Theory Report:
THE RISK-ADJUSTED PROFIT THEOREM

THE RISK-ADJUSTED PROFIT THEOREM

Table of Contents

- Introduction 02
- Expected Value 03
- The Monte Carlo Simulation 04
- Pot Odds 05
- Four Types of Bet 08
- The Q Ratio 09
- Stack Path Optionality 11
- Negative Implied Odds 12
- The Risk-Adjusted Profit Theorem 13
- Utility is a Sizing Factor 15
- Q-Score Relative Ranking 16
- RAPT as part of a standard methodology 16
- RAPT as a spot analysis tool 17
- RAPT as mental model and philosophical guide 18
- Bad News, Good News, Great News 19

THE RISK-ADJUSTED PROFIT THEOREM

Every trader (and investor) could benefit from an education in high stakes cash game poker.

Every trader – and every investor for that matter – could benefit from an education in high stakes cash game poker.

There is no better training ground than high stakes cash game poker for combining strategy, probability and human emotion. It is a game where skill dominates in the long run, but swings of luck produce wild short-term outliers. (There are few better ways to train one's gut instinct than experiencing and internalizing those swings.)

The reference here is to cash game poker specifically, and not poker tournaments, because the two are radically different. (Tournaments are far more luck-driven.)

"Deep stack" cash games have very different dynamics versus the game as played via medium / small stacks.

And the reference is to high stakes cash game poker, as opposed to medium or low stakes, because "deep stack" cash games – in which the average stack in play is thousands of dollars at minimum – have very different dynamics as compared to the game played with medium or small stacks.

For the skilled professional, deep stack cash game poker is the most profitable version of the game that can be played. This is due to the cost of mistakes, and the risk control differences between skilled and less-skilled players. For instance:

> If a low stakes cash game player makes a mistake with a $300 chip stack, the maximum amount that player can lose is $300.
>
> But if a high stakes cash game player makes a mistake with a $20,000 stack, it is possible for the whole $20K to be lost.

The skilled professional does not make the same risk control errors most opponents do. As a result, the risk of total stack loss (or a large loss in general) is asymmetric. The professional is less likely to lose a large amount, relative to available opportunities to win a large amount of – or all of – his opponent's stacks.

The larger the stacks, the larger the professional's edge becomes.

As such, the larger the stacks, the larger the professional's edge becomes. The ability to vary bet size and activity levels, sometimes dramatically, is also key, and better exploited with deep stacks. This is only the tip of the iceberg, but it paints a picture.

We spent two years playing $10-$20 No Limit Hold 'Em in the Bellagio on an almost daily basis, a game in which the average stack size was roughly $10,000 to $20,000.

Before that came multiple years of medium and high stakes cash games in Reno, Nevada, and a close call with a WSOP circuit tournament ring (second place in a $550 buy-in event, where the final hand came down to AQ versus a low pair).

Our love affair with poker waned when it became harder to do research at the table between hands – our habit of many years – as laptops began to generate suspicion, due to the availability of increasingly powerful real-time analysis software programs.

But the lessons we took from cash game poker were invaluable. If we ever had to rebuild a trading stake from scratch, the poker room is where we'd go.

And those lessons led to the Risk-Adjusted Profit Theorem (RAPT), a valuable tool not just in poker, but in markets and in life. This report will visit poker and trading-related probability and strategy concepts, and explain the theorem in light of those.

EXPECTED VALUE

The first crucial concept to understand is expected value, or EV.

Expected Value (EV) applies equally to poker, trading and investing.

Expected Value (EV) is a basic probability calculation, vitally important to poker, trading, and investing too.

In the following quote on investing, Warren Buffett is basically describing EV:

> Take the probability of loss times the amount of possible loss from the probability of gain times the amount of possible gain. That is what we're trying to do. It's imperfect, but that's what it's all about.
>
> ~ Warren Buffett

But we can simplify the Expected Value concept even further, like this:

Expected Value is the probability-adjusted gain minus the probability-adjusted loss.

EXPECTED VALUE = (Probability-Adjusted Gain) – (Probability-Adjusted Loss)

Here is a hypothetical scenario which is commonplace in poker:

> You can bet or call $100 with the possibility of winning a $400 pot.
>
> The wager has a 30% chance of winning and a 70% chance of losing.
>
> Is this a good wager? What is the Expected Value (EV)?

As stated, EV is probability-adjusted gain minus probability-adjusted loss. As a calculation that looks like this:

> $400 gain x 30% probability = $400 x 0.30 = $120
>
> $100 loss x 70% probability = $100 x 0.7 = $70
>
> **Expected Value (EV) = $50** because $120 - $70 = $50

A wager will be positive EV at a low win rate if the size of the gain overcomes the size of the more frequent losses.

Based on EV you should make the wager, even though it only "wins" three times out of ten, because the EV is positive. You will make money with that wager on average, because the size of the gain overcomes the size of the more frequent losses.

You can also test the validity of the EV equation with a brute force calculation.

> You make the $100 bet – hoping to win $400 – ten separate times.
>
> Three times (30% of the time) you win $400 for a total of $1,200.
>
> Seven times (70% of the time) you lose $100 for a loss of $700.

Your net gain is $500 via $1,200 in wins and $700 in losses.

$500 divided over ten bets is $50 per bet – your expected value (EV).

As you can see, calculating EV is simple. Again it is just the probability-adjusted gain minus the probability-adjusted loss.

