# UP THREE
# TO FOUL OR NOT TO FOUL

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Since second-guessing has recently displaced baseball as America's favorite pastime, it is more important than ever to be certain about the choices you make from the bench. Some choices are automatic, you don't let bad shooters shoot 3's, you keep the ball in the hands of good free throw shooters when you are leading at the end of the game, you sit a player down who is in foul trouble, etc. Others may present themselves only a few times a season, but to be sure almost every decision we are faced with on the bench involves probability. Your team is up 3 points, less than 10 seconds to play, your opponent has the basketball: what do you do?

Every coach has been in this situation, and most have probably tried different approaches on different nights. However, the mathematics is clear. This is not a situation the game can dictate, it should be dictated by your philosophy, and more importantly, a solid understanding of probability. If you don't know, decide now. This article will examine the probabilities in an attempt to make that decision easier to live—and win—with.

To borrow from the Bard: "To foul or not to foul, that is the question. Is it nobler to risk the slings and arrows of outrageous fortune (somebody knocking in a three), or should you just hunker down on defense one last possession and take your chances?" If you are like I was, your instinct is to hunker. You say to yourself, "we've guarded them all night, we can guard them one last time", or, "all we have to do is guard the three point line; I'll take my chances". It's this last statement I want to examine further. Exactly what are the chances? Exactly what are the chances of

being tied on the last possession with a three, or fouling intentionally and being tied, or God forbid, beaten by giving up an offensive rebound and basket on an intentionally missed free throw?  Do you know?  I didn't, until I sat down with a mathematician and worked the numbers I just wanted to hunker. Dick Vitale, almost from the advent of the three point line told me to foul, and in some ways maybe that just gave me one more reason not to do it.  I was going to hunker.

Now, I am sure I have won my share of games by three points when my opponent had the ball on the last possession.  The opponent misses a desperation three point attempt, we rebound the ball, everybody is happy. I really don't remember.  Like most coaches I remember the losses better. Much better.  Winning for most of us is the absence of losing, and that's a good thing.  Losing is the enemy.  We beat losing to death.  We analyze a loss with far greater care than we ever view the wins.  It is with this in mind that I have dissected the end of the game Up 3 Situation.

My story is a sad one.  As coaches we all expect experience to help our players be better players, and help us be better teachers.  In my case I took a beating the same way three different times before I really carefully examined what I was doing and why.  Most of us would bench a player for getting beat the exact same way three times in a row in a crucial situation.  Like all coaches I have no sub, so I had to stay in and figure it out.

1992. My second game in my current job as the Head Basketball Coach at DePauw University. The game was played on the road. We turned the ball over with 10 seconds on the clock and a three point lead. Our opponent took a time out and had a side out in the front court.  We hunkered.  The point guard back dribbled and looked to be setting a play, we relaxed and he just knocked one in from 28 feet.  Great shot. Unfortunate. Tough luck.  We lose in overtime.

The second time it happened we were at home three years later against the same team. Time out. Side out. We hunker. This time they do run a play, we guard it well, the shot is barely off in time, it hits the rim rolls around twice, hits the backboard and falls in. We lose in the second overtime. Very unfortunate. Too, too bad. Very tough luck. The player who made the shot went on to become an All-American and Player of the Year in NCAA Division III. So I guessed that great players make great plays and sometimes that's just the way it goes.

But by this time I'm starting to listen to Dick Vitale a little closer at the end of games. I'm still not convinced. I'm thinking like most of you do…*there is still the possibility we could get beat if we put them on the line… Is fouling really a sign of weakness?...What would people say if it didn't work?* I was wavering, but the third time was the charm. After playing a great game on the road we were up 3 and in a position to win on the last possession. As the clock showed 00:00 the ball went through the basket after we chased and switched out on a player running off a staggered double screen. As he fell down, he threw the ball in the basket. We lost the game in overtime. As the players took the court for the last possession of regulation, I actually had this conscious thought, *what are the chances of this happening to me three times*?

Wrong thought. It is about the probabilities over the long haul. It's not about the chances in this moment. It's about the chances in this situation every time it occurs. You can't be like the guy at the roulette table who has his money on red, watches black come up six times, changes his bet, and then it comes up red. You can't win that way. You have to be consistent, and you have to know the numbers. A lot in coaching is dictated by your feel, by your gut. This situation is not, it is dictated by the numbers. Take a look at

these numbers  and I think you will find it very difficult to make a case for not fouling in this situation.

Let's look at it closely.  We can probably all agree that the team with the ball with less than 10 seconds to play down 3 is going to get a shot.  It might not be a great shot, but barring a turnover a game tying attempt will be made.  So let's say that 95% of the time a shot will be attempted.  We'll assign 5% to the number of times your opponent will turn it over or not get the shot off in time. Good 3 point shooting teams shoot nearly 40% from the arc (33% from 3 has the same point per shot value as shooting 50% from 2, and is considered acceptable by most coaches).   We must assume however this won't be a great look, even though it may be taken by a great shooter, and we'll assign a much lower value of 20% to this desperation shot.  This means that 1 out of 5 times this situation comes up you are going to overtime.  When you go to overtime your opponent has the momentum and the emotion that comes with hitting the shot that we all thought was so unlikely. This will happen about 19% of the time. Those aren't long odds; they are very real possibilities.

What is the alternative?  FOUL!  You must practice this situation. You must train your team to let as much clock run down as possible (7 seconds and under is my time) and foul, going for the ball, BEFORE your opponent is in the act of shooting.

So you are afraid you could get beat in regulation?  Three bad things can happen here. First, you could foul the shooter taking a 3. Big mistake. That is why you practice the situation.  If you do foul the shooter the national free throw percentage indicates the odds are against your opponent making all three free throws.  The national average hovers around 67%.  Even if he does make all three free throws, it is still a tie game.  The percentage of time you would make this mistake I am assigning as 2% (which may be high).  The second bad thing is fouling the 3 point shooter who

makes the 3. This is one of the two scenarios in which you could lose the game in regulation. He hits the 3 and makes the free throw and you lose by one. Given we have established a 2% chance you will make the mistake of fouling the shooter, we can say that in 10% of those cases he will hit the shot, and in 67% of those cases he will make the free throw and you will lose in regulation. Based on these numbers Professor Mark Kannowski of DePauw University calculates that the chances of you losing in regulation in this manner are 0.134 or about 1 in 750.

The second way you can lose in regulation is by fouling intentionally, your opponent makes the first free throw, rebounds the intentional miss on the second free throw, gets the ball back to the arc and knocks in a 3. Let's look at this scenario. Remember an average free throw shooting team shoots 67%. So when your opponent steps to the line there is a 33% chance he will miss the first attempt. If this happens the second free throw if missed intentionally puts you right back in the "Up 3"Situation. If your opponent rebounds the miss your team should foul immediately, eliminating the possibility of being beaten or tied at the buzzer. When you rebound the miss the game is essentially over. In both cases your opponent has been deprived of a shot to tie the game.

Assuming your opponent makes the first, which he will do 67% of the time, he now must miss the second intentionally. There is a slight chance he will miss the shot without hitting the rim, which is a violation. Your ball. Game over. There is also a chance he could make the shot while trying to miss. I'll assign a 2% chance to these possibilities or 1 in 50. Assuming he hits the rim, your opponent must now rebound the ball. In recent years this situation has turned even more to the fouling team's advantage as the rules committee has removed all but two offensive players from the free throw lane. As the defensive team you know what is coming, have the inside spots, can have your best rebounders in the game and have a 4 to 2 advantage in the lane. I'll assign an extremely

generous 20% to the chances your opponent can rebound the ball. Should he get the rebound your opponent still must score to tie the game. Even the most optimistic of us would not allow a better than 45% chance of scoring in this situation. Let's call it 45%. If all of this happens the game is still only tied. Computing the relationship of these percentages gives us a 4.9% chance of being tied in this manner at the end of regulation. Compare that to a 19% chance of going to overtime after a made 3 on the last possession. Coaches devour stats and percentages like so much post game pizza. Is it possible to ignore the difference in those numbers? When I send a shooter to the line to shoot a technical do I send the player shooting 75% or the one shooting 59%?

Now it is also possible that the rebound will be thrown out to the 3 point line. The chances of looking to pass rather than score in this situation are low, maybe 15%. The pass opens up the possibility of a turnover, another 15%, and another 5% possibility of not getting the shot off in time after the pass. The odds of you getting beat like this are a little better than me winning the lottery, but not much, .008% or less than 1 in 12,000. Not very good. That, my friends, is a long shot.

To review, don't foul and you are going to overtime 1 out of 5 times. Foul and there is a less than 1 in 20 chance you can be tied in the missed free throw scenario. The only reason to choose not to foul is fear of the two losing scenarios which are 1 in 750, and 1 in 12,000 respectively. There is not a gambler in Vegas or a statistics professor east of the Mississippi who wouldn't take that bet and foul.

Now you know the numbers. Or most of them. Make your own decision, but I urge you not to be stubborn. I stayed up all night kicking this around after the third loss in this situation. The next day I was sitting in our hotel with a friend watching a game

between Wichita State and SMU on television.  7 seconds to play, SMU makes a free throw to go up 3.  Will they foul? No.  Wichita State runs the ball up the floor and gets a shot that in my mind is 15% better than the one that tied us the night before.  It bounces off the back of the rim, the horn sounds and everyone is happy.  But I knew better.  They got a shot, and it was a good one.  In fact I think you could make a case that not fouling creates a situation where the defense backs off (the coach's instructions were almost assuredly…*no threes, no fouls*) and allows an even better look than usual (who wants to be the guy to foul a three point shooter in that situation?).  My mind was made up.  I was fouling.  As fate would have it the next day we made a free throw to go up 3 with 7 seconds remaining.  We had not practiced it, but we took a time out, let some time go off and fouled.  A 65% free throw shooter made the first, missed the second intentionally, we rebounded the ball and were fouled as the clock runs out.  Game over.  We are 6-0 fouling in this situation.

So you think you have thought of everything?  I've thought this through forward and backward, or at least I thought I had.  The next year we were on the road practicing the Up 3 Situation (obviously we have to practice down three as well).  Our players are lined up practicing the intentional miss play.  Each time the shooter starts his motion one of my freshmen post players violates the lane.  He does it 3 times before I ask him what he is doing.  His response, *Coach, it seems to me if I violate every time he can never actually miss the free throw, the only thing he can do is make it and we will still be up one with the ball*.  I thought about it and he was right.  Think about it.  I'm not sure how it will be called.  I've run this by officials and the consensus seems to be a warning, after they realize you are doing it intentionally, for violating the spirit of the game.  Of course the next question is, what do you call fouling intentionally and intentionally missing free throws if not a similar violation.  But that's another can of worms. Worst case is I get to observe my opponent's missed free throw strategy (further

reducing his chances of rebounding the intentional miss), and best case, my guy is right and it completely takes away the tie/loss possibilities as slim as they are.

There you have it. In every case I feel I have estimated the numbers conservatively to give the doubters the benefit (in real life they might be even more compelling).  Those are the numbers and the numbers don't lie.  What will you do the next time you are up 3 with less than 10 seconds to play?  I'll let you do the hunkering if you want.  I know what I'm going to do, and more importantly, why.

*Special thanks to Dr. Mark Kannowski of DePauw University for his invaluable assistance with the mathematics, as well as Writer-at-Large Tom Chiarella for his editing assistance and friendship.*

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              ┌──────┐        │  Foul the shooter │        ┌──────┐
              │ .02  │        └──────────────────┘        │ .98  │
              └──────┘       /                    \       └──────┘
        ┌──────────────┐                              ┌──────────────┐
        │ While shooting│                             │ Before the shot│
        └──────────────┘                             └──────────────┘
     ┌────┐          ┌────┐                      ┌────┐            ┌────┐
     │ .1 │          │ .9 │                      │ .33│            │ .67│
     └────┘          └────┘                      └────┘            └────┘
 ┌──────────┐    ┌──────────┐            ┌──────────┐        ┌──────────────┐
 │ Shot made│    │Shot missed│           │ Miss 1st FT│      │ Make 1st FT   │
 └──────────┘    └──────────┘            └──────────┘        └──────────────┘
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**Foul the shooter** — .02 / .98

**While shooting** — .1 / .9

**Shot made** — .67 / .33
- FT made — .00134
- FT Missed — .00066

**Shot missed** — .301 / .699
- All FTs, OT — .00542
- FT Missed — .01258

**Before the shot** — .33 / .67

**Miss 1st FT** — .65660

**Make 1st FT** — .02 / .98

**Make 2nd FT** — .00647

**Miss 2nd FT** — .2 / .8

**They rebound** — .15 / .85

**You rebound** — .25355

**Pass for 3** — .85 / .15
- Keep possession — .05 / .95
  - Shot — .1 / .9
    - Shot made — .00008
    - Shot missed — .00074
  - No Shot — .01559
- Turnover — .00290

**Shoot for 2** — .45 / .55
- They score — .04923
- They don't score — .06016

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                        │ Hunker Down │
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              ┌─────┐ ╱                 ╲ ┌─────┐
              │ .95 │                     │ .05 │
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          │ Shoot a 3 │                 │ No shot  │
          └───────────┘                 └──────────┘
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┌──────────────┐    ┌──────────────┐
│ Shot made, OT│    │ Shot missed  │
└──────────────┘    └──────────────┘
   ┌─────┐             ┌─────┐
   │ .19 │             │ .76 │
   └─────┘             └─────┘
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