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Round 3

An Introduction to Card Counting

Chance favors the prepared mind.
—Louis Pasteur

You may be wondering what makes blackjack different from other gambling games. Why is it that a skilled player can beat blackjack, but has no hope of ever beating a game like craps over the long term? It boils down to the mathematical concept of independent and dependent trials.

In games like craps, roulette, slot machines, big six, Let It Ride, and Caribbean Stud, each and every round is *independent* from all other rounds. Even if a shooter has thrown a natural on four straight crap hands, the chances of success or failure on the next hand do not change. In fact, there is no information whatsoever to be gained by studying the outcome of previous trials.[24] There is no point in trying

[24] The statement is strictly true for fair equipment played in a fair manner. See Vancura's *Smart Casino Gambling* for a discussion of some novel attempts to beat faulty casino roulette or state lottery equipment.

to jump in on "hot" streaks and exit early on "cold" streaks; there is no predictive ability.

In blackjack, successive hands are *dependent* events. This means that past events can and do influence what happens in the future. Specifically, the cards already played affect the composition of the remaining deck, which in turn affects your future chances of winning.

Consider a single-deck blackjack game. If, in the first round after a shuffle, player one is dealt a pair of aces, while players two and three each receive naturals, then we have useful information about what may take place in the future. First, we know that no naturals can appear in the second round. Why? Because all four aces have already appeared in round one. In this instance, the players are at a severe disadvantage (and the house is at a correspondingly high advantage). Card counting identifies those times when the deck composition favors the player, allowing us to bet more when we have the advantage.

We note that baccarat, like blackjack, is a game of dependent events. However, in the case of baccarat, only a tiny advantage can be gained through the tracking of cards. This comes about because the banker and player draw to very similar fixed sets of rules, the result being that no card strongly favors either the player or the dealer.[25]

In Chapter 2 we learned that by finding a good blackjack game and playing basic strategy, we can chop the house advantage down to between 0% and 0.5%. Keeping track of the cards (counting) will allow us to push over the top to secure an advantage.

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[25] For a further discussion of baccarat, see Thorp's *The Mathematics of Gambling*, Griffin's *The Theory of Blackjack*, or Vancura's *Smart Casino Gambling*.

COUNTING GUMBALLS

To illustrate the concept of dependent trials, let's take a step back into our childhood.

You're at the local grocery store, and standing before you is a gumball machine filled with exactly 10 white and 10 black gumballs. You know this because you saw the store manager refill it just five minutes ago. All the balls are thoroughly mixed together, and there's a line of kids waiting to purchase them.

Your friend, being the betting type and needing only a couple more dollars to buy that model airplane he's been eyeing, makes the following proposition. You are allowed to bet $1 (let's pretend we're rich kids) whenever you wish that the next ball to come out will be white. If a white ball comes out, you win $1. If a black ball comes out, you lose $1. Sounds like a simple enough game, you say to yourself.

If you bet right off the top, there are a total of 20 gumballs, of which 10 will win for you. Your chance of winning is thus 10/20, or simply 1/2. Not surprisingly, your chance of losing is also 1/2. So your expected outcome is simply:

$$\textit{Expected Outcome}_{\textit{Insurance}} = \frac{1}{2}(+1) + \frac{1}{2}(-1) = 0$$

The expected outcome of 0 implies that, over the long run, you are expected to neither win nor lose money if you bet on the very first ball. Of course, each individual wager will result in either a $1 win or a $1 loss, but over time your *expectation* is to net 0 on this 50/50 proposition.

Let's say, however, that one gumball has already come out, and you know that it was white.

Since there are now 10 black balls (losers) and only 9 white balls (winners) left, making the bet would place you at a disadvantage. Your chance of winning is 9/19, but your chance of losing is 10/19. The expected outcome has become:

$$\textit{Expected Outcome}_{\textit{Insurance}} \quad \frac{4}{9}(+1) + \frac{5}{9}(\ \ 1) \qquad \frac{1}{9}$$

For every $1 you wager on white at this point, you expect to lose 1/19 of $1, or a little more than 5¢. That is, in the long run your expectation is to lose 5.26% of your wager. Again, each individual wager will result in either a $1 win or a $1 loss, but over the long haul you will lose more often than win, which leads to your demise at an average rate of 5¢ per play.

Now consider a situation where there are 10 white and 9 black gumballs left. In this case, you have the advantage, and it's times like these that you will go ahead and make the bet. Following the above example, it's easy to see that the expectation is +5.26%. Every bet you make in this situation is a long-run moneymaker.

Clearly, if your intention is to play this game for profit, you should play only when you have a positive expectation, and never play when the expectation is negative. So the question is: How can you identify the times when making the bet is favorable?

A simple way to determine whether or not you have the advantage is to track the gumballs so you have information about how many of each color remain in the dispenser. We know that removing black gumballs from the machine helps you: Every time a black ball is taken out of play, your expectation (for betting on white) goes up slightly. The opposite is true when a white gumball is removed. So to begin, we can assign black balls a value of +1 and white balls a value of –1 (these assignments are sometimes referred to as "tags").

Start at zero and keep a "running count" of all the balls as they come out of the machine. After a ball is seen, the running count is updated by adding its value. For example, if the first ball to come out is black, then the running count is +1. If the next ball is white, the running count goes back to 0 (arrived at by starting with +1 for the old running count and adding –1 for the white ball that just came out).

As you may have deduced, the running count alerts you to when it's profitable to play—whenever the running count is positive, you have the advantage. You don't need to count (and remember) the exact number of white and black balls played; you don't even need to know how many balls are left. You need only know the value of the running count to know whether or not you have an edge. The point at which we know you first have the advantage is called the "key count." At or above the key count (+1), you have the advantage; below the key count, you are either neutral or at a disadvantage.

Note that gumballs of other colors (that don't win or lose our wager) can be introduced without affecting our ability to maintain the count. We simply ignore them. For example, adding 10 red balls, 13 blue balls, and 5 green balls does not make our counting any more difficult. We simply assign a value of 0 to each of these extra colors, which do not change the running count as they exit.

