

How to win Professional Roulette

The exact price of every bet, the autopsy of every system,
and five million simulated sessions on all three wheels.

Winfield

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Contents

Chapter 1 — The 38-Pocket Decomposition: Every Bet Pays as If There Were 36

Chapter 2 — The Exact Ledger

Chapter 3 — Systems Under the Microscope

Chapter 4 — The Martingale Autopsy

Chapter 5 — Variance Shopping

Chapter 6 — Game Selection

Chapter 7 — The Biased-Wheel Era and Its End

Chapter 8 — Session Engineering

Chapter 9 — System-Selling Culture and the Gambler's Fallacy

Chapter 10 — Dealer Signature and Live Craft

Chapter 11 — Electronic Roulette, RNG, and Comps

Chapter 12 — The Field Test: Protocol and Predictions

Chapter 13 — Appendix: The Engine and the Tables

Chapter 1 — The 38-Pocket Decomposition: Every Bet Pays as If There Were 36

Every roulette wheel runs on a single arithmetic trick, and once it is seen it cannot be unseen. The American wheel has 38 pockets — the numbers 1 through 36, plus 0 and 00 — but every payout on the layout is computed as if only 36 pockets existed. A straight-up bet on one number pays 35 to 1, which would be exactly fair on a 36-pocket wheel; the true odds against are 37 to 1. A split pays 17 to 1 against true odds of 18 to 1. Red pays even money while covering 18 of 38 pockets, not 18 of 36 ([Wizard of Odds¹](#)).

The house edge falls directly out of this decomposition. On a straight-up bet, the player wins 35 units with probability $1/38$ and loses 1 unit with probability $37/38$, so the expected value per unit staked is $(35 - 37)/38 = -2/38$, or -5.2632 percent. Run the same computation for the split, the street, the corner, the six line, the dozens, the columns, and the even-money bets, and the answer is the same fraction every time: $-2/38$. The two green pockets are the entire business model. The European wheel, with a single zero and 37 pockets, prices every bet at $-1/37$, or -2.7027 percent, and the triple-zero wheel, with 39 pockets, charges $-3/39$, or -7.6923 percent.

This is why roulette is decomposition-complete in a way few casino games are: the whole game reduces to one number per wheel. There is no strategy chart because there are no decisions that matter. There is no card counting because there is no memory — each spin is an independent draw, and the wheel does not know what happened last spin. The professional's first job is simply to know this number cold, because everything sold to roulette players — systems, progressions, courses, and gadgets — is an attempt to make the customer forget it.

One bet breaks the pattern, in the wrong direction. The five-number basket (0, 00, 1, 2, 3) pays 6 to 1 against true odds of 33 to 5, producing an edge of $-3/38$, or -7.8947 percent — the only bet on the American layout priced worse than the standard 5.26 percent ([Wizard of Odds¹](#); [LCB²](#)). It is the single genuine mistake available on the felt, and avoiding it is the only "strategy" the layout offers.

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Chapter 2 — The Exact Ledger

The engine behind this book computes every bet's expected value as an exact fraction, with no simulation and no rounding. The ledger below is the complete price list for the American double-zero wheel. Every probability is the count of covered pockets over 38; every edge is a ratio of integers.

Bet	Covers	Pays	Win probability	House edge
Straight up	1	35:1	2.63%	5.26%
Split	2	17:1	5.26%	5.26%
Street	3	11:1	7.89%	5.26%
Corner	4	8:1	10.53%	5.26%
Basket (0-00-1-2-3)	5	6:1	13.16%	7.89%
Six line	6	5:1	15.79%	5.26%
Dozen / Column	12	2:1	31.58%	5.26%
Red / Black, Odd / Even, High / Low	18	1:1	47.37%	5.26%

The table's most important property is its monotony. Except for the basket, every row costs exactly the same: $-2/38$ of every unit wagered, confirmed independently by the published ledger at [Wizard of Odds](#)¹. Bet selection on a given wheel is not a lever. Choosing a straight-up number over red does not change what the evening costs in expectation; it changes only how the cost arrives — in rare large swings or steady small ones. That distinction is the subject of Chapter 5.

On the European wheel the same ledger repeats at $-1/37$ per unit for every standard bet, and there is no basket anomaly. Where the single-zero wheel offers *la partage* — half the stake returned when zero hits an even-money bet — the even-money edge halves again to $-1/74$, or 1.3514 percent, the cheapest widely available bet in commercial roulette ([Wikipedia](#)³). The engine's exact ledger, computed with Python fractions and verified by sixteen unit tests, reproduces every published figure to the last decimal. These few fractions — $2/38$, $1/37$, $3/38$, $3/39$, $1/74$ — are the entire mathematical content of roulette. Everything else in this book is about what those fractions do to real bankrolls over real sessions.

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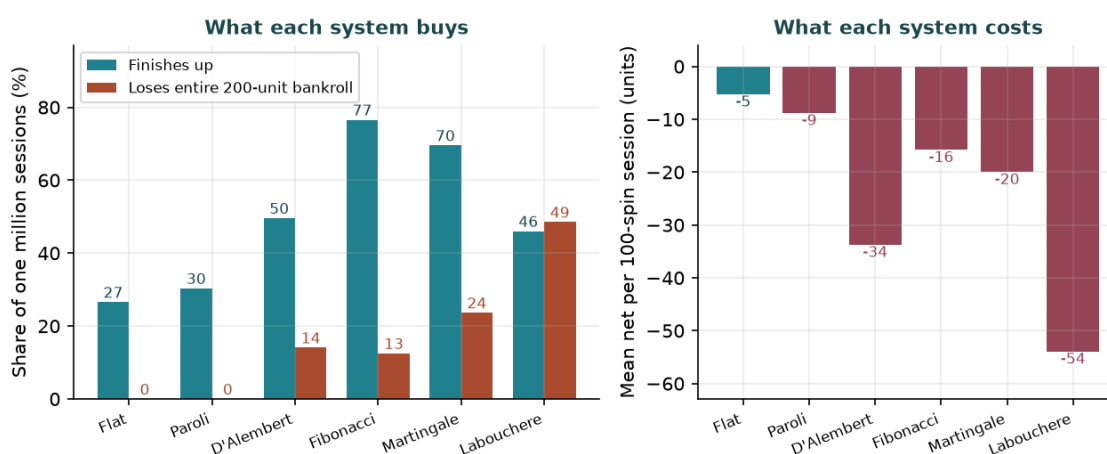
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Chapter 3 — Systems Under the Microscope

Staking systems are the folklore of roulette: martingale, paroli, d'Alembert, Fibonacci, Labouchere. Each prescribes how to size the next bet based on what just happened, and each implicitly promises that sequencing can beat pricing. The mathematical literature is unanimous that it cannot — expected loss equals total amount wagered times house edge, whatever the sequence ([Martingale Roulette](#)⁴; [Casinomoneys](#)⁵). The engine tested the claim by brute force: six systems, one million 100-spin sessions each, on a double-zero wheel, with a 200-unit bankroll and a 500-unit table maximum.

System	Mean net	Finishes up	Loses entire bankroll	Worst session
Flat	-5.25	26.6%	0.0%	-60
Paroli	-8.78	30.4%	0.0%	-80
Martingale	-19.95	69.6%	23.7%	-200
D'Alembert	-33.73	49.6%	14.1%	-200
Fibonacci	-15.77	76.6%	12.5%	-200
Labouchere	-53.92	46.0%	48.5%	-200

Six staking systems, one million sessions each, double-zero wheel



Six staking systems compared: win rate purchased versus mean cost paid

The table rewards careful reading. Every system loses on average, exactly as the theorem requires — and the aggressive ones lose more, not less, because progressions force more total

money through the 5.26 percent toll booth. What systems actually do is redistribute outcomes. Fibonacci buys a 76.6 percent chance of finishing a session ahead, and pays for it with a 12.5 percent chance of losing the entire 200-unit bankroll and a mean cost three times flat betting. Labouchere is the most instructive failure: nearly half of all sessions end in total ruin, the median session loses 93 units, and the mean cost is more than ten times flat betting (UNLV Gaming Institute⁶ derives the same structure analytically for capped martingale play).

The professional's reading of this chart is simple: systems are not strategies, they are variance products with a markup. Flat betting is the only row that never touches ruin and the only row that pays list price. Every other row pays extra for a reshaped distribution — usually a higher chance of a small win, financed by a small chance of catastrophe. A buyer should at least know that is what is being purchased.