You figure out how much you could gain, multiplied by an estimated probability of winning. You figure out how much you could lose, multiplied by an estimated probability of losing. You make sure your probability estimates add up to 100%. And then you substract the second number from the first.

Most people don't understand Expected Value on an intuitive level.

Most people don't understand Expected Value on an intuitive level.

In fact we would argue a great many would-be traders, investors and poker players don't understand the most important parts of Expected Value at all. They may pay lip service to it as a concept, but they haven't grasped the strategic implications.

Individuals who are inherently cautious, for example, may have a hard time wrapping their heads around the idea of a profitable wager with a low win rate.

Why would you ever make a wager that wins less than 50% of the time… or might only win 10 or 20% of the time… or in extreme cases only 5% of the time?

Answer: Because if the EV is positive, then the bet is a profitable one from a long-term perspective. Make that wager enough times, and you will profit from it overall.

Individuals who are inherently aggressive, on the other hand, will often justify a wager to themselves even when the EV – the bare bones math – is negative.

The aggressive player may "go with their gut" as an excuse to embrace a move they favor – without acknowledging that, if EV isn't positive, you can't justify the risk.

Skilled cash game players calculate situational EV on a constant basis. It becomes second nature, almost like breathing.

At the poker table, skilled cash game players calculate situational EV on a constant basis. It becomes second nature, almost like breathing.

A poker session is a constant stream of probabilistic decisions, literally hundreds of them – most of them instantaneous, a handful requiring significant contemplation.

THE MONTE CARLO SIMULATION

Another tool in the poker player's arsenal is the Monte Carlo simulation. This is more a mental model and an offsite research tool than something that is directly used in live play – but it's important for making sense of Expected Value and why it works.

A Monte Carlo simulation runs a scenario hundreds or even thousands of times, in order to get a handle on the probability of differing outcomes.

Every poker decision should be analyzed as if it were part of a Monte Carlo simulation. So what does that mean exactly?

You think about poker decisions via the frame of the question, "What if I took this action a thousand times?"

It means you think about poker actions via the frame of the question, **"What if I took this action a thousand times?"**

> If a decision has an expected value (EV) of $50, it means that, over a statistically relevant number of trials, the average payoff for that decision will be a $50 gain.
>
> If you ran the decision as a Monte Carlo simulation – meaning it happened a thousand times – then you would see randomly distributed clusters of results. In X hundred instances you would win Y, in X hundred instances you would lose Z, and so on. But the average result over the whole data set would be $50 per wager.

Everything that happens in poker happens again. (And again.)

Everything that happens in poker happens again. (And again.) The different scenarios and situations repeat themselves over and over.

Even the really wild scenarios – the stuff that very rarely happens – still happens on repeat. It just repeats less often.

The Monte Carlo simulation is thus key to understanding EV, and to keeping a cool head when the streaks of hot and cold show up.

> Take our EV example, the chance to risk $100 and win $400 at a 30% likelihood. That is a plus-EV wager. The expectation for winning a $400 pot 30% of the time, and losing the $100 at risk 70% of the time, is $50.
>
> And yet **even though the bet is plus-EV**, seven times out of ten it will lose. And sometimes there will be streaks where the loss side of the coin comes up over and over again: Nine times in a row, twelve times in a row, more.
>
> The same is true even of bets with, say, a 60% or 70% probability of winning. You can have the better end of a 60/40 proposition and still, as a Monte Carlo simulation would show, run into an outlier string of loss outcomes.

If you know the math, you keep a cool head and play calmly through the outlier streaks.

That is why the attitude is, "What happens if I take this action thousand times?" If you know the math, you keep a cool head and play calmly through the outlier streaks, both hot and cold (which can require significant levels of emotional control).

POT ODDS

In poker, the "Pot Odds" concept provides fodder for EV in a Monte Carlo context.

> Every No Limit Hold 'Em poker hand involves some amount of money in the middle – the pot.
>
> It also involves the chip stacks of two or more players, which are chips that could potentially wind up in the pot.
>
> Every time you bet, call, or check, you think about these factors in various combinations, to determine the EV of strategic actions, as dictated by what you can win (or lose).

Simply put, pot odds represent the ratio of the money in the pot to the amount you need to bet or call, with a factoring in of what could happen on future streets.

There are countless different pot odds scenarios, depending on factors such as: The number of players in the hand, the size of the stacks, how much is in the pot, who has position, the temperament of the opponents, the history of the hand, and so on.

What it all comes down to is how much you can potentially win, versus how much you can possibly lose, by the time the hand is over.

But what it all comes down to is **how much you can potentially win** – what is in the pot, plus the possibility of additional chips going into the pot – versus **how much you can possibly lose**, by the time the hand is over.

Here is a strategic decision example driven by pot odds (among other things):

> In a game of $10-$20 No Limit at the Bellagio, the first player to act bets $200 into a $30 pot (the $30 is from the small and big blind).
>
> Two additional players call the $200. The pot is now $630.
>
> The player on the button (last to act) bets $800. Everyone else folds.

The player on the button had nine-ten suited, a highly speculative hand. But it was a smart semi-bluff. Why? Because of EV and pot odds.

The player with nine-ten suited was overbetting the pot. But he knew there was a significant chance all three of his opponents would fold, rather than take the risk of facing an opponent acting behind them with a large stack and a possibly large hand.

