History Lessons

Turning a Problem Inside Out

Data & Analytics

OVERVIEW

Baked into any proposed solution are assumptions about the nature of the problem we're trying to solve. So what do we do when our assumptions aren't just wrong, but totally misguided? Sometimes, the answer is as easy as going back to the drawing board and questioning our understanding of the problem. This Resource takes us back to WWII and how Abraham Wald, a brilliant mathematician, used this approach to redesign Allied airplanes—and saved countless lives in the process.

TURNING A PROBLEM INSIDE OUT

It was 1943, the height of the Second World War. For the Allied mathematicians headquartered at Columbia University as part of the Statistical Research Group (SRG), the stakes could not have been higher.

Abraham Wald had more than a passing familiarity with those stakes. A brilliant young mathematician from a Hungarian Jewish family, he received his doctorate from the University of Vienna in 1931 but found it nearly impossible to build an academic career in the deeply anti-Semitic environment. He and his family fled to America, where he joined the SRG to help the Allied war effort—focusing on the agility and durability of fighter planes.

The military's goal was simple. They wanted their planes to be able to keep flying—without losing speed—even after being hit. They gave the SRG information they thought would help answer the question: American planes that came back from battle over Europe tended to have far more bullet holes in the fuselage—the central body of the aircraft—than anywhere else. Since the fuselage was the most impacted area of the plane, they reasoned, that's where the planes needed additional reinforcement. All they needed was SRG's help to figure out the right amount of additional armor for those spots.

Many of us would probably reach the same conclusion: put the armor where the bullet holes are. But not Abraham Wald. He informed the army that he would not be calculating the optimal amount of armor for the fuselage, because the planes didn't need armor on the fuselage at all.

The military had failed to account for a key variable: planes that came back with many bullet holes in the fuselage were planes that came back. Despite taking many shots to the body, they were able to tolerate that damage and continue flying. Instead, argued Wald, they needed to identify where the planes that came back weren't damaged. What crucial area had been spared that allowed these planes to return safely from enemy airspace?

The data showed that the returning aircraft had the least bullet damage to their engines—not because the engines of Allied planes were rarely hit, but because planes with damaged engines rarely returned. The armor, he concluded, needed to be placed over the engines.

Abraham Wald was a remarkably talented statistician and mathematician, but that's not how he solved the problem of vulnerable Allied aircraft. He solved it by pushing back on common knowledge and assumptions, flipping the problem upside-down, and identifying a crucial variable. And he didn't need elaborate analytical models to spot the hole (or lack thereof) in the military's initial logic. All he needed was his own capacity for creative thinking and the confidence to ask a different question.

DISCUSS

We've all gotten stuck in the middle of solving a tough issue, when another meeting or brainstorm just can't seem to move us forward. It's in those moments that creatively reframing the question can provide the spark we need to break through the plateau. Think about a time when asking a different kind of question helped shed new light on a tricky situation. Share your response in the space below and be sure to reply to your fellow learners to get the conversation going.

Add comment or @mention

Click or drop files here to upload file attachments

Post

View by Newest 0

RELATED RESOURCES

Tools

The First Five Questions

Data & Analytics

How do we make sure we're setting down the path to the right data? — 3 mins

Tools

The Semmelweis Reflex

Data & Analytics

Comfort with the status quo—and discomfort with change—can blind us to innovation. — 8 mins

Stories

Our Optimized World

Data & Analytics

For better or worse, A/B testing drives our digital environments. — 7 mins