent pot size bet will be 20 big blinds which means our opponent should defend 71.4 percent of the time against this bet to keep us indifferent to bluffing.

$$(50)(1 - X) - (20)(X) = 0 \Rightarrow$$

$$X = 0.714$$

But if using two bet sizes with the nuts makes sense, he should also raise at a frequency which keeps us indifferent to making a small bet or large bet. And if our opponent always raises all-in for 75 big blinds when he raises, the correct jamming frequency to keep us indifferent to betting 20 or 75 big blinds is 26 percent.

$$(20)(0.714 - X) + (75)(X) = 30 \Rightarrow$$

$$X = 0.260$$

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where

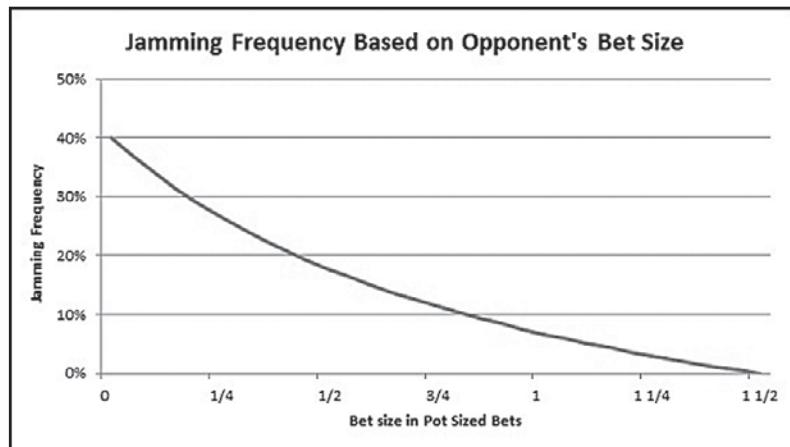
- 20 is the bet sizing,
- 0.714 is his minimum defending frequency,
- 75 is the raise sizing,
- 30 is the expected value of jamming, and
- X is the raising frequency.

We can thus conclude that our opponent needs to raise our small bet 26.0 percent of the time to keep us indifferent to overbetting and betting 40 percent of the pot with the nuts. In other words, if he wants to give us an incentive to bet small with the nuts, that is how aggressively he'll need to raise.

All of this information may seem overwhelming at first and we've only scratched the surface of bet sizing. But it's crucial not to make river bet sizing out to be simpler than it is. This is especially true when in position since betting small reopens the betting and gives our opponent the opportunity to check-raise. However, we believe it's also important to understand the mathematical significance of the statements in order to check for a contradiction in our thought process. In reality, most players are not raising small bets nearly aggressively enough to justify betting small in many spots and overbetting (either for value, as a bluff, or both based on the opponent's leak) will be the better play.

A graph can be made to show how often our opponent needs to jam against our river bet to give us an incentive to bet that sizing with the nuts. Once again, this assumes there are only 1.5 pot sized bets remaining, we cannot profitably bluff any two cards, and card removal effects can be ignored.

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Bet Sizing Examples

Since bet sizing can become as complicated as we want it to be, it's best to showcase how to apply difficult concepts using examples. After all, it's usually easiest to implement proper bet sizes in a new situation if it's similar to a familiar one.

Before moving on to specific examples, I would recommend one trick which has greatly helped me with understanding bet sizing. When checking out of position, visualize this as betting nothing rather than it being entirely different from betting. It's easy to think something significant happens when checking out of position rather than betting small, but there's little difference between betting 1 big blind and checking. This isn't true when in position since even a tiny bet allows our opponent to check-raise, but when out of position, betting small and checking are close to the same thing.

Once you realize that betting small and checking when out of position are similar, it's much easier to accept you'll often be raised after betting small and will now have a bluff catcher. After all, that's exactly what happens when we check. There's often simply no way to avoid facing a tough decision when out of position, and we'll regularly call with the losing hand or fold the winning hand against a strong opponent.

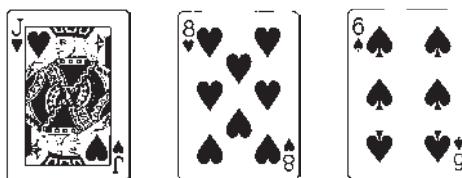
Here's an example. If the pot is \$100 on the river and we bet \$10, our opponent should know that most of our value bets are weak and constantly raise and make us indifferent to calling. Yet if we check instead, he'll frequently bet and we'll again be indifferent to calling. Sure, \$10 more is invested by betting, but this small bet is often correct and really isn't much different from checking. The difference between betting 10 percent of the pot and 0 percent (checking) usually isn't significant, but understand how it can make sense in theory and both lines are comparable. And after you begin thinking about bets in this way, it should be

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easier to consider making small bets when out of position rather than fear them simply because you'll commonly be raised.

Bet Sizing Example No. 1

Action: The button opens and we call in the big blind. The flop is the



and both players check. If the turn is the 4♦, what bet sizes make sense with hands in our range?

Explanation: As usual, this is a spot where most players bet around two-thirds of the pot when they bet. This is the typical “one size fits all” usually employed by players who give little in depth thought to each players range. While this size will be effective with some hands in our range, there are others which should use a different sizing.

When we actually stop and think about our opponent’s flop checking range, it should be apparent that he’d be unlikely to check back any strong hands. Giving us a free card is risky when our opponent has a top pair hand, and checking back a strong hand removes a round of betting from the game. So it’s safe to say he’s very unlikely to check back many or any strong hands on this flop since betting will almost certainly have a higher expected value.

Furthermore, the turn card did not put many strong hands in our opponent’s range. He likely only turned five combinations of strong hands — three combinations of a pair of fours and two of six-four suited — and the two pair hands aren’t likely strong enough to raise our bet anyway. That is very few hand

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combinations relative to how wide the button flop checking range was, and as a result he has a set on the turn usually only 2 or 3 percent of the time. Also be sure to notice that the button is unlikely to make a straight on this turn card as he would have bet the flop with a seven-five (that was probably suited to begin with).

Therefore, we should immediately consider overbetting in spots where our opponent is unlikely to raise our bets. This allows us to get more value from our strong hands as well as bluff more aggressively. While it's impossible to calculate the perfect bet size on the turn with any hand, betting large (over the size of the pot) with king-jack or stronger will probably be a great play since the majority of our opponent's range will at best be a bluff catcher.

Also notice that our opponent won't have an incentive to check back his strong hands on the flop and risk giving us a free card as long as we're not making large bets at a very high frequency. Remember, we'll sometimes check-raise on this flop as well — both for value and with bluffs — so whenever he checks back a strong hand such as a set, he'll risk losing value. Therefore, as long as we don't get too reckless, overbetting some of our strong hands on the turn should be an effective play.

But just because large bets with strong hands are effective does not mean only large bets should be made. Top pair, weak kicker and medium pair hands should make smaller bets when bet, and these ranges must also be balanced with bluffs, draws, and usually some nut type hands as well. As seen when using the river bet sizing formula, smaller bets will be best when our opponent has us beat reasonably often since this forces him to defend wider as well as results in a smaller loss for us when he has the best hand.

It can clearly be seen that many different bet sizes should be utilized in this spot, but currently most players are betting only a single size. At the time of this writing, overbetting this turn is probably more effective than it should be in theory since players rarely check back strong hands on the flop and are inexperienced with facing overbets. So while utilizing multiple sizes will be best

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on the turn, unless we believe our opponent is exploited by smaller bets, many of our bets should be overbets.

Some good hands to overbet for value on the turn in this example will be sets and king-jack. Overbet bluffs should retain their equity well as our opponent's range gets much stronger, and gutshots such as the Q♦9♦ will work in this regard. When overbet bluffing, try to use hands which can make a nut type hand on the river.

Bet Sizing Example No. 2

Action: We open under-the-gun with the A♠K♠ and only the cutoff calls. He also calls our flop bet on the T♦7♠3♠ flop and does the same on the 5♥ turn. If the river is the 2♠, will making a 1.5 pot sized bet be effective?

Explanation: This is a spot where removal effects will significantly decrease the expected value of our river jam, so overbetting is not as effective as it would otherwise be. If we bet 1.5 pot sized bets on the river, our opponent only needs to call 40 percent of the time, but many hands in his calling range will be flushes which include the A♠ or the K♠. This results in him calling much less than 40 percent of the time and encourages us to bet smaller to get value from his weaker hands.

Be sure to notice that since we opened under-the-gun and our opponent called in the cutoff, both of our ranges should be quite strong by the river. In fact, his river calling range normally would include the A♠Q♠, A♠J♠, A♠T♠, K♠Q♠, and K♠J♠, none of which he can have since we block the A♠ and the K♠. This results in his river range including more overpair hands, such as queens and jacks which will usually fold to our river jam.

Furthermore, if we bet smaller, our opponent can have a river raising range — a queen or jack high flush. Additionally, he should balance this range with some bluffs which will result in our smaller bets getting additional value. So unlike other spots where

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we must overbet to get all-in, we'll still stack our opponent with smaller bets when he has one of the strongest hands in his range.

Thus, in spots like this where we block a significant portion of our opponent's calling range, we'll usually want to bet smaller with the nuts than we otherwise would. That's because overbets cause our opponent to defend a smaller fraction of his range, and the hands we block will likely represent a large portion of that range. Although figuring out exactly what size to bet is usually time consuming and requires the help of computer software, having a general sense of when overbets are less effective due to removal effects is still useful.

Bet Sizing Example No. 3

Action: We open in the cutoff and the button calls. He calls our bet on the T♥8♥3♠ flop and the turn comes the 4♦. Is betting two-thirds of the pot here effective with many hands in our range?

Explanation: If we had to pick a "one size fits all" sizing, then two-thirds of the pot would probably be reasonable. This allows us to keep value betting hands such as king-ten without making our opponent's range too strong, as well as allows us to get a reasonable amount of value when betting overpairs and sets. Players are often told to bet one size so their hand isn't transparent, but as we already know, that's incorrect. Multiple bet sizes should be used and each range should be balanced.

In many ways, this hand is similar to the first example since this is another spot where our opponent will normally not raise our turn bet if we bet two-thirds of the pot. Unless he slowplayed a strong hand on the flop, he's unlikely to have a hand stronger than ace-ten, and this hand clearly isn't strong enough to raise a medium sized bet. So since our opponent's range is capped and he won't have a raising range, we should consider overbetting.

Let's suppose, on the turn, we decide to use two bet sizes as opposed to just one like most players use. In this case, overbetting

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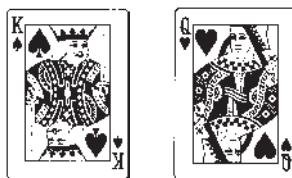
a range with value hands which are stronger than ace-ten will be quite effective since it turns every hand in our opponent's range into a bluff catcher. And smaller bets will be effective with a hand like king-ten, since we'll sometimes be beat.

Of course, we're not restricted to using only two bet sizes. But even when just two bet sizings are possible, betting two-thirds of the pot doesn't seem very effective. That's because our strong hands want to bet bigger since they cannot be beat, our opponent has position, and there are many possible draws. Yet our weaker value hands, such as king-ten, would prefer to bet smaller. So even though most players bet two-thirds of the pot here, it's actually not an effective sizing with most hands.

So if you're currently only utilizing one bet size in most spots, you'll likely find many difficult spots can be avoided if you consider different sizes. Often times players consider only betting two-thirds of the pot or checking, yet betting one-third of the pot would get the best of both worlds. This is not an easy skill to master, but those who wish to take their game to the next level should strongly consider trying to improve their bet sizing in situations like this.

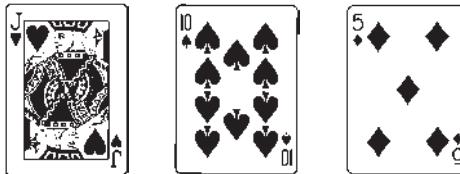
Bet Sizing Example No. 4

Action: We open in the cutoff with the



and the button calls. He also calls our bet on the

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flop and does same on the $6\spadesuit$ turn. If the river comes the $9\clubsuit$, what size should we bet?

Explanation: Our opponent likely has 16 combinations of king-queen in his range before removal effects and 9 after removal effects are applied. Although we have the nuts on the river, overbetting will not likely be an effective strategy because if we do, a large fraction of his calling range will also be the nuts and the pot will be split.

But understand that it's not only the removal effect that encourages us to make smaller river bets, but also that betting too big should cause our opponent to call with few hands which aren't the nuts.

Sometimes it helps to imagine an extreme example to visualize a concept. Suppose we're very deep and on the river overbet 50 pot sized bets. Our bet would be so large our opponent could fold every hand except the nuts without fear of us being able to profitably bluff. (An example is when there is a three flush on board and we have the ace.) This results in him only calling with the nuts and we'll never win any more money than is already in the pot. So it's possible in some spots to bet so big that it actually prevents us from getting value since we'll only end up splitting.

This spot is less common than the other concepts previously discussed, but it does show why bet sizing can be so complicated. While it's easy to ignore removal and splitting effects when talking in abstract terms, in reality, they're often relevant. So paying attention to these effects and betting a bit smaller or larger will increase our bottom line.

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Bet Sizing Example No. 5

Action: We open on the button with the A♠J♠ and call a 3-bet from the big blind. The flop comes the J♦7♦4♥ and our opponent bets. If we raise, how large should our raise be and what types of hands in his range should be close to indifferent to calling?

Explanation: A♠J♠ is a reasonable hand to raise with because it's vulnerable to being outdrawn by so many hands in our opponent's range. Nearly all the bluffs in his betting range have overcards such as the K♣Q♥, a pair with five outs such as the 5♠4♠, or a gutshot such as 8♣6♣. Raising forces our opponent to either call with these hands and put more money in the pot when he's behind, or fold without getting to realize his equity.

Remember, the pot is already so big in 3-bet pots that it's ok to raise with a capped range since our opponent cannot make large bets relative to the size of the pot anyway. Therefore, it's likely best to raise only with strong but vulnerable hands such as ace-jack and possibly king-jack, yet slowplay our stronger hands such as the 7♥7♠ and the A♦A♣.

The mistake players often make in this spot is they make their raise too large when raising near the minimum is likely best. Poker is a multi-street game, and it's fine if our raise doesn't make an immediate profit on the flop. Small raises force our opponent to call with a wider range and play the turn out of position, whereas large raises allow him to more easily jam or fold.

In this spot, many players will regularly make large raises on the flop in an attempt to deny their opponent odds to call with his flush draws or open ended straight draws, but this isn't an effective strategy. Draws with eight or more outs are strong hands on the flop and will usually make profitable calls or jams in 3-bet pots since the pot is already so large and they have much equity. Instead, we should focus on raising small so our opponent is put in a tough spot when he holds a gutshot or a pair weaker than ace-

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jack since these hands will make up a large portion of his betting range.

Lastly, remember we don't necessarily need to make our opponent indifferent to calling with many hands for raising to be the best play. Even if he can profitably call our raise with many pairs and gutshots, his expected value will be lower than it would be if we had just called his bet.²⁴ Furthermore, even if he frequently calls (on the flop) with many of his speculative hands so our bluff rarely succeeds, this causes his range to be weak on the turn so he'll have to often fold to our turn bet. This means bluff raising will still be the most profitable play with hands which are able to bet the turn effectively.

²⁴ This was first explained in *No-Limit Hold 'em; Theory and Practice* by David Sklansky and Ed Miller.

Summary

Bet sizing is probably the most difficult aspect of no limit hold ‘em, and players can make it as complex and difficult as they desire. Usually just getting reasonably close to the correct sizing is good enough to give most players a significant edge on their opponents.

While we’ll never be able to play perfectly, it’s important not to restrict ourselves to using only one bet size in a spot like many players currently are doing. A player who uses multiple bet sizes will have a significant edge against someone who does not, and it’s important we realize when overbets and small bets can make sense, and consider using these sizes. Right now players are overbetting nowhere near as often as they should be, and learning how to overbet properly should give us a significant edge against opponents who don’t have this skill.

Although we’ll never be able to balance multiple ranges perfectly, it’s possible to be reasonably balanced with practice, and most opponents won’t effectively exploit us even if we’re unbalanced. Simply knowing what bet sizes can make sense in a specific spot and betting accordingly given our hand and our opponent’s tendencies is usually enough to give us an edge against the vast majority of players.

Here’s a quick reminder of the more crucial points:

1. While it’s impossible to solve for the perfect bet sizing on the flop or turn, by looking for a contradiction in our thought process we can check to make sure our bet sizing at least makes sense relative to all the other theory we know.
2. If our opponent defends aggressively enough to prevent us from being able to profitably bet any two cards, it’s usually possible to figure out how aggressively he’ll need to raise

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small bets to keep us indifferent to overbetting or betting small with the nuts.

3. We cannot make large bets at an unreasonably high frequency after our opponent shows weakness by checking back. If we do, he'll have an incentive to always check back strong hands on the flop.
4. Betting very small when out of position is not much different from checking. Since most of the value betting hands in our small betting range will be weak, we'll regularly have only a bluff catcher when our opponent raises.
5. If our opponent doesn't figure to have a raising range for reasonable sized bets, we should consider overbetting with some of our strongest hands and bluffs.
6. We'll usually need to have some very strong hands in our range even when betting small, otherwise our opponent can recklessly raise knowing he can't be beat.
7. When our nut type hand blocks many hands in our opponent's calling range, we'll usually want to bet smaller than we otherwise would.
8. Sometimes the nuts can make up such a large fraction of our opponent's range that overbets won't be as profitable as smaller bets since small bets keep his range wide.
9. Poker is a multi-street game and it will often be best to raise before the river even if our opponent will rarely fold. When this happens, he'll call with a wide range which includes many speculative hands, and most of these hands will fold to a bet on the following street.

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10. A capped range is not problematic when there is little stack depth remaining. Raising a range of strong but vulnerable hands and bluffs is often the best play.

Part Fifteen

Applying Theory to Analyze Hands

Applying Theory to Analyze Hands

Introduction

In many poker books, when the author analyzes a hand he usually discusses how he would play one hand against a specific type of opponent and rarely makes more than 3 or 4 decisions. Since these decisions are usually based on exploitative rather than theoretical play, they often become outdated as players continue to adjust to one another. This is why as players improve they often look back at the books they read and think much of the advice was poor, even if it may have been good exploitative advice when it was written.²⁵

In the following section, “Part Sixteen: Analyzed Hands,” starting on page 423, rather than examine a specific hand, we’ll attempt to figure out how each player should play every hand in his range. Of course, there’s no way to actually solve a hand, and we’ll have to make simplifications when doing our analysis. As such, the goal for this and the following section is to show how to apply the concepts, frequencies, and ratios we’ve discussed previously to make reasonably balanced ranges that allow us to beat most opponents.

Note there will without a doubt be small mistakes in this section since it requires me to make thousands of decisions and often the expected value of two lines is very close. Furthermore, it’s common to find great players disagreeing strongly on

²⁵ Unless those books discuss the general theory of how to exploit as Two Plus Two books tend to do.

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relatively common spots with a single hand, much less on what to do with their entire range in several spots.

As such, we should be aware of the problems with analyzing hands in this manner before beginning. Most of these problems have already been discussed in much greater detail throughout the book, but it's important to make sure the analysis we're doing isn't mistaken for being closer to theoretically optimal than it actually is. Here's a quick reminder of the most important points:

1. Equity cannot be converted into expected value when there are cards left to come.
2. We can't solve for exactly how wide to defend when facing a bet even if our opponent shouldn't be able to profitably bet any two cards. On the flop and turn we'll need to defend wider if we call rather than just raise since our opponent gets to see an additional card, but it's impossible to figure out exactly how much wider.
3. Optimal play requires countless bet sizes to be used and each range to be balanced. While understanding when to use different bet sizes is useful, analyzed hands quickly become a cluttered mess when attempting to balance too many ranges at once. In fact, it's likely the theoretically optimal solution to a hand is so long and complex that it would be nearly useless for most players.
4. We'll always be limited on how much time we have to analyze a spot and make a decision. This is true whether we're currently facing an opponent's bet and have 30 seconds to act or are away from the tables using computer software to analyze a situation.

Put differently, there will almost always be a way to make a slight tweak to make a range better, but for the most part, if it

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looks like neither player has a strong incentive to change their strategy that's close enough. Our goal should be to have a good idea of how to play our range on many different board textures pretty well, not to spend countless hours learning to play one or two board textures exceptionally well.

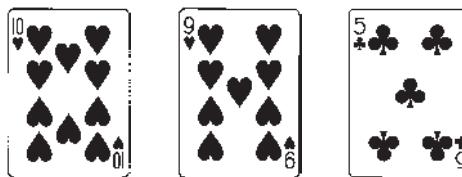
Due to these reasons and others, the pronoun "I" will frequently be used when analyzing hands to stress these are my thoughts for the best way to play the hand. I do not expect myself to play perfectly and make no mistakes, and neither should you.

Facing Bets in Position Revisted

The easiest place to start when analyzing hands is how the player in position will respond when facing a flop, turn, and river bet. This will then help us determine how to play the out of position range because it allows us to estimate how strong hands need to be to confidently bet one, two, or three streets for value.

We've already discussed the ratios and frequencies necessary to make this happen. In general, it's a good idea to start assuming the player out of position will bet around 75 percent of the pot when he bets and the player in position will try to defend at least 60 percent of the time. More advanced players should try to defend a bit more, but this is a good starting point and what we'll use in the following examples.

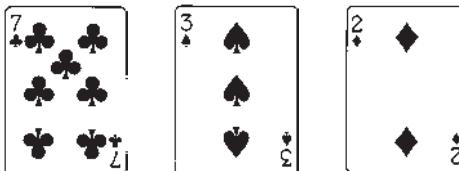
Be sure to note the qualities of the board texture when defending. If the board is wet and many draws are possible, such as with the



flop, then we should be aggressively raising and probably won't have to call with many weak hands. On these boards, we'll likely only raise the turn when we've improved since all our strong hands were raised on the flop.

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In contrast, if the board is dry and few strong hands are possible, such as on the



flop, then we'll defend almost entirely by calling and have to call with many weak hands. However, many strong hands will be in our range on the turn, and if the turn card puts some flush draws or many straight draws in our opponent's range, we'll usually have a raising range.

Lastly, remember poker is a multi-street game. If we're rarely folding to flop bets when in position on a specific flop texture, then it's likely fine to fold a bit more to turn bets. That's because our opponent effectively had to pay more for the opportunity to bluff the turn since his flop bluff was unlikely to succeed. So don't be afraid to call more on an earlier street and less on a later street if the situation calls for it.

Betting When Out of Position Revisited

Once we have a general sense of how the player in position is expected to respond to bets, it's time to design the out of position range. Again, all the ratios and frequencies have already been discussed, so we should be comfortable with making reasonably balanced betting, check-raising, and check-calling ranges.

One key to making strong out of position ranges is to remember aggressively betting will not be effective if we're having trouble defending our checks. That's because failing to aggressively defend our checks encourages our opponent to frequently bet when checked to (especially when giving free cards to our check-folding range is risky), and this encourages us to check-raise rather than bet our strong hands. Usually, some mix of betting, check-raising, and check-calling will be best assuming we didn't call from the blinds (in which case our range is weak and donk betting will be ineffective).

Since there are still two cards left to come, the turn and the river will usually determine which value hands that were bet on the flop are strong enough to keep betting. This requires us to think quickly on the later streets, but this isn't usually problematic. The same cards that make some of our value hands weaker (such as the flush draw completing) will also usually improve some of our draws and bluffs. So, although it's impossible to solve for the perfect flop betting strategy since there are so many cards left to come, our range should usually be reasonably balanced on future streets as long as we're betting with the right types of hands.

Summary

When analyzing turn and river play in “Part Sixteen: Analyzed Hands,” we’ll always assume the player out of position bet the previous street for 75 percent of the pot and the player in position called. That’s because these are very common situations and are likely the most useful for getting us comfortable with applying theory.

And once you’re comfortable with these situations, it’s a good idea to practice other situations. The same methodology used should be used in other spots, just keep in mind the frequencies and bet sizes will change. For instance, advanced players should put in the necessary work so they’re comfortable playing in 3-bet pots in button vs blind situations since they occur so frequently and so much money is at stake. They should also know how to respond against a turn bet after check-calling on the flop since this is a common occurrence.

Finally, it’s worth mentioning once again how complex the actual solution to hands would be. Assuming all bets are 0.75 pot sized bets makes analyzing hands much more manageable, but this isn’t something an optimal player would necessarily do. In addition, our time is always limited and it’s more efficient to analyze many board textures rather than be overly concerned with being as precise as possible on a few board textures. Also, it’s especially important to keep the following points in mind when examining analyzed hands.

1. It’s impossible to find the solution for a hand. Even if we could, it’d likely be extremely long and difficult to understand
2. Assuming players only use one specific bet size makes analyzing hands more manageable.

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3. Poker is a multi-street game, and it's important to remember it's acceptable to call more on earlier streets and fold more on later streets if the situation calls for it.
4. It's ineffective to bet strong hands when out of position if we're unable to defend our checking range. This is especially true if it's risky for our opponent to give free cards to our check-folding range.

Part Sixteen

Sample Hands

Sample Hands

Introduction

The following analyzed hands are always first approached from the perspective of the player in position facing a 75 percent pot sized flop bet. That's because this is the best starting point for hand analysis since we must defend around 60 percent of our range to prevent our opponent from making an immediate profit betting any two cards.

The same process occurs on the turn and river, as we'll once again assume we're facing a 75 percent pot sized bet after our opponent bet the previous street. Again, this requires us to defend around 60 percent of our range to prevent our opponent from making an immediate profit. Of course, he won't always bet the turn or river, and when he doesn't, we'll have to figure out whether to bet or check, but it's not realistic to take into account each of our opponent's possible actions.

Once we've analyzed how the player in position should respond when facing bets on all three streets, we're ready to begin designing our out of position flop ranges. These ranges should be designed as if we don't know what the turn or river card will be, but after designing positional ranges, we'll usually have a good idea of what hands work well as value bets. These are also the hardest ranges to create, as multiple ranges need to be balanced at once and there are many combinations of hands.

Next, we'll analyze out of position turn and river play assuming the previous street was bet for 75 percent of the pot. Once more, this won't always be true, but it's impossible to take into account all possible actions from earlier streets. The widest and more important ranges often occur after the out of position

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player bet and the in position player called, and as such these are the ranges we'll focus on.

The same methodology showcased in this section can be used to improve post-flop play in other situations. For instance, intermediate players who hope to become expert players should focus on how to play the turn and river after check-calling on the flop. Likewise, they should also aim to improve their play in 3-bet pots since more money is at stake and these situations occur frequently in button versus blind situations against strong opponents.

Lastly, always remember these ranges are estimates and analyzing hands in this manner is an exercise designed to improve our play in a practical way. Don't spend an unwarranted amount of time trying to get everything to balance perfectly, or assume these ranges are optimal. However, you will likely notice how difficult it is to balance ranges in certain spots and how easily a skilled opponent could exploit you. So by improving your play in these areas, you'll protect yourself from losing to advanced players as well as learn to exploit opponents who don't know how to balance their ranges in difficult spots.

Sample Hands

Hand No. 1: Under-the-Gun versus the Cutoff

First, let's examine the initial caller in the cutoff.

CO cold calling range: QQ-44, AKo-AQo, AQs-ATs, KQs-KJs, QJs, JTs, T9s, 98s, 87s, 76s, 65s

Flop: A♦7♠5♦

Total Combos: 108

Desired Minimum Combos Defended: $108 \times 0.6 = 65$

Value Raises: 77(3), 55(3), 9♦8♦ = 7

Bluff Raises: 98s(3), 65s(3), 9♦9x(3), 8♦8x(3) = 12

Calls: AK(9), AQ(12), AJs(3), ATs(3), QQ-JJ(12), T♦Tx(3), 87s(3), 76s(3), K♦Q♦, K♦J♦, Q♦J♦, J♦T♦, T♦9♦ = 53

Total Combos Defended: 72 (67%)

Analysis: Our range is strong and it's easy to defend well over 60 percent of our hands. I decided to raise all sets since our calling range already includes ace-king hands (making it difficult for our opponent to overbet the turn), but calling with some sets to raise on non-diamond turns would be fine as well.

Pocket nines and pocket eights with a diamond work pretty well as bluff raises. We can always get lucky and turn or river a set, and they can be double barreled when they turn a straight draw. If we check back on a diamond turn, we may river the flush and beat our opponent when he has an ace-king type hand without a diamond.

The worst hand in our calling range is pocket tens, which seems reasonable. There's no way to tell if calling with tens without a diamond is profitable, and since we're already defending 67 percent of our range, it's possible they should be

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folded or we can bluff raise a combination or two less. Yet overall, this looks like a solid defending strategy.

Positional range after flatting flop: AK(9), AQ(12), AJs(3), ATs(3), QQ-JJ(12), T♦Tx(3), 87s(3), 76s(3), K♦Q♦, K♦J♦, Q♦J♦, J♦T♦, T♦9♦ = 53

Turn: A♦7♠5♦K♣

Total combos: 50 [-3 AK]

Desired combos defended: $53 \times 0.6 = 30$

Value raises: 0

Bluff raises: 0

Calls: AK(6), AQ(12), AJs(3), ATs(3), K♦Q♦, K♦J♦, Q♦J♦, J♦T♦, T♦9♦ = 29

Total combos defended: 29 (58%)

Analysis: It's tough to say whether we should raise any ace-king hands on the turn. On one hand, if we raise, it's unlikely our opponent will ever feel a worse hand since raising makes his range so strong. Yet on the other hand, by calling, we allow our opponent to continue to draw with all of his flush draws. So raising a few ace-king combinations may be best, but for the most part, I prefer to call.

Notice we're calling with 24 made hands and 5 flush draws. This allows us, on the river, to bluff with most if not all of our missed draws in a balanced range if our opponent checks. Additionally, only 29 combos our defended rather than 30, but this is close enough.

Positional range after flatting flop + turn: AK(6), AQ(12), AJs(3), ATs(3), K♦Q♦, K♦J♦, Q♦J♦, J♦T♦, T♦9♦ = 29

River: A♦7♠5♦K♣K♣

Total combos: 27 [-2 AK]

Desired Combos Defended: $27 \times 0.6 = 16$

Value raises: AK(4) = 4

Bluff raises: AQ(2) = 2

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Calls: AQ(8), K♦Q♦, K♦J♦ = 10

Total combos defended: 16

Analysis: We want to value raise ace-king and balance that with around 2 combinations of bluffs, then call with as many marginal strength hands as we need to prevent our opponent from being able to bluff too much. This is a really interesting spot, and since so much of our range on the river is ace-queen, it actually makes sense to bluff raise sometimes, call sometimes, and fold other times. This by definition means the expected value of raising, calling, and folding the hand must all be 0.

In practice, we should be careful when bluff raising this river. If our opponent's value range is so polarized that almost all of his value bets are ace-king, then we shouldn't raise any bluffs on this river. It's a weird spot where our opponent's range is so polarized — most of his value bets are the nuts — that we shouldn't bluff raise any hands and our opponent will only call our river jam with an ace-king.

Now let's take a look at the under-the-gun opener.

UTG opening range: AA-33, AKo-AJo, KQo, AKs-ATs, KQs-KTs, QJs-QTs, JTs-J9s, T9s, 98s, 87s, 76s, 65s

Flop: A♦7♠5♦

Total combos: 159

Value betting range: 77(3), AK(12) = 15

Draw betting range: 9♦8♦, T♦9♦, J♦9♦, J♦T♦, Q♦T♦, Q♦J♦ = 6

Bluffing range: KQ(7), 98s(3), 65s(3), 76s(2), 88(6), 66(6), K♣J♣, K♣T♣, Q♣J♣, Q♣T♣, J♣T♣, J♣9♣, T♣9♣, 4♦4x(3) = 37

Total combos bet: 58

Flop Cbet: 36.5%

Total combos checked: 101

Check-Raising Range: 55(3), 87s(3), 76s(3) = 9

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Check-Calling Range: AA(3), AQ(12), AJ(12), ATs(3), KK-QQ(12), J♦Jx(3), K♦Q♦, K♦J♦, K♦T♦ = 48

Percent of Checks Defended: 57%

Minimum EV of our opponent's air on flop:

$$(0.635)[(0.43)(8) - (0.57)(6)] = 0.01 \text{ big blinds}$$

Analysis: Since our opponent's range is strong on this flop and he has the advantage of position, our continuation betting frequency should be quite low. Therefore, betting 36.5 percent of the time seems reasonable as that keeps our checking range strong but still allows us to value bet with our ace-king hands.

Position is not especially valuable on this board, so it's easy to check-call aggressively on the flop and keep the minimum expected value of our opponent's air low, to the point where he almost doesn't even make an immediate profit by betting. Check-calling with top set put some very strong hands in our check-calling range, and if we bet or check-raise, we're unlikely to get much action when our hand removes two-third of the aces from the deck.

And check-raising with a set of fives prevents our opponent from betting too recklessly (on the flop), but this isn't a board texture where he's too afraid of giving free cards anyway. Note our eight-seven suited and seven-six suited hands which are being check-raised include the flush draw, so it's probably possible to bluff raise an additional hand combination or two. Although check-raising all combinations of 9♦9x may be too many, bluffing with one or two is likely fine.

OOP range after betting flop: 58

Turn: A♦7♠5♦K♣

Total combos: 50 [-3 AK, - K♣J♣, -K♣T♣, and -3 KQ]

Value betting range: 77(1), AK(9) = 10

Bluffing range: T♦9♦, J♦9♦, J♦T♦, Q♦T♦, Q♦J♦, Q♣J♣, Q♣T♣, J♣T♣, J♣9♣, T♣9♣, 98s(4) = 14

Total combos bet: 24

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Turn Cbet percentage: 48%

Total combos checked: 26

Check-raising range: 77(2), KQ(2) = 4

Check-calling range: KQ(3) = 3

Percent of checks defended: 27%

Analysis: The board bringing another flush draw made it easy for us to double barrel many draws, yet since it was a king, it also reduced the number of value hands we have by blocking many ace-king hands. This caused us to bet on the turn one less than half the time.

And since we're not betting the turn especially aggressively, it helps to develop a check-raising and check-calling range. Sets of sevens can easily be check-raised, and king-queen hands can be either check-called, check-raise bluffed, or check-folded. Remember, we'd technically need to balance our check-calling range and not only check-call with king-queen, but if our opponent bets the turn, check-calling with just a few hands will often be break even or slightly profitable.

OOP range after betting flop + turn: 24

River: A♦7♠5♦K♠K♣

Total combos: 21 [-3 AK]

Value betting range: 77(1), AK(6) = 7

Bluffing range: 98s(3) = 3

Total combos bet: 10

River Cbet percentage: 47.6%

Total combos checked: 9

Check-raising range: 0

Check-calling range: 0

Percent of checks defended: 0

Analysis: This river card blocks almost one-third of the value hands in our range and misses all our draws. In other words, we simply got unlucky to get this river and shouldn't be surprised if

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we can't bet the river especially aggressively. And if we bet less than the pot on the river, we'll only be able to make around 3 bluffs for our 7 value bets, which results in betting less than half the time.

Although it's tempting to think we should try to defend our checking range since we can't bet the river aggressively, our opponent's range includes many bluff catchers while ours is polarized. Likewise, since our river checking range includes almost no bluff catchers, our opponent will bet the river with a balanced range primarily so he can win the pot with his missed bluffs. Check-raising will not be effective since he'll frequently check behind and win with his ace-queen and ace-jack hands at showdown.

Hand No. 2: Under-the-gun versus the Button

First, let's examine the caller on the button.

BU cold calling range: QQ-33, AKo-AQo, AQs-ATs, KQs-KTs, QJs-QTs, JTs-J9s, T9s, 98s, 87s, 76s, 65s, 54s

Flop: 8♣4♥2♠

Total combos: 139

Desired combos defended: $139 \times 0.6 = 83$

Value raises: 0

Bluff raises: 0

Calls: 88(3), 44(3), QQ-99(24), 77(6), 98s(3), 87s(3), 76s(4), 65s(4), 54s(3), AKo(12), AQs(3), AJs(3), KQs(3), ATs(3), KJs(3), KTs(3), T9s(3) = 86

Total combos defended: 86

Analysis: Although at a glance this board texture looks bad for our range, we still have 48 percent equity against the UTG opening range and six combinations of sets. While raising this flop will make it more difficult for our opponent to bet hands such as nines and tens for a single street of value, I prefer to instead call

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with eights and fours since we are in position and can comfortably raise any turn card. In other words, giving a free card isn't risky.

It's important to remember ace-king and ace-queen can easily be checked down and win at showdown after calling a flop bet in addition to improve. Additionally, it's difficult to say whether sevens can be profitably called here, or if it's a superior hand to ace-queen. I think they're both close to break even and have no problem with calling a few ace-queen offsuit hands, but decided to just call with sevens.

Positional range after flatting flop: 88(3), 44(3), QQ-99(24),
77(6), 98s(3), 87s(3), 76s(4), 65s(4), 54s(3), AKo(12),
AQs(3), AJs(3), KQs(3), ATs(3), KJs(3), KTs(3), T9s(3) =
86

Turn: 8♣4♥2♠2♦

Total combos: 86

Desired combos defended: $86 \times 0.6 = 52$

Value raises: 0

Bluff raises: 0

Calls: 88(3), 44(3), QQ-99(24), 98s(3), 87s(3), AK(12), 77(6) =
54

Total combos defended: 54

Analysis: This turn card is tricky since it puts no additional strong hands in our range. However, it does allow us to continue to slowplay our flopped sets since they are now full houses and raising a few of these hands would make it more difficult for our opponent to bet only two streets for value. Therefore, I think calling and encouraging him to continue bluffing is superior.

There are also almost no draws in our range since the board is so dry. This means we'll need to bluff with some ace-king hands if our opponent checks to us on the river despite the fact that these hands have showdown value. Another option on the turn is to call with seven-six suited since it's a gutshot, but I'd rather

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call with a pair of sevens because it has more showdown value and the board is already paired.

Positional range after flatting flop + turn: 88(3), 44(3), QQ-99(24), 98s(3), 87s(3), AK(12), 77(6) = 54

River: 8♣4♥2♠2♦T♣

Total combos: 51 (-3 TT)

Desired combos defended: 51 x 0.6 = 31

Value raises: TT(3), 88(3), 44(3) = 9

Bluff raises: 98s(3), 87s(1) = 4

Calls: QQ(6), JJ(6), 99(6) = 18

Total combos defended: 31

Analysis: I found this river interesting and non-intuitive. Our range has so many full houses that we're actually able to raise our opponent's river bet quite aggressively. Furthermore, two-thirds our calling range will be overpairs, though chances, except for queens, they'll all be bluff catchers as our opponent won't be value betting a hand worse than queens.

Since we can raise the river so effectively, on the turn and the river our opponent should probably be betting less than 75 percent of the pot with his overpairs. He needs to keep our calling range wide since betting large requires us to defend fewer combos.

Now let's take a look at the under-the-gun opener.

UTG opening range: AA-33, AKo-AJo, KQo, AKs-ATs, KQs-KTs, QJs-QTs, JTs-J9s, T9s, 98s, 87s, 76s, 65s

Flop: 8♣4♥2♠

Total combos: 176

Value betting range: AA-QQ(18), TT-99(12) = 30

Draw betting range: 0

Bluffing range: AQo(13), AJ(7), KQs(3), ATs(3), KJs(3), KTs(3), QJs(3), QTs(3), JTs(3), J9s(3), T9s(3), 76s(4), 65s(4) = 55

434 Part Sixteen: Sample Hands

Total combos bet: 85

Flop Cbet percent: 48.2%

Total combos checked: 91

Check-raising range: 55(6), 88(3) = 9

Check-calling range: 44(3), JJ(6), 98s(3), 87s(3), AK(16), AQs(3) = 34

Percent of checks defended: 47.3%

EV of the opponent's air on flop:

$$(0.518)[(8)(0.527) - (6)(0.473)] = 0.714 \text{ big blinds}$$

Analysis: So, as we just saw, betting all three streets results in our opponent's range getting quite strong by the river and he'll be able to often raise. While it's true the turn won't always come a blank which allows him to continue slowplaying his sets, most sets will be raised on the turn or the river and allow him to also bluff raise. Furthermore, our range only has 52 percent equity on this flop, so it is not strong enough to bet recklessly.

This is an especially difficult spot to analyze because it's tough to tell what line is best with our middle pairs. On one hand, I'm tempted to bet hands like JJ, TT, and 99 since giving free cards is risky. But even if we bet jacks, our opponent won't fold many AK, AQ, or KQs hands. (Just because we chose to fold our ace-queen offsuit hands and call with sevens doesn't mean it's correct or our opponent will.) So it may be best to check-call with jacks since betting doesn't make too many hands with overcards fold anyway. Furthermore, if our opponent checks back with tens and nines, we'll usually be able to get value on the turn and river with jacks anyway.

Betting tens and nines with the intention of only betting for one or two streets of value may be best. When our opponent folds queen-jack suited and queen-ten suited and we hold nines, it's much more useful than if we held jacks (since a turn ten outdraws our nines but gives him a losing top pair hand with jacks). So even though we have no way of solving for what line is best, betting these hands while check-calling jacks seems reasonable.

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Before designing our check-calling and check-raising range, notice if we rarely defend our checks our opponent will bet aggressively since giving free cards to our check-folding range is risky. This is a spot where players rarely check-call or check-raise, but that's unacceptable against skilled opponents so long as we have a checking range. And since we're out of position and our range isn't much stronger than our opponents, we probably should check reasonably often. (This would be even more true if he had all possible sets in his range, but luckily we assumed he folded deuces preflop.)

It's important our check-calling range is balanced and stresses keeping hands in our opponent's range that we dominate. For this reason, check-calling with ace-king is often an excellent play (though this hand can sometimes be bet as well). This ensures our opponent sees the turn with all of his AQ, AJ, and KQ hands, as well as gives us the opportunity to see a free turn card if he checks back a hand like nines or tens. Nevertheless, our check-calling range must be balanced, so check-calling a pair of jacks or a few sets is necessary.

Also notice that occasionally check-raising makes it less profitable for our opponent to recklessly bet the flop with his marginal hands, and encourages him to check back more often and give us a free card. But unfortunately, there aren't many hands which work well as check-raise bluffs, but even pocket pairs can occasionally turn a set or hit a running straight. And if we feel that defending with 47.3 percent of our hands after checking isn't enough, we could check-raise some pair of aces combos as well, but check-raising all of them should result in check-raising too aggressively.

OOP range after betting flop: 85

Turn: 8♣4♥2♦2♦

Total combos: 85

Value betting range: AA(3), KK-QQ(12), TT(6) = 21

Draw betting range: 0

436 Part Sixteen: Sample Hands

Bluffing range: AQ(10), 76s(4), 65s(4), AJ(3) = 21

Total combos bet: 42

Turn Cbet percent: 49.4%

Total combos checked: 43

Check-raising range: 0

Check-calling range: AA(3), AQ(3), 99(6) = 12

Percent of checks defended: 27.9%

Analysis: We get a tough turn card which makes it difficult to keep barreling aggressively since we don't pick up any good bluff randomizers, but luckily, our opponent's range also isn't very strong.

Although at showdown our opponent won't likely let us win with ace-queen unimproved, he may give us a free card if we check it on the turn. Since ace-queen makes up so much of our range, it makes sense to bet some and check others. In addition, we should likely check-call and/or check-raise some strong hands on the turn to protect our checking range since our opponent will be able to recklessly bet if our range is capped at nines, and aces works well in this regard.

Notice that check-calling with ace-queen isn't as unreasonable on the turn as it would first seem. Our opponent will likely check back his ace-king hands, and bet with his hands which have little showdown value such as KQs, KJs, KTs, etc. So it's possible ace-queen is the best hand after check-calling, and if it isn't, it may improve to the best hand on the river. Furthermore, if our opponent makes a small bet on the turn, we'll get a great price on our call.

OOP range after betting flop + turn: 42

River: 8♣4♥2♦T♣

Total combos: 39 (-3 TT)

Value betting range: AA(3), KK-QQ(12) = 15

Bluffing range: AQ(6) = 6

Total combos bet: 21

River Cbet percent: 53.8%

Total combos checked: 18

Check-raising range: TT(3), AQ(2) = 5

Check-calling range: 0

Percent of checks defended: 27.8%

Analysis: Another river which doesn't improve our hand, but since we had no good draws on the turn, this is expected. Furthermore, since the river removed 3 combinations of tens from our range, it actually reduced are value combos. This makes it hard to barrel aggressively, but we're still able to comfortably bet over half the time.

It might feel weird to bet the river with a range capped at overpairs, but keep in mind even if we bet the river with our sets of tens, it wouldn't stop our opponent from being able to profitably raise his full houses. In fact, it's difficult to imagine any river betting range which doesn't allow him to profitably raise these hands. So even though it's unfortunate to always have a buff catcher once our opponent raises, this doesn't mean there is a problem with our range and we must keep in mind our opponent can only raise so often and remain balanced.

Hand No. 3: Middle Position versus the Cutoff

First, let's examine the caller in the cutoff.

Cutoff cold calling range: JJ-44, AKo-AQo, AQs-ATs, KQs-KTs, QJs-QTs, JTs, T9s, 98s, 87s, 76s

Flop: 8♣7♣2♣

Total combos: 114

Desired combos defended: $114 \times 0.6 = 68$

Value raises: 87s(2), 77(3), T♣9♣, A♣J♣, A♣T♣ = 8

Bluff raises: 76s(3), 6♣6x(3), Q♣T♣, K♣T♣, Q♣J♣, K♣J♣, A♣T♣ = 11

438 Part Sixteen: Sample Hands

Calls: 88(3), JJ-99(18), T9s(3), 98s(2), AKo(12), A♠Qx(3), AxQ♠(3), A♣Q♣, K♣Q♣, A♣J♣, A♦Q♦, K♦Q♦, K♦J♦, K♦T♦, Q♦J♦, Q♦T♦, J♦T♦, JTs(3) = 57

Total combos defended: 76 (66.7%)

Analysis: Position is very valuable here, and I think it's best to try to defend significantly more than 60 percent of the time on this type of board texture when possible. And since we have so many hands with a significant amount of equity, this isn't difficult to do and our defending range looks pretty normal.

Positional range after flatting flop: 88(3), JJ-99(18), T9s(3), 98s(2), AKo(12), A♠Qx(3), AxQ♠(3), A♣Q♣, K♣Q♣, A♣J♣, A♦Q♦, K♦Q♦, K♦J♦, K♦T♦, Q♦J♦, Q♦T♦, J♦T♦, JTs(3) = 57

Turn: 8♣7♠2♦J♣

Total combos: 52 (-3 JJ, - A♣J♣, - J♣T♦,)

Desired combos defended: 52 x 0.6 = 31

Value raises: T9s(3), JJ(3), 88(3) = 9

Bluff raises: K♦Q♦, 98s(3), 99(6) = 10

Calls: QQ(6), TT(6), JTs(3), A♠Q♦, K♦J♦, K♦T♦, Q♦J♦, Q♦T♦, J♦T♦, 9♦8♦ = 22

Total combos defended: 38 (73%)

Analysis: This is an amazing turn for our range. It gives us six additional nut type hands (3 jacks and 3 ten-nine suited), and a set of eights is still strong enough to value raise. Here, our opponent shouldn't be betting very aggressively or making large bets since our range is so strong. It's simply too easy for us to aggressively raise and make his hand a bluff catcher.

As was the case on the flop, we should try to defend more than 31 hand combinations here. This is especially true because all of our opponent's bluffs will have a significant amount of equity when called. Furthermore, we could try slowplaying some straights on the turn if our opponent is likely to overbet on a blank

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river, but with so many draws on the flop, I'd be reluctant to do this in practice without a strong read.

Positional range after flatting flop + turn: QQ(6), TT(6), JTs(3), A♦Q♦, K♦J♦, K♦T♦, Q♦J♦, Q♦T♦, J♦T♦, 9♦8♦ = 22

River: 8♣7♣2♦J♣2♦

Total combos: 22

Desired combos defended: $22 \times 0.6 = 13$

Value raises: 0

Bluff raises: 0

Calls: QQ(6), K♦J♦, Q♦J♦, J♦T♦, TT(4) = 13

Total Combos Defended: 11

Analysis: So the river came a complete blank, which strongly favors the bettor's range. We're vulnerable to overbets on this river, but that doesn't suggest we misplayed the turn. Furthermore, by defending aggressively on the turn, our opponent's (turn) bluffs were effectively quite expensive, so even if he can profitably bluff any two cards on this river, it may not be a problem.

Always remember to adjust your river calling frequency based on your opponent's bet size. If he bets 75 percent of the pot, then calling 13 combos will make his bluffs around break even and this requires us to call with 4 combinations of tens. If he bets bigger, we'll call less often²⁶ and may end up folding all of our tens and even some top pair hands.

Now let's take a look at the middle position opener.

²⁶ Assuming of course he plays rationally. If you think your opponent is more likely to be bluffing when he bets big, you would use the reverse of GTO strategy.

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MP opening range: AA-22, AKo-ATo, KQo, AKs-A7s, A5s, KQs-KTs, QJs-QTs, JTs-J9s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s, 54s

Flop: 8♣7♠2♦

Total combos: 219

Value betting range: KK-TT(24), 87s(2), AA no spade(3) = 29

Draw betting range: A♠9♠, A♠5♠, K♣J♣, K♣T♣, Q♣T♣, J♣9♠, T♣9♠, 6♣5♠, 5♣4♠, T9s(3), 65s(3) = 15

Bluffing range: JTs(3), J9s(3), 54s(3), A♠Qx(3), AxQ♣(3), A♣Jx(3), K♣Qx(3), KxQ♣(3), A♣Q♣, A♣J♣, A♣T♣, A♣9♣, A♣5♣, K♣Q♣, K♣J♣, K♣T♣, Q♣J♣, Q♣T♣, 6♣6x(3), 5♣5x(3), 4♣4x(3) = 43

Total combos bet: 87

Flop Cbet percent: 39.7%

Total combos checked: 132

Check-raising range: 77(3), 88(3), 22(3), J♣9♠, J♣T♣, A♠T♣, 76s(3), 75s(3), 97s(3), A7s(3), A♠Tx(3) = 27

Check-calling range: A♠Ax(3), 99(6), A8s(3), T8s(3), 98s(3), 86s(3), AK(16), A♠Q♣, A♣J♣, K♣Q♣ = 40

Percent of checks defended: 50.7%

EV of the opponent's air on flop:

$$(0.603)[(8)(0.493) - (6)(0.507)] = 0.54 \text{ big blinds}$$

Analysis: This is the typical gross out of position spot since the board texture is low and draw heavy which greatly increases the value of our opponent's positional advantage. Nevertheless, although once we check he has a profitable flop bet, he does not likely have an incentive to bet any two cards since we are check-raising so aggressively.

Facing flop raises will also be difficult since 3-betting isn't particularly effective against a polarized range. Yet calling and letting our opponent see additional cards with his bluffs and draws is also far from ideal. We may even need to occasionally 3-bet this flop with our two pair and overpairs since if we don't, he'll get to see the turn with his bluff raises too frequently. It's tough to say.

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As you'll notice, when analyzing board textures on your own, it's simply more difficult to design out of position ranges than in position ranges, and it's easy to get caught up trying to make everything balance perfectly. This is an impossible task and not worth the time. Instead, do the best you can and get a better overall understanding for how your range fits in with the specific board texture. Here, it should be apparent that you must check-raise aggressively as well as check-call some overcards (such as ace-king), otherwise, you won't defend enough checks.

OOP range after betting flop: 87

Turn: 8♣7♠2♠J♣

Total combos: 78 (-3 JJ, - J♣T♣, - J♣9♣, - A♣J♣, - K♣J♣, - Q♣J♣, - A♣J♣)

Value betting range: KK-QQ(12),JJ(3),87s(2),AA no spade(3),
T♣9♣ = 21

Bluffing range: A♣Q♣, A♣T♣, A♣9♣, A♣5♣, K♣Q♣,
K♣T♣, Q♣T♣, A♣9♣, A♣5♣, K♣T♣, Q♣T♣, 6♣5♣, 5♣4♣,
65s(3) = 16

Total combos bet: 37

Turn Cbet percent: 47.4%

Total combos checked: 41

Check-raising range: T9s(3), TT(3) = 6

Check-calling range: A♣Jx(3), JT(3), J9s(3), TT(3), A♣J♣,
K♣J♣ = 14

Percent of checks defended: 48.7%

Analysis: We turn many top pair hands, but as previously shown, our opponent's range is quite strong. So recklessly betting top pair hands will result in us getting very little value when called as well as make us vulnerable to raises. Therefore, check-calling with our top pair hands is likely best.

One useful rule to remember when out of position is, "If you think it's close between betting and checking, consider betting smaller." That's because a small bet does not re-open up the

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betting like a bet in position does. So, for instance, making a large bet on a pair of queens may make our opponent's range too strong as well as punish us more severely when facing a raise, yet checking allows him to freely realize the equity of his ace-king hands. Hence, in this case, it may be best to make a small bet with queens, and if we do bet them on the turn, we'll likely need to check-call rather than value bet on the river.

Note that we are check-raise bluffing some combinations of tens, which also happens to have a nice removal effect. This hand is also strong enough to value bet on some turn cards, but this isn't one of them.

OOP range after betting flop + turn: 37

River: 8♣7♠2♦J♣2♦

Total combos: 37

Value betting range: JJ(3), KK-QQ(12), 87s(2), AA no spade(3)
= 20

Bluffing range: A♣T♣, A♣9♣, K♣T♣, Q♣T♣, K♣T♣, 65s(3)
= 8

Total combos bet: 28

River Cbet percent: 75.7%

Total combos checked: 9

Check-raising range: T♣9♣, Bluff(1) = 2

Check-calling range: 0

Percent of checks defended: 22.2%

Analysis: Since the river is a complete blank, I would in practice almost always bet the queens. However, if we don't think our opponent should be able to profitably bet all of his flush draws after we check, then we have to defend our checks very aggressively. This is quite possible, as he may have many missed flush draws in his range and he shouldn't be able to profitably bet them all. This would encourage us to check-call or check-raise more aggressively than we currently are. Also, note that

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overbetting this river is an option, and by doing such, we'll need to check fewer hands.

Again, this is a spot where it's easy to spend a ton of time trying to get everything to balance perfectly, but it's not really worth it. But it's most important to notice the river is a blank and this favors our polarized range and encourages us to bet at a high frequency, and then in practice consider check-raising aggressively against an opponent who bets too many missed draws on the river.

Hand No. 4: Middle Position versus Button

First, let's examine the caller on the button.

Button cold calling range vs MP: JJ-33, AKo-AQo, AQs-ATs, KQs-KTs, QJs-QTs, JTs-J9s, T9s, 98s, 87s, 76s, 65s, 54s

Flop: J♣6♥4♦

Total combos: 131

Desired combos defended: $131 \times 0.6 = 79$

Value raises: 0

Bluff raises: 0

Calls: JJ(3), 66(3), 44(3), AJs(3), KJs(3), QJs(3), JTs(3), J9s(3), TT-77(24), 76s(3), 65s(3), 54s(3), 87s(4), KQs(3), T9s(3), 98s(3), AQs(3), ATs(3), AKo(12) = 88

Total combos defended: 88 (67.2%)

Analysis: This is a very standard positional defending range which is both easy to design and play. As always, it's impossible to tell whether 77 or 9♦8♦ are profitable calls, but I think they likely are.

Positional range after flatting flop: JJ(3), 66(3), 44(3), AJs(3), KJs(3), QJs(3), JTs(3), J9s(3), TT-77(24), 76s(3), 65s(3), 54s(3), 87s(4), KQs(3), T9s(3), 98s(3), AQs(3), ATs(3), AKo(12) = 88

444 Part Sixteen: Sample Hands

Turn: J♣6♥4♦K♣

Total combos: 85 (-3AKo, - K♣Q♣, - K♣J♣)

Desired combos defended: $85 \times 0.6 = 51$

Value raises: KJs(3), 66(3), 44(3) = 9

Bluff raises: ATs(3), T9s(2), 87s(3) = 8

Calls: JJ(3), AK(9), KQs(2), AJs(3), QJs(3), JTs(3), J9s(3), TT(6), A♣Q♣, T♣9♣, 9♣8♣, 8♣7♣, 7♣6♣, 6♣5♣, 5♣4♣
= 39

Total combos defended: 56 (65.9%)

Analysis: Another pretty easy spot to defend. I chose not to raise jacks since many hands are already being raised, but raising is fine as well.

Positional range after flatting flop + turn: JJ(3), AK(9), KQs(2), AJs(3), QJs(3), JTs(3), J9s(3), TT(6), A♣Q♣, T♣9♣, 9♣8♣, 8♣7♣, 7♣6♣, 6♣5♣, 5♣4♣ = 39

River: J♣6♥4♦K♣3♦

Total combos: 39

Desired combos defended: $39 \times 0.6 = 23$

Value raises: JJ(3)

Bluff raises: J9s(2)

Calls: AK(9), KQs(2), AJs(3), KJs(3) = 17

Total combos defended: 22

Analysis: This hand is a great example of how it's quite easy to defend aggressively in position on most board textures. Since our in position calling range is designed to do well against our opponent's range, it's usually not difficult to know what to do when facing many bets.

Now let's take a look at the middle position opener.

Sample Hands 445

MP opening range: AA-22, AKo-ATo, KQo, AKs-A7s, A5s, KQs-KTs, QJs-QTs, JTs-J9s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s, 54s

Flop: J♣6♥4♦

Total combos: 217

Value betting range: AA-QQ(18), TT(6), 44(3) = 27

Draw betting range: 75s(4) = 4

Bluffing range: 87s(4), KQ(16), ATs(3), A9s(3), A8s(3), A7s(3), A5s(3), KTs(3), QTs(3), T9s(3), T8s(3), 55(6) = 53

Total combos bet: 84

Flop Cbet percent: 38.7%

Total combos checked: 133

Check-raising range: 66(3), 98s(3), 97s(3) = 9

Check-calling range: JJ(3), AJ(12), KJs(3), QJs(3), JTs(3), J9s(3), 99(6), AK(16), AQs(3), 86s(3), 76s(3), 65s(3), 54s(3) = 64

Total checks defended: 73

Percent of checks defended: 54.9%

EV of opponent's air on flop:

$$(0.613)[(8)(0.451) - (6)(0.549)] = 0.19 \text{ big linds}$$

Analysis: I chose to bet tens since betting makes some ace-queen and king-queen hands fold, and because I want some hands which can comfortably check-call on certain turn and river cards. Betting with ace-jack would likely be fine as well, but since ace-jack isn't vulnerable to an ace on the turn, I decided to check-call instead. Check-calling and betting some ace-jacks is also an option.

Hands such as AK, AQ, and KQ can all probably be bet or checked on the flop. I chose to check-call ace-king, check-fold ace-queen offsuit, and bluff king-queen. When analyzing hands in this manner, it's important to keep hands simple when possible, so it's often worthwhile not to split hands among many ranges if it can be avoided. But when playing against a particular opponent, you should consider betting or checking with all these hands and pick the line you think best exploits him.

446 Part Sixteen: Sample Hands

OOP range after betting flop: 84

Turn: J♣6♥4♦K♣

Total combos: 76 (- 3KK, -4 KQ, - K♣T♣)

Value betting range: 44(3), AA(6), KK(3) = 12

Bluffing range: A♣T♣, A♣9♣, A♣8♣, A♣7♣, A♣5♣, T♣9♣,
8♣7♣, QTs(3), 75s(3) = 13

Total combos bet: 25

Turn Cbet percent: 32.9%

Total combos checked: 51

Check-raising range: = 0

Check-calling range: KQ(12), KTs(3), TT(6) = 21

Percent of checks defended: 41.2%

Analysis: This turn card puts many medium strength hands in our range, but it also puts many stronger hands in our opponent's range. This encourages us to bet less often and defend more of our checks.

We also could easily use two bet sizings on the turn, especially if we wanted to bet smaller with a range consisting of mostly king-queen. Nevertheless, since I put ace-king and king-jack in my opponent's range but not in our range, I decided to check-call all our king-queen hands. However, we technically shouldn't have our checking capped at king-queen, though this will rarely, in practice, be a problem against most opponents. But against players who will exploit us for checking a range capped at king-queen, check-calling some sets and overpairs as well will be best.

OOP range after betting flop + turn: 25

River: J♣6♥4♦K♣3♦

Total combos: 25

Value betting range: 44(3), AA(6), KK(3), 75s(3) = 15

Bluffing range: A♣T♣, A♣9♣, A♣8♣, A♣7♣, A♣5♣, T♣9♣,
8♣7♣, QTs(3) = 10

Total combos bet: 25

River Cbet percent: 100%

Total combos checked: 0

Check-raising range: 0

Check-calling range: 0

Percent of checks defended: 0

Analysis: This is a pretty interesting spot where we're quite polarized on the river, and if our opponent's range is capped at queens, overbetting will be best. We must not be afraid to overbet if our opponent only rarely has us beat because even if we bet smaller, we're going to get stacked with many of our value hands if he raises the best hand (as would be the case if our opponent has jacks in his range on the river).

Furthermore, note the river improved our seven-five suited. In fact, our range is now so strong we can bet all of it if we overbet for 1.5 pot sized bets. This isn't a common occurrence, but it can happen when we get a fantastic river card for our range and our opponent's range is capped.

Hand No. 5: Middle Position versus Button

First, let's examine the caller on the button.

Button cold calling range vs MP: JJ-33, AKo-AQo, AQs-ATs, KQs-KTs, QJs-QTs, JTs-J9s, T9s, 98s, 87s, 76s, 65s, 54s

Flop: 8♦8♦6♣

Total combos: 128

Desired combos defended: $128 \times 0.6 = 77$

Value raises: = 0

Bluff raises: = 0

Calls: 88(1), 66(3), 98s(2), 87s(2), JJ-99(18), 77(6), T9s(4), 54s(3), AKo(12), AQ(16), AJs(3), ATs(3), KQs(3), KJs(3), KTs(3), QJs(3) = 85

Total combos defended: 85 (66.4%)

448 Part Sixteen: Sample Hands

Analysis: This is a pretty standard defending range. I chose to call with all trips since our kicker is weak and if we raise the flop and bet the turn and river, it's probably unlikely to get our opponent to call down with an overpair.

Range after flatting flop: 88(1), 66(3), 98s(2), 87s(2), JJ-99(18), 77(6), T9s(4), 54s(3), AKo(12), AQ(16), AJs(3), ATs(3), KQs(3), KJs(3), KTs(3), QJs(3) = 85

Turn: 8♦8♦6♣3♣

Total combos: 85

Desired combos defended: $85 \times 0.6 = 51$

Value raises: 98s(2) = 2

Bluff raises: T9s(2) = 2

Calls: 88(1), 66(3), 87s(2), JJ-99(18), 77(6), A♣Q♣, A♣J♣, A♣T♣, K♣Q♣, K♣J♣, K♣T♣, Q♣J♣, T♣9♣, 54s(3), AK(9) = 50

Total combos defended: = 54 (63.5%)

Analysis: This is another normal defending range, but notice I'm now raising with some trips because we're vulnerable to being outdrawn by turned flush draws. Even though nine-eight suited isn't incredibly strong, I do not want to give free cards to straight and flush draws, so raising (at least some of the time) seems best.

BU range after flatting flop + turn: 88(1), 66(3), 87s(2), JJ-99(18), 77(6), A♣Q♣, A♣J♣, A♣T♣, K♣Q♣, K♣J♣, K♣T♣, Q♣J♣, T♣9♣, 54s(3), AK(9) = 50

River: 8♦8♦6♣3♣7♣

Total combos: 46 (- 8♣7♣, - 3 77)

Desired combos defended: $46 \times 0.6 = 28$

Value raises: 88(1), 66(3), 77(3), 8♣7♣, A♣Q♣, A♣J♣, A♣T♣, 5♣4♣ = 12

Bluff raises: A♣Kx(3), AxK♣(1) = 4

Calls: K♣Q♣, K♣J♣, K♣T♣, Q♣J♣, T♣9♣, 54s(2), JJ(6) = 13

Total combos defended: 29 (63%)

Sample Hands 449

Analysis: Our range is quite strong and we're able to raise bets aggressively, which means if our opponent bets, he should probably bet relatively small. Nut flushes are still likely strong enough to raise since our opponent probably should have checked many of his full houses at some point to protect his checking range. If he's not likely to do this, then calling with them may be best.

Now let's take a look at the middle position opener.

MP opening range: AA-22, AKo-ATo, KQo, AKs-A7s, A5s, KQs-KTs, QJs-QTs, JTs-J9s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s, 54s

Flop: 8♥8♦6♣

Total combos: 217

Value betting range: KK-QQ(12), 99(6), 77(6), 98s(2), 87s(2) = 28

Draw betting range: 97s(4), 75s(4) = 8

Bluffing range: T9s(4), 54s(4), KQs(3), ATs(3), A9s(3), A7s(3), A5s(3), KJs(3), KTs(3), QJs(3), QTs(3), 76s(3) = 38

Total combos bet: 74

Flop Cbet percent: 34.1%

Total combos checked: 143

Check-raising range: A8s(2), T8s(2), 66(3), 55(6), JTs(3), J9s(3) = 19

Check-calling range: AA(6), 86s(1), 88(1), JJ-TT(12), AK(16), AQ(16), AJs(3) = 55

Total checks defended: 74

Percent of checks defended: 51.7%

EV of opponent's air on flop:

$$(0.659)[(8)(0.483) - (6)(0.517)] = 0.50 \text{ big blinds}$$

Analysis: This is an extremely difficult board to balance out of position ranges since many hands which cannot get three streets of value (such as tens and nines) are also the hands most

450 Part Sixteen: Sample Hands

vulnerable to being outdrawn by the overcards in our opponent's range that will often fold to a flop bet. It's the perfect example of a board players consider "dry" yet being in position is massively advantageous.

Since I previously assumed the player in position will call flop bets with ace-king and ace-queen, I chose to check-call with jacks since betting didn't make many high equity hands fold. But I'm not sure this is correct, as both betting and check-calling jacks is clearly profitable. I also chose to check-call aces since this hand isn't vulnerable to being outdrawn on the turn and check-calling keeps dominated hands in our opponent's range. Furthermore, note that I included sevens in the value betting range, but my plan is to check-call with it on almost all turn cards.

The fact that our opponent may bet the flop with the intention of checking the turn and river with a marginal made hand makes check-raising a reasonable option on such a dry board texture. I chose to check-raise A8s, T8s, and 66 for this reason despite them being strong enough to delay the check-raise until the following street.

We won't be able to bluff on later streets with all our overcard hands which check-called the flop, but that's fine. Ace-king especially can regularly win at showdown and bluffing won't consistently make better hands fold, and other hands with less showdown value can be bluffed on later streets if they don't improve.

Lastly, since giving free cards to our checking range is risky, note if we are not aggressively defending our checks, our opponent will bet at a high frequency. So while it's easier to recklessly bet on this flop texture and defend few of our checks, this is almost certainly far from theoretically correct.

OOP range after betting flop: 74

Turn: 8♥8♦6♣3♣

Total combos: 74

Value betting range: KK-QQ(12), 99(6), 87s(2) = 20

Sample Hands 451

Bluffing range: 97s(4), 75s(4), 54s(4), A♣T♣, A♣9♣, A♣7♣, A♣5♣, K♣J♣, K♣T♣, Q♣J♣, Q♣T♣ = 20

Total combos bet: 40

Turn Cbet percent: 54.1%

Total combos checked: 34

Check-raising range: 0

Check-calling range: 77(6), 98s(2) = 8

Percent of checks defended: 23.5%

Analysis: This turn card really misses our range and makes it difficult to keep barreling aggressively. Most turn cards either put some top pair hands or straights into our range, but this one completely misses us. Furthermore, our opponent won't want to give our check-folding range free cards, so despite our range being polarized, it's important to check-call and/or check-raise at least a few hands on the turn.

However, since nearly all our bluffs are either flush draws or straight draws, we'll frequently improve on the river. This gives our opponent an incentive to raise with many or all of his trips on the turn since we'll frequently improve to beat them on the river.

OOP range after betting flop + turn: 40

River: 8♥8♦6♣3♣7♣

Total combos: 36 (- A♣7♣, - 8♣7♣, - 7♣5♣, - 9♣7♣)

Value betting range: KK-QQ(12), 54s(4), A♣T♣, A♣9♣, A♣5♣, K♣J♣, K♣T♣, Q♣J♣, Q♣T♣ = 23

Bluffing range: 75s(3), 97s(3) = 6

Total combos bet: 29

River Cbet percent: 80.5%

Total combos checked: 7

Check-raising range: 87s(1), 99(1) = 2

Check-calling range: 99(2)

Percent of checks defended: 57.1%

452 Part Sixteen: Sample Hands

Analysis: On the river, we should usually be betting small since our range is capped relatively low and our opponent can still have many full houses and nut flushes. Hands like kings and queens especially need to either bet small or check-call on the river, as there simply isn't much value in a large bet and being raised turns our hand into a bluff catcher.

However, since the river improved so many hands in our bluffing range, it may be possible to nearly always bet this river. (It depends on our bet sizing, as this determines how aggressively we can bluff.) But when we do bet, we should bet small, as we'll rarely beat hands in our opponent's value raising range.

Hand No. 6: Cutoff versus the Button

First, let's examine the caller on the button.

Button vs CO cold calling range: TT-22, AQt-AJt, KQt, AQs-A8s, KQs-KTs, QJs-QTs, JTs-J9s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s, 54s, 1 AA combo, 3 AK combo = 182 combos

Flop: J♣4♥4♦

Total combos: 167

Desired combos defended: $167 \times 0.6 = 100$

Value raises: 0

Bluff raises: 0

Calls: AA(1), 54s(2), 44(1), TT-66(30), AJ(12), KQ(16), KJs(3), QJs(3), JTs(3), J9s(3), AK(3), AQ(16), ATs(3), KTs(3), QTs(3), T9s(3), T8s(3), 98s(3) = 111

Total combos defended: 111 (66.5%)

Analysis: I don't like raising since we're in position and there are no possible draws, so my strategy is to only defend by calling. I'm on the fence for whether or not to call with hands like king-queen offsuit and ten-eight suited, but decided to call with them figuring they can bluff later streets as needed.

Sample Hands 453

Positional range after flatting flop: AA(1), 54s(2), 44(1), TT-66 (30), AJ(12), KQ(16), KJs(3), QJs(3), JTs(3), J9s(3), AK(3), AQ(16), ATs(3), KTs(3), QTs(3), T9s(3), T8s(3), 98s(3) = 111

Turn: J♣4♥4♦5♦

Total combos: 111

Desired combos defended: 111 x 0.6 = 67

Value raises: AA(1)

Bluff raises: AQ(1)

Calls: 54s(2), 44(1), AJ(12), KJs(3), QJs(3), JTs(3), J9s(3), TT-77(24), A♦Q♦, A♦T♦, K♦Q♦, K♦T♦, Q♦T♦, T♦9♦, T♦8♦, 9♦8♦, AK(3) = 62

Total combos defended: 64 (57.8%)

Analysis: We're defending a bit less than 60 percent of the time on the turn, but this shouldn't be a problem since we called a bit extra on the flop. The turn card improved very few hands in our range and with such few nut type hands, it's hard to defend aggressively against our opponent's bets. He also may bet bigger than 75 percent of the pot.

Positional range after flatting flop + turn: 54s(2), 44(1), AJ(12), KJs(3), QJs(3), JTs(3), J9s(3), TT-77(24), A♦Q♦, A♦T♦, K♦Q♦, K♦T♦, Q♦T♦, T♦9♦, T♦8♦, 9♦8♦, AK(3) = 62

River: J♣4♥4♦5♦Q♣

Total combos: 61 (- Q♣J♣)

Desired combos defended: 61 x 0.6 = 37

Value raises: 44(1), 54s(2), QJs(2) = 5

Bluff raises: AK(2) = 2

Calls: AJ(12), KJs(3), JTs(3), J9s(3), TT(6), A♦Q♦, K♦Q♦, Q♦T♦ = 30

Total combos defended: 37 (60.7%)

454 Part Sixteen: Sample Hands

Analysis: This is probably the worst card in the deck for us since we flatted no ace-queen offsuit hands on the turn. As such, we'll have to call with some pairs of tens if we want to prevent our opponent from being able to profitably bet any two cards when he bets 75 percent of the pot.

Now let's take a look at the cutoff opener.

CO opening range: AA-22, AKo-ATo, KQo-KJo, QJo, AKs-A2s, KQs-K6s, QJs-Q7s, JTs-J8s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s-64s, 54s = 314

Flop: J♣4♥4♦

Total combos: 285

Value betting range: 54s(2), AA-QQ(18), AJ(12), KJ(12), 99(6) = 50

Draw betting range: 0

Bluffing range: AKo(13), KQ(16), ATs-A5s(18), A3s-A2s(6), KTs-K6s(15), QTs-Q8s(9), T9s(3), T8s(3), 98s(3), 65s(3), 87s(3) = 92

Total combos bet: = 142

Flop Cbet percent: 49.8%

Total combos checked: = 143

Check-raising range: A4s(2), 64s(2), 76s(3), 75s(3) = 10

Check-calling range: 44(1), JJ(3), AKs(3), QJ(12), JTs(3), J9s(3), J8s(3), TT(6), 88-77(12), AQ(16) = 62

Percent of checks defended: 50.3%

EV of opponent's air on flop:

$$(0.502)[(8)(0.497) - (6)(0.503)] = 0.48 \text{ big blinds}$$

Analysis: On this flop texture, I think that king-jack can be both bet and checked. Worse jacks will regularly call down, but we'll also occasionally lose at showdown and our opponent will sometimes bluff raise us on the turn or river. In addition, giving a free card with king-jack is not very risky, and we'll be able to pick off bluffs from our opponent by checking.

Sample Hands 455

This is a relatively easy board to play out of position since many of our check-calling hands, such as queen-jack, are not likely to be outdrawn. It's also a board texture where high flop, turn, and river betting frequencies seem very reasonable since we're not likely to have many marginal hands on later streets which want to check-call.

Furthermore, the only very strong hands in our opponent's range are 1 combo of fours, two of five-four suited, and 1 of aces for 4 combos total. This means we're unlikely to be raised on the flop or turn and should consider betting larger and closer to equal fractions of the pot on all three streets. Granted, we'll sometimes end up value betting the worse hand, but if our opponent has trips and we have an overpair, we'll likely lose a huge pot no matter what size we bet on the flop.

Additionally, note my bet on the flop with nines. That's because, on the turn, it's good to have some hands in my range which can check-call, and I can get value from overcards and some weaker pairs. Furthermore, this may make my opponent fold some high equity hands if he doesn't defend all his KQ, KTs, and QTs type hands.

Lastly, notice this is not a flop texture where our opponent will likely recklessly bet just because he can profitably bet any two cards. He has many marginal strength hands which can comfortably check back, and if he does bet, we aren't folding our ace-queen hands to a bet anyway. Check-calling ace-king would also be an option, but I chose to bet it since it can be comfortably value bet on ace and king turns.