The pot odds math worked because the pot was large relative to the small amount each earlier player had committed, making it easier for each player to individually fold. The player on the button also had additional opportunity, to either bluff again from position or possibly hit a concealed hand, even if someone called.

The above is a simplification. To really understand the hand it would be necessary to know things like the temperament and playing style of the opponents, the size of each player's stack, the reputation of the player on the button (which would impact how the other players interpreted his raise), and so on.

The bottom line, though, is that multiple factors were used to make an **Expected Value** calculation… which hinged off **pot odds** (a ratio of what could be won versus what was at risk)… in a spot that was analyzed in a **Monte Carlo simulation** type way. Meaning even if one of the blinds then pushed all in, causing the button player to fold, the button bluff was still a good play.

In markets, a simplified version of Pot Odds is the basic risk-reward calculation. If you have the chance to make $1,000 on a trade for every $100 at risk, that is a far more attractive "R" than, say, risking $1,000 to make $100. (Though you need to know outcome probabilities here too, in the EV style, to really compare the two.)

You calculate EV using pot odds and other situational factors, then think about the whole thing in a Monte Carlo simulation context.

To sum up, you calculate EV using pot odds and other situational factors, and then think about the whole thing in a Monte Carlo simulation context.

BEHAVIORAL STRATEGY

Behavioral strategy comes into play because it impacts probability assessments.

Consider the difference between two basic poker profiles, the aggressive player and the conservative player.

> If you bluff an *aggressive* player, there is a higher than average probability that the aggressive player will call your bluff (or even raise you).
>
> If you bluff a *conservative* player, there is a higher than average probability that the conservative player will fold (or only call instead of raising).
>
> If you have the best possible hand against an *aggressive* player, you should probably make a large bet on the river relative to the size of the pot, due to the increased odds they will call (thus making you more profit).
>
> If you have the best possible hand against a *conservative* player, you may want to make only a modest bet on the river, due to the increased possibility a large bet would cause them to fold (so you settle for extracting a bit less).

Behavioral profiles change the likelihood of an opponent's response to a given action.

Behavioral profiles change the likelihood of an opponent's response to a given action, which in turn changes the probability calculations for an action, which then in turn changes the EV calculation, which then changes the actual decision you make.

> If a bluffing situation against an aggressive player only has a 33% chance of success (because the player is more likely to call by temperament), the probability may be too low to justify the action relative to Expected Value.
>
> But if the same situation against a *conservative* player has a 66% chance of causing him to fold, a bluff may be the best move due to the improved EV.

This is why it's crucial to observe the behavior of opponents.

The more you understand about your opponents' habits and behaviors and general style of play, the more you can accurately tailor the application of probability scenarios, which in turn changes the EV assessment of the decisions that you make.

PLAYING FROM POSITION

Position is a major factor in poker, due to the fact poker is a game of incomplete information.

"Position" is a major factor in poker, due to the fact that poker is a game of incomplete information, and having position gives you more information.

In a poker hand, having position means being last to act. This confers a significant advantage, because the last player to act has more data than the other players.

> If you are last to act, you can observe the actions of all other players in the hand – and thus adjust for those actions – **before having to act yourself**.
>
> Other players, meanwhile, have to act "in the dark" – meaning they **don't know what action the player in position will take** when acting behind them.

The information asymmetry edge created by acting from position is quite valuable.

The information asymmetry edge created by acting from position is quite valuable.

It is so valuable that, for the skilled professional, position impacts the entire structure of the game, with countless strategic decisions using it as a factor.

Many decisions are made, in a second nature / just-like-breathing type of way, in regards to whether or not there will be position for the duration of the hand, or whether or not position will be likely after the flop.

The tone of a game, and the shape of a session strategy, can also be influenced significantly by the behavioral tendencies of the two players to a professional's immediate left – because these players are likely to have position on the pro a meaningful percentage of the time.

In markets, concepts exist that are analogous to playing from position.

In markets, concepts exist that are analogous to playing from position.

While markets do not exist in a physical space with players taking turns, there is a difference between acting in the dark – not knowing the positioning or bias of large institutional players – versus waiting for the institutionals to "tip their hand," or otherwise reveal their stance or what they are thinking through a series of actions.

This is the difference between acting without a sense of what your opponent is thinking or what they are holding, versus waiting for the "a-ha!" moment of clarity, or the inflection point born of data and price action, that reveals the critical information to be used in calculating EV to make a better strategic decision.

FOUR TYPES OF BET

In the original *Market Wizards*, commodities trader Larry Hite talked about four types of bets: Good Bets, Bad Bets, Winning Bets and Losing Bets.

Hite's point was that a winning bet is not always a good one, and a losing bet is not always a bad one. We can see why through the lens of EV and Monte Carlo simulation. There are streaks where smart moves lose and dumb moves win.

A winning bet is not always a good one, and a losing bet is not always a bad one. We can see why via EV and Monte Carlo simulation.

It's possible to do something smart and still lose money. It's also possible to do something dumb and still make a profit, or even a string of profits. But this is true in the short run. In the long run, the law of large numbers settles up all the accounts.

EV gets down to differences of habit in respect to winning versus losing players.

> Winning players strive to always take positive EV actions (make "good bets") **without concern for immediate outcome**, while avoiding the negative EV bets at all costs **regardless of short-term emotional appeal.**
>
> Losing players, in their emotional quest for winning bets, **often wind up making bad bets instead,** in respect to negative EV decisions that may deliver short-term profits but ultimately result in losses (via unwise risks).
>
> Losing players may also chase negative EV bets on a 'gut feel' basis without doing the math or otherwise confirming the strategic viability of the play.

Las Vegas, of course, was founded on a constant stream of minus-EV bets (placed en masse by tourists) as the other side of en masse plus-EV bets taken by "the house" (i.e. the casinos). The difference between the minus and plus-EV side, which is only a few notches on either side of 50/50, is enough to light up the Vegas strip.

THE Q RATIO

With the above concepts out of the way – crucial for building a foundation of understanding when it comes to probability – we can get into the proprietary stuff.

The Q Ratio represents Quality of Decisions divided by Quantity of Decisions.

The Q Ratio is a deceptively simple concept. It represents **Quality of Decisions** divided by **Quantity of Decisions**.

$$Q\ RATIO = \frac{\textbf{QUALITY}\ \text{OF DECISIONS}}{\textbf{QUANTITY}\ \text{OF DECISIONS}}$$

There are multiple operating principles at work here.

Generally the fewer decisions you have to make, the better. Every decision has a cognitive cost. Every set of actions you carry out has a time and energy and resource cost. If you can reduce your quantity of decisions and actions overall, you are probably better off. The wisdom of "doing more with less."

If you keep the high quality decisions, and cut away the marginal ones, average quality goes up.

If you keep the high quality decisions, and cut away the marginal ones, you improve net decision quality overall. Say you make 100 decisions but only 10 of them are great, and at least 50 of them are blah. If you cut out the blah decisions, and even some of the "okay" ones, average quality goes up.

If you make fewer decisions, you can focus more on the top-tier high quality decisions, and likely get more out of them. Less energy devoted to marginal action means more time and energy for genuinely strong actions.

If you cut away marginal decisions, you cut away unnecessary losses. A lot of the nicks and cuts and costs, financial or time / energy-related or otherwise, are tied to the blah decisions, if lots of decisions are being made.

Most poker players play too many hands. Most traders take too many trades. And most entrepreneurs pursue too many ideas or strategies at a time. For whatever reason, the universe just makes it easy to load up on decisions in general, and to generally do too much "stuff" as a result.

The practical idea behind the Q Ratio is to rank your decisions in Expected Value terms, relative to the other decisions you make in that same group. Then you can weed out the blah performers, and even weed out the "middle-of-the-roaders."

Just take all the calls you've made – in poker, in trading, in business or wherever – and imagine focusing on cutting away the bottom third or bottom half. Less activity, less friction, less distraction, more emphasis on the top tier stuff that is solid.

Simply by killing the marginal stuff, you are likely to get a better result.

Simply by killing the marginal stuff, you are likely to get a better result.

Like the Monte Carlo simulation, the Q Ratio is more a concept than a specific instruction set. But the idea is powerful. **If you can reduce the quantity of your decisions while maintaining your top-tier high quality decisions, overall results should improve.**

Here is another way to think about the Q Ratio:

> Imagine a simple **A-B-C-D grading system** for decisions or actions.
>
> "A" means highly desirable or worthwhile. Slam Dunk.
>
> "B" means solidly desirable or worthwhile. Meat and Potatoes.
>
> "C" means marginal, fifty-fifty. On the fence.
>
> "D" means sketchy, questionable. Probably a weak idea.
>
> To apply the Q Ratio concept, you would **not only throw out all the Cs and Ds, you would be happy discarding a good chunk of the Bs as well, if there was any question they *might* be Cs in disguise.**

Do less stuff. Make sure it's the good stuff. Throw away the crap.

Do way less stuff. Make sure it's the good stuff. Throw away the crap, and also throw away the stuff that's "meh" or "okay." Get lean and mean and serious about leveraging up the good stuff only, and suddenly life looks different. That's the Q Ratio.

The distribution of opportunities is far more fat-tailed than people realize.

One of the reasons the Q Ratio works well in poker and trading is because the distribution of opportunities is **far more fat-tailed than people realize,** meaning the big profits are in relatively infrequent outlier situations, with large inherent size.

The distribution of opportunities is SO fat-tailed, in fact, that it's very hard (if not impossible) to truly grasp how fat-tailed the opportunity distribution is just by hearing about it or reading about it.

You need to personally experience, on an emotionally involved level, the implications of fat-tailed distributions to register the depth and power of this observation (a big reason why poker is valuable for emotional training purposes).

These relatively infrequent opportunities demand patience and vigilance, and ability to play small while waiting, and yet are far LARGER than most realize when they come – and sometimes come in clusters – which is why the ability to scale up is key.

The same ideas apply in trading and investing.

The same ideas apply in trading and investing. The big trades are generally more rare than people would prefer, but also more worthy of size (loading the boat when the time is right) than most traders can get their heads around.

It's a similar story with big investment ideas, which is why Warren Buffett has talked about the twenty hole punchcard concept (the forced discipline and mandated patience of only being allowed to make a handful of very big moves).

STACK PATH OPTIONALITY

Like the Q Ratio, a term of our own coinage via the poker years is Stack Path Optionality (SPO).

STACK PATH OPTIONALITY: The potential to win an opponent's entire chip stack.

The best opportunities offer a large payoff relative to risk.