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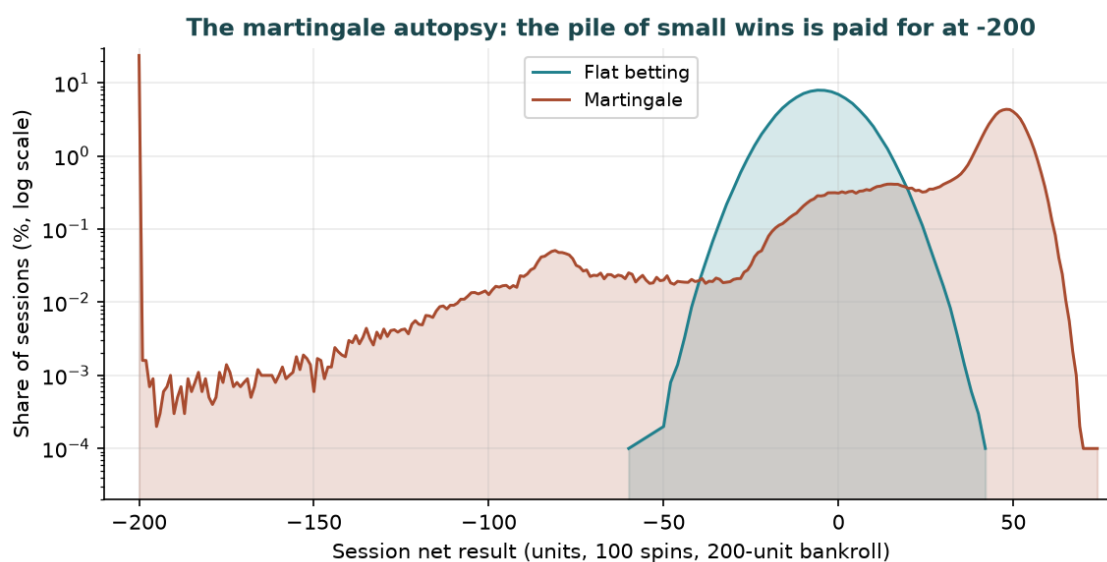
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Chapter 4 — The Martingale Autopsy

The martingale deserves its own chapter because it is the most sold, most rediscovered, and most misunderstood object in gambling. The rule is one sentence: double the bet after every loss, so the first win recovers everything and banks one unit. The seduction is real — in the engine's million-session trial, martingale players walked away winners 69.6 percent of the time. The autopsy explains where the money went.



The histogram has two masses. The tall right-hand hill is the advertised experience: hundreds of thousands of sessions ending between +30 and +74 units, each one a satisfied customer. The spike at -200 is the invoice. In 23.7 percent of sessions the doubling ladder — 1, 2, 4, 8, 16, 32, 64, 128 — collided with either the 200-unit bankroll or the 500-unit table maximum during one of the losing streaks that a 100-spin session makes nearly routine. The exact streak arithmetic: over 100 even-money spins on a double-zero wheel, the probability of at least one losing streak of six or more is 64.5 percent, of eight or more is 23.6 percent, and of ten or more is 6.9 percent. The probability that a martingale session ends with a loss of 100 units or worse is 24.0 percent — almost exactly one session in four.

The required capital grows exponentially against those streaks. Surviving seven consecutive losses at a \$10 base bet requires \$1,270 of bankroll; ten losses requires \$10,230; fifteen requires \$327,670 ([GamblingCalc](#)⁷). After roughly ten consecutive losses the required bet exceeds nearly every table maximum, which is precisely why table maximums exist ([Wikipedia](#)⁸). The UNLV Gaming Institute's formal analysis of the capped system reaches the same verdict analytically: negative expected gain per round, enormous variance, and a roughly 18 percent chance of finishing 10,000 rounds in profit ([UNLV Gaming Institute](#)⁶). A stochastic treatment models the

martingale bankroll as a random walk with strictly negative drift ([Charles University](#)⁹).

One experiment in the engine explains why the system never dies commercially. Simulating martingale with no table limit and no bankroll cap for only 2,000 sessions produced a positive empirical mean of +20.66 units per session — because the catastrophic branch is rare enough that a small sample can miss it entirely. Any system seller running a short, honest-looking backtest can therefore produce genuine-seeming evidence of profit. The tail does not disappear; it merely goes unsampled. That is the untouched-tail illusion, and it is the engine of a century of martingale marketing.

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Chapter 5 — Variance Shopping

If every bet on a wheel costs the same, what does bet selection actually buy? The answer is variance, and it is priced very differently across the layout. For an even-money bet on the American wheel, the standard deviation is approximately 0.999 units per unit staked — almost exactly one ([Wikipedia](#)¹⁰; [LTCC Online](#)¹¹). For a straight-up bet the standard deviation is roughly 5.76 to 5.84 units per unit staked — meaning a straight-up bettor experiences roughly 33 times the variance of an even-money bettor for the same expected loss ([Mayfair Casino](#)¹²).

