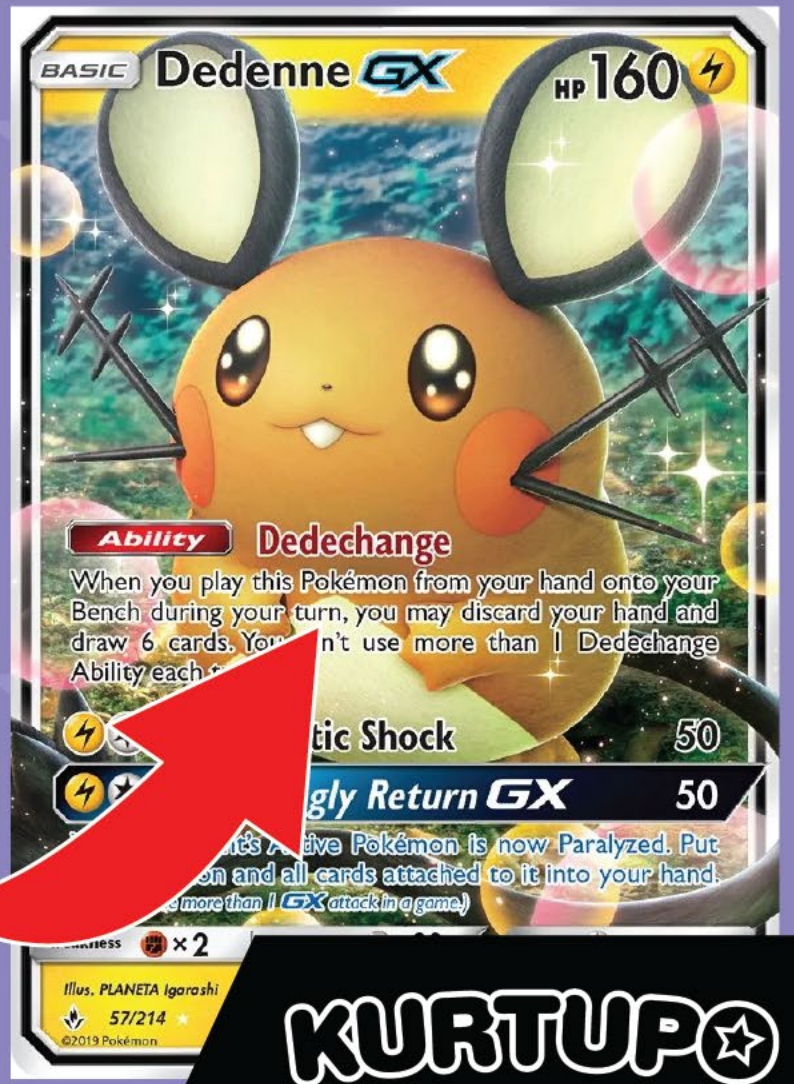
MODEL - ANALYZE - LEARN

CASE 1

# I made a POKEMON TCG SIMULATOR to find the odds of being stuck with THIS RODENT




KURTUP

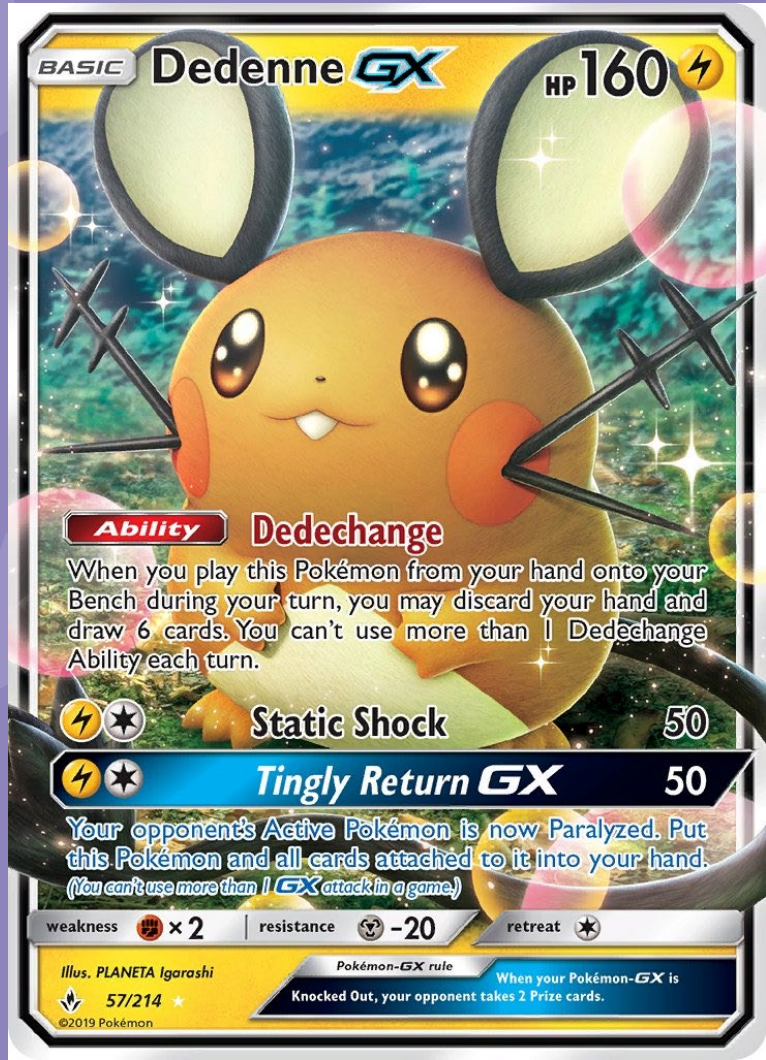
# Summary

- A simulation of the Pokémon Trading Card Game was constructed using MATLAB to empirically test certain opening hand probabilities.

- The opening hand probabilities predicted by "*The probability of starting with the