Causal Inference for Toddlers: Luca and the Meatball Recipe

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About the author:

Vasil Yasenov is an applied statistician specializing in causal inference. He holds a Ph.D. in economics and has worked as a data scientist at UC Berkeley, Stanford University, and Adobe Inc. His research has been published in major academic journals such as the Proceedings of the National Academy of Sciences, the Journal of Public Economics, and JAMA Pediatrics. His data work has been featured in The New York Times, The Washington Post, and The Wall Street Journal.

About the book:

Luca is a curious young boy with a rich sword collection. Unfortunately, his village has recently been captured by an evil king. Now all his friends and neighbors are hungry and miserable because the secret meatball recipe is missing.

How can Luca choose the best sword with which to protect his village and restore happiness? A careful data-driven causal inference analysis might just hold the right answer.

To my son

Causal Inference for Toddlers:
Luca and the Meatball Recipe

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Causal Inference for Toddlers:
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Once upon a time, in a faraway village, there lived a young boy named Luca. Luca was brave, strong, and curious. He loved eating delicious meatballs and collecting precious swords. The village had recently been attacked and captured by the terrible dragon King Dragster.

King Dragster had done many awful things. But the worst was stealing the village's special meatball recipe that rhad been passed down for many generations. Now everyone was gloomy because they could only eat pizza crust, goat cheese, and eggplant.

Luca was determined to bring back the recipe and restore happiness to the village. But this was a difficult and ambitious goal—the recipe was locked away in the darkest room of the highest tower in the farthest castle of King Dragster's kingdom.

To get there, Luca would have to spend weeks away from home and fight many, many dragons. Even though he was still a young boy, he owned the largest sword collection in the village. His swords came in all shapes and sizes: big and small, heavy and light, straight and curved.
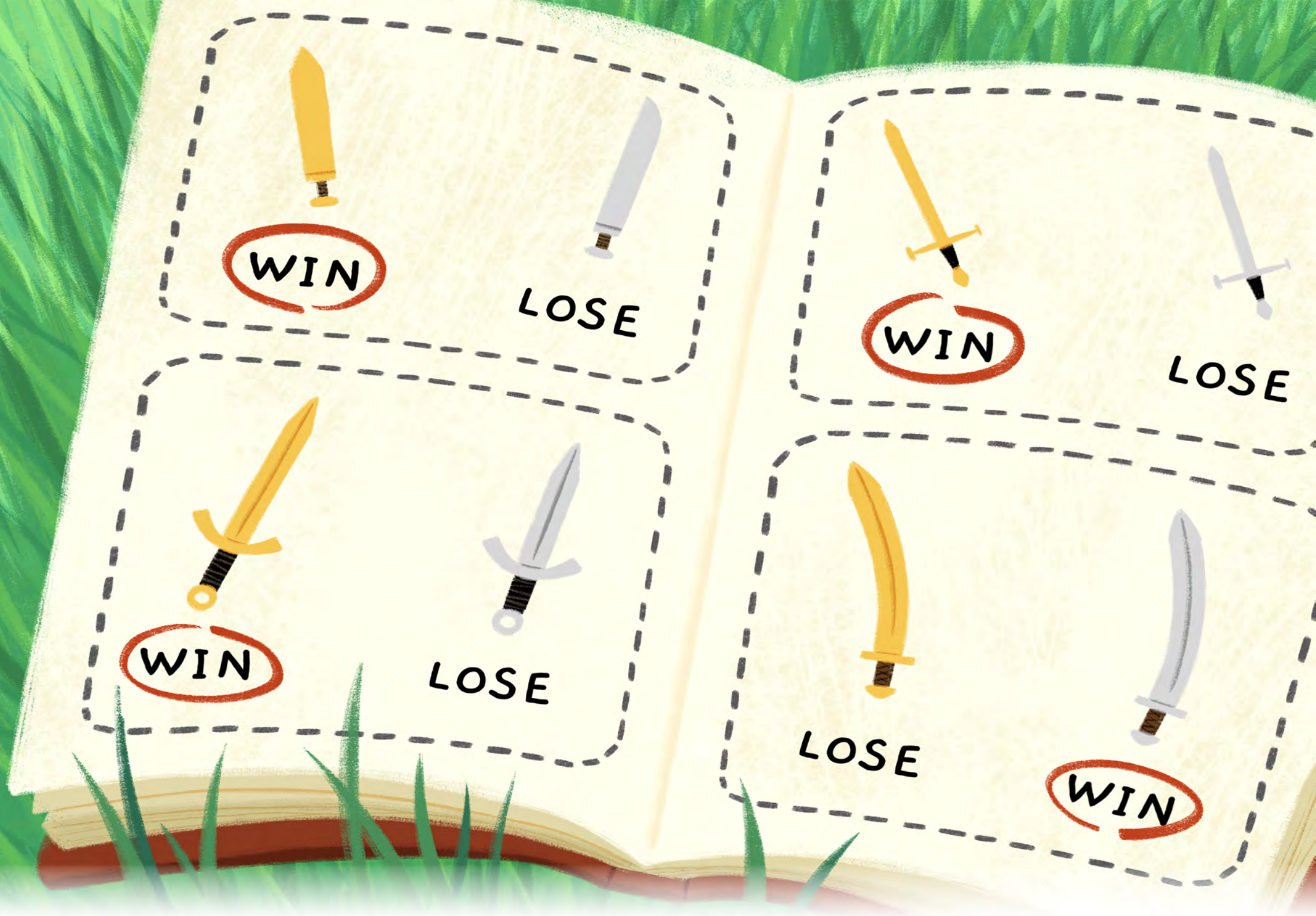
MOST IMPORTANTLY, *SOME WERE GOLDEN AND THE REST WERE NOT*. LUCA WAS VERY CURIOUS TO KNOW WHETHER THE GOLDEN SWORDS WERE BETTER. HE KNEW HE COULD NOT SIMPLY COMPARE HIS WIN RECORD WITH GOLDEN SWORDS TO HIS RECORD WITH NON-GOLDEN SWORDS, BECAUSE HE ALWAYS SELECTED HIS SWORD DEPENDING ON THE ENEMY HE FACED—RESERVING GOLDEN SWORDS FOR THE SCARIEST DRAGONS. SO PERHAPS GOLDEN SWORDS LOOKED WORSE ONLY BECAUSE THOSE BATTLES WERE HARDER. ONE DAY, HE PACKED ALL HIS SWORDS AND A NOTEBOOK—WITH EGGPLANT-AND-GOAT-CHEESE SANDWICHES—AND SET OFF.