OOP range after betting flop: 142

Turn: J♣4♥4♦5♦

Total combos: 140 (- A♦5♦, - 6♦5♦)

Value betting range: AA-QQ(18), AJ(12), KJ(12) = 42

Bluffing range: A♦T♦-A♦5♦(6), A♦3♦-A♦2♦(2), K♦T♦-K♦6♦(5), K♦Q♦, Q♦T♦-Q♦8♦(3), A♦K♦, T♦9♦, T♦8♦, 9♦8♦, 8♦7♦, 6♦5♦, AK(8), KQ(11) = 42

456 Part Sixteen: Sample Hands

Total combos bet: 84

Turn Cbet percent: 60%

Total combos checked: 56

Check-raising range: 0

Check-calling range: 54s(2), AK(7), 99(6) = 15

Percent of checks defended: 26.7%

Analysis: Notice despite “bluffing” with ace-king on the flop — most players would call it a bluff since it can make pocket pairs which beat it fold — the hand now can be check-called on the turn. Many of the hands our opponent bluffs with will lose to ace-king at showdown, and it still has a reasonable chance to improve on the river. Because of this, I chose to both bet some ace-king hands and check-call others.

Betting large on the turn is again a reasonable option since our opponent did not likely improve. Therefore, this allows us to more easily get all-in by the river, which we’ll probably want to do with many of our overpairs.

Also, since our range is quite polarized on the turn, it should not be overly surprising that we’re not defending our turn checks aggressively. Instead, we’re betting at a high frequency and defending our turn checks once in a while. That said, check-raising some hands on the turn would also be fine to prevent our opponent from being able to easily bet his marginal strength hands for one street of value. This requires us to sometimes bet and sometimes check-raise our overpairs and bluffs.

OOP range after betting flop + turn: 84

River: J♣4♥4♦5♦Q♣

Total combos: 78 (- 3 QQ, - 3 KQ)

Value betting range: AA-KK(12), QQ(3), KQ(8), Q♦T♦-Q♦8♦(3), AJ(12) = 38

Bluffing range: AK(8), A♦T♦-A♦5♦(6) = 14

Total combos bet: 52

River Cbet percent: 66.7%

Total combos checked: 26

Check-raising range: 0

Check-calling range: KJ(9) = 9

Percent of checks defended: 34.6%

Analysis: We're able to continue betting the river pretty aggressively as well as defend some of our checks by check-calling king-jack. Although we could defend a few more of our checks by check-raising some strong hands and some bluffs, it doesn't seem overly concerning if our opponent is able to profitably bet any two cards once we check. After all, he only gets the opportunity to bluff about one-third of the time, and it's not usually worth the effort to try to get everything to balance perfectly.

Hand No. 7: Cutoff versus the Button

First, let's examine the caller on the button.

Button cold calling range vs. middle position: TT-22, AQo-AJo, KQo, AQt-A8s, KQs-KTs, QJs-QTs, JTs-J9s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s, 54s, 1 AA combo, 3 AK combo = 182 combos

Flop: A♠8♦7♦

Total combos: 155

Desired combos defended: 93

Value raises: A8s(2), 87s(3), 88(3), 77(3), T♦9♦, 6♦5♦, J♦9♦ = 14

Bluff raises: 97s(3), 76s(3), 75s(3), JTs(3), 54s(3), 86s(3), 6♦6x(3) = 21

Calls: AK(2), AQ(12), AJ(12), ATs(3), A9s(3), K♦Q♦, K♦J♦, K♦T♦, Q♦J♦, Q♦T♦, J♦T♦, 5♦4♦, TT(6), 99(6), T8s(3), 98s(3), T9s(3), 65s(3), K♣Q♣, K♣J♣ = 65

Total combos defended: 100 (64.5%)

458 Part Sixteen: Sample Hands

Analysis: This is a pretty standard defending range. Whether it's best to call or raise with ace-king is probably close, but I feel we're already raising aggressively enough as it is and it's nice to have some strong hands in our flatting range.

Positional range after flatting flop: AK(2), AQ(12), AJ(12), ATs(3), A9s(3), K♦Q♦, K♦J♦, K♦T♦, Q♦J♦, Q♦T♦, J♦T♦, 5♦4♦, TT(6), 99(6), T8s(3), 98s(3), T9s(3), 65s(3), K♠Q♠, K♣J♣ = 65

Turn: A♠8♦7♦8♣

Total combos: 63 (- T♠8♠, - 9♣8♣)

Desired combos defended: $63 \times 0.6 = 38$

Value raises: T8s(2), 98s(2) = 4

Bluff raises: J♦T♦, 5♦4♦, 65s(2) = 4

Calls: AK(2), AQ(12), AJ(12), ATs(3), A♦T♦, K♦Q♦, K♦J♦, K♦T♦, Q♦J♦, Q♦T♦ = 35

Total combos defended: 43 (68.3%)

Analysis: This is another normal defending range, as we're calling with all of our top pair hands and bluff raising with hands which retain their equity well. Our range is strong so we're able to defend over two-thirds of it with little difficulty.

Note I decided to raise the 5♦4♦ to encourage our opponent to fold a better flush draw. This is a play I'm quite fond of and feel is easy to overlook, especially since it's unfortunate when our opponent 3-bets and makes us fold our flush draw and gutshot. However, I don't think he will often 3-bet on the turn, especially since the board is paired, so it's probably worth the risk.

Positional range after flatting flop + turn: AK(2), AQ(12), AJ(12), ATs(3), A♦T♦, K♦Q♦, K♦J♦, K♦T♦, Q♦J♦, Q♦T♦ = 35

River: A♠8♦7♦8♣5♠

Total combos: 35

Desired combos defended: $35 \times 0.6 = 21$

Sample Hands 459

Value raises: 0

Bluff raises: 0

Calls: AK(2), AQ(12), AJ(7) = 21

Total combos defended: 21

Analysis: Since we're only calling with some ace-jack hands, calling and folding must both have an expectation of zero. And this seems reasonable since it's unlikely our opponent would ever be value betting ace-jack or worse and our hand is a bluff catcher.

Now let's take a look at the cutoff opener.

Cutoff opening range: AA-22, AKo-ATo, KQo-KJo, QJo, AKs-A2s, KQs-K6s, QJs-Q7s, JTs-J8s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s-64s, 54s = 314

Flop: A♣8♦7♦

Total combos: 267

Value betting range: A8s(2), A7s(2), 87s(3), AK(12), AQ(11), TT(6) = 36

Draw betting range: K♦6♦, Q♦J♦, Q♦T♦, Q♦9♦, J♦T♦, 6♦5♦, 6♦4♦, 5♦4♦, T9s(3), 65s(3) = 14

Bluffing range: 99(6), 66(6), J8s(3), K8s(3), Q8s(3), 98s(3), 97s(3), 76s(3), 75s(3), J9s(3), JTs(3), 64s(3), 54s(3), KQ(7), K♦Jx(3), Q♦Jx(3), K♣J♣, Q♣J♣, K♣T♣, K♣9♣, K♣6♣, Q♣J♣, Q♣T♣, Q♣9♣ = 66

Total combos bet: 116

Flop Cbet percent: 43.4%

Total combos checked: 151

Check-raising range: 77(3), 88(3), T8s(3), 86s(3), K7s(3), Q7s(3), T♦9♦ = 19

Check-calling range: AA(3), A♦Q♦, A♦9♦, A♦6♦-A♦2♦(5), AJ(12), AT(12), KK(6), QQ(6), JJ(6), K♦Q♦, K♦J♦, K♦T♦, K♦9♦ = 56

Percent of checks defended: 49.7%

460 Part Sixteen: Sample Hands

Minimum EV of our opponent's air on flop:

$$(0.566)[(8)(0.503) - (6)(0.497)] = 0.59 \text{ big blinds}$$

Analysis: Since many flush draws and straight draws are possible, position is more valuable than it would be on a dryer ace high flop texture such as the A♠7♦3♣. Nevertheless, this isn't an unreasonably difficult board to play out of position, and check-raising sets and bluffs should prevent our opponent from being able to recklessly bet once we check.

Notice I'm betting tens and nines, and neither is really a value bet or a bluff, and this is being done to make king-queen and king-jack type hands fold, and if he does call, he may check back on the turn with a worse hand and allow us to win at showdown. This is a great example of why the terms "value bet" and "bluff" don't always work well, but I've got to put these hands somewhere when organizing my ranges. The same concept applies to hands such as king-eight and queen-eight suited.

Also notice if we never check-call any flush draws, all the hands in our check-calling range will have showdown value and this makes it difficult to effectively bluff on later streets (since the same hands we're bluffing with will likely win by checking anyway). It's tempting to only check-call with marginal strength made hands on the flop since they work so well in this fashion, but this results in our range being unbalanced.

OOP range after betting flop: 116

Turn: A♠8♦7♦8♣

Total combos: 110 (- A♣8♣, - 8♣7♣, - J♣8♣, - K♣8♣, - 9♣8♣, - Q♣8♣)

Value betting range: AK(12), 98s(2), K8s(2), A8s(1) = 17

Bluffing range: JT(1), K♦7♦, K♦6♦, Q♦J♦, Q♦T♦, Q♦9♦, J♦T♦, 6♦5♦, 65s(3), T9s(3), J9s(3) = 17

Total combos bet: 34

Turn Cbet percent: 31.0%

Total combos checked: 76

Sample Hands 461

Check-raising range: J8s(2), Q8s(2), T9s(3), 5♦4♦, 6♦4♦ = 9

Check-calling range: AQ(12), 87s(2), A7s(2), TT(6), 99(6) = 28

Percent of checks defended: 48.6%

Analysis: This turn card didn't improve many hands in our range and ace-seven suited is now weaker. Because of this, it's difficult to bet the turn aggressively. Although we'd much prefer the turn card to come a blank which allows us to keep value betting aggressively as well as bet large, sometimes we get a less favorable card.

I also think ace-queen isn't strong enough to value bet, as our opponent won't call down with many worse hands and giving free cards isn't particularly risky. Additionally, betting makes our checking range very weak. Therefore, I think we should just check-call with ace-queen since this punishes our opponent for betting the turn too aggressively.

Another thought that crossed my mind is I should have bet the flop with our A♦X♦ hands. These hands are able to comfortably check-call on any turn card and this keeps our opponent's dominated flush draws in his range. Furthermore, they also do well when facing a flop raise since they beat bluffs and have outs to the nuts when behind. When making ranges, it's important to think back to the previous street and see if there's a way your range can be improved.

Lastly, I'm not sure if check-calling tens and nines will have a positive expectation, especially in practice. Notice we're check-raising the turn reasonably often, which encourages our opponent to bet smaller and gives us a better price on our call, but in reality, most players will bet too much once we check. This makes calling worse than it would otherwise be and further reinforces the fact that betting A♦X♦ hands on the flop and check-calling on the turn may be best.

OOP range after betting flop and turn: 34

River: A♠8♦7♦8♣5♠

462 Part Sixteen: Sample Hands

Total combos: 33 (- 6♦5♠)

Value betting range: AK(12), K8s(2), 98s(2), A8s(1) = 17

Bluffing range: 65s(3), T9s(3), 65s(2) = 8

Total combos bet: 25

River Cbet percent: 75.8%

Total combos checked: 0

Check-raising range: 0

Check-calling range: 0

Percent of checks defended: 0

Analysis: This river misses our range and our opponent's, so we can continue to value bet all our strong hands. We're also able to bet the river quite aggressively and can likely bet large since there aren't many hands in our opponent's range which are better than bluff catchers.

It's possible we should check-call some hands on the river, but there aren't many (if any) hands which want to bet the flop and turn then check-call the river. That's because our turn bet will be raised reasonably often, so marginal strength hands such as ace-queen are probably more profitable to check-call.

Remember, it's impossible to get everything to balance perfectly, so don't waste your time worrying about small details. Once you feel you have a good sense for how this board texture should be approached, it's likely time to move on as hands which are close can often be played multiple ways in theory, and in practice you should always try to take the line which best exploits your opponent.

Hand No. 8: Cutoff versus the Button

First, let's examine the caller on the button.

Button cold calling range vs. middle position: TT-22, AQo-AJo, KQo, AQs-A8s, KQs-KTs, QJs-QTs, JTs-J9s, T9s-T8s,

Sample Hands 463

98s-97s, 87s-86s, 76s-75s, 65s, 54s, 1 AA combo, 3 AK combo = 182 combos

Flop: Q♦J♦4♣

Total combos: 161

Desired combos defended: $161 \times 0.6 = 97$

Value raises: QJs(3), 44(3), T♦9♦, K♦T♦, A♦9♦, A♦8♦ = 10

Bluff raises: T8s(3), 98s(3), 54s(3), A♣9♣, A♣8♣, 7♣5♣, 6♣5♣ = 13

Calls: AA(1), AQ(12), KQ(12), QTs(3), AJ(12), KJs(3), JTs(3), J9s(3), KTs(3), T9s(3), ATs(3), TT(6), AK(3), A♦T♦, T♦8♦, 9♦8♦, 9♦7♦, 8♦7♦, 8♦6♦, 7♦6♦, 7♦5♦, 6♦5♦, 5♦4♦ = 77

Total combos defended: 100 (62.1%)

Analysis: Since most turn cards will improve some hands in our range (preventing our range from being capped) and giving free cards is relatively risky, it's probably fine to raise all our strong hands. Additionally, even if a set combo or two is slowplayed, it doesn't prevent our opponent from being able to overbet effectively on blank turn cards since we won't have many very strong hands in our range.

Positional range after flatting flop: AA(1), AQ(12), KQ(12), QTs(3), AJ(12), KJs(3), JTs(3), J9s(3), KTs(3), T9s(3), ATs(3), TT(6), AK(3), A♦T♦, T♦8♦, 9♦8♦, 9♦7♦, 8♦7♦, 8♦6♦, 7♦6♦, 7♦5♦, 6♦5♦, 5♦4♦ = 77

Turn: Q♦J♦4♣6♣

Total combos: 77

Desired combos defended: $77 \times 0.6 = 46$

Value raises: 0

Bluff raises: 0

Calls: AA(1), AQ(12), KQ(12), QTs(3), AJ(12), KJs(3), A♦T♦, T♦8♦, 9♦8♦, 9♦7♦, 8♦7♦, 8♦6♦, 7♦6♦ = 50

Total combos defended: 50 (64.9%)

464 Part Sixteen: Sample Hands

Analysis: The turn card is unfortunately a blank and thus puts no strong hands in our range. While it's easy to think we must have done something wrong on the previous street, it's important to remember our opponent cannot bet the turn (much less overbet) too often or he'll be unbalanced. So while facing a large bet from a balanced opponent is undesirable, it can only happen occasionally or we can exploit him by frequently calling.

It's still quite easy to call a balanced range against a normal sized bet, and we don't need to call with any made hand worse than king-jack suited (though calling with a few weaker jacks as well may be fine). Furthermore, notice the turn card improved most of our flush draws by giving us either a pair or a straight draw.

Positional range after flatting flop + turn: AA(1), AQ(12), KQ(12), QTs(3), AJ(12), KJs(3), A♦T♦, T♦8♦, 9♦8♦, 9♦7♦, 8♦7♦, 8♦6♦, 7♦6♦ = 50

River: Q♦J♦4♦6♣2♠

Total combos: 50

Desired combos defended: $50 \times 0.6 = 30$

Value raises: 0

Bluff raises: 0

Calls: AA(1), AQ(12), KQ(12), QTs(3), AJ(2) = 30

Total combos defended: 30

Analysis: Since our range is condensed on the river and our opponent's range is polarized, it makes no sense to raise and we should defend only by calling. Despite the turn and river coming blanks, our river calling range includes few hands weaker than king-queen. In fact, we're only calling with two out of the twelve ace-jack hands in our range.