A university statistics course tabulates the full spectrum per \$100 wagered on the double-zero wheel: straight up 576, split 402, street 324, corner 276, six line 219, dozens 139, even money 100 ([LTCC Online](#)¹¹). Reading down that column is shopping in the only store roulette has. A player who wants lottery-shaped evenings — long quiet losses punctuated by rare 35-unit hits — buys the top of the table. A player who wants the cheapest possible seat time buys the bottom.

Session standard deviation scales with the square root of the number of spins, and results fall within one standard deviation of the mean about 68 percent of the time ([Wizard of Odds](#)¹³). The exact engine puts hard numbers on a flat even-money session at one unit per spin on the double-zero wheel: over 100 spins, expected value is -5.26 units, standard deviation 9.99 units, and the probability of finishing ahead is 26.5 percent. The middle 90 percent of sessions land between -22 and +12 units. Variance dwarfs expectation at session scale — which is exactly why casual players can win often enough to keep coming back, and exactly why the professional treats the standard deviation, not the mean, as the number that sets the size of the bankroll.

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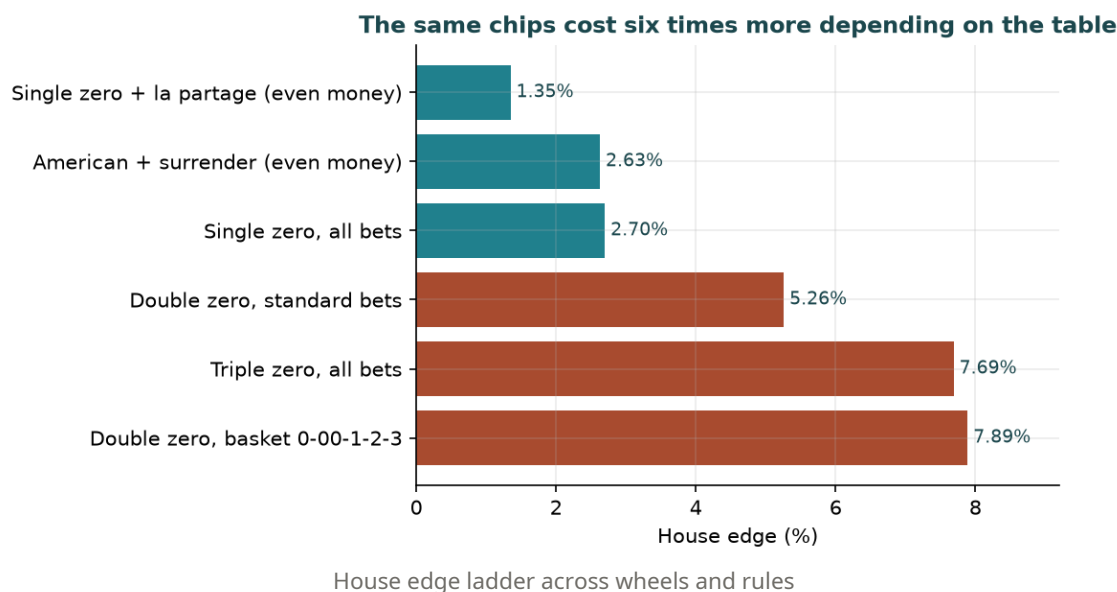
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Chapter 6 — Game Selection

Bet selection is not a lever, but game selection is — the one genuine lever in the entire game. The identical red-or-black wager costs 5.26 percent on a double-zero wheel, 2.70 percent on a single-zero wheel, 1.35 percent on a single-zero wheel with la partage, and 7.69 percent on a triple-zero wheel. Choosing the table is choosing the price.



La partage returns half of an even-money stake when the ball lands on zero; en prison instead imprisons the stake for one more spin, with similar economics. Both cut the single-zero even-money edge from 2.70 to 1.35 percent ([Wikipedia](#)³; [Bonus Insider](#)¹⁴). An Atlantic City variant applies the same principle to the double-zero wheel, cutting the even-money edge to 2.63 percent ([OnlineGamblingWebsites](#)¹⁵). The engine's 200,000-session trials show what the ladder means over a 100-spin evening at one unit per spin: mean cost 1.33 units with la partage, 2.68 on plain single-zero, 5.24 on double-zero, and 7.66 on triple-zero, with the probability of finishing ahead falling from 43.9 to 19.3 percent from the top of the ladder to the bottom.

