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Introduction

Casinos today earn more money from slot machines than from all their table games combined. If slot machines didn't exist, there would be no pirate battles, canals, or 1,000-foot-tall towers at the casinos we frequent.

Today's slot machine is a high-tech marriage of computers, mathematics, and graphics—a far cry from the slot machines found in casinos even as recently as five years ago.

Because there's now such a variety of slots (with new ones appearing every year) and so many different things to be aware of while playing them, slot players need to keep abreast of how today's machines work. Like aficionados of any gambling game, slot players can use knowledge about their favorite game to improve results while playing.

This book will show you how to recognize the different types of machines and explain what makes them different. You'll learn which

types of machines let you play for a long time and which types eat your bankroll quickly.

You'll also learn how many coins should be played in each type of machine, as well as techniques for stretching both your bankroll and your play time.

I can't guarantee that you'll win every time you play if you follow these tips. But I can guarantee that you'll play longer on the same bankroll and have more fun while you do.

The Lingo

Modern slot technology has its own jargon. In order to get the most out of this book, you need to understand the terms that are associated with slots.

Here is the Slot Expert's short list of slot terminology.

Action— The total amount of money played through a slot machine is called the action. Because action includes winnings that are replayed, the amount of money you bring to play will generate various amounts of action. I've gotten slightly more than $100 in action from a $100 buy-in, and I've gotten thousands of dollars in action from a $100 buy-in. How much action you get out of your buy-in depends on what you hit during play.

Bonusing— Bonusing is slot-industry jargon for any kind of payback over and above the return from the main reel-spinning game. Bonusing can be either a secondary event, such as spinning the wheel on a Wheel of

Fortune machine, or an event unrelated to the game, such as a mystery jackpot awarded to a player chosen at random.

The MotorCity Casino in Detroit has a promotion called MotorCity Millionaire, in which $1,000,000 may be given away to a slot player chosen at random. The casino gave away the first million eight days after opening, which was two days before Christmas.

It's important to remember that any money you win in the bonus event has to be paid for with a reduction in payback in the main reel-spinning game.

Coinless Gaming—This is the industry name for systems in which players are paid with tickets printed and dispensed by the machine, rather than with coins. The purest implementation of coin-free gaming is usually called "ticket-in/ticket-out." In this implementation, all cash-outs are paid by tickets, which can also be reinserted into other machines and played.

Full Coin—Playing the maximum number of coins that a slot machine accepts per spin is called "playing full coin." Playing less than the maximum is known as "playing short coin."

Hit Frequency—Hit frequency is the percentage of the spins that will return something to the player. It's a theoretical number based

on how many times each symbol is present on each reel. A hit frequency below 10% (that is, one spin in 10 wins something) is generally considered low, while a hit frequency of 25% or higher (one spin in four returns something) is generally considered high.

Machines with high hit frequencies pay out small amounts frequently. Machines with low hit frequencies have fewer payouts overall, but compensate with more high payouts (or jackpots). You tend to get more play for your money on machines with high hit frequencies.

There is no set correlation between hit frequency and long-term payback. Machines with low hit frequencies can have high long-term paybacks, and machines with high hit frequencies can have low long-term paybacks. It's also possible that both the hit frequency and the long-term payback can be either high or low at the same time.

You'll learn later how to recognize machines that have low hit frequencies.

Hold—The hold is the percentage of the money played through a machine that is not returned to the players. This number represents the casino's win from the machine. The hold percentage for a slot machine is 100% minus the long-term payback percentage. For example, if a Double Diamond machine has

a long-term payback of 92%, the hold is 8%.

Long-Term Payback—Also called "average payback" or simply "payback," the long-term payback of a machine is a number that indicates how much of the money put through it will be returned to the players. It's always expressed as a percentage, as in "97% payback." It's a theoretical number based on how many times each symbol appears on each reel. Because the outcome of each spin is chosen at random, a machine's actual payback can vary greatly on either side of the theoretical return. It typically takes 10,000,000 spins for the percentage of money a slot machine has actually paid back to be within one-half percentage point of its predetermined long-term payback.