wrong Pokémon - The case of Dedenne GX - Pokémath - Episode 2*" were then verified using the simulation.

# The Case of the Lone Dedenne

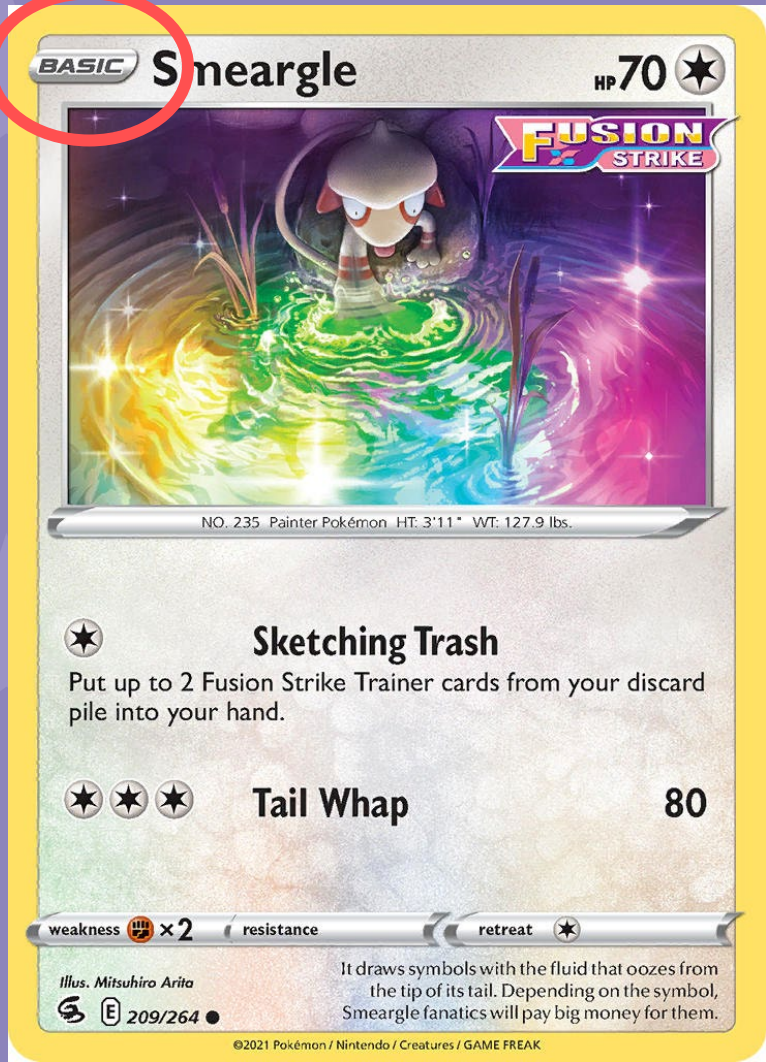
- Dedenne-GX is a very powerful card in the Pokémon Trading Card Game.
- However, Dedenne-GX is harmful when it is the only Pokémon in your opening hand.
- Thus, it's in the best interest of players to be aware of the odds of this unfortunate event occurs.