The industry has spent a decade pushing players down that ladder. The triple-zero wheel debuted commercially at The Venetian in October 2016 as "Sands Roulette," with the third zero disguised inside a casino logo and a lower table minimum as bait ([Las Vegas Advisor](#)¹⁶). Strip-wide table counts grew from roughly 25 in 2019 to 83 in 2022 ([Vegas Advantage](#)¹⁷), and a 2026 survey found 27 Strip casinos dealing triple-zero at \$10 to \$25 minimums while single-zero survives mostly at \$50-plus tables ([Vegas Advantage](#)¹⁸). The countertrend is notable: Wynn and Encore eliminated triple-zero company-wide beginning September 2025, the first major Strip operator to remove the format entirely ([CDC Gaming Reports](#)¹⁹). An electronic "quadruple-zero" format now pushes the edge toward 10 percent ([Flip The Switch](#)²⁰). The cheap minimum is the

lure; the extra zero is the hook. The professional pays the higher minimum for the cheaper wheel, or does not play.

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Chapter 7 — The Biased-Wheel Era and Its End

Roulette was genuinely beatable once, and the history matters because every modern system seller borrows its glamour. Joseph Jagger, a Yorkshire textile businessman, took his mill-trained understanding of spindles to Monte Carlo around 1881, hired clerks to record outcomes, identified nine numbers that hit more often than chance on one wheel, and won over two million francs — roughly £7.5 million in modern terms — before the casino began rearranging wheel partitions nightly ([Wikipedia](#)²¹). A century later, Gonzalo Garcia-Pelayo and his family recorded tens of thousands of spins at Casino Gran Madrid, identified statistically biased wheels, and won more than a million euros across 1991 to 1995; a Spanish judge overturned the casino's ban, ruling that observation and record-keeping are not cheating ([Casino.org](#)²²; [El País](#)²³).

The physics era ended the same way the bias era did: the casinos bought better machines. In March 2004, a three-person team at London's Ritz Club used a laser scanner concealed in a mobile phone to time the ball's decaying orbit, narrowing effective odds from 37-to-1 to roughly 6-to-1 and winning about £1.3 million over two nights; police returned the money because no law then in force covered the device ([ABC News Australia](#)²⁴; [Telegraph](#)²⁵). The UK closed that gap with the Gambling Act 2005, and Nevada classifies prediction devices as a Category B felony ([Mayfair Casino](#)²⁶).

Meanwhile the wheels themselves became instruments. Cammegh's Mercury 360 carries four in-rim sensors logging rotor and ball speed on every spin, and its Random Rotor Speed feature adds an imperceptible randomized deceleration twice per game, enough to make timing-based prediction statistically useless even with computer assistance; TCS John Huxley's Saturn wheel ships comparable countermeasures ([Mayfair Casino](#)²⁶; [Cammegh](#)²⁷). Low-profile Starburst-style metal frets wear slowly and predictably, and floor systems run continuous statistical bias detection ([Casino.org](#)²²). The honest summary: the exploits were real, they are the best stories in the game, and they are closed. A method that worked on an 1881 wooden wheel or a 2004 unmonitored one says nothing about a sensed, randomized, felony-protected wheel in 2026.

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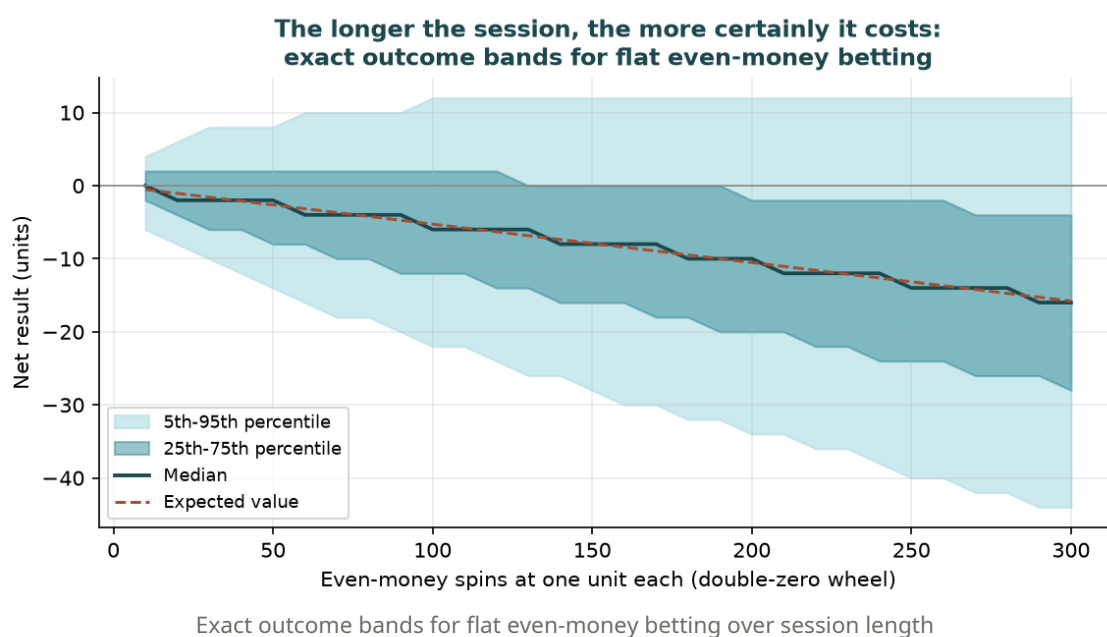
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Chapter 8 — Session Engineering

