

# Prediction

This is one chapter of a yet to be completed guide to competitive Pokémon RBY battles by Hipmonlee.

## Introduction

Pokémon is, more than anything else, a game of prediction. You must look deep inside the mind of your opponent, understand their hopes, their dreams and their fears, and exploit that knowledge to anticipate their every action. Of course, having done your research, and discovered that your opponent has never emotionally recovered from the trauma of Ash's Butterfree leaving, trying to translate that into an action in a Pokémon game may not strike you as entirely intuitive. So here I am going to help you with that.

When a new player is looking for advice about how to get better at Pokémon, the most common question they will ask is "How can I be better at prediction?" And the most common piece of advice they receive is "Don't predict". It's good advice, despite being obviously incorrect. You absolutely need to predict to be good at Pokémon. But it is helpful because not predicting makes it really easy to understand when you need to predict and when you just don't. Plus a lot of new players fall into the mistake of trying to predict everything, rather than the far less glamorous approach of forming a coherent strategy. Firstly you need a practical game plan that isn't based around mind reading. And then you can start to think about how your opponents will likely respond to certain situations, and how you might be able to take advantage of that.

In other words, all that stuff in the first paragraph is complete bullshit. So for now I am going to first go through the cold hard mathematical reality of Pokémon, and explain in great detail why your opponent's move choices are irrelevant. Then, I will cover why the cold hard mathematical reality doesn't actually work in practice and why this is actually the bullshit paragraph.

## Nash Equilibria

Pokémon is what is known as a finite, simultaneous, symmetric, zero-sum game with imperfect information. And it turns out these have been studied by [people a lot smarter than me](#). The important thing about such games is that there exists at least one strategy, called the Nash Equilibrium, whereby no matter what your opponent does their chance of winning can be no better than 50%. This isn't actually a mind boggling conclusion when you think about it, but the key part of the line is "no matter what your opponent does"—in other words *you don't need to predict shit*.

The perfect strategy to Pokémon would of course be inhumanly complicated. It would also probably be incomputerly complicated as well—at least for the time being. Pokémon is an extremely complex game, with a ridiculous number of variables. The solution to Pokémon is

likely several orders of magnitude more complicated than the solution to Chess<sup>1</sup>. But knowledge of how Nash Equilibria are calculated is still going to help us. We can break a larger game of Pokémon up into smaller sub games, which we have a much better chance of understanding. And we can reasonably assume that our opponents are generally as constrained by the limitations of the human body as we are, so we don't really need to aim for perfection, just to be slightly less incompetent than our pea-brained opponents.

The first thing we should know about the perfect strategy for Pokémon is it would be what is known as a "mixed strategy". That is to say there won't always be a single correct choice for every decision you need to make in a battle. Instead there will be a set of actions, each with a different probability with which they should be selected. For instance, when selecting the Pokémon for your team, rather than always selecting the same 6 Pokémon with the same moves, you should for instance probably use Zapdos not much more than about one fifth of the time<sup>2</sup>, and the rest of the time select something else. Otherwise you'll probably find that your opponents will start to bring Rhydon against you more and more and more.

## A Simple Example: 2x2 Games

So to get a better idea of how this works let's consider an example from a battle. This game is from the finals of the 2020 RBY Global Championship, between Amaranth and ziloXX.

<https://replay.Pokémonshowdown.com/gen1ou-1185783066>

In this battle on turn 14 Amaranth's Exeggutor is facing ziloXX's Chansey. Amaranth would like to put the Chansey to sleep with Sleep Powder, but obviously ziloXX would like to avoid this, which he can do by switching to his paralysed Jynx. Amaranth does not want to allow the Jynx to come in freely to Rest, so might prefer to attack with Psychic to give himself a chance to KO the Jynx if the Psychic lowers the Jynx's Special stat. But if Exeggutor uses Psychic then that could give Chansey an opportunity to Seismic Toss the Exeggutor. And now we have come full circle, because if ziloXX intends to use Seismic Toss, then Amaranth can just put it to sleep with Sleep Powder.

Each player has two possible actions (hence a 2x2 game), and no action completely outclasses the other. The correct action for either player is dependent on what their opponent chooses to do. Since neither player is a mind reader, they instead should calculate a probability of selecting each action. Or they could just click something, that's definitely an option that is available to them. But you and I, we are above such things.

The first step in determining the probability with which we should select an action is determining the payoff for every possible outcome. In practice this is not something we are going to be able to do an especially good job of. Particularly when we are fighting against a timer. But, as always, we only have to do a better job of it than our dunderheaded

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<sup>1</sup> That says nothing about the quality of any of these games, they are all far, far too complicated for any human to ever fully solve, so the relative complexity is not really relevant.

<sup>2</sup> This is a very rough estimate based on tournament usage.

opponents. So let's start by going really, really, really simple. Here is an example payoff matrix based on the above scenario, from Amaranth's perspective:

	Switch to Jynx	Seismic Toss
Sleep Powder	Bad	Very Good
Psychic	Good	Bad

So with this as a starting point, we can probably aim to be a little bit more sophisticated here. We could, for instance, ask ourselves a couple of fairly straightforward questions. Is using Sleep Powder on the switch to Jynx worse for Amaranth than using Psychic when Chansey uses Seismic Toss? I would argue no. Psychic against an unparalysed Chansey will only do trivial damage, but the Seismic Toss will leave Exeggutor with only one chance to use it's sleep move. Considering that it is a 75% accurate move from a paralysed Pokémon, it might be better for Amaranth to just Explode to guarantee some value from his Exeggutor at that point. So this could be his last chance to inflict sleep. And allowing Jynx to come in on a Sleep Powder might not be the worst thing in the world either. Even if Jynx rests, Exeggutor will get a free opportunity to Sleep Powder as the Jynx wakes, and if Amaranth switches to Snorlax, as Jynx rests, in the worst case he gets a free hit with Snorlax (which Chansey has not got enough health to switch into), and in the best case scenario, Jynx is Fully Paralysed, so nothing is lost.

We can then analyse the other actions in a similar fashion and we might come up with a matrix that looks something like this.