This is the basic concept behind card counting—employing a weighting system to determine who, player or casino, has the advantage.

PIVOTS AND IRCS

There are many differences between blackjack and gumballs, but let's stay with our gumball example a little longer to demonstrate two additional concepts: the "pivot" and the "IRC."

Though ultra-simple, the gumball count system has a fairly serious drawback. While we always know *when* we have an advantage, we often have little information about how great (or small) it is. For example, a running count equal to the key count of +1 could occur with 1 white and 0 black balls remaining (an expectation of +100%), or with 10 white and 9 black balls left (an expectation of "only" +5.26%).[26]

Indeed, for the game starting with 10 white and 10 black gumballs, the only time we have a precise handle on the expectation is when the running count is exactly 0. At this point, we know our expectation is precisely 0%.[27] We may therefore define the pivot point as the count at which we have reliable information about our expectation. The pivot point is important because, later, we will base betting strategies on this gauge of our expectation.

To further illustrate this effect, let's alter the initial conditions. Instead of 10 white and 10 black, let's assume that there are initially 20 white, 24 black, and 8 yellow gumballs. We can still use our counting system (black = +1, white = –1, yellow = 0) to track the game. But if we start at a count of zero, we no longer have the advantage when the count is just slightly greater than zero. It's easy to see why. If a black ball comes out, our count is +1. However, we are still at a disadvantage in the game since 23 losing black balls remain, compared to only 20 winning white balls (remember, the 8 yellow balls don't matter).

A little thought will convince you that in this case, with a starting count of zero, we always have an expectation of 0 when the running count is +4 (indicating that the number of white and black balls remaining is equal). Hence, the pivot point for this game is +4. Further reflection will reveal that we now need the running count to be equal to or greater than +5 to have the advantage. The key count for this game is therefore

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[26] The way out of this problem is to keep a separate count of the total balls remaining. In this case, dividing the running count by the number of balls remaining gives the exact value for the expectation.

[27] This effect and nomenclature was first introduced by Arnold Snyder.

+5. As you can see, both the key count and the pivot point changed in response to altered starting conditions.

Since this can all become a bit unwieldy, we can, if we choose, make an adjustment in the point at which we begin our count. That is, we adjust the "initial running count" (IRC) in order to provide more convenient key-count and pivot-point numbers. For example, we could start the IRC at, say, +2, and then we'd have the advantage when the running count was equal to or greater than +7. Or we could use an IRC of –4, in which case we'd have the advantage when the count was equal to or greater than +1.

The point of all this is that the pivot point and key count are a function of what we choose as the IRC. We'll see later how this can be used to simplify our system.

Let's review.

• To get an advantage in our gumball game, we can assign an integer value to each colored gumball and keep a running count of those we've seen come out of the machine.

• Two special count values are the key count, at or above which we have the advantage, and the pivot point, at which we have reliable information about our expectation.

• The key count and pivot point will depend on our initial running count.

Counting cards is not dissimilar to counting gumballs. First, just as there were good gumballs, bad gumballs, and neutral gumballs, in blackjack there are good cards, bad cards, and neutral cards. And just as we assigned a value to the different gumballs, we can also assign a value to each type of card. We then start with an initial running count and count through the deck as the cards are played. Once the running count reaches the key count, we know we generally have the advantage. When the running count is equal to the pivot point, we have a reliable estimate of the expectation.

ALL CARDS ARE NOT CREATED EQUAL

Okay, we know that keeping track of cards already played tells us about hands yet to come. But to make use of this information, we need to know which cards are beneficial to us as players, and which cards are not. Once we know this, tracking the cards played will tell us when the remaining deck is to our liking. Ultimately, we will bet small when the remaining deck is unsavory, and bet big when it's juicy. Anyone hungry yet?

To help determine which cards are good for us and which are bad, we must consider the rules of the game and the difference in playing strategies between a basic strategy player and a dealer employing the house rules. A lot can be gleaned from this comparison; there are several factors at work that show why it's important to be able to distinguish between decks made up of predominantly high cards and decks made up of predominantly low cards:

1. The payoff structure for naturals favors the player.

When the remaining deck has an excess of aces and tens, you're more likely to be dealt a natural. This fact favors the player. Although the dealer is always as likely as we are to receive a blackjack, our two-card 21 is paid at a premium. Imagine a game in which there is at least one natural guaranteed to show each hand; that is, on each deal the player and/or dealer will have a blackjack. Let's suppose we are betting $20 a hand. When we and the dealer get a blackjack, we push and no money changes hands. When the dealer has a natural and we don't, we lose $20. But when we have a natural and the dealer doesn't, we win $30 because our blackjack pays 3 to 2. We come out far ahead overall.

2. The dealer must hit until reaching a pat total of 17 through 21.

All casino dealers play by a fixed set of rules: any hand of 16 or less must be hit and, of course, any hand of 22 or more is busted. Totals of 17, 18, 19, 20, and 21 can be thought of as a "safe zone" into which the dealer climbs, then stops. Clearly, with an excess of high cards remaining, the dealer's chances of reaching the safe zone, without going beyond it, when drawing to a stiff total decrease. On the other hand, if a lot of small cards remain, the dealer is more likely to draw to a pat hand. When an excess of big cards remains, the knowledgeable player can choose to stand on a stiff hand, forcing the dealer to draw from a deck rich with high cards and (hopefully) bust.

3. When doubling down, the player is usually hoping to get a high card.

Two conditions must generally exist for us to double down: (a) we expect to win the hand; (b) we are satisfied drawing only one more card. Furthermore, as noted in our discussion of the basic strategy, most double downs occur against a weak dealer upcard (a 3, 4, 5, or 6). An abundance of high-valued cards helps us in two ways here. Our hand is likely to improve greatly (if doubling on a total of 10 or 11), and the dealer is more likely to bust, especially when showing a weak upcard.

4. Many splitting opportunities are more favorable with an abundance of big cards left in the deck.

A look at the basic strategy table, and at the splitting discussion in Chapter 2, shows that a preponderance of high cards is usually beneficial to us when splitting, regardless of whether we are splitting offensively or defensively. This is especially true of splitting 7s, 8s, 9s, and aces.

5. Insurance can become a profitable bet.

This should not be underestimated, as the proper use of the insurance wager while card counting is worth roughly 0.15% (or more). As discussed in the basic strategy, we should never take insurance with no knowledge of deck composition. But if we're tracking the game and know that the ratio of tens to non-tens is large (greater than 1/2), then insurance should be taken. The great thing about insurance is that you take it only when you want to—it's an optional side bet that can be put to good use by a card counter.

These are the main reasons why certain card denominations are favorable or unfavorable for the player. Clearly, a deck relatively rich in high cards (or, equivalently, poor in low cards) is good for the player. Conversely, a deck rich in low cards (poor in high cards) favors the dealer.

ASSIGNING THE VALUES

To take the value of a card-counting system further, we need to know exactly how much each card is worth. To determine this, we simulate a benchmark single-deck game using the basic strategy. As mentioned in Chapter 2, we come up with an expectation of –0.02%.

We then simulate the same basic strategy in a single-deck game that has one card removed, for example a 2, and note the resulting expectation of +0.38%. Comparing the expectation of the two games gives us a measure of how valuable the 2 is. For this particular example, we find that removing the 2 is "worth" 0.40% to us.

We then repeat the process for each other card rank. In so doing, we can construct a table of the relative values of each card. (All values are changes in the expectation for the benchmark single-deck blackjack game, assuming we are playing by the fixed generic basic strategy of Chapter 2.[28])

[28] These values were derived from simulations of the benchmark game assuming a fixed generic basic strategy. In fact, the relative value of the cards is a slowly varying function of the game conditions and strategy adopted. See, e.g., Griffin's *The Theory of Blackjack* for values associated with the dealer's hitting soft 17.

The table below gives the change in player's expectation that arises from *removing* a card of a certain denomination. For example, if we remove just one 5 from a single deck, the change in player's expectation is +0.67%. For our benchmark single-deck game (with an initial expectation of –0.02%), the "new" expectation, after removing the 5, is now +0.65%. On the other hand, removing a single ace changes the expectation by –0.59%.

What happens if, for example, both an ace and a 5 are removed? To a very good approximation, we simply *add* the resulting effects. So the total change in expectation is –0.59% (for the ace) + 0.67% (for the 5) for a total change of +0.08%. Thus removing these two cards leaves us almost where we started; they've nearly canceled each other out. Refer to

Relative Value of Cards in Single-Deck Blackjack Assuming a Fixed Generic Basic Strategy

Removed Card	Change in Player's Expectation
2	+0.40%
3	+0.43%
4	+0.52%
5	+0.67%
6	+0.45%
7	+0.30%
8	+0.01%
9	–0.15%
ten	–0.51%
ace	–0.59%

Figure 3 to see the cumulative effect of adding or removing aces and 5s (aces and 5s were chosen because these are the two cards that create the greatest change in expectation with their addition or removal).

As we've discussed, a deficit of high-valued cards, mainly aces and tens, is bad for the player. This is confirmed in the table below, where it can be seen that removing these cards from play (hence, creating a deficit of them) causes our expectation to go down. As players, we want the pack to contain an excess of these high-valued cards. We will label tens and aces as *good cards*.

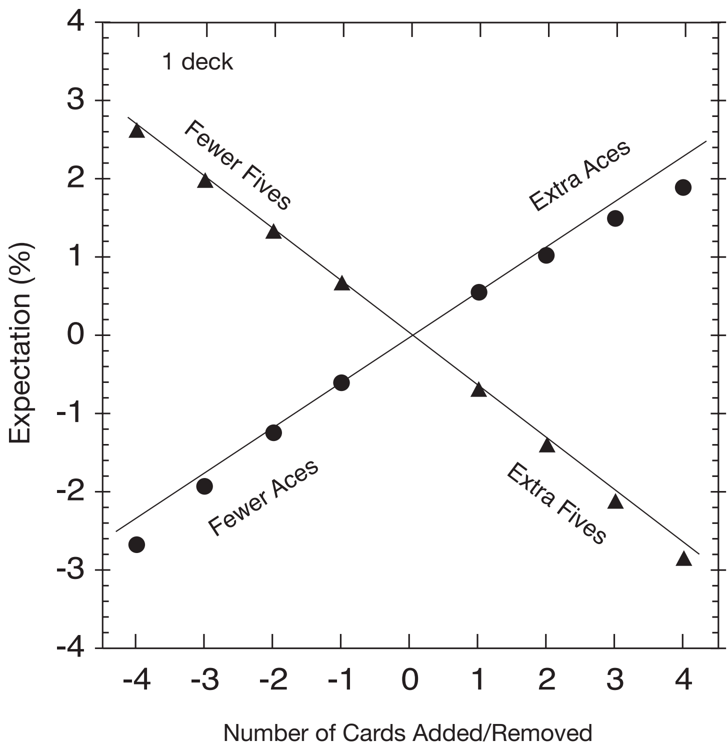


Figure 3: *The effects of adding/removing aces/5s, which are the two most "valuable" cards. Removing or adding additional like-cards leaves us with a change in expectation which nearly follows a straight line.*

In this same vein, removing low cards (namely 2s through 7s) from the deck increases our expectation. In removing these cards, we are in effect creating an excess of high-valued cards, which gives us an advantage. These are the cards we'd like to see out of the deck. We will label 2s through 7s as *bad cards*.

We can now summarize the crux of card counting. We keep track of cards played in order to ascertain which cards remain unplayed. As the deck composition changes, the excess or deficit of good and bad cards shifts the advantage back and forth between the player and the house. The key, then, is to identify when we have the advantage and when we don't. We make big bets when we do and small bets when we don't. In so doing, the gains from the big bets will more than make up for the losses from the small bets. We will come out ahead in the long run.

COUNTING CARDS—THE OLD WAY

You should by now be ready to move on to the Knock-Out system. Before doing so, however, we'll take this opportunity to show you why we developed K-O. It's a matter of manageability: The traditional systems are just too difficult to implement. (For more on traditional vs. unbalanced, see Appendix 7.)

The example that follows is representative of the process a card counter using a traditional balanced count system must go through. Note that it's not necessary that you understand all of the steps, but we're sure that you'll appreciate the ease of K-O once you're aware of them.

> Like all card-counting systems, balanced counts assign a value to each card (+1, –1, etc.). A running count is kept and continually updated.

The Cut-Card Effect

The "cut-card effect" is a subtle nuance that generally causes basic strategy to have a slightly worse expectation than the figure calculated "theoretically" off the top of the deck.[29] It generally has the greatest effect in a single-deck game.

The effect arises as follows. Let's say the cut card is placed about two-thirds of the way through the deck, at 36 cards. At an average of about 3 cards per hand and a total of 5-6 hands per round (4 or 5 players plus a dealer), roughly 36 cards are typically dealt out after two rounds.

However, if fewer cards have been dealt out and the dealer has not reached the cut card, another round will be dealt. What are the circumstances under which fewer cards will be dealt? Typically, it's a succession of hands in which a lot of high cards appear. This causes the average number of cards-per-hand to be less than three. So, the dealer preferentially deals out an extra round when the high cards have already been played!

Similarly, if a lot of low cards come out in the first two rounds, the dealer will assuredly reach the cut card at some point during the second round. Consequently,

[29] The cut-card effect has not been mathematically *proven* to exist, although it is plausible that the effect is real (Edward O. Thorp, private comm.; see also Thorp's revealing article "Does Basic Strategy Have the Same Expectation for Each Round?" in *Blackjack Forum*, June 1993). Simulations also demonstrate the effect, even in head-to-head play. For example, in a single- deck game with 65% penetration in which the dealer hits soft 17, our simulations suggest that the generic basic strategy player has an expectation of roughly -0.38%, as opposed to the "fixed number of rounds" value of 0.22% as depicted in Chapter 2.

there will be no third round of hands. The fact that the running count will be high (due to the excess of high cards now remaining) is immaterial, since the dealer will shuffle away the advantage.

Some casinos have gone so far as to introduce tables with only five betting spots to take advantage of this cut-card effect at their single-deck tables. And you thought they were just trying to give you more elbow room!

Now imagine the following 2-deck scenario. You're keeping the running count in your head; say it's +3. It's time to bet and the dealer is waiting on you. But before you can bet, the system requires that you convert the running count to a standardized measure, which is called a true count. Here's how it goes. While remembering the running count, you need to look over at the discard rack and estimate the number of decks already played—let's say a deck and a quarter. Now you think to yourself, "2 (decks) less 1 1/4 leaves 3/4 unplayed." Okay, now divide the running count (Still remember it? It's +3.) by the number of decks unplayed, and round down toward zero to get the true count. Quick, what's the answer? (It's 4.) Finally, you size your bet according to the true count of +4 and make the bet. It's necessary to repeat this process before you make every big wager.

Now that the wager is made, you have to go back to the running count (Still got it?) and count the cards as they're dealt. When it's your turn to play (dealer waiting on you again), it's often necessary to go through the process of converting to the true count again to decide how to play your cards. This constant conversion between running count and true count is mentally taxing, prone to error, and leads to quick fatigue. It certainly detracts from enjoyment of the game.

What's more, the mental gymnastics necessary to effect the true-count conversion are only part of the problem. Some systems are far more difficult due to demands such as the following:

Multiple-level card values—Many systems count by more than one numeral, incorporating higher-level values, for example –3 to +3. They're called "multi-level" counts. If you think counting up and down by 1 is tough, try counting up and down by 2, 3, or even 4 at a time.

Side counts—As if multiple levels and true-count conversions weren't enough, some systems would have you keep an extra count of certain cards, usually aces. These are called "multi-parameter" counts. Imagine keeping two separate running counts going in your head. Every time you see a 2 through king, you add its value to one running count, and every time you see an ace, you add to a different running count. When it's time to bet (or play), you need to compare the number of aces played with the average number that should have appeared at this point in the deck, estimate the discrepancy, then add to (or subtract from) the running count, prior to calculating the conversion to … Well, you get the picture.

Strategy-variation indices—Some systems require that you refer to complicated strategy-index matrices. These sometimes have upwards of 200 entries that need to be memorized in order to realize a small gain in performance.

This example may make you want to stop before you even step into the ring. Take heart; it's time to lighten up. The

Knock-Out system eliminates many of these steps, at virtually no reduction in power.

SUMMARY

• In blackjack, each hand is not an independent event, so the tracking of cards already played yields information on remaining deck content. The idea is to monitor the deck to determine when it's good or bad for the player. It's important to understand that card counters do not memorize every card that's played; they merely keep track of the relative number of high cards compared to low cards left in the deck. This can be done by assigning a value to each type of card and maintaining a running count of all cards seen. The player can then modify his betting and playing strategy accordingly.

• Certain deck compositions are favorable to the player, while others help the dealer. In particular, a deck that is rich in tens and aces favors the player. This is true for several reasons, among them the fact that blackjacks (which pay a bonus to the player) are more prevalent; the dealer is more likely to bust with a stiff; double down and split plays are more advantageous; and the insurance side bet can become profitable. On the other hand, a deck that is rich in low cards (or poor in tens and aces) favors the dealer.

• With regard to betting, when the deck is favorable the card counter will bet a lot. Conversely, when the deck is unfavorable, the card counter will bet a little or perhaps not play at all.

• While accurate and powerful, traditional balanced card-counting techniques that require a true-count conversion are often difficult to employ without error.

Round 4

The Unbalanced Knock-Out System

Everything should be as simple as possible, but not more so.

—Albert Einstein

Today's modern point-count systems are commonly classified according to three main categories: their level, type, and whether or not a side count is required. We touched on these at the end of Chapter 3. Let's take another look at each.

CLASSIFICATIONS

Level—Level refers to the integer values assigned to the cards themselves. If each card is assigned integer values of either –1, 0, or +1, this is said to be a level-1 count. Similarly, systems employing values between –2 and +2 are level-2 counts, and so forth. As a rule, it's easier to use a level-1 system than a higher-level system. This is partly because it's always easier to add and subtract 1 than to add 2 and subtract 3, etc. In addition, the expert card counter looks for card patterns that cancel to zero, which are more common in a level-1 count.

Type—Type refers to whether the card-counting system is balanced or unbalanced. Both balanced and unbalanced systems keep track of a running count (as introduced in Chapter 3), which is an up-to-date cumulative total of all cards already seen. Historically, balanced counts have been more popular and well-studied, because they provide more accurate playing strategies. But balanced counts require additional effort to employ, particularly during the true count conversion.

Even with perfect mental arithmetic, true-count conversion is a source of error, because players must *estimate* the number of decks remaining to be played. This is typically approximated to the nearest one-half deck, and often leads to a true-count conversion that may be off by about 10%. The use of an unbalanced count eliminates the need for a true-count conversion.

Side Count—Several balanced counts use an additional side count to enhance their power. These are often called "multi-parameter systems." Particularly because of the uniqueness of the ace, many systems assign it a neutral value in the point count, then count it separately (an "ace side count"). As you can imagine, keeping a separate count of aces (or any other card for that matter) greatly complicates the picture. Instead of keeping one count in your head, you now have to keep two of them. Needless to say, keeping side counts is mentally taxing. Quite often, chips, feet, cigarettes, drinks, or anything else that's handy are employed to facilitate the task.

Thankfully, we can avoid the worst of these headaches by using the K-O system. The K-O is a single-level single-parameter count. More important, though, is that K-O is unbalanced, which completely eliminates the necessity to convert to a true count. As you'll see later, K-O also eliminates, or greatly simplifies, most other tasks associated with successful card counting.

Let's get to the business at hand.

LEARNING THE K-O CARD-COUNTING VALUES

The first step in any card-counting system is assigning values to the respective cards. The unbalanced Knock-Out system employs the following card-counting values:

Knock-Out System Card-Counting Values

Card	K-O Value
2	+1
3	+1
4	+1
5	+1
6	+1
7	+1
8	0
9	0
10, jack, queen, king	–1
ace	–1

The astute reader will immediately notice that there are more "+" than "–" designations. That's because the sum of the card tags does not equal zero. And that's why the K-O system is referred to as unbalanced.

Since the count values are restricted to +1, 0, or –1, and each card has only one value associated with it, the K-O system is a true level-1 system. A level-1 system allows for fast counting of a blackjack table full of cards. Combinations of cards that cancel to zero are easy to spot and eliminate from consideration. The suits of the cards are not considered, so a mere glance at a card is sufficient to determine its card-counting value.

To become a proficient card counter, you need to memorize the Knock-Out values of each card. In game conditions, you must be able to recall each Knock-Out value instantly.

LEARNING TO KEEP THE K-O RUNNING COUNT

To maintain the running count (or "RC"), we continually update it according to the cards that we see played. Based on the previous table, we add 1 for each low card (2, 3, 4, 5, 6, or 7), and subtract 1 for each high card (10, jack, queen, king, or ace) that we see. The RC is the important count that we need to remember, even during and in-between hands, and keep updating until the next shuffle.

The running count begins at the IRC. For reasons that will become clear in a moment, after a shuffle, we start with a *standard* initial running count that conforms with the following equation: 4 – (4 × *number of decks*). We adopt the term "standard" here as a reference point for discussion; later we will discuss ways to customize the K-O system (for example, to avoid the use of negative numbers).

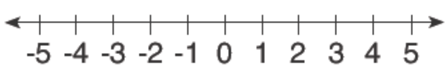
Applying our equation, we start with a standard IRC of 0 for a single-deck game, IRC = 4 – (4 × 1 deck). For a double deck, it's 4 – (4 × 2) for an IRC of –4. For a 6-deck shoe, 4 – (4 × 6) equals a standard IRC of –20. The lowest standard IRC you will begin with is –28 for an 8-deck shoe game.

By starting with an IRC equal to 4 – (4 × *number of decks*), we will always end with a count of +4 after all the cards in a pack have been counted. Because of the unbalanced point

Dealing With Negative Numbers

Dealing with negative numbers is nothing to be alarmed about.[30] Just imagine a number line with zero in the middle, positive numbers increase to the right and negative numbers increase in magnitude to the left.

To refresh the memories of those who may not have recently been exposed to negatives, adding a positive number means we move to the right on the number line. On the other hand, adding a negative number (or equivalently subtracting a positive number) means we move to the left.



For example, if we're at a total of –4 and we want to add 1, we move to the right and arrive at a new total of –3. That is, (–4) + (1) = –3. Or, if we're at 1 and subtract 2, then the sum is –1. In other words, (1) – (2) = –1, which is the same as (1) + (–2). When you visualize the number system in this left-right fashion, it becomes fairly easy to do the necessary addition and subtraction.

[30] As mentioned, for those with an aversion to negative numbers, we'll later discuss alternatives to the standard K-O counting scheme.

values, each deck has a net count of +4, so the net count of the entire pack will exactly cancel out the "4 × *number of decks*" initially subtracted and leave us with +4 as the sum.

Let's look at a 2-deck game as an example. The IRC for a double decker is 4 – (4 × 2) = –4. As we count through the deck, the running count will generally rise from the IRC of –4 toward the final count, which will be +4 after all cards are counted. In practice, the running count will jump around on its journey, sometimes dipping downward below –4 and at other times cresting above +4. But at the end, it must equal +4 if we've counted correctly.

Figure 4 shows what a *representative* running count distribution might look like in the 2-deck game. We'll soon see that these statistical variations are what we, as counters, will take advantage of while playing.

The *average* running count behaves quite differently. In this case, the assumption is that we've played a great many hands, rendering the statistical variations negligible. On average, we expect the running count to rise linearly with the number of decks (total cards) already played, such that the rate of increase is +4 per deck.

FOUR STEPS TO KEEPING THE K-O RUNNING COUNT

To achieve proficiency at maintaining the running count, we recommend the following steps.

1. Memorize the Knock-Out card-counting value associated with each card.

Your recognition of the values of the card tags should be as natural as telling time. It should become ingrained and second nature.

One former professional card counter, a colleague of the author Lawrence Revere some 20 years ago, described it like this: "To this day I can't get away from card-counting values. When I turn on my computer and it says 'Windows 95,' I see the 9 and 5 and still automatically think +2." (The system he uses is not K-O, and values 5s as +2 and 9s as 0.)

Similarly, you should be able to recall the card-counting values without pausing. It's important that this step be instantaneous. You should be able to look at a card and instantly recall its value of +1, 0, or –1 without hesitation.

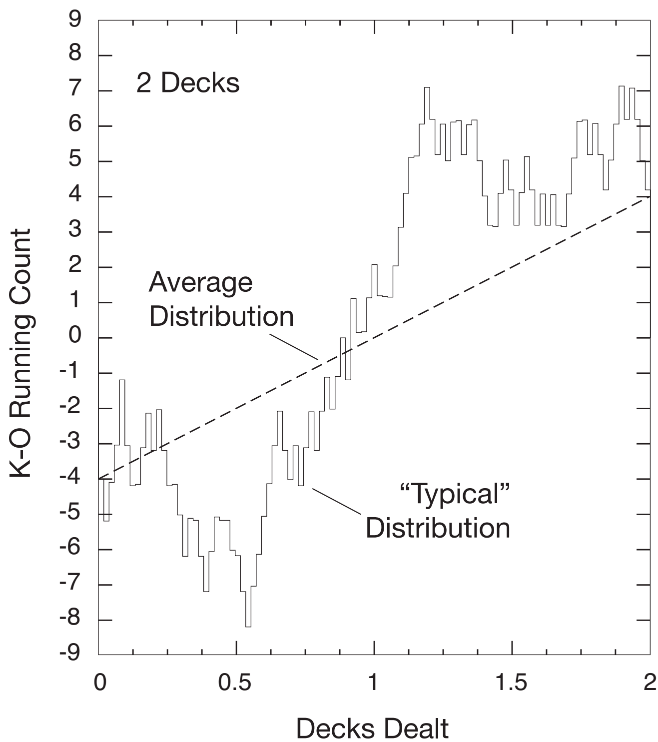


Figure 4: *A representative journey of the standard running count in a 2-deck game, with the running count plotted vs. the number of cards already played. The depiction is representative only in the sense that it gives a flavor of the magnitude of fluctuations during the course of play. Note the contrast with the average running count, represented by the ascending straight line.*

BLACKJACK Fallacy

Pictures follow pictures

Players who have just seen a face card come out will often refuse to hit their own stiff hands, believing that "pictures always follow pictures." Clearly, a face card can't always follow another face card (what if it was the last one?). In fact, it turns out that given that a picture card has just appeared, the chances of the next one also being a picture actually decrease.

This can be likened to a gumball machine where a known number of yellow gumballs (representing the picture cards) and green gumballs (representing the other cards) have been mixed together. Let's say we buy a gumball and it's yellow. The chance that the next one is also yellow has clearly decreased, since we've already taken one of the yellows out.

Similarly, all else being equal, given that the last card was a picture, it is less likely that the next card will be another picture card.

Begin with a deck of shuffled cards. As you turn each card over, recall its Knock-Out value. (Note: You don't want to recite it aloud, as this could lead to the troublesome habit of mouthing the count.) For example, for a sequence of cards 3, 5, king, 2, 8, queen, you would silently think +1, +1, –1, +1, 0, –1.

2. Count through an entire deck one card at a time and keep a running count.

For a single deck, the running count starts at zero. As each card is played, you need to recall its value and add that to the running count. Again, this must be done completely silently and with no lip movement. If you make no mistakes, your RC will be +4 at the end of the deck. For the example above, the same sequence of cards would be counted in the following fashion.

Single Card	K-O Value	Running Count
3	+1	+1
5	+1	+2
king	–1	+1
2	+1	+2
8	0	+2
queen	–1	+1

3. Practice with pairs of cards.

When you've become comfortable keeping the count, practice by turning the cards over two at a time and determining the net count for each pair of cards. For example, a hand of jack and ace (a blackjack) has a net count equal to (–1) + (–1) = –2. Two tens also have a net Knock-Out count value of –2. A stiff total of 16 made up of Q,6 has a net count equal to (–1) + (+1) = 0.

Practice this until counting pairs is second-nature and you don't need to do the addition. Strive to recognize pairs that cancel to zero, such as 10,2, Q,4, A,5, etc. This canceling technique will save you a great deal of effort and greatly increase your speed.

4. Count through an entire deck in pairs while keeping a running count.

Turning two cards over at a time, you need to recall (not calculate) their net Knock-Out value, and add it to the running count. For our card sequence above, we would count in the following fashion.

Pair of Cards	Net K-O Value	Running Count
3,5	+2	+2
K,2	0	+2
8,Q	–1	+1

How fast do you need to be? A good rule of thumb, no matter which card-counting system you use, is to be able to count down an entire deck of cards in 25 to 30 seconds.

Many beginners find the prospect of counting an entire deck in 30 seconds a bit daunting. Don't worry. Once you master the technique of netting (and canceling) two cards at a time, you'll literally fly through the deck. In a short amount of time, counting cards will become as easy as reading. When you read words, you don't recite the sound of each letter and you don't try to sound out the word. You simply view the word and your brain immediately recognizes it. The same will happen with card counting after some practice.

Once you can count one deck, the transition to multiple decks isn't difficult. The only change is the new value for the initial running count, which is necessary to ensure that you always end up with a final RC of +4.

We recommend practicing with the number of decks that you will most often play against. For example, if you live on the East Coast and know you'll be visiting Atlantic City or Foxwoods, you'll be best served practicing for the 6- and 8-deck shoes that you'll encounter in those destinations. The same is true for patrons of Midwestern and Southern riverboat casinos. On the other hand, visitors to Nevada will have a choice of several different games, and may want to become proficient counting both single and multiple decks.

To succeed in casino-like conditions, you must be able to count the entire pack quickly *and* correctly. If you're too slow, you won't be able to keep track of all the cards in a casino environment. Counting only a fraction of the cards is self-destructive, as you aren't making use of all the informa-

Speed at the Tables

In actual play, you should strive to be able to count a table full of cards in a few seconds. While this may sound formidable, you'll find that it's easier done than said.

Remember first that all cards of zero value are ignored. Thus, all 8s and 9s can be disregarded. Next, combinations of cards with a total value of zero can also be ignored. If you see somebody stand with a hand of K,7, you simply ignore the net count of zero. Similarly, a hand with J,6 that hits and busts with an 8 can also be ignored.

Eventually, you'll be able to cancel cards that are in adjacent hands. For example, with three adjacent hands of a J,Q, a 4,8,8, and a 3,9,Q, you might view it as follows. Ignore the 8s and 9; the 3 and queen in the third hand cancel. What's left is two –1 cards (the jack and queen) and one +1 card (the 4). The jack cancels the 4, leaving only the queen unaccounted for. Hence, the net count for this group is simply that of the queen: –1. With a little practice at thinking like this, you'll be able to glance at a group of five to ten cards and quickly determine the net count for the group.

tion available to you. Far worse is counting only a fraction of the cards and consistently missing the same *type* of card.

Let's take an example where you're just a little slow and seem to miss counting a player's last card when he busts. This is a reasonable scenario, since dealers tend to snatch up the cards from a busted hand quickly. Missing (or neglecting) this card will cut into profits in two major ways. First, you won't count about one in every 15 cards dealt, which has negative consequences with regard to effective deck penetration (a factor in profitability that will be discussed later in the text).

Second, and far more damaging, your count will become an inaccurate indicator, signaling you to increase your bet at inopportune times. Why? Hands tend to bust with high cards. Always missing these cards (which are preferentially negative in their count values) will greatly inflate your running count, causing you to incorrectly conclude that you have the advantage when you don't. Not only will you suffer from inaccurate betting, you'll compound the error by playing key hands wrong.

SUMMARY

• The Knock-Out system eliminates, or greatly simplifies, most tasks associated with successful card counting. The K-O is a single-level, single-parameter, unbalanced count, which means that no true-count conversion is necessary—the count is started at the IRC, and decisions made according to the running count only.

• You must learn to keep the running count perfectly. This will require practice. In time, you will learn to recognize the K-O values instantly and update the count automatically.

• The information the running count provides allows you to make proper betting and playing decisions. The techniques for using this information are described in the chapters that follow.

Round 5

The Knock-Out System—Rookie

Eureka! I have found it.
—Archimedes

It's time to start putting what we've learned to practical use. As we've made clear throughout this book, the K-O system was designed to incorporate the best combination of strength and ease of use. It's powerful and it's easy—but it's not a "gimme." To capture the full potential of the system (and maximize your earnings), you'll have to study and practice. That said, however, we're at a point, right now, at which we can use our knowledge to actually play the game of blackjack with an advantage over the mighty house.

The K-O Rookie system, presented here, is a streamlined ultra-simple manifestation of the K-O technique. But it's also something more. In the purest sense, K-O Rookie is the essence of winning blackjack. That's because winning at blackjack, more than anything else, is about bet variation—betting a lot when you have the advantage and betting a little when you don't. The K-O Rookie system shows you how to do exactly that.

Two subsets of players will benefit from this incarnation of the K-O counting system. The first consists of novice counters who find the initiation into the casino environment somewhat overwhelming. Playing "for real," with real money and real distractions, often turns out to be quite daunting. Because of this, we've found that card counters making their debut in casinos sometimes do better starting with an extremely simple approach.

The second subset comprises a much larger group. It's made up of thousands of players who have learned (or partially learned) basic strategy, but either can't or won't learn to count cards; they've been convinced that counting is too difficult. Many of these players know intuitively that in order to win they have to raise their bets at some point during play—if they don't, the house edge will grind them down and, eventually, out. But at what point do you raise?

The only time it's truly correct to raise your bet is when you have an advantage over the house, and those times can only be identified by counting cards. Since most players don't count, they turn to other means to guide their betting. Most rely on "money-management" techniques. There's only one problem with this approach: it doesn't work. You cannot overcome the casino's advantage at blackjack with bet variation that *isn't correlated* with the count. Blackjack players using basic strategy along with such betting systems can expect to lose at a rate equal to the house advantage—no more and no less.

Knock-Out Rookie is a betting system, too. But it's a choreographed system that *is correlated* with the count.

By combining perfect basic strategy play and the ability to keep the running count (perfected by the techniques in Chapter 4) with the betting advice in this chapter, you can play blackjack with an advantage. It's time to find out how.

ANOTHER LOOK AT THE KEY COUNT

Recall the gumball analogy (Chapter 3) in which we introduced the concept of the key count. The key count is the count at which we first have the advantage. It was +1 in the gumball game, which signified that there was one extra winning gumball in the mix and favorable for us to raise our bet.

It works the same way when playing blackjack. Instead of counting gumballs, though, we count the cards according to the K-O values. We then monitor the running count as we play, betting small when the RC is below the key count, and betting big when it's at or above the key count.

It's that simple. There are only two bets, small and large, and the key count is the point that separates them. The chart below lists the two crucial numbers you need to know: the IRC and the key count. (Note: Refer to Chapter 4 for the equation to derive the standard IRCs for games not listed, and Appendix 7 for data on 4-deck games.)

KNOCK-OUT SYSTEM
STANDARD IRCS AND KEY COUNTS

Conditions	IRC	Key Count
1 deck	0	+2
2 decks	–4	+1
6 decks	–20	–4
8 decks	–28	–6

What constitutes big and small in your betting scheme? It's a matter of personal preference, as well as a function of your gambling bankroll, your aversion to risk, and so forth. You might choose the table minimum, say $5, for your small bet.

