



Trade-off of Three Pack-opening Strategies in Hearthstone

— Using Monte Carlo Simulation

FOUR TYPES OF CARDS



Common



Rare



Epic



Legendary

RULES OF PACK-OPENING

- 1. Each pack contains 5 cards.**
- 2. There are maximum numbers for each type of cards: 2 Common, 2 Rare, 2 Epic and 1 Legendary.**
- 3. Cards can be disenchanting into dust.**
- 4. Dust can be used to craft any certain card.**

DISENCHANTING AND CRAFTING

	Disenchancing	Crafting
Common	+ 5 dust	- 40 dust
Rare	+ 20 dust	- 100 dust
Epic	+ 100 dust	- 400 dust
Legendary	+ 400 dust	- 1600 dust
Golden Common	+ 50 dust	N/A
Golden Rare	+ 100 dust	N/A
Golden Epic	+ 400 dust	N/A
Golden Legendary	+ 1600 dust	N/A

PROBABILITIES OF OPENING EACH TYPE OF CARD

Expansion Type	Classic	Knights of the Frozen Throne	Whispers of the Old Gods	Goblins vs Gnomes	Mean Streets of Gadgetzan
Common	69.98%	70.16%	69.96%	69.50%	69.75%
Rare	21.39%	21.74%	21.47%	21.60%	21.75%
Epic	4.28%	3.95%	4.28%	4.60%	4.19%
Legendary	1.08%	0.84%	0.96%	1.00%	0.92%
Golden Common	1.47%	1.47%	1.62%	1.45%	1.65%
Golden Rare	1.37%	1.47%	1.33%	1.50%	1.37%
Golden Epic	0.31%	0.26%	0.27%	0.25%	0.25%
Golden Legendary	0.11%	0.11%	0.11%	0.10%	0.12%
Total	100%	100%	100%	100%	100%

COMPONENTS

The expansion set 'Knights of the Frozen Throne' has 49 Common cards, 36 Rare cards, 27 Epic cards and 23 Legendary cards.