# Setting Up the Game

- In order to have a legal decklist for the Pokémon Trading Card Game, your deck must contain:
  - Exactly 60 cards
  - At least one Basic Pokémon card

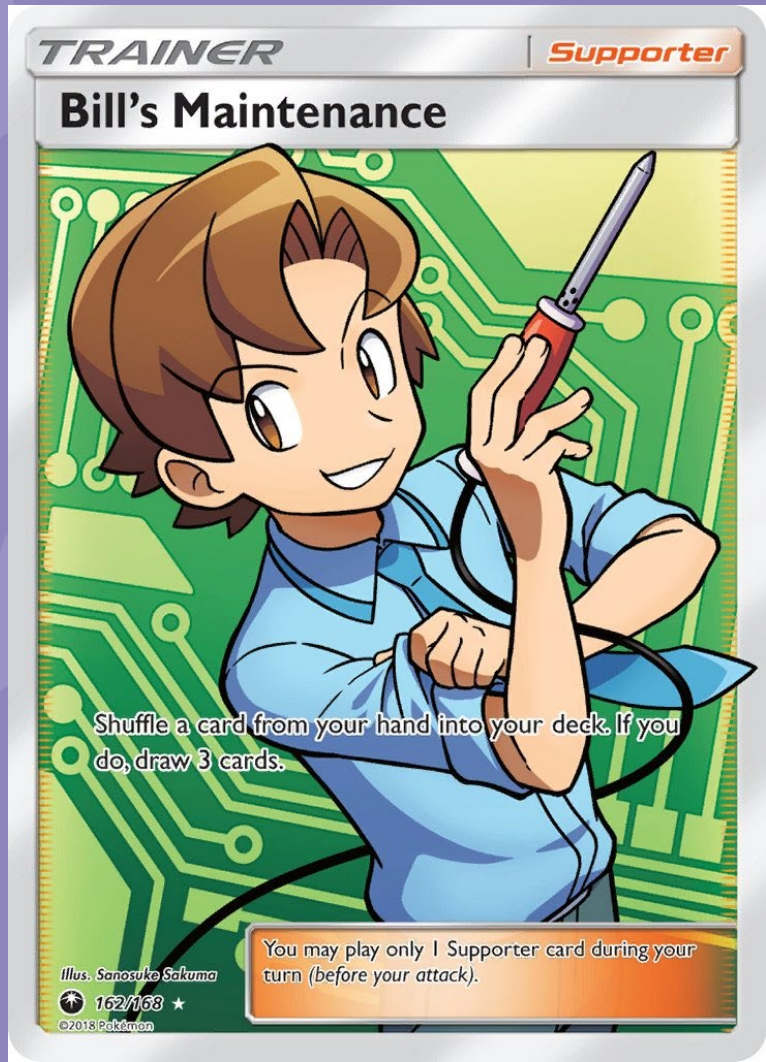
- When setting up to play, you must have at least one Basic Pokémon card in your opening hand (first seven cards).



# Setting Up the Game

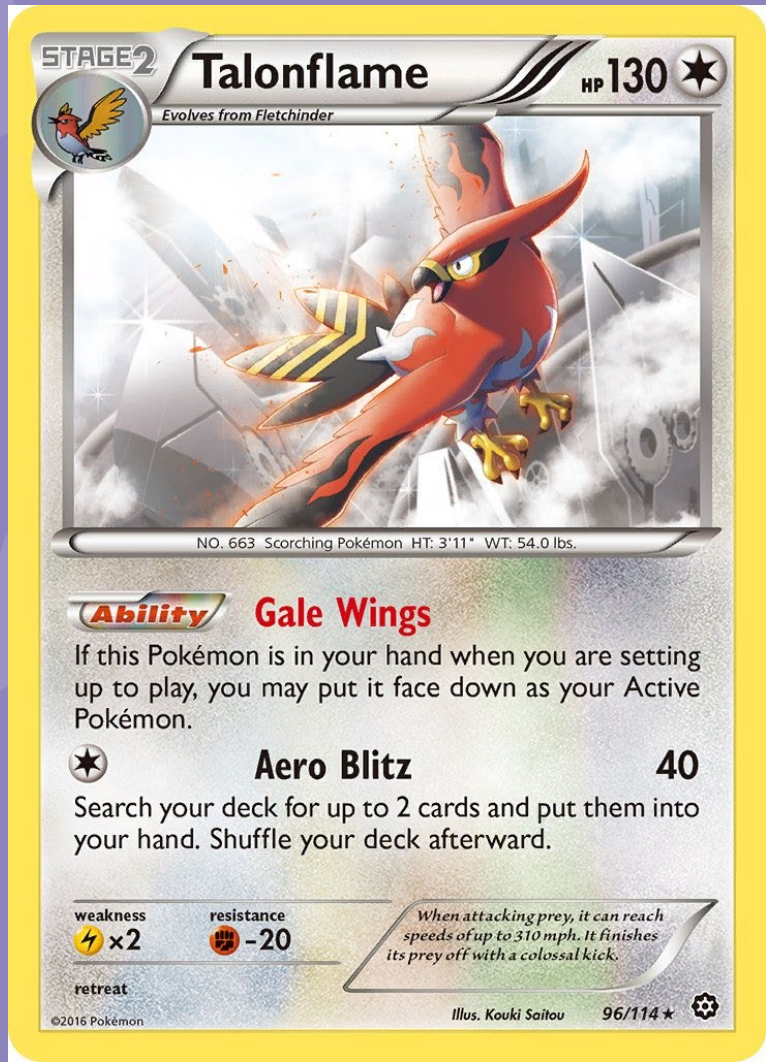
- If you do not have at least one Basic Pokémon card in your opening hand, you must **mulligan**.

- To mulligan:
  - Reveal your opening hand to your opponent
  - Shuffle your opening hand into your deck
  - Draw a new hand of seven cards
  - Your opponent may draw an extra card



# Setting Up the Game

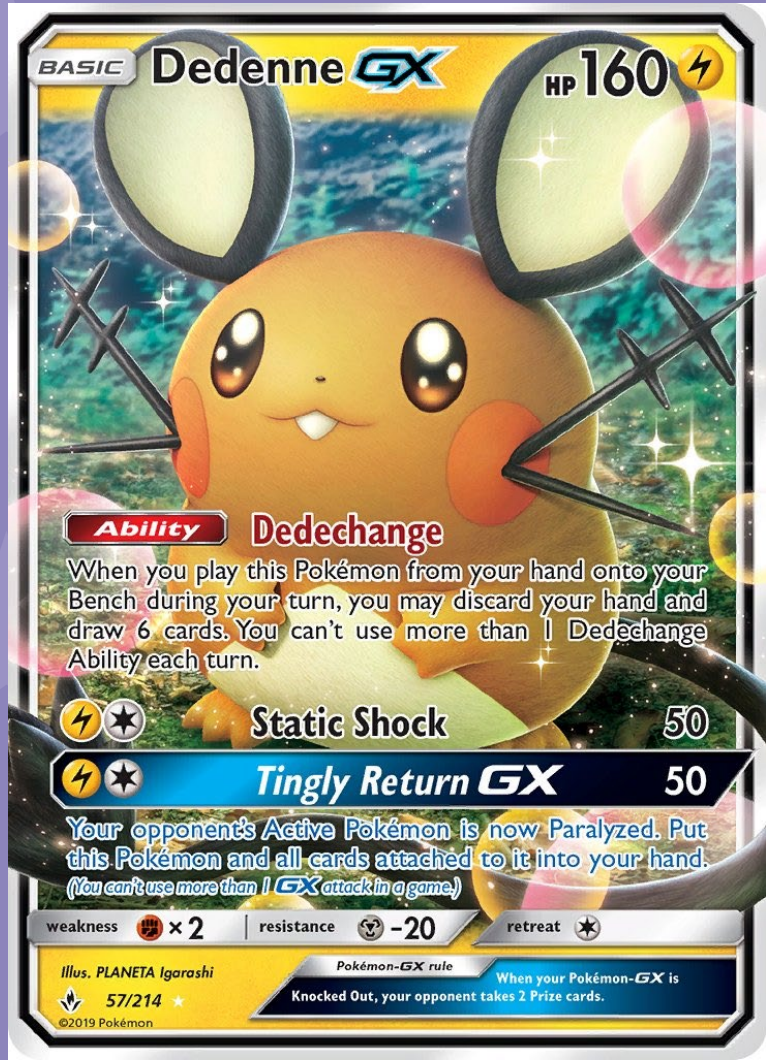
- For the purposes of this analysis, mulligan interactions with the opponent are neglected.
- Cards that ignore the Basic Pokémon requirement are also neglected.
- However, the mulligan rate is noteworthy and is not completely ignored.



# Setting Up the Game

- If there are multiple Basic Pokémon cards in your opening hand, you may choose which Basic Pokémon card to start the game with.