Paytable—The paytable identifies the machine's winning combinations, tells you how much they're worth, and indicates how many coins you must play to win on each combination.

Payback Program—This is industry jargon for the different long-term paybacks available for a particular slot game. A two-coin Wild Cherry machine, for example, has 11 different payback programs available, with long-term paybacks ranging from 75% to 98%, and hit frequencies ranging from 16% to 20%. The payback program is also called

the "percentaging model."

RNG— The familiar term RNG is short for Random Number Generator. This is a special part of the computer program that runs a modern slot machine. The RNG generates a series of numbers that corresponds to the stops on each reel. The computer program uses the output of the RNG to determine the outcome of each spin.

Stop— A position at which a slot reel can land. A stop is designated by either a symbol or a blank. Most modern slot machines have 22 stops on each reel.

Virtual Reel— A technology that renders the chances of hitting winning combinations different from what they appear to be.

If there were a single jackpot symbol on each of three 22-stop reels on a slot machine, the chances of hitting the jackpot would be easy to calculate as 1 in 10,648 (22 x 22 x 22 = 10,648). It would also mean that the largest jackpot this machine could pay would be 10,648 coins—less, actually, because that number wouldn't allow for any lower-paying winning combinations or profit for the casino. But such machines with jackpots greater than what would appear to be the maximum possible coins are common. Something else must be going on inside the slot machine.

In order to make a jackpot larger, the odds

of hitting it have to be lowered. In the mid-'70s, slot manufacturers investigated three ways to do this. One way was to add more reels to the machine. By adding two more reels to the jackpot-only machine discussed above, the chances of hitting that jackpot decrease to 1 in 5,153,632. Now the machine can pay a huge jackpot; offer many lower-paying combinations, such as mixed bars and single bars; and still earn some money for the casino. But slot players intuitively knew that landing five jackpot symbols on the payline was less likely than landing three. Five reels may be the standard for most video slots, but reel-spinning slot machines with more than three reels never caught on.

Another technique slot manufacturers looked at to decrease the probability of hitting the jackpot was to place more stops on each reel. By squeezing just three more stops onto each reel of the machine, the chances of hitting the jackpot drop to 1 in 266,200. This machine can also pay a nice jackpot, offer many lower pays, and make a profit for the casino. It's also less obvious that the odds have been lengthened.

But what about the life-changing jackpots on machines like Megabucks? Those jackpots can't be offered without adding many more stops to the reels. To add enough stops to send

jackpots into the millions of dollars, either the reels would have to be much larger than those on a normal slot machine, or the symbols would have to be much smaller. Yet the reels on a Megabucks machine appear to be the same size as those on any other slot. Again, something else has to be going on inside.

The last option that slot manufacturers looked at is the technique used in almost every slot machine today. It's the implementation of "virtual reels," also referred to as "Telnaes mapping," after the man who patented the method.

The word "virtual" in computer science means using something that you *do* have to pretend you have something that you *don't*. Hence, the computer program in a slot uses a virtual reel in its memory to pretend that the slot machine's reels have more than 22 stops.

The virtual reels in a slot machine contain from 32 to as many as 256 (or even more) virtual stops. Each blank and symbol you see on the reel corresponds to one or more virtual stops on the virtual reel. The more times a blank or symbol appears on the virtual reel, the more likely it is to land on the payline.

Have you ever noticed how many times the blank above or below the jackpot symbol lands on the payline? When the jackpot symbol lands above or below the payline,

it's called a "near miss." The blanks above and below the payline appear many more times on the virtual reel than the jackpot symbol, so they are more likely to land on the payline than the jackpot symbol. The fact that the blanks above and below the jackpot symbol appear so many times on the virtual reel explains the prevalence of near misses above and below the payline.