This journey was the perfect
opportunity to answer that question once
and for all. Luca fought many scary dragons along
the way. He always picked a sword from his backpack at random
and did not look at its type. After each battle, Luca recorded in
his notebook whether he had won or lost, and which kind of sword
he had used. Weeks into his journey, he finally reached the door
to the darkest room in the highest tower of the farthest castle.

He was about to enter his last and most difficult battle: against King Dragster himself. Now was the perfect time to find out whether golden swords were indeed better. Luca placed all his swords on the ground and matched each golden sword with the most similar non-golden sword.

When he was done, he had multiple pairs of nearly identical swords. Within each pair, the only difference was that one sword was golden. He then checked each matched pair against his battle records to see which swords had won most often.

Favorite golden sword and headed into the final battle. King Dragster was already waiting with his own great sword. But Luca was not afraid. He trusted the numbers and knew he had the best weapon.

At last, Luca had the answer: golden swords were better! All else being equal, he was much more likely to win a battle when he held a golden sword. This pattern was so strong that it could not have been mere luck. Armed with this knowledge, Luca chose his

As they battled, Luca suddenly noticed that King Dragster was fighting with a silver sword. The king did not know that golden swords were better. Luca delivered the final blow—he used the heavy golden edge of his weapon to slash King Dragster's silver sword. Thus, he defeated the awful king. After the battle, Luca found the king's treasure chest. Inside was the secret meatball recipe! He put it in his backpack and headed back home.

Luca is hero

When Luca returned, everyone cheered and welcomed him as a hero. The mayor organized a week-long meatball festival with music and dancing to celebrate Luca's brave deed and the village's renewed joy.

But the happiest of all was Luca, for he held a secret: the best swords were golden. From that day on, Luca always remembered: when you want to know what really works, you have to test it fairly.

THE END

Acknowledgements: