The tragedy of luck

By Ali Mohammed

Imagine this, a divorced dad named Jimmy is feeling a little heartbroken. Little does he know his best buddy bought him a ticket to Vegas! When he arrives the first thing he does is bring $1000 to the casino and sprints straight to the roulette wheel to put $1000 worth of chips on 31 black. The dealer spins the ball and it actually lands on 31 black. Now Jimmy has gotten all excited as he's made a whopping $36,000. You see, the thing about Jimmy is that he's an ambitious person and so he does the idiotic move (as some would say) of placing that $36,000 on 31 black again. The crowd was quite shocked by this move. The dealer spins the ball and it stops, on none other than 31 black!! Jimmy is satisfied with the $1,296,000 he earned and walks out the casino with over a million dollars.

What actually is luck?

From what we have seen from Jimmy, any normal person with a sane state of mind says that Jimmy is a 'lucky' individual, but what does luck actually mean? The Oxford Dictionary definition of luck is 'the chance of occurrence of situations or events favourable to a person's interests' which is the definition I will be referencing. Going back to Jimmy, let's just say that he wanted the ball to land on 31 black twice, making that situation in his interest. Now we know that each of the 38 slots should have an equal chance of the ball being landed on. Yes there could be a chance that a gush of wind lowers the chance of some slots being landed on but for the sake of Jimmy we won't account for any of that malarkey. That means that for the ball to land on 31 black there is a 1 in 38 chance of that happening (2.63%) which is quite low but not impossible. However for the ball to land on 31 black a second time there is a 1 in 1444 chance of that happening (0.0693%) which is astronomically lower than getting 31 black a single time, considering that the wheel has no memory of the spin before. Now for Jimmy that only took two

spins to achieve, but for someone who isn't Jimmy we have to assume it would take 1444 spins for that to happen. To put into perspective you can do around 40 spins an hour, and considering we need to do 1444 spins that would take around 36 hours of continuous playing just to get 31 black twice in a row. In reality no one has that amount of money to put $1000 each time and no one is super human enough to not sleep through that period of time. Even if you did manage to get black 31 twice in a row you would have probably lost more money in the process in making that $1,296,000 you so desire. But luckily for Jimmy it only took him 3 minutes of his life to make that money. But what makes Jimmy lucky? Does he have magical powers that can control how much the wheel spins or can he see into the future and find out what the ball lands on. In reality it's probably none of those things, it's just the fact that in all the possible outcomes of the 1444 spins he got the two that he desired. The interesting thing is that all the slots have an equal chance of being landed on. It would also take 1444 spins to land on say 3 red then 28 black. In the 1444 spins we would have had to do to achieve Jimmy's victorious outcome we may have come across spinning 3 red and 28 black together. But it's the matter of the fact that we don't care about that said result, only the victorious one that awaits our $1,296,000.

Luck behind games:

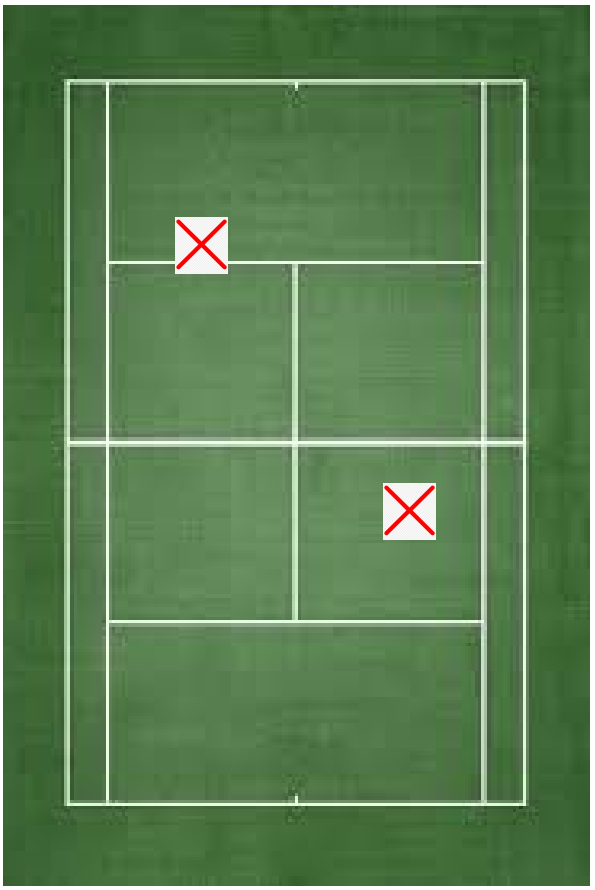
Most likely in your life you have played snakes and ladders. Now the thing with this board game is that the outcome of the game is 100% dependent on a dice roll, meaning there is no skill to the game. Yes you could say that rolling the dice and moving the piece along the grid involves skill but for this instance we can assume that the youngest that'll be playing the game is a 4 year old who can do those things with ease. Now considering that the game is 100% based on your luck of the dice, a 4 year old has a fair chance of winning against an Oxford Maths student who is doing a PhD. The maths student is a lot smarter than the 4 year old (I'd hope so) so it would be surprising to see the 4 year old actually beat this maths student but the game is dependent on the dice roll so there is realistically a 50% chance of winning. However, if we take into account chess, where the outcome has 100% dependency on the smarts of the players, the 4 year old has no chance of winning. With that you