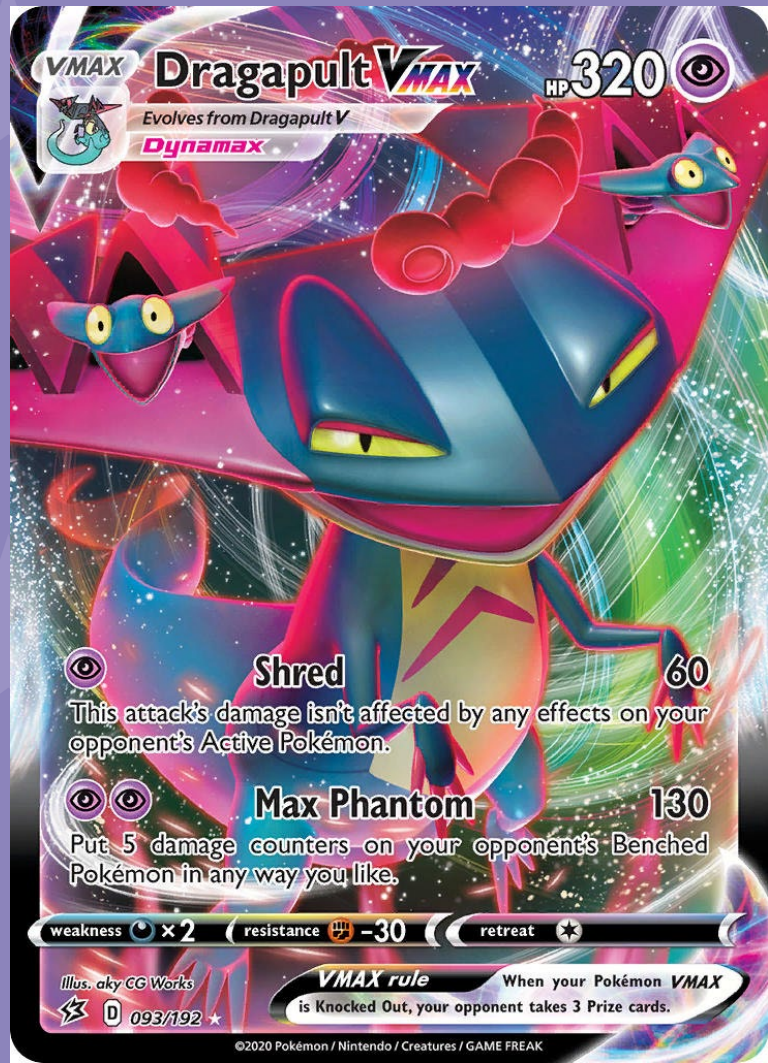
- Thus, the rate at which we are forced to start with Dedenne-GX is dependent on both the amount of Dedenne-GX in our deck and the total amount of Basic Pokémon cards in our deck.



# Pokémath Episode 2

- *Pokémath - Episode 2* uses math to determine the probability of encountering the Lone Dedenne situation.
- The example deck contains exactly one Dedenne-GX and 11 other Basic Pokémon cards.
- The probability of encountering a Lone Dedenne with this deck is determined to be **3.93%**.