The best opportunities offer a large payoff relative to risk. In poker that means winning an opponent's entire chip stack, relative to only a small commitment of risk.

This is possible in situations where the chip stacks are quite large, the initial investment in the hand is small (relative to the stacks), and the hand unfolds in such a way that the best hand is obtained early on or without undue risk, the opponent blundering their way to a strong but second-best hand and losing their whole stack.

For example:

> One particularly memorable Bellagio cash game hand we played saw a final pot size of +$36,000. In a $10-$20 No Limit game, we open for $200 (a small bet for this game) in late position with A-J of hearts. The small blind calls.
>
> The flop comes with two hearts, giving us a heart flush draw. Check-check.
>
> The turn is a third heart, giving us an ace-high flush with no pair on the board. Nice! We have the best hand at this point.
>
> The small blind, first to act, bets $500. We raise his $500 bet to $2,000. The logic is that we have to bet to get some value from our flush, and with an obvious flush possibility on the board, our opponent is likely to fold to ANY bet from us at this point – UNLESS he has something strong, like two pair or a set, in which case he may grit his teeth and call a raise. Of course, if he is playing a heart flush worse than ours, that would put him in HUGE trouble.
>
> The river is a blank, no pair on the board. Our ace-high flush is without question the best hand. The opponent, first to act, bets $5,000.
>
> We push all-in on top of his $5,000 with our remaining $16,000 or so. Why? Because if the opponent now folds, we've already got the 5K. But because he is in for $5,000, he may well be in for the rest – and we can't lose the hand!
>
> The opponent snap calls our all-in and immediately flips over his cards, showing a king-high heart flush. He smirks a little, assuming he is good. We show the ace-high flush. He looks as if he'd seen a ghost. We drag the pot.
>
> The beautiful thing about that hand was that, in winning +$18,000 (his stack matched ours) **our risk was never more than the initial $200 bet.** If the board had paired, a very tough decision would have come up. But it didn't.
>
> Our opponent, meanwhile, played the second-best hand (a king-high flush) like the stone cold nuts when it wasn't – a huge mistake we wouldn't have made. This is the beauty of deep stack poker – and Stack Path Optionality.

In markets, SPO can dwarf the biggest poker games ever played.

In markets, Stack Path Optionality can dwarf the biggest poker games ever played. For instance, off the top of our heads we can think of:

> Warren Buffett scooping up huge quantities of American Express in the 1960s, the Washington Post in the 1970s, or Coca-Cola in the 1980s.
>
> George Soros making a $10 billion leveraged bet against the British pound in 1992, to make more than $1 billion in a single day, in a wager where the asymmetry was huge and his relative risk exposure was very small.
>
> John Paulson shorting mortgage-backed securities in huge quantities ahead of the 2007 subprime crisis, with massive asymmetry and small defined risk.

Stack Path Optionality can be thought of as a number that gets bigger as the size of the potential payoff gets larger.

In defining Stack Path Optionality as a multiple, it can be thought of as **a number that gets bigger as the size of the potential payoff gets larger**.

> In cash game poker, the SPO versus a $20,000 deep stack – if you are also deep stacked – is far larger than the SPO versus a $300 short stack.
>
> In trading, a trade you can put huge size into with high conviction, for a multi-month or multi-year payoff, has far more SPO than, say, a trade you can only take in limited size or modest conviction for a short time span.

NEGATIVE IMPLIED ODDS

Stack Path Optionality has a flipside. We call it Negative Implied Odds (NIO).

NEGATIVE IMPLIED ODDS: The potential for added loss as the situation unfolds.

In high stakes poker, the skilled pro wants to carve a path to winning their opponent's whole stack.

Risk control is involved, because the opponent can also potentially carve a path to your whole stack.

But risk control is involved because, in wielding a large stack yourself, an opponent can potentially do the same thing – and carve a path to YOUR whole stack.

This is where risk control comes in, and the awareness of danger in future phases of the hand. For example:

> You have queen-ten offsuit in the big blind. One player limps into the pot. There are no raises and you are first to act throughout the hand. You check.
>
> The flop is queen-high with two spades, pairing your queen.
>
> First to act, you check your paired queen and ten kicker. Your opponent bets modestly and you instantly fold.
>
> Why did you fold with top pair? Because of Negative Implied Odds. This hand can only go bad places. You are out of position on the hand. If your opponent has king-queen, ace-queen or queen-jack, you are out-kicked. If they have a draw, they can bluff you with it from position. You have no staying power. If you call the first bet and a blank comes and they bet at you again, now what?

Go back to the Bellagio cash game hand we described, where a king-high flush wound up losing to an ace-high one. Consider the NIO errors of the player who lost.

The guy with the K-high flush screwed up by calling a small bet without position in the first place, instead of just folding and giving up his blind. He should have bailed instantly. Playing K-x suited out of position, in a deep stack cash game, has monster Negative Implied Odds. Really bad things can happen (as he majorly found out).

NIO applies in markets when it's possible to lose a lot more than one anticipates.

NIO applies in markets when it's possible to lose a lot more than one anticipates.

One ugly market instance of NIO was the sudden drastic revaluation of the Swiss Franc in 2015, an event that instantly caused billions in losses. Many traders had been aggressively gaming the artificial peg, with dangerous amounts of leverage, on the assumption the peg would hold and the trade was 100% safe. The Swiss National Bank surprised them and a few large hedge funds got carried out on a stretcher.