	Switch to Jynx	Seismic Toss
Sleep Powder	-3	12
Psychic	3	-4

In a 2x2 game, the probability with which you should select an action is equal to the difference in payoffs for the possible outcomes of the alternative action divided by the sum of the difference of payoffs for both actions. In the example above Amaranth's difference in payoff for Sleep Powder is  $12 - (-3) = 15$ , and his difference in payoff in Psychic is  $3 - (-4) = 7$ . So he should Sleep Powder  $7/(15+7) * 100 = 32\%$  of the time and Psychic  $15/(15+7) * 100 = 68\%$  of the time.

The way I like to think about this is that once we select our action the actual payoff for us is dependent on what our opponent chooses to do. So if you select an action with a large difference between its potential payoffs more often, you are increasing the power your opponent has to influence the battle.

If you look closely, however, there is something here that might sit uneasily with you. In this scenario the potential payoff for using Psychic is definitely lower than the potential payoff for

Sleep Powder, and likewise the potential drawback for using Psychic is worse than the potential drawback for Sleep Powder. And yet that is the action we should select more often. But the real kicker is that if the potential payoff for Psychic was even worse, that would mean we should select it even more frequently.

The explanation for this comes from the fact that in this scenario attacking with Psychic is the best alternative action available. If the potential payoff for Psychic was lower, it is likely that some other action would be preferable to it, so we would never select Psychic at all. And given Psychic is the best alternative action available, then we just have to take our medicine and do what we can to reduce our opponents opportunity to control the game.

## Calculating Payoffs

When calculating payoffs, the most important thing to keep in mind is that the values should reflect the probability of winning. Nothing else is relevant. The value for a given action depends on the current situation. For instance, putting Chansey to sleep with your Jynx when your opponent has no other Pokémon capable of surviving a Blizzard is extremely valuable and should have a very high payoff. Doing the same thing when your opponent has a full health Slowbro that you have no way to check aside from putting it to sleep will have a very different payoff.

This is very important to bear in mind when there is a significant skill gap between you and your opponent. For instance, when playing against a weak opponent they may have a very low likelihood of beating you overall. However, if you were to allow your only check to a certain Pokémon to get too badly damaged, you might find yourself lacking the tools you need to stop them sweeping you. Taking risks with key Pokémon in such a situation should obviously come with very large negative payoffs. And the nature of Pokémon is that no team ever fully covers everything you would like. Consequently, when you are playing against weaker players, taking risks often comes with significant negative payoffs.

This also applies when one player is close to winning. When you are a long way behind in a battle, the difference in payoff between a “safe” action and an action that risks the one Pokémon remaining that is keeping you in the game might not be all that large. Whereas for the player who is close to winning, taking a risk with the Pokémon that is their key to victory might have a truly enormous difference in payoffs.

## 3x3 Games

Games where you have more valid options are considerably more complicated. The maths requires solving simultaneous equations, which, for some of you at least, may be plausible within the time you have for a turn in a Pokémon game. But I am a ponderous individual, and frankly I find such vulgar mathematical circus tricks distasteful. I will, however, go through some of the maths to give you some rough heuristics for how to decide which actions to choose.

Firstly, it is important to be sure that your 3 x 3 game is actually a 3 x 3 game. A lot of the complexity of the maths actually comes from ensuring that the actions you are selecting from are not actually outclassed by another action. I know of no better approach than just following your intuition. When you have identified an action as something you want to do, you can assume it is going to be a part of the strategy.

One thing to bear in mind is if your opponent is selecting from two actions, you almost always want to select from two actions as well. So if you have two options that are both good against one of your opponents actions, you should figure out which of those two options is better, eliminate the other one entirely, and then start thinking about how often you want to select your remaining actions.

To help get our heads around this one let's consider an example scenario again. This a RBY NU battle from the finals of a RoA Spotlight tournament between myself and Earthworm, here using the name *the pirate99*.

<https://replay.Pokémonshowdown.com/smogtours-gen1uu-522554>

In this battle on turn 8, my Venusaur is facing Earthworm's Dewgong. I would like to put Dewgong to sleep with Sleep Powder, but Earthworm has two options he could use to block this: a paralysed Mr. Mime or a Poisoned Charizard. If he switches to Mr.Mime my best option is to Razor Leaf, which will comfortably 3hko the Mr.Mime netting me some serious damage against one of NU's biggest threats. This is also a nice move to use in this situation because it does a lot of damage against Dewgong. Against Charizard however, Razorleaf does almost nothing, I would much rather use Body Slam. But Body Slam does very poor damage to Dewgong, which can hit me back with a very powerful Blizzard.

So our matrix might look something like this

	Switch to Mr. Mime	Switch to Charizard	Blizzard
Sleep Powder	-4	-4	10
Razor Leaf	5	-3	-1
Body Slam	-1	3	-10

So the first little trick here is to look at the sum of our opponents payoff for each action. The closer these are to the same value, the closer we are to picking each action with the same probability. In this case the returns are 0, -3 and -1. So there is probably going to be a bit of variety in the probability with which we pick our actions.

Then to solve this we look at the differences between the values in two pairs of columns. So we get 0, 8 and -4 as the differences between the first two columns, and -14, -2 and 13 as the differences between the second two columns. Then we solve the following equations:

- $0p_1 + 8p_2 - 4p_3 = 0$  (the sum of the differences between columns 1 and 2 multiplied by the probability of the row for each row should equal 0)

- $-14p_1 + -2p_2 + 13p_3 = 0$  (the sum of the differences between columns 2 and 3 multiplied by the probability of the corresponding row should equal 0)
- $p_1 + p_2 + p_3 = 1$  (just how probabilities work---they have to add up to 1)

Trying to explain this is a little tricky. I would be lying if I said I had a great handle on it, but it more or less follows the reasoning of the 2x2 case. And without actually doing the maths here we can easily see a few things about how this will work. From the first equation obviously  $p_3$  has to be twice  $p_2$ . And then looking at the first equation, we can see that  $p_1$  is going to be a little bit less than  $p_3$ . So that gives us a pretty good basis from which to go on. If all this maths isn't for you, luckily you can just use an online solver. [Here](#) is one I use. It turns out the actual figures are: I should Sleep Powder ~36.4% of the time, Razor Leaf ~21.2% of the time, and Body Slam ~42.4% of the time.

But I would note here that actually using an online calculator in game is probably a waste of your time. You don't need perfect accuracy in calculating what action to take, your opponents definitely won't, and it's not like we spent a lot of time ensuring the values that we found for each action were flawless. But, if you want one general rule of thumb: large differences between the payoffs of an action generally mean you should take that action less. Even if that action has better overall payoffs than the alternatives.

## Imperfect Information

In all of the examples up until this point I have told you all of the potential actions both players can choose. Of course in Pokémon RBY most of the time you won't know what all of your opponents Pokémon are, let alone the moves they carry. You will have to infer the possible actions that your opponent may be able to make.

In RBY, for the most part, this is fairly straightforward. Your opponent's Tauros will have the moves Body Slam, Earthquake, Blizzard and Hyper Beam or it is a bad Tauros. But for quite a lot of Pokémon, there can be a lot of variation in what moves they may use.

The technical name for games where your opponent knows information that you do not is *imperfect information games*. The ideal mathematical solution for such games involves collapsing a decision tree into a single table. In the case of Pokémon, this would require fully solving the game, so that you would know exactly how likely your opponent is to have selected any possible combination of moves and Pokémon. As I mentioned earlier, this is not even remotely practical. However, we can analyse some simple scenarios, and maybe fudge things a little, to help us put together some useful heuristics<sup>3</sup>.

So let's consider a very common scenario. You have a Snorlax in against your Opponent's Chansey. Chansey has revealed Thunderwave and Softboiled, and your Snorlax has revealed Body Slam and Earthquake. Both are still at full health but the Chansey is paralysed.

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<sup>3</sup> NB: This whole section skips over a lot of details that could impact the maths a lot. Bear in mind that the goal here is to identify rough heuristics that will help us in a live battle, not to pinpoint with mathematical certainty the ideal course of action when a Chansey is facing a Snorlax.

You want to Body Slam the Chansey, but you are worried that it might have Counter.

We'll start by calculating separate tables for the two possible sets Chansey might have.

If the Chansey has Counter the table might look something like this:

	Counter	Thunderwave
Body Slam	-15	6
Earthquake	6	0

And based on this table Snorlax should Body Slam 22.2% of the time, and Chansey should Counter 22.2% of the time. The overall payoff of this table is 1.33.

And if the Chansey doesn't have Counter it would be something like this:

	Thunderwave	Thunderwave
Body Slam	6	6
Earthquake	0	0

Based on this table Chansey has no choice but Thunderwave and Snorlax should always Body Slam, and the overall payoff is 6.

To solve the overall picture what you might try and do here is collapse these two tables into a single table. However, what you will find if you do that is that the Chansey should always have Counter on its moveset. The problem is that Counter is the best move it has to help it deal with Snorlax and we have ignored all other scenarios that this Chansey might find itself in. Since we are only looking at the payoffs from a Snorlax match-up it is obvious that we would find that Chansey should always have its best move for that match-up. In reality Chansey is likely to have to face other Pokémon over the course of the battle, so to combine these tables we would have to include all of those scenarios and we quickly realise that this is far too complicated to be useful.

But this gives us a clue as to how to move ahead here. In general there will be one moveset that is the worst case scenario for whatever we are using at the moment, and that if we were to only consider the payoffs against our current Pokémon we would find that we should always use that one moveset. For Snorlax it's a Counter set but for Starmie it would be Thunderbolt, and for Parasect it would be Fire Blast.

So let's come back to the Snorlax example. When we play the first game, where Chansey has Counter, then we know it should use Counter 22.2% of the time, and the overall payoff is 1.33. So let's assume that Chansey has Counter less than 22.2% of the time, for the sake of argument let's call it 10% of the time. That being the case Chansey cannot ever force us to

play the first game. From our point of view, if we were to always Body Slam, even if the Chansey user selects Counter 100% of the time when they have it, our overall payoff is always going to be  $-15 * 10\% + 6 * 90\% = 3.9$ . Conversely the payoff for Earthquaking will be  $6 * 10\% + 0 * 90\%$ , or .6. Clearly that being the case we should always Body Slam.

So what if Chansey has Counter more than 22.2% of the time? Let's assume it has it 25% of the time. Well, if it uses Counter every time that it has it, then the payoffs would be  $-15 * 30\% + 6 * 70\% = -0.3$  for Body Slam or  $6 * 30\% + 0 * 70\% = 1.8$  for Earthquake. That being the case, we clearly ought to Earthquake all of the time. But the Chansey user can actually do better than this. When they have Counter, they should use it frequently enough that their overall usage of Counter is 22.2%. When they do that we are forced to play the first game above, with an overall payoff of 1.3.

So the only relevant question is whether we think Chansey has a more than 22.2% chance of having Counter. If so, then we must play the first game and Body Slam 22.2% of the time. Alternatively if we think Chansey has a less than 22.2% chance of having Counter, we should always Body Slam.

So when you don't know your opponent's full team you should start by assuming your opponent is capable of making the best possible response to any action you want to take. Based on that, work out roughly how often they ought to choose that response and then consider the probability they actually have the right team that would allow them to make that response. If the probability that they have the necessary team is less than the probability with which they should select a specific action, then you can ignore that action completely.

## Stupid Opponents

So one thing to remember about finding a Nash Equilibrium is that all it does is guarantees that your chance of winning can be no worse than a certain value regardless of what your opponent does. That isn't necessarily the same thing as maximising your chance of winning, especially if your opponent isn't very good.

If we were to play against an incredible future supercomputer that had fully solved Pokémon, then yes, our best plan would be to calculate Nash Equilibria and we would win at best 50% of our games. But luckily for us, most of our opponents are going to be human beings, and therefore, most of our opponents are going to be stupid.

In the last section we saw how we should respond when we know our opponent is not able to select an action as frequently as the Nash Equilibrium suggests they should: we should ignore that action entirely. Likewise, if we know our opponent is disproportionately likely to pick a certain action, then we should use our best response against that action 100% of the time.

However, in practice, exploiting that can be harder than you might think. It turns out that collectively people are actually fairly effective at following Nash Equilibria<sup>4</sup>. And while, as individuals, your opponents are sure to be terrible, it can be very hard to know on any given day, for any particular opponent, in what way they are going to be terrible.

## Perfect Opponents

When you have a complicated situation, where it seems like there is far too much going on to ever make any sense of it, one trick I often find useful is to consider the absolute extreme cases. They often are a lot simpler, and can provide useful clues for how you might better approach a realistic scenario. For instance, in Pokémon, one extreme case would be the perfect opponent.

So let's reconsider the first example from this chapter, and let's imagine that we were playing against a perfect opponent that has calculated the Nash Equilibrium for Pokémon RBY in its entirety and will be playing accordingly. And let's just pretend that the example pay-off values I used just happen to actually be 100% correct.

Our perfect opponent is going to switch to Starmie with the exact probability of 18/29 and will Thunderwave with the exact probability of 11/29. So let's consider what happens if we don't play perfectly here. For instance if we just always explode, our payoff is  $-6 \cdot 18/29 + 10 \cdot 11/29 = 0.069$ . And if we always switch to Tauros our payoff is  $5 \cdot 18/29 - 8 \cdot 11/29 = 0.069$ . It turns out that whatever probabilities we choose for our actions, our payoff will be the same: this is actually the definition of the Nash Equilibrium. For each player it is the set of probabilities for which the opponent cannot improve their payoff no matter what action they select, because the payoffs for every action in their best strategy will be equal.

So does this mean that it doesn't matter at all what action we choose? Not exactly. While we can't improve our outcome, we could certainly make it worse. Note that I said the expected payoff for every action *in our best strategy* is equal. If we introduce other actions then it will reduce our payoff for sure.

From this it suggests that the best plan is to ensure that we have correctly identified the actions that should be in our strategy rather than worrying about the exact probability we should select each one. Although, we should bear in mind that generally our opponents are not perfect, they are deeply flawed halfwits, so ensuring we get as close to the correct probability for each action is still very important.

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<sup>4</sup> For instance see: Palacios-Huerta, I. (2003). Professionals play minimax. *The Review of Economic Studies*, 70(2), 0395-415.

# The Wishy Washy Part

Congratulations! We have basically reached the end of where Mathematics is going to help us. From here on in we are getting into the world of what I have learnt from practical experience. Or—if you prefer—my opinions.

But I thought I would take a moment to just recap the key takeaways from all of this maths.

- It is better to ensure that we have successfully found the correct set of potential actions than to ensure that we select actions with the correct probabilities
- You should have the same number of choices in your action set as you have in your opponent's action set.
- Once you have identified the ideal set of potential actions, the closer the sum of payoffs for your opponent's potential actions is to being equal, the closer to randomly you should select your actions.
- You should select actions with a large difference in payoffs less frequently, and actions with a small difference in payoffs more frequently.
- When you don't know your opponent's team you should assume the worst case scenario unless you consider that scenario unlikely enough that you can ignore it.
- When you know that your opponent is not going to select an action as often as they should, you should ignore that action entirely.
- When you know that your opponent is going to select an action more often than they should, then you should always predict them to take that action.

Hopefully this has been useful for you. But, this is a prediction guide, and in terms of actually predicting what your opponent will do, so far my advice just boils down to “if you know what your opponent is going to do then you should predict them to do that”. I suspect if I left it at that you might feel a little underwhelmed.

Unfortunately what remains to be covered is not founded in irrefutable mathematical certainty. Fortunately I am a man with opinions and I am not afraid to share them.

The key question for us for the rest of this guide is going to be: when can we safely assume that our opponent is going to select a certain action either too often or too infrequently? And, in my opinion, this is absolutely possible, just not in the way most people seem to think of when they talk about prediction.

But first, let's stop and think about how people decide what to do when they are playing Pokémon.

## Finding Potential Actions

The skill of finding what actions should be in your strategy is essentially the skill of Pokémon. Unfortunately Mathematics won't really help us much with this until the game is fully solved.

But, by considering the process by which people find actions, it may help us identify when people might tend to select something too often or too little.

It is my belief that basically every Pokémon player, good or bad, in any generation or format, starts by thinking about the moves that the currently active Pokémon could use against each other. If you look back at the examples I have used in this chapter, they all start with one player wanting to use a specific move against their opponent's currently active Pokémon.

There will be two likely outcomes to this. The first is that the payoffs of those moves will be mostly pretty even. In that scenario a common mistake of weaker players is just to accept that and select their move, whereas true Pokémon masters like us will always look for better options. But the more interesting scenario is that one player does very well out of staying in and attacking and the other does not. For the most part, this is when people will try to predict.

We therefore have two players, one who benefits from both Pokémon staying in, whom I like to refer to as being in a position of strength, and the other in what I like to call a position of weakness. It could well be that the player in the position of strength is losing horribly, but based on the fact that if both players stay in this player will improve their chance of winning I am calling their position one of strength. The player in the position of weakness must look for an alternative action.

So the player in the position of weakness chooses their best response to their opponent's best move. Bearing in mind they may not know what their opponent's best move is. They may have to cover multiple possible moves with a single action. A lot of the time this will actually be a prepared line, for example, if I need to switch into Rhydon and my Exeggutor is still at full health, I know that that will be part of my solution.

Likewise the player in the position of strength must consider what they believe their opponent's response to the threat of the current Pokémon may be. Of course this also may include multiple possibilities. And they must consider what options they have that best cover all of their opponent's possible actions.

Each player will continue examining the set of potential actions they have chosen, identifying a new potential action for one player or the other, and deciding how that affects the other player's current set of potential actions. Remember that you should have one best response to each action your opponent may choose. If you do not have the same number of actions as your opponent that is probably a sign that either one player has an inferior action in their strategy, or that the other player is missing their best response to one of their opponent's actions.

It is important that you think about actions as a part of a set, however, and not just as individual responses to individual actions. Just because an action is the best option against one of your opponent's actions does not necessarily mean it should be in your strategy. If there is an alternative response to the opponent's action that involves less risk against your opponent's other actions that might be a better option overall.

