One-Armed Bandit

By Michael Shackleford

Once you drop your money in the slot and pull the lever, there's no going back. But there is a way to improve your chances that what comes out is more than broken dreams.

IN GENERAL, CONSUMER PROTECTION LAWS ARE DESIGNED to ensure that consumers know what they're buying. Ingredients are listed on food labels, octane content appears on gas pumps, and nicotine content is printed on cigarette boxes. Even in most casino games, the rules are disclosed so the odds are quantifiable. Lottery tickets even state the odds on the back of every ticket. But there's one financial transaction that takes place millions of times a day and consumers have almost no idea what they're getting in return. It happens every time a gambler drops a coin in a slot machine.

Slot machines are usually programmed to pay back between 85 percent and 98 percent of total money bet. State laws mandate certain minimum return percentages—75 percent in Nevada, for example, and 83 percent in Atlantic City. Either the casino or the local jurisdiction usually require monthly reporting of the actual slot return, but these statistics combine video poker and other electronic games with reeled slot machines. Unless someone is playing at selected machines with signs that indicate the return percentage—97 percent, for instance—the player has at best a foggy idea of what kind of value the slot machine is offering.

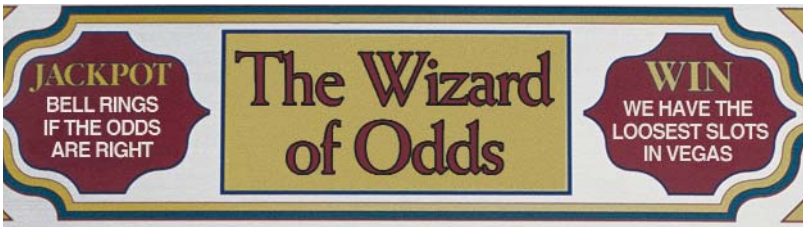
In an effort to break this code of silence, I tested the slot machines at every major casino in the greater Las Vegas area. Armed with confidential "par sheets" that explain how the games are programmed, I was able to determine the exact theoretical return percentage of certain types of slot machines. About four months later I put out my initial study that ranked the major Las Vegas casinos according to the return of nickel reeled-video slots.

For the first time the code of silence around slot machines had been broken.

THE IMAGE BANK/BONGOTOM STUDIO, INC.

or Robin Hood?

At first the study was confined to my website at www.thewizardofodds.com, where it received relatively little attention. Later, when I directed the attention of Anthony Curtis, publisher of the *Las Vegas Advisor*, to the study, he knew he was looking at something that had never been done before. After Curtis published the study in the *Advisor*, word quickly spread around the city. On May 19, the *Las Vegas Review-Journal* did two articles on the study for the front page of the business section. On May 31 the *Wall Street Journal* ran a short article about it as well.



Meanwhile, the highest ranked casino, the Palms, was making the most of the study. Billboards, mailers, and a television commercial boasted of having the loosest slots in Vegas. Surprisingly, it wasn't the lowest ranked casinos that were the most upset but other casinos close to the top. Evidently, finishing in the lower top 10 isn't good enough.

Criticisms of the study by people who didn't understand it were published in a certain gambling tabloid. The basic methodology of using par sheets to identify the return percentage of a slot machine, however, has never been challenged by the slot makers or the Nevada Gaming Control Board. There are some legitimate arguments regarding the sampling or averaging, and that's what I'll address here.

EPROM

Before going further, let me explain briefly how slot machines work. The casino manager may choose from various erasable programmable read-only memory (EPROM) chips supplied by the manufacturer. These chips tell the slot machine the probability for each symbol on each reel, which ultimately determines how often each paying combination can be expected to occur, and ultimately the theoretical return of the game. There will generally be about six to nine chips to choose from for each game, ranging in return from 85 percent to 98 percent.

Random numbers ultimately determine the outcome of each play. The numbers the machine generates the moment the player spins the reels get passed through a look-up table, which dictates where the wheels will stop. In the case of single-payline slot machines, each stop on each reel has a certain weighting. This can be shown by the fact that the reels will stop just above or below a jackpot symbol much more frequently than the jackpot symbol itself. Even with the program sheets, it would take a sampling of thousands of spins to fairly determine the weighting of each stop on a single-payline machine.

Multi-line video slots, however, are evenly weighted. In other words, each stop on any given reel has an equal probability. What separates a 90 percent and a 92 percent paying slot machine is a few changes in the order of symbols on the reels. The 92 percent machine will have slightly more higher paying symbols. The player is able to view three consecutive symbols on each reel. With the program sheets, it's possible to identify certain sequences of three symbols that appear on some but not all par sheets. With a listing of these particular sequences, it's just a matter of playing for a few minutes to narrow down the par sheet, and thus the return, to just one possibility.