Since the price of play cannot be negotiated, the professional's craft moves to the session: deciding in advance what an evening may cost, and making the worst case a design parameter rather than a surprise. The governing equation is the simplest in the book: expected loss equals average bet, times spins per hour, times hours, times house edge ([easy.vegas](#)²⁸). At a live table dealing roughly 30 spins per hour, \$10 even-money bets on a single-zero wheel cost about \$8.10 per hour in expectation ([Kyruus Health](#)²⁹); the same play on a double-zero wheel costs about \$15.79.



The fan chart shows the exact distribution of flat even-money results as a session extends on a double-zero wheel. Two features matter. First, the median walks steadily downward with the expected value — the longer the session, the more certainly it costs. The probability of finishing ahead falls from 30.3 percent at 50 spins to 26.5 percent at 100, 20.7 percent at 200, and 16.6 percent at 300. Second, the bands stay wide: even at 300 spins the 95th percentile is still +12 units. Variance is why people remember winning; drift is why casinos build fountains.

Bankroll sizing follows from the variance ladder in Chapter 5. A working rule of thumb from a detailed published model: session bankroll of at least 30 times the average bet for even-money play, and five to six times more than that for straight-up numbers, whose per-spin standard deviation runs near six times the stake ([Mayfair Casino](#)¹²). The same source works a cautionary example: at \$500 straight-up per spin, a \$25,000 bankroll faces roughly a 63 percent chance of ruin over a four-hour session.

Stop-loss and stop-win rules complete the design. They do not change expected value — the edge lives in the bet, not the schedule (*Effortless Math*³⁰). What they do is truncate the outcome distribution: the worst case becomes a chosen number instead of an open-ended one. The engine's million-session test of this book's field protocol — flat one-unit even-money bets, 40-unit bankroll, stop-loss 20, stop-win 20, at most 100 spins — produced a mean cost of 5.08 units, a hard floor of exactly -20, and no session outside the designed range. Session engineering does not make roulette profitable. It makes roulette cost what an evening's entertainment was budgeted to cost, with the receipts decided in advance.

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Chapter 9 — System-Selling Culture and the Gambler's Fallacy

The gap between roulette's mathematics and roulette's marketing is filled by one cognitive bug: the conviction that independent events keep score. On August 18, 1913, at the Casino de Monte-Carlo, black came up 26 times in a row. As the streak lengthened, gamblers bet ever-larger sums on red, reasoning that red was overdue, and lost millions of francs as black kept arriving; the probability of such a streak is on the order of one in 67 to 68 million, and the wheel produced it anyway ([Wikipedia](#)³¹; [IFLScience](#)³²). Every doubling system is the 1913 crowd's reasoning with a spreadsheet: the belief that a losing streak makes the next win more likely, or at least more deserved.

Psychologists Daniel Kahneman and Amos Tversky formalized the error in the 1970s, and modern treatments distinguish two versions — expecting a streak to correct itself, and expecting a streak to continue ([Elder Research](#)³³; [UNSW Sydney](#)³⁴). Both are wrong for the same reason: the wheel has no memory. The streak arithmetic in Chapter 4 is worth rereading in this light. Six-loss streaks appear in nearly two-thirds of 100-spin sessions; they are not omens, they are baseline.

The commercial ecosystem built on this bug is old and adaptive. Systems are sold as e-books, courses, software, and "guaranteed" progressions, and the pitch always has the same shape: a plausible mechanism, a short honest-looking track record, and a refusal to state the expected value ([Voalacs](#)³⁵; [Ancient Games](#)³⁶). Chapter 4 showed how easy the track record is to generate: an unbounded martingale backtest over 2,000 sessions showed a profit of more than 20 units per session simply because the catastrophe went unsampled. The honest disclosure that no seller makes is a single sentence: expected loss equals total wagered times house edge, under every system ever devised ([Martingale Roulette](#)⁴; [Casinomoneys](#)⁵). A system that does not claim to change that number is a pacing preference, which is fine. A system that does claim to change it is a lie with a price tag.