would say that there is no luck in chess, that's where I see a slight misconception. In chess there is perfect information, both players have the same set up and can both see everything that's going on. Unlike the roulette problem it is highly difficult to calculate a probability of luck occurring in chess, not because it is non-existent but simply because of the fact that there are too many outcomes in chess. Just to put into perspective there are 10^{120} possible games, this is also known as Shannon's number. Just to show how huge this number is there are an approximated 10^{80} atoms in the universe, Shannon's number is 10^{40} times greater than the amount of atoms in the universe. The point being that it is impossible to make any predictions when it comes to chess. Let's go back to the 4 year old and assume he also knows how to play chess at a beginner level, and imagine we put him against Magnus Carlsen (one of the best chess players to have lived), is there any possibility that the 4 year old could beat Magnus Carlsen. Since the 4 year old is a beginner it is obvious to say that Magnus will beat him with ease as he has an elo of 2840 where the 4 year old would have an elo of around 400. The only way that the 4 year old could beat Magnus Carlsen is if he unintentionally played a brilliant move for each and every one of his moves (or as many possible moves). Now for obvious reasons the chances of the 4 year old pulling that off are astronomically low, but not impossible. Magnus Carlsen could also be very sleepy when playing with the 4 year old and make a lot of blunders, therefore allowing the 4 year old to win (but Magnus Carlsen is too good for that). But if we are talking about traditional games played between two players with the same elo, there is still luck to be found and calculated. The main appearance of luck is in the opening, in chess there are many different openings some of them being quite famous and widely used like the queen's gambit. If you play a rare opening and the opponent doesn't know the preparation for it you have basically won the lottery. This is because you can manipulate the game to your advantage all because the opponent doesn't know what your opening is. Now the chances of this are still astronomically low and probably won't guarantee you the win. Now there is actually a way to calculate the probability of this happening, if we take into account the opening tree, after the first move each there are already 400 possible positions, after 2 each its around 197,281 possible positions and it just keeps getting bigger. Take Magnus Carlsen, if he prepares around 10,000

specific opening lines. The total possible lines to move are 10. So if we use the formula: positions after n moves ≈ 30^{2n} we get 30^{20} which is around 3.5×10^{29}. So the probability of having the exact preparation would be $10{,}000/3.5 \times 10^{29} \approx 2.86 \times 10^{-26}$. Which is basically zero, it's so small that you would have a higher chance of getting 31 black 16 times in a row. However this may be slightly extreme as there is no human on our planet that knows all these different openings, this would only be relevant if Magnus Carlsen was playing against some intergalactic being who had infinite knowledge about chess. But if we think about the reality, lets say at Magnus Carsen's level there are roughly 1,000 truly critical positions, if a player prepares 500 of them the probability works out to be 500/1000 which is just 50%, so you have a 50% chance of getting lucky that you have the right preparation in a chess game.

Luck in sports

I have gone through luck in roulette, snakes and ladder and chess. Where luck becomes less and less apparent, but luck in sports?! In sports like tennis, the outcome of the match is entirely dependent on the skill set of the player. For example if one player knows more techniques than the other they will most likely win the game. There are obvious contestants for the factors that affect luck, for example the wind direction in a game and which side the sun is facing but for this we will ignore those factors. A way to visualise luck in tennis is by thinking about mishaps when the ball is hit, by this I mean when someone hits the ball it goes into the complete wrong part of the tennis court, this could be for many reasons such as the player over estimating the amount power they need or the put to much spin. From this we can model the probability of luck for a player.



Let's say that the player at the top of the court is player 2 (P2) and the one at the bottom is player 1 (P1). P2's objective in this scenario would be to hit the ball to the back of the court which would make it hard for P1 to reach, however there was a mishap in this swing so the ball went elsewhere. The best case would be if the ball would land on the right of P1 (if he is right handed) he has a perfect opportunity to hit the ball to the back end of that court, leaving P2 unprepared and allowing P1 to win the point. We can calculate the probability of this happening by taking into account the area of the tennis court (assuming it's a normal adult tennis court). The total area of one side of the court (ignoring tram lines) is around 97.65m^2, and let's assume that the area that P1 wants the ball to go into is the right third of the right service box. The area equates to around 8.77m^2, if we do $\frac{8.77}{97.65}$ we get around 8.98%. This would be the % of luck that player 1 would have at this moment. So the better your position in the game the higher % of luck you will have.

What is the tragedy of luck?

Luck is a tragedy because it can make you reliant on it. If we go back to Jimmy, he's going to think he is a master at roulette when in reality he has no idea how to play. This creates a false deception of hope for those who have lots of 'luck' - forming a mindset that depends on luck rather than putting in work.

References:

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