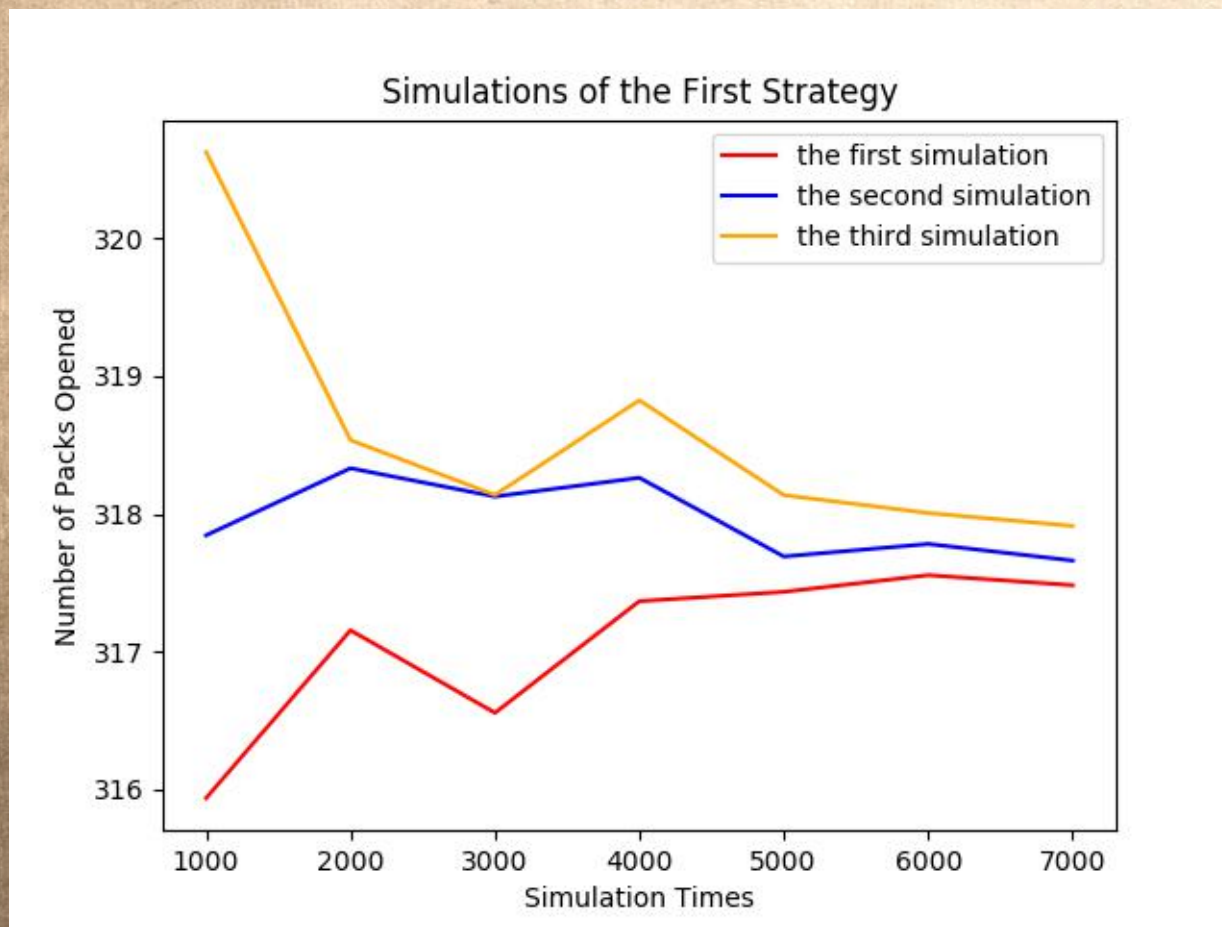
THREE PROPOSED STRATEGIES

Index	Description	Repeated Legendary Cards	Usage of Dust	Bonus Pack
1	Every time you open a Legendary in a card pack, it will be a Legendary card from the same set that you don't already own.	No	Any card	No
2	You can exchange a certain number of dust for a new pack but you cannot craft cards with dust.	Yes	A new pack	No
3	You can obtain an pack containing only Epic and Legendary cards after you have opened a certain number of packs.	Yes	Any card	Yes

THE FIRST STRATEGY

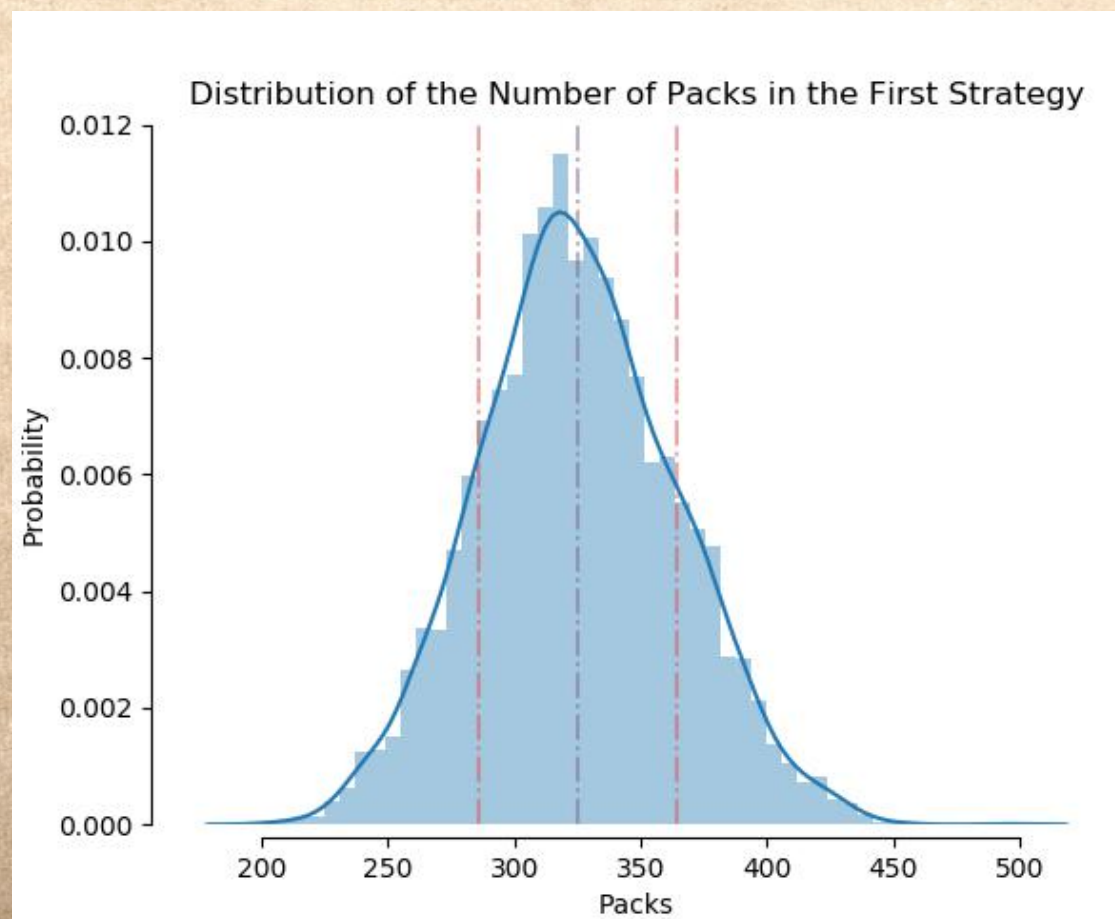
Every time you open a Legendary in a card pack, it will be a Legendary card from the same set that you don't already own.

THE FIRST STRATEGY



An expectation of 317.5 packs to get all the cards in an expansion set.

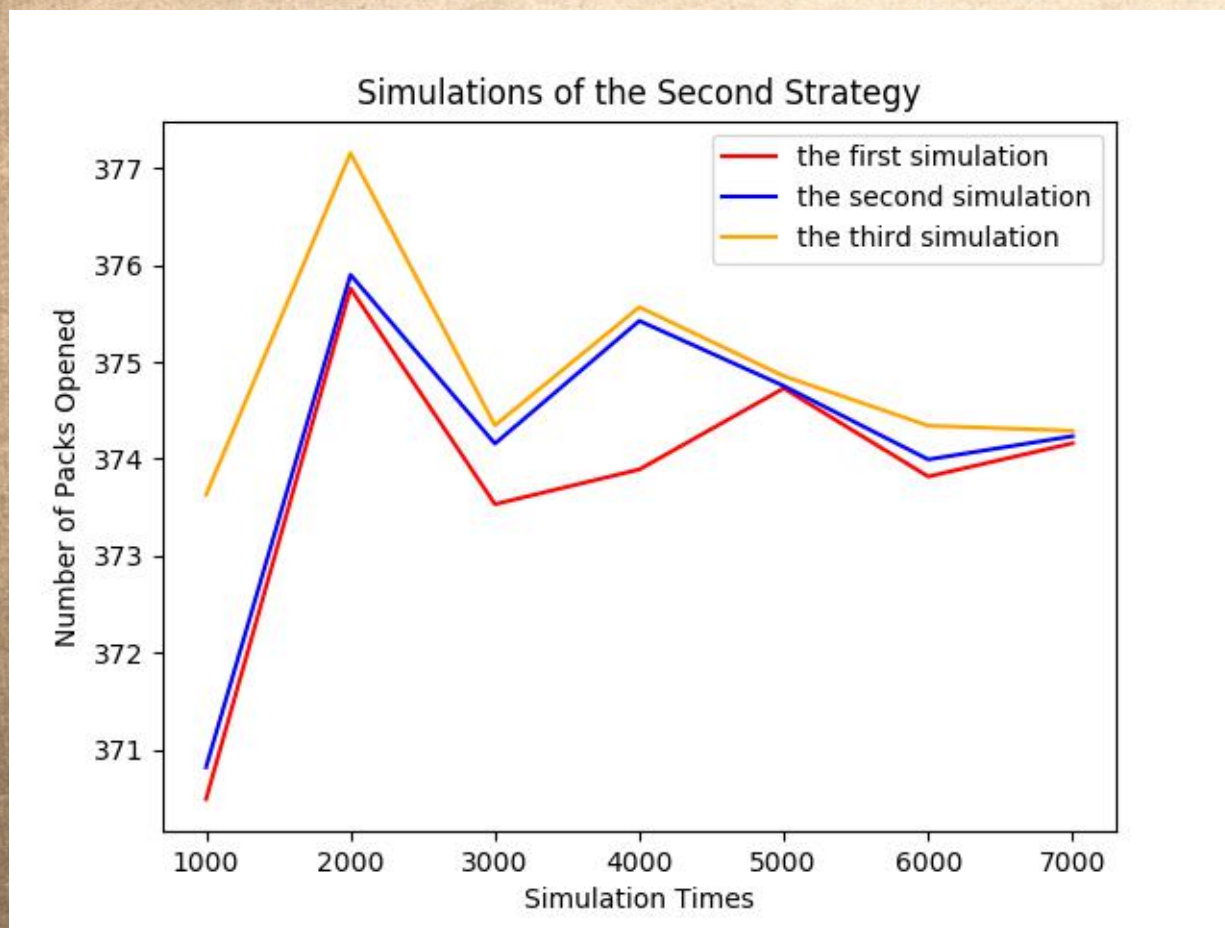
THE FIRST STRATEGY



THE SECOND STRATEGY

**You can exchange a certain number of
dust for a new pack but you cannot
craft cards with dust.**