So while I might confidently sit in front of specific video slots and ascertain the return, there are still weaknesses in the study. First, the study covers only video nickel slots. Since I played that same type of game at all casinos, I feel it's a fair comparison. Yet a casino that's stingy at the nickel coinage may or may not be generous at the higher coinages. I did notice a general positive relationship between nickel and quarter returns, but there are too few quarter video slots to do a full study. And besides, a nickel video slot can accept up to about 90 nickels ($4.50) per spin, so there isn't much call to bet more than that at a time.

There is also a problem with sample size. I had par sheets for only seven kinds of machines. Some casinos in the survey had only two of the seven on the floor. (Those that had only one type aren't included in the study.) Some casinos I visited before completing the reports on all seven games. As of this writing, I've played and recorded the return of 440 nickel machines in the Las Vegas area, not counting the casinos excluded from the survey. Four hundred forty machines, divided by the 77 casinos in the survey, results in an average of 5.71 machines per casino. I would have liked to have a larger sample size, but as a married man with two small children, I couldn't spend too much time on a project for which I received no compensation.

There was another problem in how to average the results. For example, suppose a sample at a particular casino consisted of three games of type *x* and five games of type *y* at a given casino. If I took a straight average of the eight games, then game *y* would get a heavier weighting than game *x*.

Furthermore, suppose I didn't like a particular casino. I could deliberately include more of the lower paying games in the sample. The most accurate method, I believe, is to weight the results of each machine by the proportion of that kind of machine over all the machines on the floor. This, in fact, is how the Tunica, Miss., study was conducted by Marcus Addams, using my code sheets. But anyone who has been to Las Vegas can testify that surveying a casino floor for the total of each kind of game would be a very time consuming and tedious task.

A reasonable and unbiased approach, I believe, was to take an average of averages. For example, if the three games of type *x* had an average return of 90 percent and the five games of type *y* had an average return of 92 percent, then the overall average was defined as (90 percent+92percent)/2 = 91percent.

RANK	CASINO	RETURN
1	Palms	93.42%
2	Rainbow Club	92.97%
3	Gold Coast	92.84%
4	Sahara	92.81%
5 (tie)	Bourbon Street	92.63%
5 (tie)	Imperial Palace	92.63%
5 (tie)	Slots a Fun	92.63%
8	Key Largo	92.60%
9	Western	92.57%
10	Ellis Island	92.56%
11	El Cortez	92.56%
12	Orleans	92.56%
13	El Dorado	92.56%
14	Circus Circus	92.56%
15	Gold Spike	92.55%
16	Fitzgeralds	92.54%
17	Fiesta - Rancho	92.53%
18	Arizona Charlie's East	92.51%
19	Barbary Coast	92.50%
20	Terrible's	92.49%
21	Arizona Charlie's	92.49%
22	Hard Rock	92.47%
23	Town Hall	92.47%
24	Longhorn	92.47%
25	Riviera	92.23%
26	California	92.14%
27	Lady Luck	92.10%
28	Nevada Palace	92.06%
29	Plaza	91.94%
30	Luxor	91.92%
31	Paris	91.92%
32	San Remo	91.88%
33	Excalibur	91.84%
34	Palace Station	91.84%
35	Bally's	91.82%
36	Las Vegas Club	91.76%
37	Four Queens	91.75%
38	Texas Station	91.71%
39	Casino Royale	91.67%
40	Boulder Station	91.55%
41	Aladdin	91.50%
42	O'sheas	91.48%
43	Hilton	91.40%
44	Sunset Station	91.33%
45	Boardwalk	91.28%
46	Hyatt Regency - Lake Las Vegas	91.14%
47	Green Valley Ranch	91.11%
48	New York New York	90.99%
49	Horseshoe	90.96%
50	Sam's Town	90.89%
51	Santa Fe Station	90.87%
52	Flamingo	90.86%
53	Golden Nugget	90.85%
54	Stratosphere	90.80%
55	Tropicana	90.71%
56	Golden Gate	90.64%
57	Silverton	90.57%
58	Main Street Station	90.56%
59	Westward Ho	90.40%
60	Fremont	90.37%
61	Castaways	90.36%
62	Monte Carlo	90.24%
63	Stardust	89.97%
64	Frontier	89.91%
65	Railroad Pass	89.90%
66	MGM Grand	89.81%
67	Harrah's	89.32%
68	Treasure Island	89.32%
69	Mirage	89.30%
70	Caesars Palace	89.05%
71	Mandalay Bay	88.87%
72	Rio	88.72%
73	La Bayou	88.26%
74	Mermaids	88.26%
75	Bellagio	87.42%
76	Venetian	86.66%
77	Airport	85.02%

A flaw in this method is unbalanced representation. For example, if a casino has 1,000 of game *x* and 10 of game *y*, then the average return of the 1,010 machines would be 90.02 percent. So although the reported overall averages aren't perfect, I took great pains to be unbiased and used the same methodology at all casinos.

Opting Out

I excluded any casino that didn't cooperate with the study. In the course of this study, I or my assistant were prohibited from completing play at the Suncoast, Fiesta Henderson (at the time it was known as the Reserve), and the Rampart Casino in Summerlin. At the Suncoast casino, for example, I was told that if I persisted, security would remove me from the building.