Not every modern slot machine uses a virtual reel. Video slots, for example, have no need to map a virtual reel to a physical reel, because they don't have physical reels. The reels in a video slot machine can be as large as the manufacturer wants them to be.

Virtual Stop—A symbol or blank on the virtual reel. There is no way to tell exactly how many virtual stops are on a virtual reel in a slot machine's computer program. As a general rule, though, the larger the machine's top jackpot, the more virtual stops it has on its virtual reels.

Potent Patent

International Game Technology (IGT) owns the Telnaes patent and a manufacturer must license the patent from IGT to be able to use the technique. WMS Gaming developed its own mapping method, called the Fractional Branching Algorithm, but IGT sued and the courts ruled that WMS Gaming's method infringed on IGT's patent. As a result, WMS reprogrammed its machines so they wouldn't use any mapping method at all, a move made possible by the fact that all of its reel-spinning machines have bonus games. The top jackpot on the base reel-spinning game is very low; the big jackpots are on the bonus games. Because the bonus game is video-based, WMS does not need to use a virtual reel to decrease the odds of hitting the bonus game's jackpot.

Know the Machine You're Playing

To get the most out of slot machines, it's imperative to know exactly what kind of machine you're playing. Always look at the paytable before you start to play to determine what type of machine it is, what the winning combinations are, and how many coins activate the winning combinations.

In addition to making your overall play more intelligent, understanding how to win at the machine you're playing will prevent embarrassing situations, such as complaining to a slot floorperson that you didn't get paid for three sevens on the payline when you didn't play enough coins to activate the sevens combination. More important, knowing which type of machine you're playing will also help you determine how many coins to play per spin, so you won't be wagering too much (or too little) for your play.

Following are the key considerations for the all-important decision about how

many coins to play. Since playing slots usually falls under the category of a "negative-expectation" activity, you should be prepared to lose money over the long-term. But there's no reason to lose more than necessary. If you think of your expected losses during play as a "tax" on the enjoyment you reap from playing (and for your chance to get lucky and score big), you can consider the advice that follows to be reliable tax-reducing methods. That is, they will allow you to cut the price of playing.

Play One Coin at a Time on Straight Multipliers

Playing more than one coin at a time on a Straight Multiplier is a waste of your bankroll. Extra coins do not buy additional winning combinations, nor do they buy a bonus for a winning combination.

The long-term payback of a Straight Multiplier is the same regardless of how many coins you play. Let's say you're planning to play for an hour, about 1,000 spins, on a $1 two-coin Double Diamond with a long-term payback of 95%. Would you rather expose $1,000 to that 5% house edge for an expected loss of $50, or $2,000 for an expected loss of $100? Most would choose the route that's least expensive—betting a single coin.

Play One Coin at a Time on Bonus Multipliers

Even though Bonus Multipliers encourage you to play full coin to qualify for their juicy bonuses on the top jackpot, it's so rare to hit it that even huge bonuses on the top payouts increase the long-term payback by very little.

On a three-coin Red White & Blue, for example, figuring in the top jackpot that pays a 2,800-coin bonus for the third coin, the long-term payback when playing three coins at a time is 92.47%. Meanwhile, the return for single-coin play is 91.757%, a mere 0.713% less. The gain for three-coin play is not enough to warrant playing the two additional coins, unless you also cut back on the number of spins in such a way that results in the same amount of action.

Example: It makes sense to play three coins at a time if you're putting through $1,500 at a 92.47% payback (expected loss $112.95), rather than $1,500 one coin at a time at a 91.757% payback (expected loss $123.65). But it doesn't make sense to play $4,500—the same 1,500 spins times three coins—at a 92.470% payback (expected loss $338.75) versus the $1,500 at a 91.757% payback.

Play Full Coin on Buy-A-Pays

Playing more than one coin in a Buy-A-

Pay activates additional winning combinations and buys increased long-term payback and hit frequency. Another good reason to play full coin on Buy-A-Pay is that the payback on the first coin is sometimes very low—sometimes as low as the regulations in a jurisdiction allow.

One of the payback programs available for a two-coin Sizzling 7s machine pays back 95.315% when played with one coin per spin, and 98.088% when played with two coins per spin. On 1,000 spins, the expected loss is 46.85 coins (4.685% of 1,000 coins) when playing one coin at a time, but only 38.24 coins (1.912% of 2,000 coins) when playing two coins at a time.

Although you're better off playing full coin on the Sizzling 7s payback program in the example above, there are other Sizzling 7s programs for which you're better off playing only one coin. These can't be identified on the floor, so there's no way to guarantee that the increase in payback for playing additional coins will always outweigh the additional risk. But because that possibility exists, playing full coin on Buy-A-Pays makes sense.

Besides the mathematical reason to play full coin on a Buy-A-Pay, there's an emotional reason. It can be very frustrating to get a winning combination on a payline that's ineligible because you didn't bet enough coins

to activate it. Playing full coin eliminates this potential frustration.

Play Full Coin on Hybrids

As we've seen, Hybrids are part Buy-A-Pay, part Multiplier. And that combination presents a dilemma. We know it's not worth playing full coin on a Multiplier, but it usually is worth playing full coin on a Buy-A-Pay. How do we reconcile this conflict?

Let's look at one of the Blazing 7s payback programs. It pays back 91.33% when played with one coin at a time, 95.10% when played with two coins, and 97.18% when played with three. Let's take 1,000 spins on this machine. The expected loss is 86.7 coins (8.67% of 1,000 coins) when playing one coin, and 98 coins (4.90% of 2,000 coins) when playing two coins. But the expected loss drops to 84.6 coins (2.82% of 3,000 coins) if you play three coins at a time. You're better off playing full coin.

In addition, if a Hybrid has a bonus game, you must play full coin. There's no way to know how much the bonus game adds to the base payback, and it might not be enough to make playing full coin the best option. But again, the fact that it might suggests that full coin is best.

I once analyzed a Hybrid slot machine from Anchor Gaming called Wheel of Gold.

While you may not have seen a Wheel of Gold machine, you've definitely seen its famous offspring. IGT partnered with Anchor, made a few modifications to the game, and changed the name to Wheel of Fortune—and the rest, as they say, is history. You have to play three coins on a Wheel of Gold to be eligible to spin the wheel on the top of the machine. When I looked at the payback of each coin played individually, I discovered that the amounts you could win when you spun the wheel pushed the payback on the third coin to well over 100%—123.43% to be exact. The catch, of course, is that you have to play the first two coins (on which the house has a big edge) before you can play the third coin (on which you have the edge).

Overall, the payback on the machine was 80% when played with one coin at a time and 94.99% when played with three coins. Take another 1,000 spins. At one coin per pull, the expected loss is 200 coins (20% of 1,000 coins). At three coins per pull, the expected loss is only 150 coins (5% of 3,000 coins).

I always play full coin on a Hybrid, but you can play less as long as you buy all the winning combinations; this ensures that you'll be playing with the highest hit frequency possible on that machine, even though your payback may not be as high as the machine can offer.

Play Full Coin on Multi-Lines

This one is really player's choice, since there's a funny trade-off between hit frequency and the expected result.

Dropping one coin at a time into a Multi-Line isn't as bad as dropping one coin at a time into a Buy-A-Pay. The additional coins played in a Multi-Line machine buy increased hit frequency and, usually, very small increases in long-term payback. But since the probability of hitting the jackpot is the same on all paylines, even a large bonus for the jackpot on the last payline leads to only a small increase in payback—hence, the trade-off.

For example, one of the payback programs available for a five-line Double Diamond machine returns 88.757% when played with one coin per spin and 92.516% when played with five coins per spin. So for 1,000 spins, the expected loss rises from 112.43 coins (11.243% of 1,000 coins) for one-coin play to 369.25 coins (7.385% of 5,000 coins) for five-coin play. That's a pretty hefty difference.