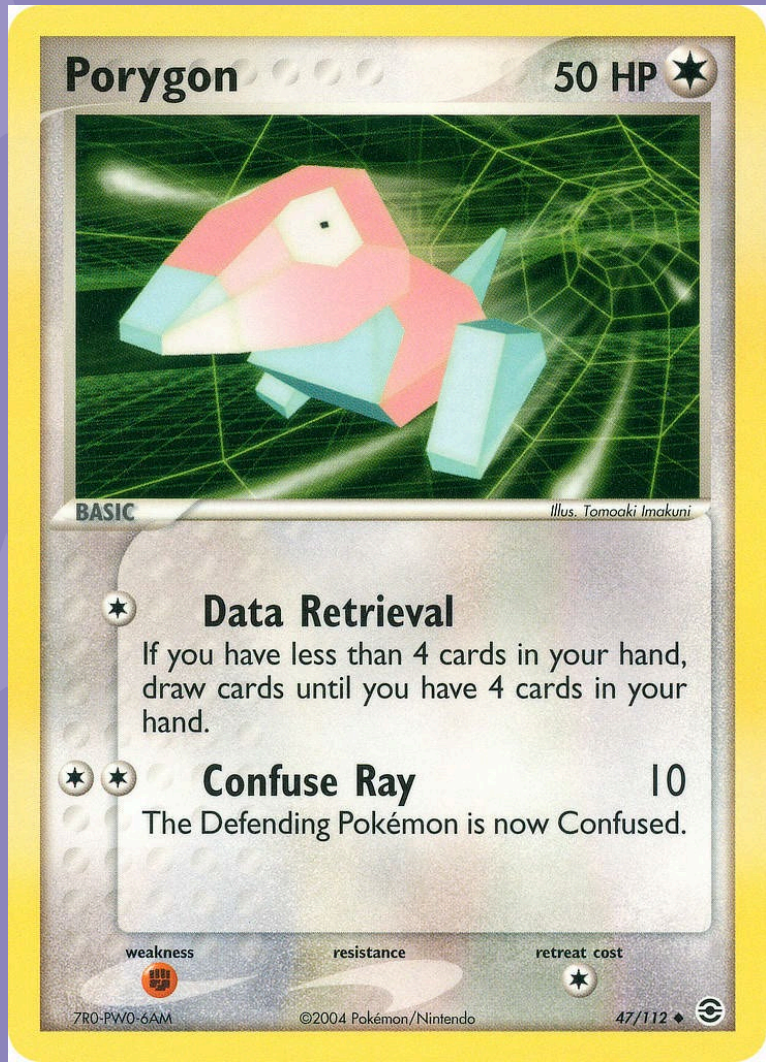
3.92659172623%



# Verifying the 3.93%

- In order to verify the mathematical model, I made a simulation of the Pokémon Trading Card Game and made a computer play with this deck thousands of times.

- This simulation allows us to not only verify the math but also allows us to analyze other situations with ease.



# Verifying the 3.93%

3.92659172623%

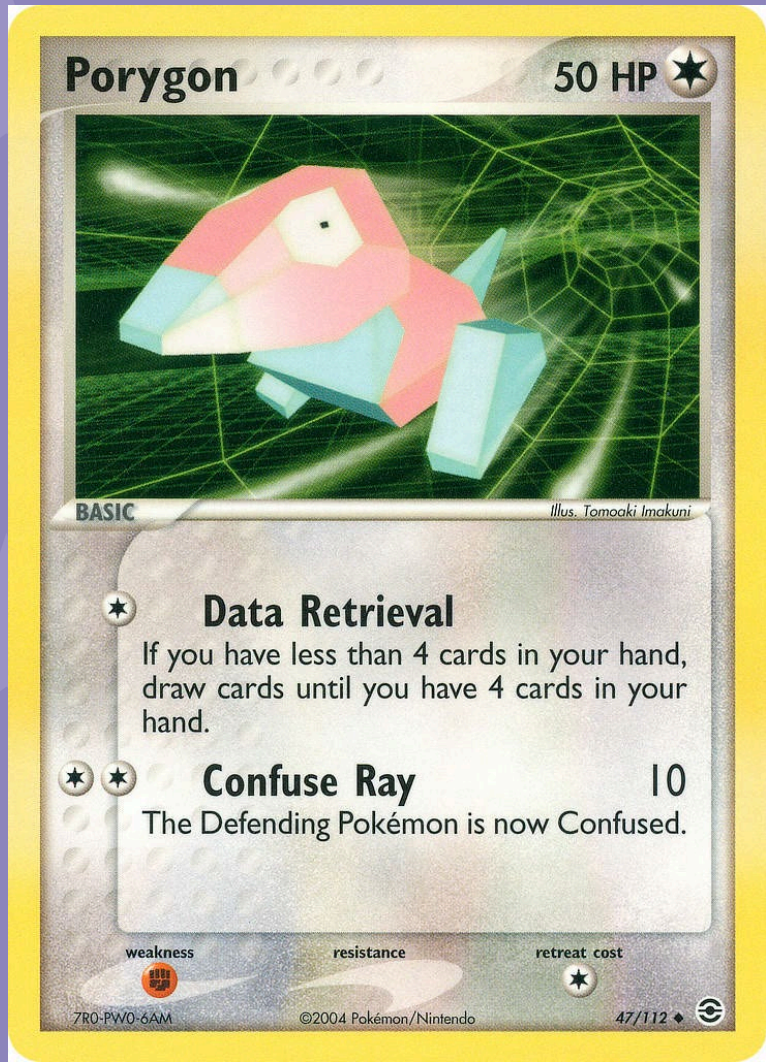
- The empirical data suggests the math is “accurate enough”.

```
A total of 39120 Lone Dedenne's occured in 1000000 games! :(
That's 3.912 percent of all games!
```

```
A total of 39465 Lone Dedenne's occured in 1000000 games! :(
That's 3.9465 percent of all games!
```

```
A total of 39302 Lone Dedenne's occured in 1000000 games! :(
That's 3.9302 percent of all games!
```

```
A total of 391667 Lone Dedenne's occured in 10000000 games! :(
That's 3.9167 percent of all games!
```



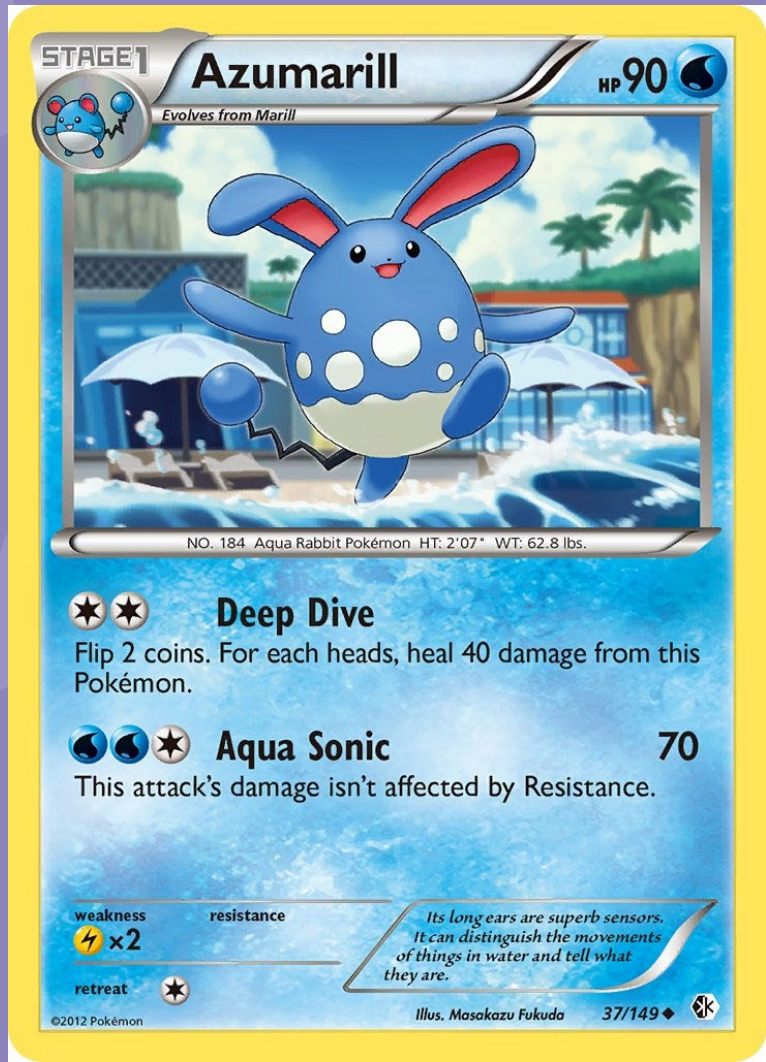
# Diving Deeper...

Each test used
1 million games!

- We can use the same simulation to test other configurations:
  - Different number of total Basic Pokémon
  - Different number of target Basic Pokémon

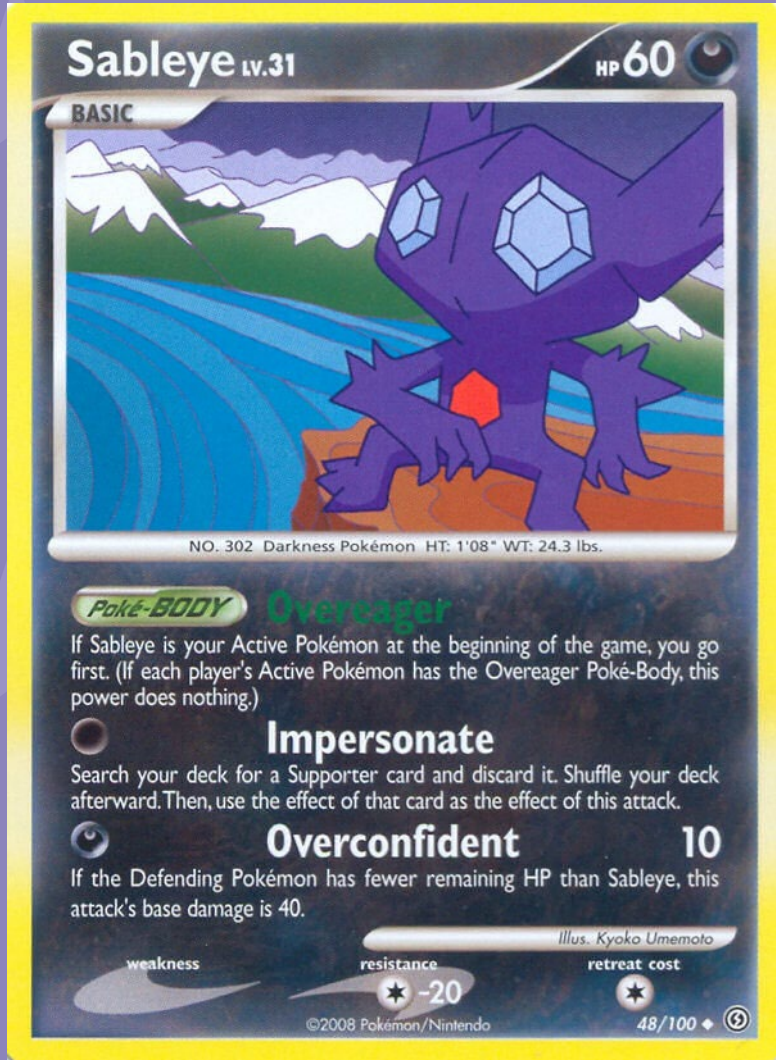
(If ALL Basics are the target Basic, it counts!)