A $5 wager thus represents a 1-unit bet. Your big bet will then be the multiple of $5 that you choose. For example, if your big bet is $25 (5 × $5), you'll be employing a 1-5 "spread."

Benchmarks

In order to gauge the effectiveness of the strategies presented in this book, it's necessary to create benchmarks for comparison. The performance results presented henceforth assume perfect play (no betting or playing-strategy errors) and the conditions listed here.

1 deck: H17, DOA, noDAS, 65% penetration
2 decks: S17, DOA, no DAS, 75% penetration
6 decks: S17, DOA, no DAS, 75% penetration
8 decks: S17, DOA, no DAS, 75% penetration

A COMPLETE SYSTEM

In essence, we now have the makings of a complete blackjack system. For playing we use the basic strategy as presented in Chapter 2. For betting, we use the K-O card-counting method and bet one of two values: We wager 1 unit below the key count, and X units at or above the key count, where X is an amount greater than 1 unit. Everything else about how we play the game remains the same. We've dubbed this system "K-O Rookie" because it's the most basic application of the concept of varying your bet according to the count. Still, with a big enough "jump" in the bet, it's enough to beat the game.

How well do we fare with the K-O Rookie system? The table below portrays the theoretical results. The table shows a spread of 1 unit to X units, with X being either 2, 5, or 10. For example, in a single-deck game (with our benchmark rules) where you spread from 1 unit below the key count to 5 units at or above the key count, your expectation is .88% of your average initial bet.

EXPECTATION (IN %) FOR K-O ROOKIE

Decks	1-2	1-5	1-10
1	.20	.88	1.24
2	.07	.69	1.05
6	–.15	.26	.54
8	–.22	.16	.43

These results are quite impressive. An expectation of .88% means that, in the long run, you will win at a rate equal to .88% of the total initial amount of money wagered.

As you can see, greater spreads correspond to greater profits. Unfortunately, you may not be able to get away with highly profitable bet spreads for long. Moving wagers directly from 1 unit to 5 units in hand-held games and 1 to 10 in shoes is about the outside limit for bet variation unless you have a very good "act." And even at these levels, casinos may soon identify you as a winning player and take action to limit your effectiveness. You may even be barred from playing altogether (see Chapter 8 for more about the casino vs. player cat-and-mouse game).

Even at less-profitable spreads, however, K-O Rookie will get you close to breakeven or better. It's highly unlikely that anyone will stop you from going 1-2 in hand-held or

1-5 in shoe games. Even with these modest bet variations, you're no longer the underdog. You can play blackjack with an expectation of making money.

Remember, there are no strategy plays to learn; this betting method and basic strategy represent the complete Rookie version of the Knock-Out system. Casual players may not want to go any further.

FLUCTUATION PROVISO

As counters, we have the advantage when betting and playing properly. However, this does not mean that we will win each and every time we play.

Consider craps, which (for the pass line wager) has a player expectation of –1.4%. Despite this disadvantage, players sometimes win at craps in the short run. Indeed, if players never won while gambling, casinos would cease to exist. The point, however, is that in the long run, a crap player must lose.

In blackjack, the situation is reversed. While we know that we must win in the long run, in the short run we'll have fluctuations and sustain losing sessions. We must be careful, therefore, not to "overbet," lest we lose our bankroll during these negative swings. We want to be sure that we remain in the game for the long run.

To do this, you must always bet within your means. Though many players will decide how to bet based on "what they think they can get away with," severe caveats are in order for this approach. Unless your bankroll is sufficiently large to warrant this high frequency of maximum wagers, you will almost certainly go broke eventually by implementing an arbitrarily large jump spread. It's true that the bigger the jump spread you employ, the higher your expectation will be. But, an arbitrary jump spread with no regard for the size of your bankroll should be attempted only if you honestly don't mind losing the entire stake.

A good rule of thumb is to limit your maximum bet to no more than 1% of your total blackjack bankroll. For example, if your bankroll is $10,000, then your max bet might be $100. Keeping your maximum bet below 1% of your bankroll should reduce your risk of ruin to an acceptable level. We can't emphasize enough the danger of betting too much, even when you have the advantage (see Chapter 7 for a more detailed discussion of this crucial concept).

CUSTOMIZING

If you have an aversion to working with negative numbers, we highly recommend that you customize the count. Customizing means tailoring the IRC and key count values, and it can be done so that you never have to count with negative numbers. It's an easy process that's explained in Appendix 8, along with a specific example of a count customized for the K-O Rookie.

THE K-O ROOKIE IN GAME CONDITIONS

Let's assume we're playing head-up in a 2-deck game. For a double deck, the IRC is –4 and the key count is +1. We'll employ the K-O Rookie system with a unit of $5 and a spread of 1 to 3 units.

The dealer shuffles and we're ready to go. At the start, the running count is the same as the initial running count of –4, so we bet just $5. The cards come out and we're dealt 5,6 while the dealer has a 4 up. Following basic strategy, we double down, and receive a 9 for a total of 20. The dealer turns over the downcard, a queen, and draws an 8 to bust. We win

$10 ($5 for the original wager and $5 for the double). The RC is now –2.

Because the RC of –2 is still below the key count, we again bet $5. This time we're dealt 8,8 and the dealer has a 6 up. As prescribed by the basic strategy, we split our 8s. On the first hand we're dealt a jack and stand. On the second we receive a 5 and stand. The dealer turns over a 6 (for a total of 12) and hits the hand with a 7 for a total of 19. We lose $10 ($5 on each of our split hands) this round. Now the RC is +1, which is equal to the key count. We have the advantage! We go ahead and bet $15. May the cards be with us.

SUMMARY

• K-O Rookie is the simplest incarnation of the Knock-Out system. For betting, we count according to the K-O card values and jump our bet at or above the key count. For strategy, we play according to the basic strategy.

• There are several easy ways to enhance the K-O Rookie system. This takes us to the K-O Preferred system, presented in the next chapter.