Although that is not to say that because an action has a high downside against a particular action of your opponent's it is necessarily a bad option. In fact, although having a large difference in payoff means an action should be chosen from your action set infrequently, it does not affect how often it should be in your action set. Remember that actions with a high difference in payoff only need to be used infrequently to act as a powerful deterrent. By including one in your mixed strategy, it may mean that another action, that potentially has a high reward and only a small downside can be selected more frequently.

## A Position of Strength or Weakness

In theory, a position of strength or weakness is just a way to dress up the cold hard mathematics underlying prediction. But I think it is a useful tool for helping us understand Pokémon for two reasons. The first is that due to the type chart, it is a fundamental part of the game that some Pokémon are advantageous over others. The second is that on a turn a player can only choose to attack or switch. And if a player chooses to switch, then the only possible downside to any action for their opponent is losing their position of strength.

One of the biggest mistakes new players make is predicting too often from a position of weakness. You might be sure that my Rhydon isn't going to Earthquake your Gengar, but even if you're right 90% of the time, that could mean you are pretty much just losing one game out of ten on the spot. The reason that I am not going to Earthquake very often against your Gengar is because I don't have to, the payoff for me is just that huge.

The other reason it is hard to predict from a position of weakness is that the player in a position of strength usually has a lot of options available to them. The potential risk to a player in a position of strength is often not as bad as the risk to their opponent *no matter what action they choose*. So not only would the player in the position of weakness be taking a huge risk by attacking, it's also a lot harder for them to know what any attack they choose would be hitting.

However, not all positions of strength are created equal. It is also important to be aware of how forcing your advantage is. Sometimes your opponent needs to switch immediately or they will risk being OHKOed. But sometimes, despite the fact that they will lose by not switching *in the long run*, they might be perfectly able to stick around for a few turns before switching out. It's a common error for even advanced players to overlook the possibility of staying in for just one turn when in a position of weakness. Sometimes the risks might not be all that great, provided you only roll the dice once or twice. This is a particularly useful thing to be aware of when you are facing a player who is behind in the game and is trying to predict often to help them catch up.

Another very common mistake that catches out intermediate players, and can be a cause for a great deal of anguish, is to think that because they have a position of strength that there is no risk. A simple rule of thumb is to be wary of making an action where the downside would be greater than the upside of you attacking and your opponent staying in. That isn't to say

never do it of course, just don't get carried away thinking that you are invincible because your position is advantageous.

## Double-Switching and Pivoting

When a player has a position of weakness their most likely action is to switch to the Pokémon on their team which is the most advantageous against the Pokémon they are facing. In general choosing to attack has the effect of trading a position of strength to your opponent for the outcome of whatever move you select. And we have just established that the benefits of being in a position of strength are significant. Consequently, you generally only want to attack if your attack is going to do something you really want. A better alternative can be to predict your opponent's switch and switch to a Pokémon that preserves your advantage until you get an opportunity to really punish your opponent. This is one of the most common forms of exploiting a position of strength, and is known to Pokeprofessionals as the *double-switch*.

A similar tool exists for the player in a position of weakness. It is used when you have a benched Pokémon that is advantageous against the current Pokémon you are facing, but it does not switch easily into the enemy's most likely attack. A common option is to switch into another Pokémon, which may not give you a significant advantage, but that forces the opposing Pokémon to select a different move. This allows you to more easily switch to your more advantageous Pokémon. This technique we refer to as *pivoting*.

## Story-Telling

If we are going to predict what our opponent will do, then gathering as much info as possible will help us do that. By paying attention to when your opponent double-switches or pivots and when they choose to just attack or switch to a counter it can provide a lot of useful information about their team and their overall gameplan.

When you are in a position of strength the safest thing to do is just attack. Choosing to double-switch introduces the risk that your opponent will stay in and get a free hit against you. As a consequence people will only choose to double-switch when it benefits their overall strategy.

For instance, your opponent sure as hell didn't just double-switch to their Starmie just so they could Thunder Wave your already paralysed Chansey. So stop and think about why they would make that move. Are they particularly afraid of your Tauros? Have they got no better options? But be careful: just because using Thunder Wave isn't their primary objective doesn't necessarily mean they won't risk losing momentum for a chance at paralysing your Tauros all the same.

If your opponent is choosing to double-switch or pivot frequently that can be an indication that they feel like they are behind in the game and need to take extra risks to make up for it. That may tell you something more about the rest of their team, and the more you know about

their team, the fewer options you will need to consider, which will make it easier to correctly identify the best sets of actions.

## Difficult Actions

One thing to consider when evaluating your opponent's play, is certain actions are more difficult than others.

For instance, consider this replay from SPL 2020

<https://replay.Pokémonshowdown.com/smogtours-gen1ou-472254>.

On turn 22 Metalgro\$\$ switches to his Starmie against ErPeris's Starmie, threatening a potential KO with a critical hit Thunderbolt. But rather than selecting Thunderbolt he decides to Thunder Wave instead, catching ErPeris's Chansey on the following turn instead. He goes on to make similar plays throughout the game, countering ErPeris's Starmie with his own, and each time predicting ErPeris to switch. The game ends with Metalgro\$\$'s Starmie still never having used Thunderbolt.

So, can we infer whether Starmie has Thunderbolt or not? To make that sequence of actions when the Starmie knows Thunderbolt is fairly straightforward. The initial switch to Starmie is just a simple pivot. Metalgro\$\$ wants Starmie in against Starmie but does not want to let his own Starmie get paralysed. So he pivots to Chansey (which only has Ice Beam as an attack and therefore cannot harm ErPeris's Starmie) to help Starmie avoid the Thunder Wave. And then, once his Starmie is in, he realises that ErPeris is likely to want to switch, so just Thunder Waves. Nothing here is beyond the capabilities of any intermediate player.

But bluffing Thunderbolt in that situation is extremely difficult for two reasons. The first is that bluffing a move is always a bit difficult. The moves your Pokémon knows are always going to be right there in front of you, but other potential moves you'll just need to remember. And summoning that information at a key moment is never guaranteed.

Secondly, Metalgro\$\$ has to plan the Thunder Wave before even sending out Chansey in the first place. So not only does he need to be aware that his Starmie could have had a move that it doesn't have, but he also needs to think of what happens two extra turns down the line if he did have it. It's very hard to spend precious seconds considering multiple turn sequences for lines that involve moves your Pokémon don't even have.

Unless you are playing against a very strong player, if your opponent switches Starmie in a situation where it needs to have Thunderbolt, that is probably a pretty strong indication that it has Thunderbolt, even if it does not use it. Of course Metalgro\$\$ is a legend of RBY, so the normal rules may not apply here.

# Differences in Information

Actions also are more difficult the more insight they require. To illustrate this, here is an example battle from SPL 2017.

<https://replay.Pokémonshowdown.com/smogtours-gen1ou-235525>

On turn 27 in this replay, Lusch has brought Peasounay's Snorlax down to low enough health that it is going to need to rest. It runs the risk of easily being KOed in two hits if it doesn't. Should Lusch stay in, there is no risk for Peasounay to reflect and then rest. This isn't a completely obvious case, but this means Peasounay holds the position of strength here.

Peasounay should then consider what alternative options Lusch may have. Switching to any of his revealed Pokémon will not prevent Snorlax from resting, and so he must consider what possible unrevealed Pokémon Lusch may have. Since the obvious line for Peasounay is to reflect, it is fairly obvious that switching to any physical attacker is not going to help Lusch. So, it is reasonable for Peasounay to infer that the logical action for Lusch is going to be to switch to a special attacker. Generally when you anticipate a switch to a special attacker the best action is for Snorlax to attack with Body Slam. However, considering the likely special attackers, Peasounay is able to use his metagame knowledge to deduce that Exeggutor is the most likely candidate. Anticipating that, Peasounay notices that he can use Amnesia to allow his Snorlax to rest against the Exeggutor.

In the situation, this is an action that demonstrates fairly solid awareness. It's an unusual enough situation that finding this probably requires noticing this all in battle, so all in all I would say this is a plan that an intermediate player would probably miss. But for an advanced player it is a fairly reasonable option.

From Lusch's perspective, however, things look a little different. Most importantly, the information available to him is not the same as the information available to Peasounay, and that changes how difficult certain options can be to find. Lusch is about to exploit this difference in information masterfully.

Lusch is in a position of weakness and considers his potential switches. The switch to Exeggutor is obvious and upon evaluating the situation he realises that the switch to Exeggutor will give him a position of significant advantage. Considering what counterplay Peasounay has, he realises that the only option that really minimises Peasounay's downside is to use Amnesia. He then realises that if Peasounay does choose to Amnesia his Snorlax can Hyper Beam it for the KO.

Let's compare the insight required for each of these players to select these actions.

Insights Peasounay needs in order to Amnesia	Insights Lusch needs in order to Hyper Beam
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<ul style="list-style-type: none"> <li>• Lusch is likely to switch to Exeggutor</li> <li>• If Snorlax uses Amnesia it will be able to rest safely against Exeggutor</li> </ul>	<ul style="list-style-type: none"> <li>• Switching to Exeggutor will prevent Snorlax from resting.</li> <li>• Peasounay is likely to know that Lusch is likely to switch to Exeggutor</li> <li>• If Snorlax uses Amnesia it will be able to rest safely against Exeggutor</li> <li>• Peasounay is likely to realise that if Snorlax uses Amnesia it will be able to rest safely against Exeggutor</li> <li>• If Peasounay selects Amnesia then Lusch's Snorlax can KO his by using Hyper Beam</li> </ul>
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It is fair to say in this situation that Peasounay made a good move, but that Lusch's move required so much insight that we can call it a truly great move. And it is fair to say that it was not as necessary for Peasounay to think as deeply as Lusch to identify the actions they chose. However, let's now consider what insights it would have taken for Peasounay to expect Lusch to Hyper Beam.

<p>Insight Peasounay needs in order to anticipate Hyper Beam</p>
<ul style="list-style-type: none"> <li>• Lusch is likely to switch to Exeggutor</li> <li>• Lusch is likely to realise that Peasounay knows his most likely switch is Exeggutor</li> <li>• If Snorlax uses Amnesia it will be able to rest safely against Exeggutor</li> <li>• Lusch is likely to realise that if Snorlax uses Amnesia it will be able to rest safely against Exeggutor</li> <li>• Lusch is likely to realise that Peasounay realises that if Snorlax uses Amnesia it will be able to rest safely against Exeggutor</li> <li>• Lusch is likely to have Hyper Beam on his Snorlax</li> <li>• If Lusch has Hyper Beam on his Snorlax then it can KO Peasounay's if Peasounay selects Amnesia</li> <li>• Lusch is likely to realise that his Snorlax can KO Peasounay's with Hyper Beam if Peasounay selects Amnesia</li> </ul>

If that was a great move by Lusch, then this, by Peasounay, would be simply incredible. Peasounay is an amazing player, but there is a point at which you can simply stop analysing and just be satisfied that your opponent is not going to have calculated a correct Nash Equilibrium for this turn.

## Prediction

And finally, after sixteen pages of the prediction guide we reach the part where we actually predict something. Trying to unravel how a person's psychological mindframe might affect the likelihood of them selecting certain actions is, in my opinion, never going to give you

reliable results. Maybe there are players out there that have mastered that art, but I am not one of them. You'll have to wait for one of them to write a prediction guide.

However, by using what we know about our opponent's team, their overall strategic goals, and most importantly their overall skill level, and by understanding the difference in knowledge between ourselves and our opponents we will undoubtedly find opportunities where we can be confident that our opponent is likely to not have found a key action in their strategy. And that being the case, there is sure to be an action in our potential action set that they are disproportionately unlikely to respond to. And that is an action we should select 100% of the time.

## Easy Actions

<https://replay.Pokémonshowdown.com/smogtours-gen1ou-503004>

Here is a battle of mine, against Serpi (using the name *Marvin Ducksch*) from the RBY Cup 2020. In this battle I have a significant team advantage, which, coupled with a little luck, is going to create a small feedback loop of advantages that are going to allow me to make a number of very glamorous looking plays, that are actually very easy to make, and almost impossible for him to respond to.

The first key turn to look at is turn 19. On this turn my Snorlax has low health but has it's Reflect set up and has two turns where it can Rest safely if Serpi chooses to stay in with Snorlax. Serpi, anticipating me to rest on the first of these two turns, switches in his Alakazam. This sticks out as a very unusual choice on his part, which gives me a huge amount of information about his team.

Firstly it tells me that he doesn't want to fight Snorlax vs Snorlax, which makes me think he probably doesn't have Ice Beam and potentially doesn't have Reflect. He also chooses not to switch to his paralysed Cloyster, which I think he would readily admit was an error on his part, but suggests to me that he is eager to maximise his control over the game, even if it is very risky to do so. This makes me suspect that he might think he is losing.

Typically on a turn like this most players would switch to a special attacker with high defence, the classic example being Exeggutor, but Starmie, Slowbro, Victreebel or Lapras would all do the job better than Alakazam, who runs the risk of being 2hkoed. It is pretty clear to me that whatever his last Pokémon is (alongside the inevitable Tauros), he has a strong reason to not want to send it in. There are really only two plausible options—It's either an Electric or a Rhydon. However, combining this with the fact that I suspect that he believes he is already behind in the game, suggests to me that perhaps he is worried he is facing an Electric vs Rhydon matchup. While I don't think there is too much about my play so far that really suggests that Rhydon is obviously on my team, what I have revealed so far does match the single most common Rhydon team exactly.

If he suspects that he is facing a Rhydon and is worried about it, that could explain why he chose not to switch to his Cloyster against Snorlax. Since it is already paralysed he needs it

at full health to be able to switch it into Rhydon safely. This is all starting to feel like a pretty compelling picture overall.

Then the second key moment is turn 24. My Exeggutor is facing his Snorlax, I Psychic and get a special drop and he Body Slams and does not paralyse me. And although he still has two Pokémon unrevealed, that was just enough luck to assure me that I am already a long way ahead in this game.

Thanks to the special drop, my Exeggutor facing his Snorlax is now very favourable to me, another Psychic will leave his Snorlax unable to face my own, and it guarantees I will KO in two hits from here. It makes it very hard for him to make a prediction here, since the potential downside is now that much greater.

In general he would want to switch in this situation, but he has nothing good to switch to. Alakazam is easily 2hkoed, Chansey is sleeping, Cloyster and Tauros will take far too much damage. So that leaves his Electric type, which makes this turn an easy switch to Rhydon for me. Especially when we can consider his alternative options: Snorlax could Body Slam and just hope for Paralysis, he could sacrifice Alakazam, or he could attempt to wake his Chansey up. Rhydon covers every single one of these perfectly.

Let's consider the insight I need to switch to Rhydon here:

Insight I needed to switch to Rhydon	Insight Serpi needs to anticipate the Rhydon Switch
<ul style="list-style-type: none"> <li>● Serpi is likely to switch</li> <li>● The likely switch in is an Electric Type</li> <li>● The alternatives are all good for a Rhydon anyway</li> </ul>	<ul style="list-style-type: none"> <li>● I know that Serpi is likely to switch</li> <li>● My unrevealed Pokémon is likely Rhydon</li> <li>● I suspect that that his last Pokémon is an Electric type</li> <li>● I suspect that his likely switch is to an Electric type</li> <li>● I wouldn't be satisfied just Psychicing the Electric type</li> <li>● I am most likely to switch to Rhydon</li> </ul>

A couple of these steps for Serpi are in fact very difficult. For instance, it is just much easier for me to know that he has an Electric than it is for him to know that I have a Rhydon. My sixth could just as easily be a Jolteon or an Alakazam. He has to consider all of these possibilities and what the consequences of that would be. Whereas I have enough information to be confident enough that his last is an Electric that I can just ignore the other lines.

The second major problem he has anticipating this line is that his intended line was switching to Chansey anyway. That being the case he was just as likely to be concerned about me switching to Tauros or Snorlax as Rhydon. If he is concerned about Snorlax or Tauros coming in his most likely counter play would be to Body Slam, which isn't particularly useful against Rhydon.

So what went wrong for Serpi here? Well, basically he loaded up a team with a Jolteon and faced a team with a Rhydon. That was already a huge advantage for me. But then, even before either Pokémon is revealed, the threat of the bad matchup encouraged him to take large risks early. Not only did those risks not come off, but they also gave up a lot of information. Then, down the line, the difference in information and a little bit of bad luck means that he has a lot of potential lines he has to consider whereas I simply do not.

This all leads to a play on my part which might look outwardly fairly spectacular, but was in fact very straightforward for anyone who had been paying attention. And you might even argue it was a mistake. Whereas, for Serpi, to outpredict me and Earthquake or switch to Tauros as I went to Rhydon would have been almost superhuman.

There is a risk that I could look over a battle like this and consider it proof of the overall superiority of my play. But I was put into a significantly privileged position before it even started just because of the teams we chose. While it might seem as though we are playing the same game, for him his options were fewer, his risks were greater, and his rewards were smaller. And as with anything, even minor structural advantages for one side will, over time, tend to compound into drastic differences in outcome. In other words, racism is for fools.

## Teambuilding with Prediction in Mind

So how can we build a team to make it easier for us to predict our opponents, and make it harder for them to predict us?

The first piece of advice I can give you should be pretty obvious: introduce variety. Don't just limit yourself to the same 9 Pokémon over and over again. For any given Pokémon don't just always use the same 4 moves. This means your opponent will have to consider more possibilities on every turn, which increases the likelihood they will miss the one that you are using. And even if they think of it, you will be able to spend more time considering the long term consequences of your actions, whereas your opponent will have to waste time considering options you haven't even got.

The second thing is that you want versatility from your Pokémon. You want to have as many options available in as many situations as possible. While UU Pokémon can fill useful roles in an OU team, they are generally capable of filling far fewer roles than an OU mon. Having only one situation where you can get value out of one of your Pokémon will make you far more predictable when that situation comes up. Likewise it will probably mean that in other situations, when you would otherwise have multiple options, you may find yourself left with only one.

Thirdly, while variety is a good thing, not needing variety is better. It is difficult for your opponent to guess whether your Starmie will Blizzard, Thunderbolt, Psychic or Surf on a given turn, but it's still much harder to deal with a Tauros that they know is going to Body Slam, but they have no counter for regardless.

# Common Mistakes

I want to cover some common mistakes I have seen, but that I haven't mentioned in the guide otherwise. I find trying to predict your opponents to fall for these is a little unreliable, I will sometimes adjust the probability I assign to a specific action because of them. But generally I think it's better to think of them as examples of traps that you need to make sure you aren't falling into.

## Never Considering a Switch

The most basic error. Beginners take a while to cotton on to the idea that they might have to select a move to hit what you are switching to rather than what you currently have on the field. But, I think this goes even deeper. Even advanced players seem to have a bias towards attacking the Pokémon currently on the field. Yes, this is partly because attacking the active Pokémon reduces risk, but I personally think this bias often goes too far.

## The Myth of the 50/50

People often refer to a 2v2 game as a 50/50, even when they know that in reality the correct play is not 50/50. For a new player though, there is often no one around to explain to them that just because people call it a 50/50 or a coin-toss, that doesn't literally mean that you should select each action half of the time. You need to think of the long term consequences of each action to understand what the correct ratio should be.

## Only Predicting from a Position of Strength

It's true that predicting from a position of weakness has all the maths against it, but you still have to do it sometimes or your opponent will just continue to double until they get their perfect matchup. You just give up all control over the game if you aren't willing to bite the bullet at some point.

## Infinity == 5

Sometimes you just will have an action where your opponent has to predict the exact turn when you pull the trigger, and if they get it wrong they will be in big trouble. For a lot of players they will wait just long enough to feel safe and then immediately attack. This typically is around the 4th or 5th turn. So even if your opponent has all of the time in the world, maybe the 5th turn is a good time to gamble.

## Never Taking an Early Risk

This is pretty common for advanced players. In general, for an advanced player, taking a significant risk early is a bad idea, the costs usually are very high, and there is usually a better midground option. But against another advanced player, it is likely that in a lot of those situations the maths of the risk can actually be fairly favourable. Risking the whole game on

the first turn is certainly very embarrassing when it goes wrong, but that doesn't mean it should never be done.

## Ignoring All Risk When in a Position of Strength

I mentioned this one earlier, but it is such a common mistake I wanted to repeat it here. It is not necessarily incorrect play to attack when in a position of weakness, especially when the payoff is high. It should probably never be your most common choice of action, as it will always have a higher risk and reward than the alternative, but that does not mean that you should never do it.

## Looking for a Mid Ground on a Strong Turn

Imagine a turn where you are picking between two actions, each will get a KO if you choose correctly, but will do no damage otherwise. Both of your actions have a very high difference in payoff, which is often an indication you should look for a safer option. But in this situation both your options are extremely valuable. If you are going to look for a midground, it had better be really, really good.

## Missing a Change in the Lead

The relative value of every turn varies a lot depending on whether you are currently winning or not. The cost of a high risk turn is exaggerated for the winner and reduced for the loser. But sometimes, when you feel like you are scrambling from behind, you can miss the fact that your scrambling has already paid off. A common situation where this can be the case is when the winning player is getting low on PP for a key move. It can be an easy thing to overlook, but it may make all the difference in the world.

## Idiot Opponents

Throughout this guide, I have spent a lot of time berating our opponents for being idiots, but to be honest with you I don't actually believe it. In general, I think most people are a lot smarter than they get given credit for. It's easy to assign the most trivial motivations to the actions you see people make because that is what is easy to understand. But individual human beings are extraordinarily complex, it's very hard to read too much into why they do what they do. Just judge them by their actions.

But! I think the most frequent mistake I see in Pokémon is assuming your opponent is omniscient. A lot of the actions I have described above are not really that extraordinary when you stop and think about them. But, in a battle, with the timer on, stopping and thinking about things is exactly what you can't do. Identifying lines and trying to think several turns ahead to work out exactly how to execute a strategy requires a lot of mental energy. It's usually only after you've done that you can start to worry about what action your opponent is going to take on this turn exactly. And it's very hard to keep track of things like what your opponent does or doesn't know.

On most turns your opponent is just going to be clicking the straightforward move. Even if you're up against a great player. You treat your opponents like idiots because 90% of the time idiots and geniuses are just gonna do the exact same thing.

## Be Brave, Be Patient

A long time ago, before Showdown, or Pokémon Online, or Shoddybattle, or even Netbattle, I used to have to keep track of the state of my opponent's benched Pokémon on a piece of paper. The online simulators at the time would only show you the currently active Pokémon, it's HP and Status and nothing else. Before important games I would write down my own team and list the potential Pokémon my opponent might be using, with key moves to remind myself to look out for whether my opponent was carrying them, or to remind myself to keep track of their PP. And at the top of the page I would write "Be Brave, Be Patient" in big letters. I think, almost 20 years later, this is still the best advice I can give anyone in Pokémon.

To be brave means that you have to believe in your own ability. If you see a line, and you believe that your opponent hasn't seen it, then *always* commit to it. Sometimes you'll miss something obvious, sometimes you'll get things 100% correct, but your opponent will just happen to click the right move at the right time, and sometimes your opponent will just straight up outplay you. But all of those are a thousand times better than just taking the safe route and losing anyway.

But bravery isn't enough on its own. Patience means understanding the position in the battle and knowing how much time you have available to you. Maybe you are going to have to risk everything on a crazy hail Mary play, but maybe you don't need to do that right now. If you need to Explode on a specific Pokemon on this turn and this turn only, then perhaps your game is a true 50/50. But if you can explode on this turn or the next and you still think of it as a 50/50 then you are throwing games away. I personally believe that knowing how much time is available is the single biggest factor in separating great players from the greatest players.

## Final Word

Prediction is just looking at the state of the game and determining how likely each player is to win, and then recognising when your opponent is likely to have failed to do that. In the end the secret to being great at prediction is just to be great at Pokémon<sup>5</sup>.

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<sup>5</sup> Which is why this is going to be the last chapter of my Pokemon guide. Unfortunately for you suckers, I haven't written the rest of it. You're gonna have to figure out how to actually play the game yourselves! I hope you didn't waste too much time reading this 22 page prediction chapter only to find out right at the end it's all just a massive tease for the rest of a guide that will very likely never be written!