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Chapter 10 — Dealer Signature and Live Craft

The most durable soft claim in roulette is that live play contains residual, legal edges: that some dealers release the ball with mechanical consistency (a "dealer signature"), or that a trained eye can read the ball's decaying orbit and bet a sector before the no-more-bets call (visual ballistics). The evidence deserves an honest audit, because unlike staking systems, physics-based prediction was once demonstrably real.

The academic high-water mark is the 2012 study by Michael Small and Chi Kong Tse, which modeled ball and rotor dynamics and reported that computer-derived timing could produce an expected return of at least 18 percent of money bet; in a 700-spin test the model's predictions beat the 99 percent confidence bound, and a hand-timed trial on a casino-grade wheel identified the correct half of the wheel in 13 of 22 attempts (LCB³⁷). The lineage runs back through the Eudaemons — the Santa Cruz physics collective whose shoe computer earned a documented edge near 20 percent on favored sectors in the late 1970s — to Edward Thorp and Claude Shannon's 12-transistor wearable, which found a 44 percent advantage on the most-favored octant under laboratory conditions (Mayfair Casino²⁶).

Three forces closed this door. First, hardware: Random Rotor Speed wheels randomize rotor deceleration within each spin, in-rim sensors log every ball and rotor revolution for the pit, and the published engineering assessment is blunt — on a modern monitored wheel "the physics-based advantage is gone" (Mayfair Casino²⁶). Second, procedure: croupiers are trained to vary release force and call no-more-bets early, removing the late-orbit observation window that visual ballistics requires (LCB³⁷). Third, law: device-assisted prediction is a licensing offence in the UK under the Gambling Act 2005 and a Category B felony in Nevada (Mayfair Casino²⁶).

As for the unaided version sold in courses, the same editorial that documents the computer results states plainly that manual visual ballistics works only in the theoretical sense and cannot match a computer, and that course sellers' incentive is selling courses (LCB³⁷). No rigorous source located for this book defines a reliably exploitable dealer signature under modern conditions. The professional verdict: the physics chapter of roulette history is genuine, closed, and criminalized — and any live "craft" edge offered for sale in 2026 should be priced at exactly zero.

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Chapter 11 — Electronic Roulette, RNG, and Comps

Modern roulette increasingly arrives without a physical wheel: stadium terminals, hybrid units where electronic betting stations surround one live wheel, and fully electronic games driven by random number generators. The regulatory machinery behind the RNG versions is worth knowing because it settles a common suspicion. In Nevada, a software RNG may not use a static seed, must be seeded from a value expressed in milliseconds or finer, and must keep cycling at no less than 100 calls per second even when idle ([Nevada Gaming Control Board³⁸](#)). The selection process must pass a chi-squared goodness-of-fit test at 95 percent confidence ([Nevada Gaming Control Board³⁹](#)), and devices approved from 2027 onward must use a cryptographically secure generator validated against the Diehard, Dieharder, or NIST SP 800-22 test batteries ([Nevada Gaming Control Board⁴⁰](#)). Certification requires an independent, ISO/IEC 17025-accredited laboratory with full source-code review ([Nevada Gaming Control Board⁴¹](#)). Electronic roulette is not rigged against the player beyond the printed payable; it does not need to be. The payable is the rig.

The practical significance of electronic roulette is different: it changes the price of a seat. Electronic terminals commonly offer lower minimums — \$5 at MGM National Harbor's stadium units on weekdays versus \$25 at its live double-zero tables ([MGM National Harbor⁴²](#)) — but they also deal faster, and expected loss scales with decisions per hour. The slow pace of a live table is one of roulette's few genuinely player-friendly features: at 30 to 40 spins per hour, roulette pushes less money through the edge per hour than blackjack's 60 to 100 hands ([Casino Player Magazine⁴³](#)).

Comps close the loop, because they are computed from the same equation as expected loss. Casinos rate players on theoretical loss — average bet times decisions per hour times hours times house edge — and return roughly 10 to 40 percent of it in complimentaries, regardless of whether the player actually won ([Wikipedia⁴⁴](#); [Casino Player Magazine⁴⁵](#)). A \$10 bettor at 40 spins per hour generates about \$21 of theo per hour and earns back a few dollars in comps ([Casino Player Magazine⁴³](#)). The professional treats comps as a partial rebate on a known cost, worth collecting and never worth chasing: increasing bet size to raise comp value is buying dollars for roughly twenty cents each, in reverse.

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Chapter 12 — The Field Test: Protocol and Predictions

Doctrine that cannot survive contact with a casino floor is decoration. This chapter registers a low-stakes field protocol and its predictions before any live spin, so the outcome can be scored honestly. The venue map is Maryland's six licensed casinos, all of which deal live roulette: Ocean Downs from \$5, Rocky Gap from \$10, Hollywood Perryville from \$15, Live! Casino & Hotel Hanover from \$15, and Horseshoe Baltimore and MGM National Harbor from \$25 live, with triple-zero variants present at Horseshoe and MGM ([US Casino Advantage](#)⁴⁶; [Casino Player Magazine](#)⁴⁷). MGM National Harbor also runs electronic roulette from \$5 on weekdays ([MGM National Harbor](#)⁴²). Online roulette remains illegal in Maryland: the 2026 legislative session ended without any iGaming bill advancing ([Southern Maryland Chronicle](#)⁴⁸). The field test is therefore a live-table exercise.

The protocol, sized in table units. Wheel selection: the best available edge, which in Maryland means any double-zero table — and never a triple-zero wheel or a basket bet. Bets: flat, even-money only, one unit per spin. Bankroll: 40 units. Stop rules: quit at -20, at +20, or at 100 spins, whichever comes first. No progressions of any kind. Record every spin.

The engine played this exact protocol one million times. The registered predictions: mean session result -5.1 units; probability of finishing ahead 26.5 percent; 86.7 percent of sessions reach the 100-spin limit, 11.8 percent hit the stop-loss, 1.4 percent hit the stop-win; the middle 90 percent of sessions land between -20 and +12 units; and no session, ever, loses more than 20 units. A five-session field campaign should therefore be expected to cost roughly 25 units in total, with one or two winning sessions among the five being the single most likely outcome. If the field data lands far outside these bands — in either direction — the correct conclusion is a recording error, not a broken wheel.

What would falsify the book's thesis: any repeatable method producing a positive mean over a sample large enough that the 95 percent band excludes zero. Nothing less counts. Winning a session proves nothing; the engine wins 26.5 percent of its sessions while losing 5.26 percent of everything it wagers.

Sources

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Chapter 13 — Appendix: The Engine and the Tables

Every number in this book is reproducible from the open-source engine in the `gamestats` repository, `roulette` module. The wheel model represents all three commercial layouts — 37, 38, and 39 pockets — with bets priced as exact Python fractions, so the ledger in Chapter 2 contains no floating-point error. The exact-session calculator computes the full probability distribution of flat even-money sessions by convolution, producing the expected values, standard deviations, percentiles, and finish-ahead probabilities quoted in Chapters 5, 6, and 8, and the streak probabilities in Chapter 4 by dynamic programming over streak states. The simulator implements the six staking systems of Chapter 3 as a common state machine with bankroll, table-maximum, stop-loss, and stop-win constraints, and played more than five million seeded, reproducible sessions for this book.

The key exact figures, for reference. House edges: American double-zero 5.2632 percent on all standard bets; the basket 7.8947 percent; European single-zero 2.7027 percent; single-zero with la partage 1.3514 percent on even-money bets; triple-zero 7.6923 percent. Flat even-money play on the double-zero wheel over 100 spins: expected value -5.26 units, standard deviation 9.99, probability of finishing ahead 26.50 percent. Streaks in 100 even-money spins on that wheel: at least one run of six or more losses in 64.5 percent of sessions, eight or more in 23.6 percent, ten or more in 6.9 percent. Systems over one million 100-spin sessions each, 200-unit bankroll, 500-unit table maximum: flat -5.25 mean and zero ruin; paroli -8.78 and zero ruin; martingale -19.95 with 23.7 percent ruin; fibonacci -15.77 with 12.5 percent ruin; d'Alembert -33.73 with 14.1 percent ruin; Labouchere -53.92 with 48.5 percent ruin. Field protocol, one million sessions: mean -5.08, floor -20 by construction.

The sixteen-test suite validates the ledger against published figures ([Wizard of Odds¹](https://wizardofodds.com/games/roulette/basics/)), the exact-session mathematics against binomial identities, and the simulator against the exact calculator where the two overlap. The engine, the campaign scripts, and the chart generators ship together, and every simulation in the book carries a fixed seed. Anyone who doubts a number in these pages is invited to run the code and watch the wheel lose, on schedule, exactly as priced.

Sources

1. <https://wizardofodds.com/games/roulette/basics/>

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