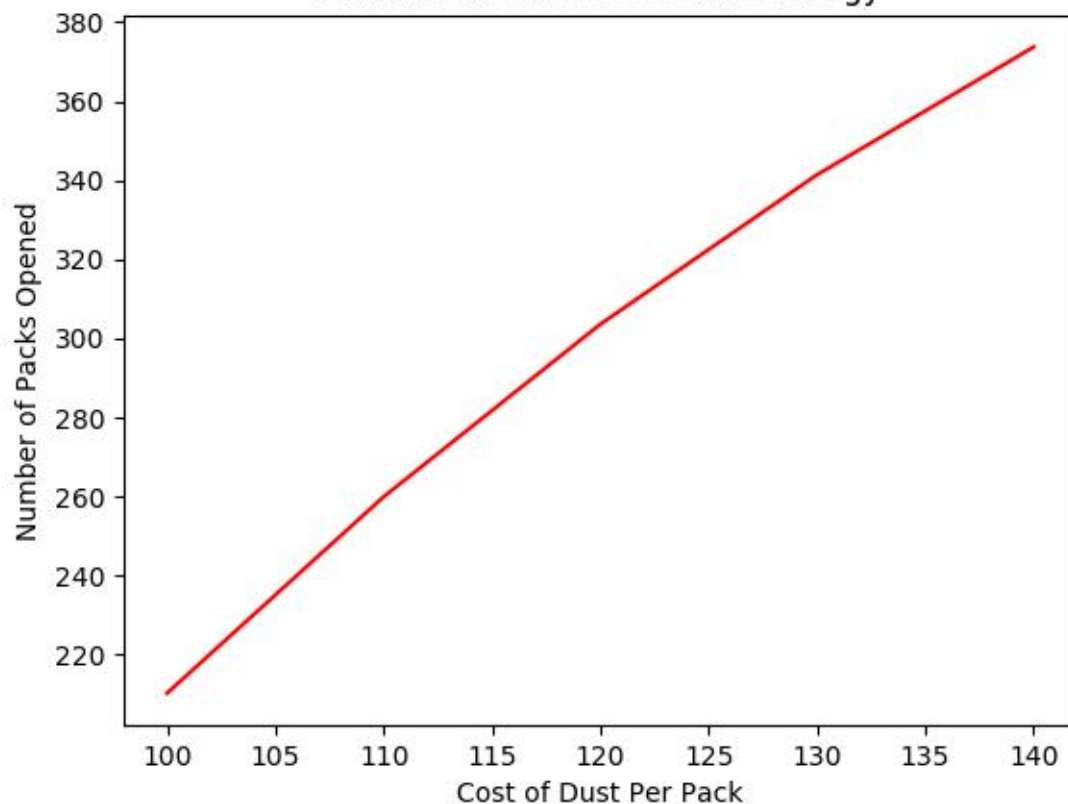
THE SECOND STRATEGY



**Three lines converge
when the simulation
time is 5000.**

THE SECOND STRATEGY

Simulations of the Second Strategy

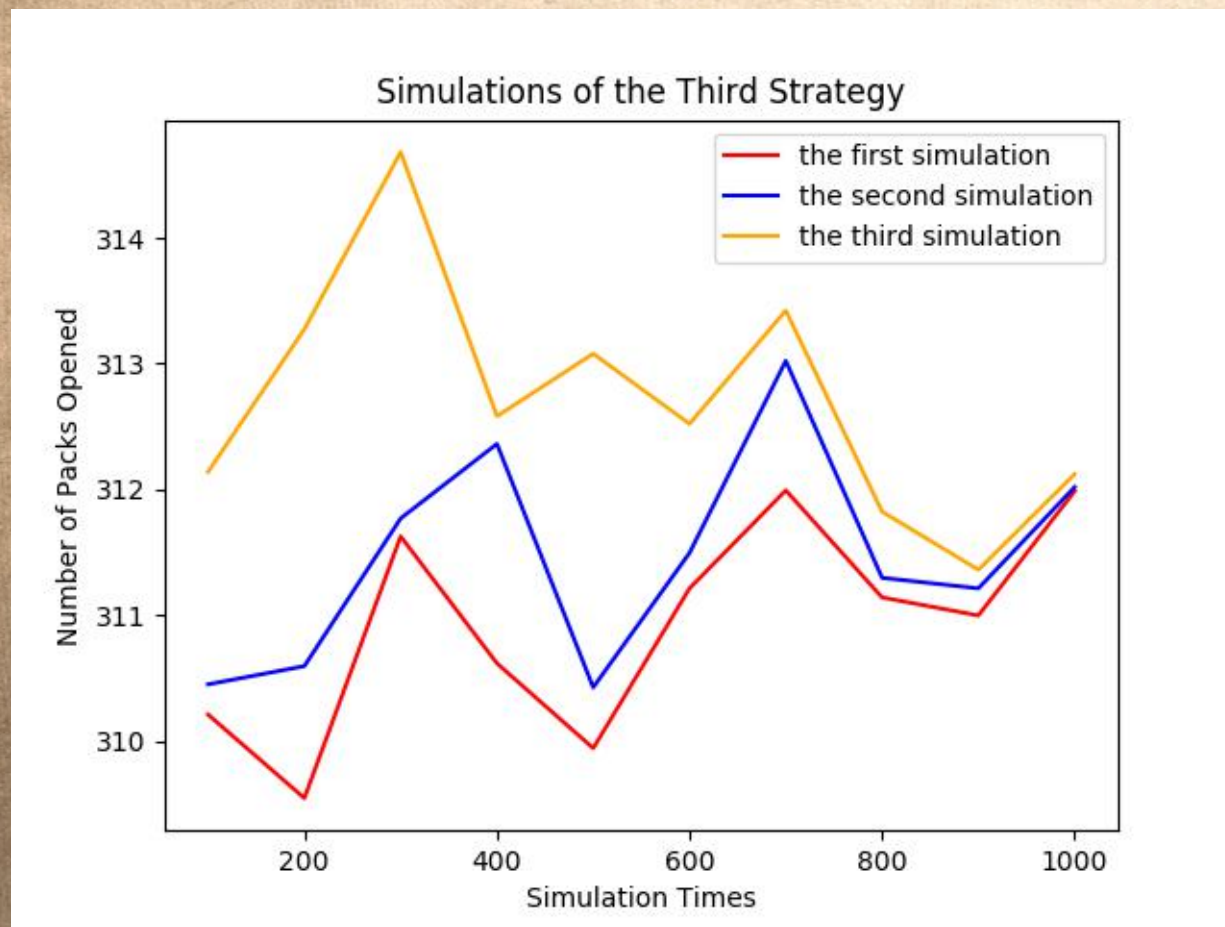


When the number of packs opened is 317, the corresponding cost of dust is around 125.

THE THIRD STRATEGY

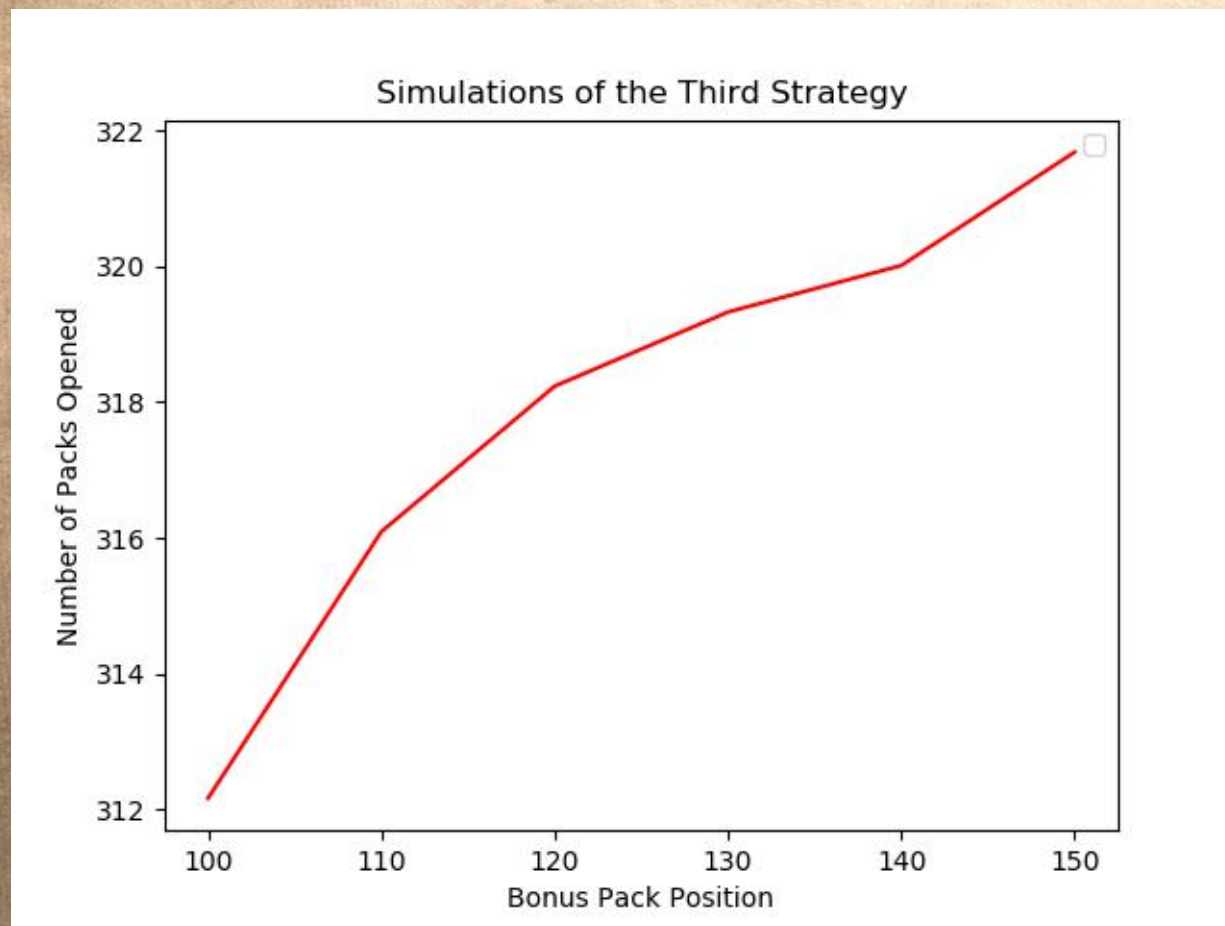
**You can obtain a pack containing only
Epic and Legendary cards after you have
opened a certain number of packs.**

THE THIRD STRATEGY



**Three lines converge
when the simulation
time is 1000.**

THE THIRD STRATEGY



When the number of packs opened is 317, the corresponding position of bonus pack is around 115.

CONCLUSION

Index	Description	Repeated Legendary Cards	Usage of Dust	Bonus Pack	Expectation
1	Every time you open a Legendary in a card pack, it will be a Legendary card from the same set that you don't already own.	No	Any card	No	317 packs to get all the cards
2	You can exchange 125 dust for a new pack but you cannot craft cards with dust.	Yes	A new pack	No	
3	You can obtain an pack containing only Epic and Legendary cards after you have opened 115 packs.	Yes	Any card	Yes	

THANK YOU

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