This hand showcases why it's hard to get three streets of value when out of position with marginally strong hands. If our opponent decides to bet 75 percent of the pot on the flop, turn, and river with king-queen, he's not going to get much value on his

Sample Hands 465

river bet. More specifically, the river bet sizing formula would almost certainly suggest a 75 percent pot sized bet is too big.

Now let's take a look at the cutoff opener.

Cutoff opening range: AA-22, AKo-ATo, KQo-KJo, QJo, AKs-A2s, KQs-K6s, QJs-Q7s, JTs-J8s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s-64s, 54s = 314 combos

Flop: Q♦J♦4♠

Total combos: 272

Value betting range: AA(6), KK(6), AQ(12), QJ(9) = 33

Draw betting range: KTs(3), T9s(3), K♦T♦, K♦9♦, K♦8♦, K♦7♦, K♦6♦, T♦9♦, T♦8♦, 9♦8♦, 9♦7♦, 8♦7♦, 8♦6♦, 7♦6♦, 7♦5♦, 6♦5♦ = 20

Bluffing range: TT(6), 99(6), AK(15), AT(15), K9s(3), T8s(3), 98s(3), A4s(3), 64s(3), 54s(3), A♠9♠-A♠5♠(5), A♠3♠, A♠2♠ = 67

Total combos bet: 120

Flop Cbet percent: 44.1%

Total combos checked: 152

Check-raising range: JJ(3), 44(3), A♦7♦, A♦6♦, A♦5♦, A♦3♦, A♦2♦, JTs(3), J9s(3), J8s(3), 6♠5♣ = 21

Check-calling range: QQ(3), KQ(12), QTs(3), Q9s(3), Q8s(3), Q7s(3), AJ(12), KJ(12), A♦K♦, A♦T♦, A♦9♦, A♦8♦, A♦4♦, 6♦4♦, 5♦4♦ = 58

Percent of checks defended: 52.0%

EV of opponent's air on flop:

$$(0.559)[(8)(0.480) - (6)(0.520)] = 0.40 \text{ big bets}$$

Analysis: Although many players bet king-queen on this flop with little thought, it's unlikely our opponent will call down with worse if we bet all three streets. That's because, on this flop, typical button calling ranges have king-queen or better 19 percent of the time, so it's unlikely he'll have to call down with many worse hands. Additionally, it's important we adequately defend our

466 Part Sixteen: Sample Hands

checks against strong opponents, and check-calling helps accomplish this.

Since there are two high cards on the flop, it's not overly difficult to check-call aggressively. Hands such as queen-ten, ace-jack, and king-jack make excellent check-calls, and by check-calling with some flush draws as well, we'll be able to effectively bluff the river if our opponent checks back the turn.

One of the hardest aspects of this hand is determining how to divide our flush draws among our betting, check-calling, and check-raising range. I tried to check-call flush draws with showdown value that could be check-called twice, as well as bet weak flush draws with no showdown value to encourage our opponent to fold a better hand.

OOP range after betting flop: 120

Turn: Q♦J♦4♠6♣

Total combos: 119 (- 6♣4♣)

Value betting range: AA(6), KK(6), QJ(6), AQ(10) = 28

Bluffing range: KTs(3), T9s(3), K♦T♦, K♦9♦, K♦8♦, K♦7♦, K♦6♦, T♦9♦, T♦8♦, 9♦8♦, 9♦7♦, 8♦7♦, 8♦6♦, 7♦6♦, 7♦5♦, 6♦5♦, AK(15) = 35

Total combos bet: 63

Turn Cbet percent: 52.9%

Total combos checked: 56

Check-raising range: 64s(2), QJ(3), AT(5) = 10

Check-calling range: TT(6), AQ(2) = 8

Percent of checks defended: 32.1%

Analysis: In this spot, there are many important concepts at play. The first, and perhaps the most important, is we should strongly consider overbetting. Many straight and flush draws were possible on the flop, so it's unlikely our opponent would slowplay his strong hands. Because of this, he likely has no raising range on the turn. Furthermore, our flop betting range was quite polarized, so there are few hands (in our range) which prefer to bet small.

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Also note most of our bluffs have a considerable amount of equity and will often improve on the river. Since several of them will likely become value hands, we're able to bluff a bit more aggressively on the turn.

Additionally, notice our range includes no medium strength hands which work particularly well as check-calls. This encourages our opponent to bet smaller since we won't frequently be check-calling and will instead usually either check-fold or check-raise. Thus, when our opponent bets small, check-calling tens or nines may be profitable since we're getting such a good price and he won't usually be value betting middle pair hands anyway. And since I don't want my check-calling range to be too transparent, my strategy is to check-call a couple of ace-queen hands to protect my check-calling range.

Finally, understand we could have bet a few ace-jack or queen-nine suited type hands on the flop so we'd have some holdings in our range which work well as check-calls on blank turns. In retrospect, it may have been correct to bet a few of these hands (on the flop) for this very reason. However, on the flop, these hands do poorly when facing a raise and don't particularly fear giving free cards, so while betting a few of them is probably best, I wouldn't bet too many.

OOP range after betting flop + turn: 63

River: Q♦J♦4♠6♣2♠

Total combos: 63

Value betting range: AA(6), KK(6), QJ(6), AQ(10) = 28

Bluffing range: AK(15), KTs(1) = 16

Total combos bet: 44

River Cbet percent: 69.8%

Total combos checked: 19

Check-raising range: 0

Check-calling range: 0

Percent of checks defended: 0

468 Part Sixteen: Sample Hands

Analysis: Since our range is very polarized after marking a large turn bet, I wouldn't worry about defending our checks on a blank river. It's not usually a problem if our opponent can profitably bluff the river with his missed draws since his turn call was so expensive, and it's again not worth our time trying to get everything to balance perfectly. Instead, I'd rather bet big with all our value hands and bluff aggressively.

It's also tough to say whether it's best to bluff with ace-king since it has better removal effects or with a missed flush draw since it has no showdown value. In practice, it may be better to bluff with hands which have less showdown value since our opponent may call our turn bet with a draw and not bluff the river. But in theory, I think it's better to bluff ace-king since it blocks some ace-queen and king-queen hands, especially since these holdings make up most of our opponent's calling range.

Hand No. 9: Cutoff versus the Button

First, let's examine the caller on the button.

Button cold calling range vs. middle position: TT-22, AQo-AJo, KQo, AQt-A8s, KQs-KTs, QJs-QTs, JTs-J9s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s, 54s, 1 AA combo, 3 AK combo

Flop: 8♦4♣3♠

Total combos: 167 = 100

Desired combos defended: 167 x 0.6 = 100

Value raises: AA(1), 44(3), 33(3), A♣9s, A♣T♣, 7♣6♣, 7♣5♣, 6♣5♣ = 12

Bluff raises: 76s(3), 75s(3), 54s(3), 5♣5x(3), T♦9♦, 9♦7♦, J♦9♦ = 15

Calls: 88(3), TT-99(12), 77(6), A♣Q♣, A♣J♣, K♣Q♣, K♣J♣, K♣T♣, Q♣J♣, Q♣T♣, J♣T♣, J♣9♣, T♣9♣, 9♣7♣, A8s(3), T8s(3), 98s(3), 87s(3), 86s(3), 65s(3), AK(3), AQ(15), KQ(7), A♣Jx(3), A♦J♦, A♦T♦ = 80

Sample Hands 469

Total combos defended: 107 (62.6%)

Analysis: It's really amazing how much easier it is to defend in position than out of position. This is a flop texture that's extremely difficult to play well out of position, but in position, it's quite easy to tell which hands make reasonable calls, raises, and folds. That's also why when analyzing hand examples, it's best to start with the positional range first, especially for newer players.

Notice I'm emphasizing calling with hands that will keep dominated hands in our opponent's range and raising with hands which make hands that dominate us fold. For example, A♠Jx has some good bluff raising properties as it can turn top pair or the nut flush draw, but raising makes our opponent fold weaker ace-x and jack-x hands. For this reason, calling is probably best even if raising is also profitable.

Likewise, I'm raising hands like the J♦9♦ and T♦9♦ to encourage him to fold hands like ace-jack and ace-ten. This reduces how often we'll turn top pair and be outkicked. Additionally, these hands can effectively double barrel when a straight or flush draw is turned.

Positional defending range after flatting flop: 88(3), TT-99(12), 77(6), A♠Q♠, A♠J♠, K♠Q♠, K♠J♠, K♠T♠, Q♠J♠, Q♠T♠, J♠T♠, J♠9♠, T♠9♠, 9♠7♠, A8s(3), T8s(3), 98s(3), 87s(3), 86s(3), 65s(3), AK(3), AQ(15), KQ(7), A♠Jx(3), A♦J♦, A♦T♦ = 80

Turn: 8♦4♠3♠T♥

Total combos: 76 (-3 TT, - T8s)

Desired combos defended: $76 \times 0.6 = 46$

Value raises: 88(3), T8s(2) = 5

Bluff raises: 65s(3), 9♠7♠, J♠9♠ = 5

Calls: TT(3), A♦T♦, A8s(3), 98s(3), 87s(3), 86s(3), 99(6), 77(6), A♠Q♠, A♠J♠, K♠Q♠, K♠J♠, K♠T♠, Q♠J♠, Q♠T♠, J♠9♠, T♠9♠ = 37

Total combos defended: 47 (61.8%)

470 Part Sixteen: Sample Hands

Analysis: I'm not sure whether to call or raise with tens. By raising, we may be raising too frequently, but I also dislike giving cheap cards on this board texture. In practice, against most players, I'd probably raise, especially since few players overbet on blank rivers. But I wouldn't be surprised if, in theory, calling is the superior play.

Positional defending range after flatting flop + turn: TT(3), A♦T♦, A8s(3), 98s(3), 87s(3), 86s(3), 99(6), 77(6), A♣Q♣, A♣J♣, K♣Q♣, K♣J♣, K♣T♣, Q♣J♣, Q♣T♣, J♣9♣, T♣9♣ = 37

River: 8♦4♣3♠T♥J♣

Total combos: 37

Desired combos defended: $37 \times 0.6 = 22$

Value raises: TT(3), J♣T♣ = 4

Bluff raises: 98s(2) = 2

Calls: A♦T♦, A♣J♣, K♣J♣, K♣T♣, Q♣J♣, Q♣T♣, J♣9♣, T♣9♣, 99(6) A8s(2) = 16

Total combos defended: 22

Analysis: This is a pretty tough river card as we now only have a few top pair hands. As such, we're required to either call with nines or allow our opponent to profitably bluff with any two cards. However, since he will not be bluffing with a hand stronger than nines or value betting a weaker hand, it's still a bluff catcher.

We also can fold enough here to allow our opponent to profitably bluff with any two cards if we think the river card is particularly atrocious, but I don't think that's the case. Additionally, having tens in our range helps significantly as this makes our opponent's river overbets less effective.

Now, let's look at the cutoff opener.

Sample Hands 471

Cutoff opening range: AA-22, AKo-ATo, KQo-KJo, QJo, AKs-A2s, KQs-K6s, QJs-Q7s, JTs-J8s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s-64s, 54s = 314

Flop: 8♦4♣3♠

Total combos: 293

Value betting range: QQ-99(24), 77(6), 66(6), A♣8♠, K♣8♠, T♣8♠, 9♣8♠, 8♣7♠, 8♣6♠ = 42

Draw betting range: A♣5♣, Q♣J♣-Q♣7♣(5), J♣T♣-J♣8♣(3), K♣Q♣, 7♣6♣, 7♣5♣, 65s(3) = 15

Bluffing range: A5s(3), A2s(3), 75s(3), 76s(3), AK(15), KQ(7), A♣Tx(3), QJ(7), A♦T♦, A♦9♦, A♦7♦, A♦6♦, K♦J♦, K♦T♦, K♦9♦, K♦6♦, J♦T♦, T♦9♦, 9♦7♦ = 55

Total combos bet: 112

Flop Cbet percent: 38.2%

Total combos checked: 181

Check-raising range: AA(3), KK(6), 88(3), 44(3), 33(3), A♣9♠, A♣2♠, 6♣5♣, K♣Jx(3), AJ(7), Q♦T♦, Q♦9♦, J♦9♦, 5♣5x(3), A4s(3), 64s(3), 54s(3), A3s(3) = 49

Check-calling range: AA(3), AQ(15), A8s(2), K8s(2), Q8s(2), J8s(2), T8s(2), 98s(2), 87s(2), 86s(2), A♣K♣, A♣Q♣, A♣J♣, A♣T♣ = 38

Percent of checks defended: 48.1%

EV of opponent's air on flop:

$$(0.618)[(8)(0.519) - (6)(0.481)] = 0.78 \text{ big blinds}$$

Analysis: It's tough to develop ranges for this spot since the cutoff opening range is so wide and this flop is hard to play out of position. Although both the cutoff opening range and the button flatting range have about 50 percent equity and include many strong and weak hands, and since position is so valuable on this board texture, it makes sense to assume the button is in a more favorable position.

It's also important to remember that if we don't defend enough checks on this flop, our opponent will almost always bet. Just as we dislike giving many hands in his range free cards, he

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dislikes giving our check-folding range free cards. While many players on this flop texture prefer to recklessly bet and rarely check-call, this clearly is a weak strategy against a strong opponent. And since I expect our opponent to frequently bet, my strategy is to check-raise all sets as well as some overpairs.

In addition, my strategy includes betting our pair plus flush draw hands since I want to be able to check-call with these hands on the turn. Without them, it would probably be difficult to have flush draws in our turn check-calling range. Additionally, these hands do well when facing a raise on the flop, as they work well as both calls and 3-bets.

When betting a hand like sevens or sixes, we're hoping our opponent folds despite our usually being ahead when called. The reason for betting these hands is to make high equity hands fold, and if our opponent calls, they can be check-called on many turn cards.

Lastly, notice that although the strongest hand in our flop betting range is queens, if the turn is a blank, it will effectively be the nuts. Our opponent isn't likely to slowplay on this flop, so if he does call, we can be confident that many of our holdings are best on many turn cards.

OOP range after betting flop: 112

Turn: 8♦4♣3♠T♥

Total combos: 108 (- AT, -3 TT)

Value betting range: QQ-JJ(12), A♦Tx(2), A♦T♦, K♦T♦, J♦T♦, T♦9♦, Q♠T♠, J♠T♠, 99(6) = 26

Bluffing range: Q♠J♠, Q9s, Q♠7♠, J♠9♠, J♠8♠, K♠Q♠, 7♠5♠, 7♠6♠, A♠5♠, 65s(3), 9♦7♦, J♦9♦, QJ(7), AK(4) = 25

Total combos bet: 51

Turn Cbet percent: 47.2%

Total combos checked: 57

Check-raising range: TT(3), AK(3) = 6

Check-calling range: 77(6), 66(6) A♠8♠, K♠8♠, T♠8♠, 9♠8♠, 8♠7♠, 8♠6♠, AK(8) = 26

Percent of checks defended: 56.1%

Analysis: This is a great example of a spot where using multiple bet sizes is important. Our opponent rarely has queens or jacks beat, so making a large bet with these hands will be a strong play. In contrast, a large bet with a hand like nines will not be effective since he'll have us beat more often.

In addition, I dislike check-calling with nut type hands on this board since it's so wet. Sure, our opponent can overbet all-in when the river comes a complete blank if he knows we can't be strong, but the river won't blank all that often and giving a free card is risky.

Furthermore, it should come as no surprise that we're able to comfortably defend our turn checks since our flop betting range wasn't especially polarized. In other words, we bet hands such as sevens and sixes on the flop knowing they'd likely be check-called on the turn. This was done because it's desirable to make high equity hands fold, and our opponent almost always has two overcards to our sixes.

Lastly, notice I put ace-king in three different ranges. It makes sense to bet it as a bluff, check-call with it for its showdown value and redraw, and check-raise bluff with it. If we always took the same line with this hand, it'd be pretty easy for our opponent to exploit us since we'd have so many combinations of it in our range.

OOP range after betting flop and turn: 51

River: 8♦4♠3♣T♥J♣

Total combos: 47 (-3 JJ, - Q♣J♣)

Value betting range: QQ(6), JJ(3), QJ(6), Q♣9♠, 9♦7♦, A♣J♣, K♣J♣, Q♣J♣, J♣T♣, J♣8♠, J♦9♦, K♣T♣, A♦T♦, A♣Tx(2) = 27

Bluffing range: AK(4), K♣Q♣, Q♣7♠, 7♣6♠, 7♣5♣, A♣5♣, 65s(3) = 12

Total combos bet: 39

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River Cbet percent: 83.0%

Total combos checked: 8

Check-raising range: 0

Check-calling range: Q♠T♠, 99(4) = 5

Percent of checks defended: 62.5%

Analysis: This river card improved many hands in our range, especially since we bet eight combinations of queen-jack on the turn. As such, it's easy to bet the river aggressively. However, on the river, our opponent should have some very strong hands in his range which can raise our bet, so sometimes expect to face a raise, especially when betting smaller.

It of course makes sense to bet the river aggressively when we get an excellent river card for our range. Although it's uncommon to bet the river over 80 percent of the time, it's likely justified here since our range includes so many top pair hands.

Hand No. 10: Cutoff versus the Button

Button cold calling range vs. middle position: TT-22, AQo-AJo, KQo, AQs-A8s, KQs-KTs, QJs-QTs, JTs-J9s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s, 54s, 1 AA combo, 3 AK combo

Flop: K♣9♦6♥

Total combos: 161

Desired combos defended: $161 \times 0.6 = 97$

Value raises: 99(3), 66(3) = 6

Bluff raises: 75s(4), T8s(4), A8s(3) = 11

Calls: AA(1), AK(2), KQ(12), KJs(3), KTs(3), TT(6), A9s(3), J9s(3), T9s(3), 98s(3), 97s(3), QJs(4), QTs(4), JTs(4), 87s(4), 88(6), 86s(3), 76s(3), 65s(3), AQs(3), AJs(3), ATs(3) = 82

Total combos defended: 99 (61.5%)

Analysis: There is a surprising amount of possible straight draws on this board, and for this reason I prefer to raise our sets. It's

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close though, and calling with some sets is probably fine as well. In theory, the expectation of raising and calling is probably the same. But if we always or never raise our sets, our opponent can probably exploit us. Nevertheless, as usual, it's not worth getting bogged down with details when analyzing a board texture.

It's tough to say whether aces or ace-king should be raised. Aces are quite strong, but I dislike their removal effect since it blocks half of our opponent's ace-king combinations. Additionally, since our opponent will not need to call down with any hands worse than ace-king, I'd rather call with it despite the fact that he will sometimes outdraw us with his bluffs.

Also note this board texture is a bit trickier to defend than it would at first seem, mainly because king high flops do not hit our range as well as ace, queen, or jack high flops. If we believe our preflop calling range isn't making enough strong hands on king high flops, then perhaps it should include king-jack offsuit or more ace-king hands. As previously discussed, theory is useful for determining if preflop ranges must be wrong, but there's no way to determine if a range is optimal. So always think back to previous streets when analyzing hands and try to decide if there is a way to improve a previous range.

Positional defending range after flatting flop: AA(1), AK(2), KQ(12), KJs(3), KTs(3), TT(6), A9s(3), J9s(3), T9s(3), 98s(3), 97s(3), QJs(4), QTs(4), JTs(4), 87s(4), 88(6), 86s(3), 76s(3), 65s(3), AQs(3), AJs(3), ATs(3) = 82

Turn: K♣9♦6♥5♠

Total combos: 81 (- 6♣5♠)

Desired combos defended: $81 \times 0.6 = 49$

Value raises: 65s(2) = 2

Bluff raises: 86s(2) = 2

Calls: 87s(4), AA(1), AK(2), KQ(12), KJs(3), KTs(3), TT(6), A9s(3), J9s(3), T9s(3), 98s(3), 97s(3) = 46

Total combos defended: 50 (61.8%)

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Analysis: I chose to call with eight-seven suited rather than raise since no flush draws are possible and our opponent will often be drawing dead against the nuts. We may lose some value by slowplaying if he gets scared by the river, but I prefer to call and encourage him to keep bluffing. Additionally, calling with the nuts will prevent him from being able to overbet effectively on certain river cards.

Whether or not to raise six-five suited is a bit trickier, and while I'm not certain, in my opinion, it's a raise. That's because I want to get value from my opponent's aces, ace-king, and king-queen hands, and dislike allowing him to cheaply see an additional card. Furthermore, our hand blocks most possible sets of sixes and fives (in case they are in his range), and he may not bet pocket kings or nines on the flop. So if we're behind on the turn, it will frequently be to the straight, and he shouldn't have it often enough to justify calling rather than raising.

Also, keep in mind that just because I'm "value raising" it doesn't necessarily mean getting action is best. On the turn, I'm quite happy winning the pot immediately, and certainly don't want to face a 3-bet from someone whose range will almost certainly just include sets, straights, and bluffs.

Positional defending range after flatting flop and turn: 87s(4),

AA(1), AK(2), KQ(12), KJs(3), KTs(3), TT(6), A9s(3), J9s(3), T9s(3), 98s(3), 97s(3) = 46

River: K♦9♦6♥5♣3♣

Total combos: 46

Desired combos defended: $46 \times 0.6 = 28$

Value raises: 87s(4) = 4

Bluff raises: 98s(2) = 2

Calls: AA(1), AK(2), KQ(12), KJs(3), KTs(3), TT(1) = 22

Total combos defended: 28

Analysis: The river card is a blank, but fortunately, since we just called with our straights on the turn, our range isn't capped. This

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allows us to raise the river aggressively as well as forces our opponent to bet smaller.

Despite the river coming a blank and improving no hands in our range, nearly every hand in our calling range is still top pair or better. If the turn or river would have improved more hands in our range, then it wouldn't even be necessary to call with all our top pair hands.

Now let's look at the cutoff opener.

Cutoff opening range: AA-22, AKo-ATo, KQo-KJo, QJo, AKs-A2s, KQs-K6s, QJs-Q7s, JTs-J8s, T9s-T8s, 98s-97s, 87s-86s, 76s-75s, 65s-64s, 54s = 314

Flop: K♣9♦6♥

Total combos: 275

Value betting range: AA(6), AK(12), K9s(2), KQ(12), TT(6), A9s(3), Q9s(3) = 44

Draw betting range: 87s(4) = 4

Bluffing range: QJ(16), QTs(4), JTs(4), T8s(4), 75s(4), Q8s(3), Q7s(3), J8s(3), A8s(3), A7s(3), A5s(3), A4s(3), A3s(3), A2s(3), AQ(8) = 67

Total combos bet: 115

Flop Cbet percent: 41.8%

Total combos checked: 160

Check-raising range: 99(3), 66(3), 86s(3), 76s(3), 65s(3), 64s(3) = 18

Check-calling range: KK(3), QQ-JJ(12), 88-77(12), KJ(12), KTs(3), K8s-K6s(9), J9s(3), T9s(3), 98s(3), 97s(3), AQ(8), AJs(3), ATs(3) = 77

Percent of checks defended: 59.4%

EV of opponent's air on flop:

$$(0.582)[(8)(0.406) - (6)(0.594)] = -0.184 \text{ big blinds}$$

Analysis: I chose to bet king-queen because the button is unlikely to have called with ace-king preflop. While this hand is strong

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enough to bet, it isn't likely strong enough to bet 75 percent of the pot on all three streets, so we'll need to either check at some point or bet smaller.

Since I'm defending 59.7 percent of our flop checks, our opponent cannot make an immediate profit by betting. It's possible that some hands I chose to check-call with, such as ace-queen or sevens, will have a negative expectation, but I think they're slightly profitable. However, this isn't something that can be proven and these hands are undoubtedly tough to play, so make your best guess when designing ranges. New players especially should emphasize playing tighter in close spots.

OOP range after betting flop: 115

Turn: K♣9♦6♥5♠

Total combos: 114 (- 7♣5♠)

Value betting range: AA(6), AK(12), K9s(2), KQ(6) = 26

Bluffing range: A7s(3), Q7s(3), QJ(16), 75s(4) = 26

Total combos bet: 52

Turn Cbet percent: 45.6%

Total combos checked: 62

Check-raising range: 87s(4), QTs(4) = 8

Check-calling range: A9s(3), Q9s(3), TT(6), KQ(6) = 18

Percent of checks defended: 41.9%

Analysis: Everything looks pretty normal on the turn. We're not betting especially aggressively, but it's not difficult to defend a large portion of our turn checks, and this prevents our opponent from being able to profitably call us with weak hands on the flop.

Since not all our king-queen hands are bet, I probably should have a bluffed a bit less aggressively on the flop. Hands like ace-four and ace-trey suited should perhaps have been check-folded, as a tighter flop betting range allows us to bet the turn at a higher frequency. Besides, check-folding a few more hands on the flop doesn't seem problematic since we're already defending so many of our checks.

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OOP range after betting flop and turn: 52

River: K♣9♦6♥5♠3♣

Total combos: 52

Value betting range: AA(6), AK(12), K9s(2), KQ(6) = 26

Bluffing range: QJ(10) = 10

Total combos bet: 36

River Cbet percent: 69.2%

Total combos checked: 0

Check-raising range: 0

Check-calling range: 0

Percent of checks defended: 0

Analysis: The river card is a blank, so our range remains polarized while our opponent's is condensed. I expect him to check back on the river at a high frequency since his range consists mostly of medium strength made hands. Because of this, I don't think we should worry about defending any of our checks, and should instead just continue to value bet with all of our strong hands and the proper amount of bluffs.

Conclusion

With the current state of online poker, it's sometimes easy to get frustrated and remember the "glory years" which occurred when online poker was new. Players often lament thinking about how much money they could make if only they had a time machine which could take them back in time when games were much softer. And while the future of poker may be undetermined, one thing for sure is that dedicated players will keep improving as information becomes more available and they continue to work on their game.

However, while it's true games were much easier in the past, player's frequently exaggerate the current skill level of their opponents and refuse to acknowledge their own numerous leaks. So those who care about winning must put in the necessary work to stay ahead of the learning curve or else they should expect to win less money and have to move down in stakes.

I hope this book succeeded in increasing your understanding of poker theory and gave you the necessary tools to improve your game. Furthermore, I hope every time a leak was found or a misunderstood concept was identified, you got a bit excited. Each one is an opportunity to increase your win rate, and while fixing some leaks may be difficult, hopefully you'll enjoy the process of improving and increasing your understanding of poker. After all, if poker included no difficult concepts, then edges would be harder to find and the game wouldn't be as much fun.

As of right now, there are many significant edges waiting to be developed by talented and dedicated players. Here's a short list of mistakes I believe most players are currently making:

1. Not 3-betting and calling aggressively enough against button opens. Likewise, few players realize how aggressively they

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must defend when they open the button very wide and face a 3-bet.

2. Using one generic bet sizing in spots when large or small bets are more effective. While balancing multiple ranges is hard, it's not usually overly difficult to identify spots where overbets are best and the increased expectation from making a large bet can be significant. Most players don't even bother to think about their bet size before betting, and this leak will become more significant as players continue to improve.
3. Failing to understand how frequencies and ratios change based on the street. It's possible to bluff more aggressively on the flop than on the river since there are still two streets remaining, and few players are currently bluff raising aggressively enough when in position.
4. Recklessly betting as the preflop raiser and not adequately defending their checking range. Balancing multiple ranges is difficult, but it's crucial to defend checks against skilled opponents. Despite initiative having no theoretical value, players often choose to thoughtlessly bet when out of position simply because they haven't put in the effort necessary to learn how to protect their checking range.
5. Few players truly understand why not all equity is created equally and why equity cannot be converted into expected value. This usually causes many small leaks to develop in nearly every aspect of their game.

In addition, players often get worried when good information becomes available, as if that information will be immediately absorbed and no one will make mistakes anymore. But simply understanding a concept when it's explained isn't enough, as you

must be able to apply it quickly while playing. And like most everything else in life, this takes work, practice, and talent.

Continuing with this idea, think about how silly this thought process would be when applying it to any other subject or game with freely available information. Everyone in a college classroom usually has access to all the information necessary to do well in the course (either by reading the textbook or getting lecture notes), yet the ones who excel are usually those who put in the most work. Simply having access to information isn't enough.

Moreover, I'd recommend against overwhelming yourself trying to implement too many new concepts at once. There is no magic pill, and all leaks take time to fix. That is, trying to fix too many at the same time may cause your game to fall apart, so it's better to focus on one or two leaks and methodically try to fix them before moving on to others. And while drastic measures are sometimes necessary to fix previously misunderstood concepts, it's usually easier to continuously improve and tweak your game rather than rebuild it completely from scratch.

Lastly, I'd like to thank you for reading *Applications of No-Limit Hold 'em; A Guide to Understanding Theoretical Sound Poker* and wish you luck. Hopefully, this book got you excited not only about poker but also with how applying math and theory can be useful for shedding light on complex situations even if a solution cannot be found. So always remember to check your thought process for contradictions, and get excited when one is discovered as that means you've found an opportunity to improve.

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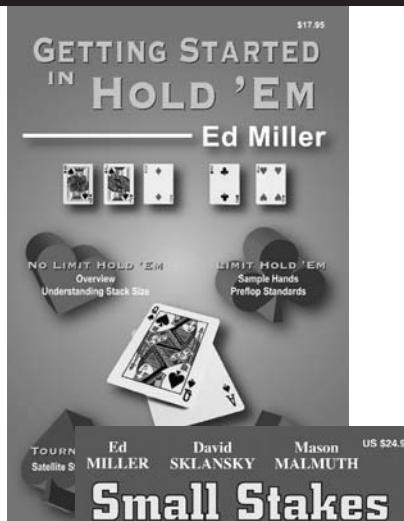
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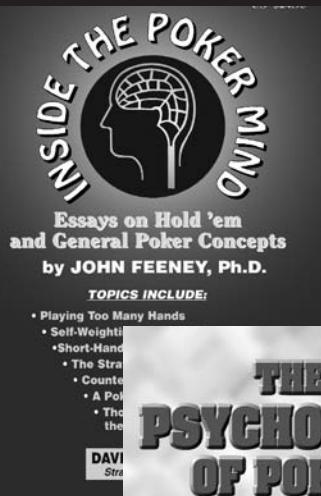


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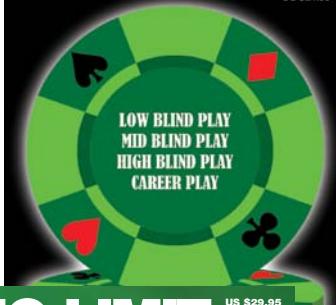
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