In daily life, think of NIO like choosing to pet a strange dog on the sidewalk. If you don't know anything about this dog, chances are it's okay to pet it. But there is a non-trivial possibility the dog could bite you.

NIO is the possibility of a negative outcome, along with considerations of potential magnitude, danger and cost if an outlier loss scenario occurs.

NIO is the possibility of a negative outcome, along with considerations of the potential magnitude, danger, and cost if an outlier loss scenario occurs.

THE RISK-ADJUSTED PROFIT THEOREM

SPO and NIO have a relationship because most risk-taking decisions have an SPO aspect and a NIO aspect to them. They're opposite sides of the same risk-taking coin.

> Stack Path Optionality (SPO) is **the potential upside of the risk you are taking**, adjusted for utility and magnitude. The bigger the SPO the better.
>
> Negative Implied Odds (NIO) represent **the potential downside of the risk you are taking**, adjusted for cost and danger. The smaller the NIO the better.

Now recall the EV equation: Expected Value equals the probability-adjusted gain minus the probability-adjusted loss.

SPO and NIO have a relationship comparable to the gain-loss relationship of Expected Value.

SPO and NIO have a relationship comparable to the gain-loss relationship of Expected Value, except the calculation is slightly different.

This brings us to the Risk-Adjusted Profit Theorem (RAPT):

$$Q = \frac{SPO}{NIO} - 1$$

The Q-Score is SPO divided by NIO minus 1.

Now let's explore what that means…

We've already given some basic term definitions. To recap:

> **Q Ratio: Quality of Decisions versus Quantity of Decisions.** The higher the Q Ratio, the better (denoting higher quality).
>
> **SPO: Stack Path Optionality.** The higher this is the better, representing the magnitude and utility of opportunity.
>
> **NIO: Negative Implied Odds.** The lower this is the better. As NIO increases in size, danger and loss costs also increase.

The equation once again:

$$Q = \frac{SPO}{NIO} - 1$$

You may notice the highest that Q can go in this equation is infinity. You may also notice that the lowest it can go is negative one (minus one).

The upside is unbounded because, in life, the relative scope of future opportunity is unbounded.

The upside is unbounded because, in life, the relative scope of future opportunity is unbounded. For hypothetical example:

> **Scenario #1:** You get credible news regarding a long lost relative who turned out to have amassed a fortune in ball bearings. You are the sole heir of this verified fortune worth $100 million. All you have to do is travel to New York to complete some paperwork. The SPO here is an insanely huge number and the NIO is tiny (cost and time of the trip, infinitesimal risk of a plane crash etc). The Q-Score for this decision is astronomical. It would be above 10,000 and maybe above 100,000. You would say yes to this decision instantly.

If there is a tough call to be made, the Q-Score may come out in low single digits or even as a fraction.

If there is a tough call to be made, and the decision turns out to be marginal, the Q-Score might come out in low-single digits, or even as a fraction. For example:

> **Scenario #2:** Same as scenario #1, except instead of $100 million the amount is now only $4,000. But you still have to travel to New York to do paperwork if you want the funds, and cover your own travel expenses and have your routine interrupted to do so. On the one hand you have a relative in NYC you've been meaning to visit, so you could do that on the same trip. On the other hand the timing isn't great, and you don't feel like traveling right now.
>
> Now you really have to decide if the light is worth the candle. You game it out at an SPO factor of 3 over a NIO factor of 2 for 1.5, and after subtracting the 1 you get a Q-Score of 0.5. That is a pretty marginal decision.

If SPO is outweighed by NIO then the Q-Score is negative, which is an instant "Nope."

If SPO is outweighed by NIO then the Q-Score is negative. That is because dividing a smaller number by a larger number produces a fraction, and the "minus one" aspect of the equation makes any fraction come out negative. **Anything negative is an instant "Nope,"** and anything in the general zero realm (like a 0.2 or something like that) is a potential nope even if the number is positive.

In a deep stack poker game you have K-3 suited in the small blind.

A player in late position, whose style and profile is unknown, puts in a modest raise. Your stack is large and so is his.

NIO dwarfs SPO here because of your lack of position and lack of any kicker. If the flop has a king, giving you a pair, that is actually bad for you. If it brings a 3 for a low pair, that is not much better. If you are given a flush draw, with two deep stacks in the hand (yours and his) it could become a nightmare.

Because the denominator (NIO) is so much larger than the numerator (SPO), the Q-Score is a fraction. Subtract the 1 from the fraction and the Q-Score is then negative. You calculate all this in half a second and fold instantly.

If SPO is zero, the Q-Score is instantly minus one (the lowest possible).

If SPO is zero – meaning no effective benefit at all from a decision – the Q-Score is instantly minus one (the lowest possible), because zero divided by any number is zero, which after subtracting the one becomes minus one.

A strange acquaintance texts to ask if you want to take lunch at a crowded Costco and eat the little samples on toothpicks. You really don't want to. The upside is zero…. so SPO/NIO is zero… which then goes to minus one.

UTILITY IS A SIZING FACTOR

When determining the SPO or NIO multiple, personal utility is an important factor.

When determining the SPO or NIO multiple, personal utility is an important factor. The needs or risks of the situation, i.e. your personal utility at the time, have a say in whether you adjust an SPO or NIO multiple higher or lower.

For example, when does $5,000 have more personal utility than $50,000? When you're in a spot in life where you could really use the five grand in a big way, versus a different spot in life where 50K is inconsequential.

In one scenario, you might have the opportunity to make $5,000 when it would really, really come in handy or even be a lifesaver. **The utility of the 5K might thus be very high here**, causing the SPO multiple to be evaluated as a larger number in this instance.

In another scenario – a different time and place in life, where you're already cash rich – the opportunity to make $50,000 might be seen as low utility, especially if you're focused on other things and don't really need the funds. So SPO for that opportunity might be evaluated as a lower number.

The utility of money, like anything else, is relative. Imagine getting ahold of Bill Gates' private phone number, then attempting to get him excited about the chance to make $50,000. (Good luck!)

Then again, as Chris Rock once put it: If Bill Gates woke up with Oprah's money, he'd jump out the window. A lot of things in life are relative.

The upside of a decision is also relative – depending on the dynamics and requirements of your personal situation. The SPO multiple is adjusted for this.

It also works in terms of the negatives. Downside risk can be situational.

It also works in terms of the negatives. Downside risk can be situational.

At one point in your life, an investment opportunity with a material risk of losing $100,000 might be off the charts in terms of NIO.

At some other more prosperous point in your life, a minimum 100K risk profile for an investment might be little more than a two-second pause.

Utility is relative, and you can bake that into the SPO and NIO multiples you assign.

Q-SCORE RELATIVE RANKING

Again, the Q Ratio emphasizes quality of decisions over quantity of decisions. To improve your Q Ratio you start cutting away marginal quality decisions, improving the average level of quality in the decisions that are left.

With the Risk-Adjusted Profit Theorem (RAPT), you can thus **assign Q-Scores to various opportunities or decisions,** then rank their attractiveness in a group.

You line them up from the highest value Q-Score decisions to the lowest ones, then you get rid of the lowest. Or you get a feel for what a good cutoff number is, and then make a habit of cutting away or looking askance at any possible decision that has a Q-Score below your standards bar.

Running the RAPT equation lets you assign Q-Score variables, which in turn creates a practical ability to apply the Q Ratio.

Either way the destination and goal is the same: Running the RAPT equation lets you assign Q-Score variables, which in turn creates a practical ability to apply the Q Ratio (seeking quality of decisions over quantity of decisions). The more marginal Q-Score decisions you cut away, the better.

This relative ranking process works on at least three levels.

First, RAPT can be used as part of a standard methodology.

A poker player or trader can use RAPT (Q = SPO/NIO minus one) to run probabilities and pot odds equations in real time, quickly assigning a final variable to assessments and then comparing that variable automatically across hands or trades, cutting away the low or marginal Q-Score multiples and keeping the higher ones as a habit.

With practice it becomes second nature to gravitate towards the higher Q-Score outputs.

With practice it becomes second nature to gravitate towards the higher Q-Score outputs, recognizing that a Q-Score close to zero is marginal, and a Q-Score that is negative should automatically be thrown out.

It also becomes second nature to do this extremely quickly, often in the space of a few seconds, because so many poker and trading decisions have comparable dimensions, like positions on a chess board registered in subconscious memory.

Again the idea here is taking a complex basket of variables and probabilistic scenario estimates and boiling it down to two numbers – the upside multiple (SPO) and the downside multiple (NIO)… then quickly dividing and subtracting.

Baking this habit into a methodology also encourages automaticity, a huge benefit.

Baking this habit into a methodology also encourages automaticity, a huge benefit.

After just one more step (subtracting the one) beyond gaming out SPO and NIO – which gets easier with familiarity and practice – this creates a handle on a **simple, single, comparable variable** that gives a sense of the optionality, or inherent attractiveness, of a risk-adjusted profit opportunity.

The helpful thing here is providing a simple management tool for complex calculations that could otherwise be hard to track.

The helpful thing here is providing a **simple management tool for complex calculations** that could otherwise be hard to track, while also providing a conversion tool that allows for the comparison of different things on the same vector.

In trading methodologies, the Average Trading Range (ATR) allows for a normalization of risk point standards across different vehicles.

If you choose to make 2.5 ATR your default multiple for a position risk point, for example, that means two-point-five times the average (daily) trading range – a calculation that applies to stocks, ETFs, currencies and futures with equal ease, and which **adjusts for situational volatility** regardless of the vehicle in question.

The Q-Score produced by RAPT can apply to poker situations, trading situations, and life situations with equal ease.

In a similar "universal standard" type comparison, the Q-Score produced by RAPT can apply to poker situations, trading situations, and life situations with equal ease, allowing a cluster of opportunities to be ranked and compared:

> If you quickly do Q-Score calculations on poker situations in your head, training your brain to quickly assess whether to raise, call or fold, you learn to pursue all decisions with a high Q multiple while cutting away others.
>
> If you do Q-Score calculations on potential trading and investing ideas, you get in the habit of thinking about optionality and hidden downside risks **as a structured matter of habit**, again gaining access to a single formulaic tool that lets you apply a template to different opportunities – ranking them all, then kicking out the negative or low Q multiples and keeping the high ones.

The RAPT equation normalizes upside optionality and downside risk as inputs regardless of the situation.

This is possible because, just as ATR normalizes volatility as a trading input regardless of the vehicle, the RAPT equation **normalizes upside optionality and downside risk as inputs regardless of the situation,** and creates a habit of thinking in terms of the final variable that has both SPO and NIO factored into it.