Some players prefer to put the math aside in favor of having more fun playing a machine. I'm one who sometimes does this. I don't like having winning combinations land on a payline that I haven't activated, so I always play full coin on Multi-Line machines, even though it's not the right thing to do, mathematically speaking. Decide for your-

self how you want to play it (but remember, you've been warned).

Play One Coin on Each Line on an Australian-Style Slot Machine

This one is also player's choice between one coin per line and one coin per spin, though there's a strong argument for playing only one coin per spin.

Let's start by ruling out full coin. Unless the machine is a progressive or pays a bonus when you bet full coin, each combination pays the same amount regardless of which payline it lands on and that amount is a straight multiple of the number of coins you bet on the line. Playing additional coins on a given line merely multiplies the amount you win for each combination on that line. With no bonus for additional coins, you're not buying an increase in payback, so there's no advantage to risking more of your bankroll. And on machines that do pay a full-coin bonus on some combinations, I've yet to see one on which the increase in payback warranted the increase in wager. Playing one coin at a time on each line instead of full coin stretches your bankroll and playing time.

You can further stretch your bankroll and playing time by playing only one coin per spin. When each combination pays the

same on each payline, activating additional paylines buys only increased hit frequency, not increased payback. Again, there's no advantage to risking more of your bankroll. Playing one coin at a time, in addition, is less frustrating on an Australian-style slot than it is on a Multi-Line. That's because the paylines on an Australian-style slot are so complicated that it's difficult to tell when a winning combination lands on a payline you didn't activate.

As with Multi-Lines, this one is player's choice. I usually activate most or all of the paylines, even though it's not the mathematically correct play, because I like the high hit frequency.

One other thing to consider is that most Australian-style slots are low-denomination machines, so playing one coin on each line can require a smaller wager than playing full coin on a traditional three-reel slot. Thus, you can activate each payline, get a high hit frequency, and still risk less money per spin.

Read the paytables on Australian-style slot machines very carefully. Some machines advertise the huge payouts available when playing full coin on all paylines, but when you read the fine print, the payouts turn out to be straight multiples of the number of coins bet. In such cases, the extra coins are not worth betting. Some games, such as Wheel

of Fortune and Addams Family, are progressives and only pay the progressive when the jackpot symbols land on the last payline with a full-coin bet. These machines force you to play max coins, which could be anywhere from 45 to 90 coins or more, to be eligible for the progressive. I don't like being forced to bet so much to be eligible for a jackpot that I have almost no chance of winning, so I don't play these games. If you want to play them, heed the advice that follows for playing progressives.

Play Full Coin on All Progressives

Always play full coin, regardless of what type of Progressive the machine is. When you play less than full coin on a Progressive, you're building the jackpot for someone else, with no chance of winning it yourself.

Slot Expert's Summary

The coin-per-play advice in this chapter is designed to balance the two most important concerns of slot players: fun and finance. Playing the recommended number of coins on each style of machine should provide you the best bang for your buck, while also limiting expected losses. A summary of this advice appears in the chart on the next page.

Style	Coins Per Play	Examples
Straight Multiplier	1 coin per spin	2-coin Double Diamond, Wild & Loose, Wild Cherry
Bonus Multiplier	1 coin per spin	3-coin Double Diamond, Red White & Blue, Five Times Pay
Buy-a-Pay	Full coin	2-coin Sizzling 7s, 2-coin Blazing 7s
Hybrids	Full coin	3-coin Blazing 7s, Wheel of Gold
Multi-Lines	Full coin or 1 coin	5-coin Double Diamond
Aussie-Style	1 coin per spin or 1 coin per line	Ripley's Believe It or Not, Price Is Right, Scrabble
Progressives	Full coin	Megabucks, Wheel of Fortune, Millionaire Sevens