| Total Basics | Target Basic x1 | Target Basic x2 | Target Basic x3 | Target Basic x4 |
|---|---|---|---|---|
| 6 | 12.2853% | 26.2666% | 41.6903% | 59.0811% |
| 8 | 8.0696% | 17.1432% | 27.3293% | 38.9728% |
| 10 | 5.5623% | 11.8818% | 18.9259% | 26.9736% |
| 12 | 3.9450% | 8.3946% | 13.4981% | 19.2791% |
| 14 | 2.8204% | 5.9988% | 9.7035% | 13.9733% |
| 16 | 2.0233% | 4.3421% | 7.059% | 10.1384% |



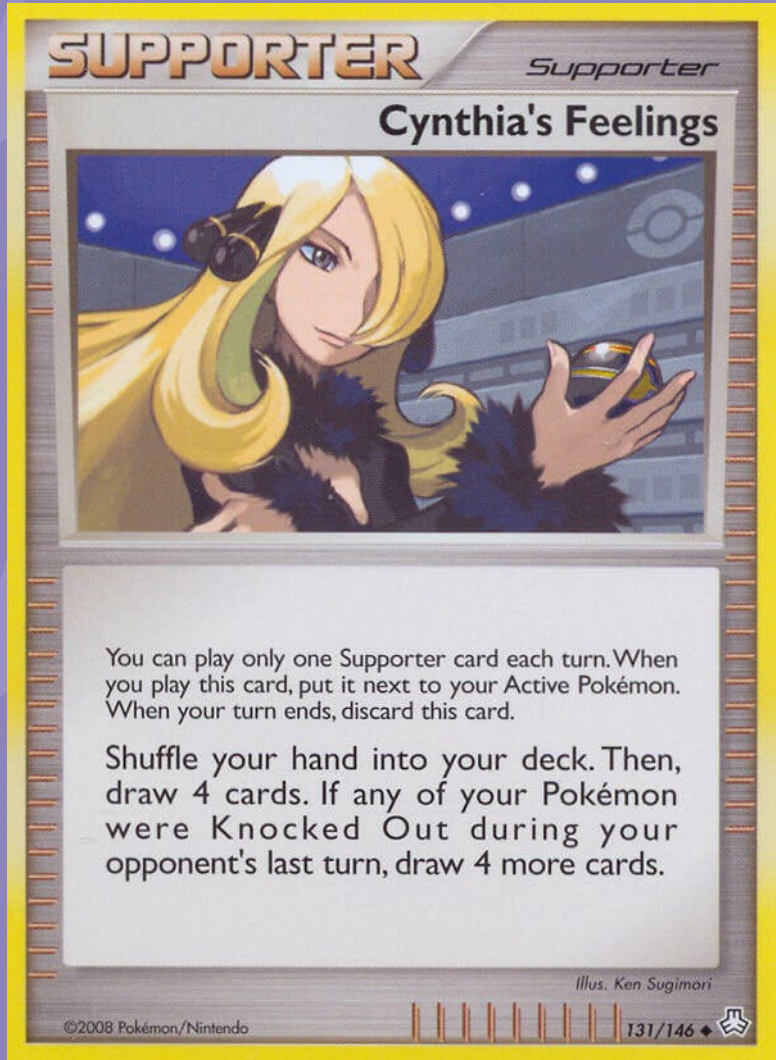
# Is This Data Trustworthy?

- A model is only as good as its assumptions
- Different calculators used
  - Desmos used to redo Steffen's calculations
  - MATLAB used in our simulations
  - Unlikely to cause discrepancy
- Randomizer Concerns
  - Computers are not truly random
  - MATLAB's randomizer imperfect
  - Deviation in randomness more apparent with large numbers of games



# Is This Data Good Enough?

- At the end of the day, hard numbers aren't as important to a deck's success as the player's comfort playing the deck
- Can you tell the difference between 3.93% and 3.92% opening hands?
- At what percent would you feel that a deck "bricks too much" for you?
- Are these concessions worth the price of "good enough"?



# What's Next?

- More features will be added to the simulator to conduct more empirical tests
  - Pokégear 3.0
- Where to find me:
  - youtube.com/kurtupo
  - twitter.com/kurtupo
  - twitch.tv/kurtupo
- Where to find my code:
  - github.com/kurtupo