Second, RAPT can be used as a spot analysis tool.

$$Q = \frac{SPO}{NIO} - 1$$

We post the RAPT equation above once again.

The elegant simplicity here is paramount, because that is what lets you use it on the fly as a strategic assessment tool in spot situations, ranging from medium-stakes decisions to very high stakes.

Imagine you have two options for an upcoming weekend: You can go on a whitewater rafting trip with friends, or you can get caught up on a huge work-related project that you've gotten behind on.

What is the immediate best answer? Which to choose, the trip or the project? It's hard to say. There are risks and rewards for either course of action.

Both choices offer rewards. The whitewater rafting trip will be psychologically and emotionally rewarding, and life is short and friendships should be cherished. But working on the project might be financially rewarding, or might have an urgent strategy component.

Both choices also offer risks. If you choose the whitewater trip, you might be racked with project worries the whole time, and then suffer the consequences of not getting the project done. Conversely if you choose the project, you might later feel regret that you chose work over the type of experience that only happens a few times a year.

But how do you even compare the two? How do you compare the rewards and risks of a whitewater rafting trip with a work project?

Answer: **You apply a Q-Score to both.** You use the RAPT equation and suss out the different factors, boiling them down to SPO and NIO multiples.

Using RAPT to think things through and apply an individual Q-Score to both sides, your final decision is then simplified: Pick the higher Q-Score between the two.

RAPT can be equally valuable for small and fast decisions or eye-bulgingly huge and ponderous decisions.

A cool thing here is that RAPT can be equally valuable for small and fast decisions on the fly – like deciding whether or not to grab pizza – or for eye-bulgingly huge and ponderous decisions, like whether or not to pursue a life changing opportunity that would require moving to a foreign country.

Third, RAPT can be used as a mental model and philosophical guide.

Humans are instinctively terrible at thinking in abstract probabilities.

Humans are instinctively terrible at thinking in abstract probabilities. They are just awful at it. Even today, in the modern and educated world, most people have no working sense of "probability" at all, beyond a very basic familiarity with coin flips and percentages (and with a whole slew of misconceptions built in).

This makes sense in light of the hunter gatherer paradigm and the requirements of our formative biological environment. There was no time for calculating probability on the savanna.

Gut instinct ruled much of the time, because the gut and nervous system had been trained by a robust "fight or flight" paradigm that geared toward basic survival.

The reason why numbers like "three" or "five" are intuitive is also because of where we came from, and how the mind-body system was shaped by its environment.

Back in the day, it was useful to instantly be able to process TWO boulders or THREE trees or FIVE nasty looking hyenas circling the fresh wildebeest you had just killed.

The brain can grasp countable whole numbers in the low to mid-single digits almost instantly because there were necessary occasions for doing so routinely in our formative biological environment. So the brain, marvel of efficiency that it is, expended energy to develop exactly what was needed without getting too abstract.

This is also likely why seven digits is the outer bound for an easy-to-remember phone number. And it's why probability is, for the most part, a mystery to the average person. There wasn't any persistent natural selection pressure to grasp it.

Via the brain's amazing plasticity, thinking in probabilities can become a habit as natural as reaching for a glass of water when thirsty.

But this is where RAPT comes in. If you **train your brain to think in probability as a matter of structural routine – to assess SPO and NIO and contemplate EV and such** – then the brain's amazing plasticity kicks in, and thinking in probabilities becomes a habit as natural as reaching for a glass of water when thirsty.

This, in turn, gives you a significant advantage over all those who do NOT possess the natural ability to think in probabilities – because such is only achieved by a combination of training, familiarity and habit.

BAD NEWS, GOOD NEWS, GREAT NEWS

Trying to master poker or trading without becoming fluent in the basics of probability, learning to think in probabilities on a constant basis, is a futile exercise.

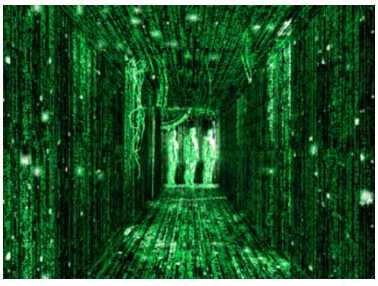
Millions of would-be poker players and traders attempt this anyway. They pay lip service to probability concepts without ever truly understanding them, let alone embracing their deeper implications… and so they fail in their quest and fall away.

As such, the bad news is that the average individual has no real chance of success in poker or in trading. That is because the "average" individual treats probability like a foreign language, one they can uncomfortably mutter a few phrases of and that's it.

The good news is that it is possible to become an "ABOVE average" individual fairly easily, simply by making a concerted effort to understand probability concepts and apply them routinely.

The good news is that **it is possible to become an "ABOVE average" individual fairly easily, simply by making a concerted effort to understand probability concepts and apply them routinely.** Which probability concepts you ask? The ones that were just discussed for starters…

And the great news is that simple and elegant mental models – like the concepts and tools embedded in the Q Ratio, the Q-Score, and RAPT – can make the challenge of learning to think in probabilities much easier.



When you learn to see the abstract probability factors driving strategic decisions – the math behind the real world, not separate from reality but intertwined with it – it's like learning to see the code behind the Matrix. The better you understand that hidden code, the closer you come to an ability to shape it and change it.