I also offered casinos the option of opting out of the survey, although no casino has exercised the option. Some smaller casinos were excluded for an insufficient variety of games.

This survey was conducted between October 2001 and May 2002. When the *Las Vegas Review-Journal* reported my study on May 19 of this year, I'm told some casinos were outraged and I felt it was in my best interests to terminate the study, at least in Las Vegas. However, I did add the Las Vegas airport later in July. As expected, the airport has very stingy machines. So this study is now admittedly a bit dated.

With all the explanations and caveats out of the way, I now present the most up-to-date ranking of the loosest nickel video slots in the greater Las Vegas area.

One generalization that can be made from this list is that the nicer the casino, the tighter the slots. Another is that the more remote the casino, the looser the slots. This survey did confirm the commonly held belief that the loosest slots were in the off-strip "local" casinos, followed by downtown, and then followed

by the Strip. However, the overall groupings weren't as far apart, and there was wide variation within groupings.

One important factor this study doesn't consider is slot club cash back. Most casinos offer free slot cards that, when inserted in a machine, keep track of total money bet. These generally offer about 0.5 percent cash back on total money bet. In addition, the more money a person runs through a machine, the more and better the coupons and promotions that person will get from that casino in the future.

One commonly held belief that this survey did appear to debunk was the correlation between location and return. Many slot players believe that aisle machines and machines in high-traffic areas pay better. The reason for this belief is that the slot manager wants to showcase people winning and make it up from the people playing in the corners or in the middle of a bank. My research showed no such correlation. Most casinos were very consistent. If one game of type *x* paid 92 percent, then all other *x* machines also paid 92 percent. The MGM/Mirage casinos were an exception to this rule, seemingly mixing up loose and tight machines at random. The Park Place and Mandalay Bay group of casinos were very consistent in slot placement.

This survey is part of a larger goal of mine. I believe players have the right to know the odds against them in any casino game. In the case of slot machines, I believe the theoretical return percentage should be posted on each machine. Until this happens, I invite any casino that has nothing to hide to post its slot returns voluntarily, or at least make the information available upon request. ●

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Miracle on the Strip

MIKE SHACKLEFORD'S WORK HAS PRODDED SOME LAS VEGAS CASINOS into advertising the consumer friendliness of their slot machines—something Albert Brooks was less successful at in the 1985 movie *Lost in America*.

In the movie, Brooks plays David Howard, an L.A. ad executive who quits his job after being passed up for an expected promotion. Feeling liberated, he and his wife Linda liquidate their assets, consolidate their nest egg, and head off cross-country in a new Winnebago to find themselves and "touch Indians." First stop is Las Vegas, where they plan to renew their wedding vows.

But it doesn't quite work out that way. In a night of compulsive gambling (while David sleeps), Linda proceeds to lose their entire nest egg at the Desert Inn casino. Ever the ad man, David tries to persuade the casino manager (Garry Marshall) to give them their money back.

DAVID: Think of the publicity! The Hilton hotel has billboards all over Los Angeles where the winners of these slot machine jackpots… their faces are all over L.A.… and I know that works…

MANAGER: Well, first of all, those people on those signs, they won. You lost.

DAVID: That's it! That's the campaign!

MANAGER: What's the campaign?

DAVID: You gave us our money back because you reviewed our situation and you realized that we dropped out of society, we weren't just gamblers. We made a mistake and you gave us our money back.

But the manager isn't buying it. Everybody who loses money would want their money back, he reasons. That makes no sense for a casino. No deal. So David tries another tack: a word game.

DAVID: What word do you think of when you think of a hunting lodge?

MANAGER: Hunt.

DAVID: What do you think of when you think of a rest home?

MANAGER: You rest.

DAVID: So you're going to associate the Desert Inn with something beautiful. You don't think of anything here now, do you?

MANAGER: Gambling! That's why people come here. They gamble! People want to hunt, they go to Wisconsin. You see signs around this town of guys with guns shooting ducks? It's a gambling place!

DAVID: What about "Miracle on 34th Street"?

MANAGER: That's a Christmas movie.

DAVID: Yes, it was. Now, there was Gimble's, afraid that if he gave to Macy's he would lose his business, and he didn't. He wound up benefiting.… It's the same situation. This costs you nothing… You would be the one who would benefit.

MANAGER: Wrong. In that movie, Santy Claus took care of everything. There was Macy's and Gimble's, but Santy Claus came and he fixed the whole thing. We don't have Santy Claus.

DAVID: Then we'll get him!

MANAGER: Who?

DAVID: Santa Claus! That's the ad campaign! Santa Claus is the one on the billboard. He gives us our nest egg back. We associate for the first time ever Christmas and Las Vegas. Las Vegas, a Christmas place to be.

MANAGER: We're finished talking.

Lost in America

WRITTEN BY **ALBERT BROOKS** AND **MONICA JOHNSON**