

# ***The Flip of the Coin***

By

Andrew Breslin

"Now, to conclude our discussion of unexplained mysteries of science," I said, strutting across the front of the lecture hall, "I shall make use of a visual aid."

I removed a half-dollar from my pocket and held it up for the class to see. "This," I said, "is a half-dollar, a fifty cent piece. Four bits, if you will."

Some members of the class diligently scribbled in their notebooks. Had I stated that the building was on fire, they would have made a note of it and only committed themselves to processing the information at a later time in preparation for regurgitating the fact.

"You will note that this coin, like all coins, has two sides, and like all U.S. coinage, one of these sides has the image of a famous individual from our nation's history. Far more often than not a U.S. President, as is the case here, where we observe the handsome profile of our 35th president, John Fitzgerald Kennedy. This coin made its first appearance in 1964, the year after his assassination, though this particular coin was minted just last year."

Again, many of the students transcribed all this. "This is not history class," I informed them. "That won't be on the exam."

Some of the students tittered appreciatively. Most of them stopped writing.

"You will also note that on the other side of this coin we see the Presidential Seal, commissioned in 1877 by Rutherford B. Hayes, who does not appear on any U.S. coins or currency, and whose chances of being thus immortalized are slim."

Some of the students with shorter attention spans, or perhaps with a genuine interest in history, recorded this fact, and I chose not to remind them that they would not be tested on this, at least not in my class.

"Since all U.S. coins have the head of a famous personage on one side, it is convenient to refer to this side as 'heads' and for the sake of uniformity, to call the other side 'tails,' though in point of fact, no U.S. coin has an image of a tail, with the exception of the tail feathers of eagles, as we see here on the presidential seal, but I digress. . .

"Now if I were to throw this coin up, catch it in the air with my right hand, and slap it on my left forearm, what side of the coin would you expect would show?"

The students looked puzzled at the somewhat ridiculous question for just a second before announcing in unison the obvious answer.

"Heads!" they shouted.

"Of course," I said. "But before we are so certain . . ." I hurled the coin into the air, snatching it spinning in front of me, and slapped it on my other arm. My hand still over it, I walked toward the class, down the central aisle to maximize visibility. "Any last minute detractors?" I asked, jovially. There were none.

I removed my hand, revealing Kennedy's face for the closest students to see, then held it up for the benefit of the rest of the class. "Heads, of course, which I'm sure will come as a surprise to none of you bright students," I said, returning the coin to my pocket. There was a very real possibility that I would have to surrender my visual aid along with some of its fellows in exchange for lunch, as I'd neglected to bring any paper money with me and had nothing but coins, and precious few of these. I didn't intentionally set out to fulfill the stereotype of absent-minded professor, but the role seemed thrust upon me.

"Now, why is it that when coins land or are caught and slapped down they invariably show the heads side?"

None of the students offered any postulates.

"Nobody knows," I announced. "In fact, scientists at MIT have been conducting a study for the last 3 years flipping coins. They've used pennies, dimes, quarters, half dollars, dollars, and even francs, deutchmarks, and pesos. They had, as of a paper published late last year, analyzed 3,787, 298 consecutive flips. All of them came out heads. As has every coin flip in history, as far as we know.

"And the results of the study? Well, as you might have guessed, it illustrated nothing we didn't already know. Namely that there is no physical explanation whatsoever. As far as our current understanding of science goes, there is no aerodynamic, magnetic, thermodynamic or quantum physical explanation for heads to be any more likely to show than tails."

I removed the coin once again from my pocket, placing it tails side up on the small table I used for simple physics demonstrations.

"As you can see, there does not seem to be any instability with the coin in its current state. It does not appear to be eager to flip over to the other side. And were we to watch it for a very long time, it is likely that this table would rot away to nothing before the coin moved of its own accord. The presidential seal would be visible to any who cared to look upon it for decades. Centuries. Millennia. But. . . ."

I picked up the coin and repeated the earlier demonstration. JFK did not disappoint us. I returned the coin to my pocket once more, fearful I might lose it if I hurled it into the air again.

"According to all our knowledge of physics, a flipped coin should land tails up about as often as heads. And the laws of probability say that given two equally likely results, as the trials are iterated, an equal distribution of the two outcomes will be more and more closely approached, though one might expect an uneven distribution in a small number of trials." I paced without speaking for just a moment. "3,787, 298 does *not* constitute a small number of trials.

"Throughout most of history, the idea that a coin could show tails when flipped was never seriously examined. Such a result was unthinkable and rarely considered. It only appeared as part of the stuff of myth, tales of ancient gods and heroes who'd flipped coins and showed tails. Pure fantasy.

"Can anyone think of a reference to this phenomena by ancient peoples?"

A dreadlocked, pierced and punctured young woman in the back raised her hand. She was by far the most studious pupil in the class, though she always looked as if she'd just returned from Bonnaroo. "Yes, Ms. Burton?" I said, inviting her input.

" 'And may thou be haunted until the day a coin show not the face of Caesar,' " she quoted.

"Excellent!" I said. "Cicero, yes?"

Ms. Burton nodded.

"A superb example. 'Until a coin show not the face of Caesar.' Every Roman citizen knew immediately that this evocative description meant 'forever' because that was never going to happen. But though this observation has been made since antiquity, it still admits of no explanation."

"Now, we have established by experiment that a flipped coin will come up heads, in a manner analogous to the fact that we've established through experiment that the sun will rise tomorrow. The experiment in question began long before the scientific method was even invented. Evidence uncovered by archaeologists indicates that the ancient Lydians, the first minters of coins, observed this effect back in the 7<sup>th</sup> century BCE, attributing it, as was the wont of ancient people faced with phenomena not directly explainable, to the action of gods, demons, and other supernatural forces of that ilk."

Several students snickered derisively at the folly of the founders of ancient civilizations.

"You laugh," I said. "But now, have we come so far?" I asked rhetorically "Are we so much more advanced than those primitive *barbarians* of ancient Lydia? Oh we are so high and mighty," I said, gesticulating dramatically, "We have our calculators, our computers, our differential equations, our complex analysis, but

while the ancients wrote it off to the imponderable whims of unseen celestial entities, what have we to offer, hmmm?"

None of the students spoke, though I allowed a long pause.

"We have nothing to say on the subject other than, 'This is an example of unexplained phenomena on which much research has been done and will continue.'

"Unexplained phenomena," I repeated. "The Egyptians had Thoth and Isis, the Sumerians, Ishtar and Marduk. The Romans had their Jupiter, and the Greeks had their Apollo. And we modern, civilized, infinitely superior people," I said puffing myself up with exaggerated hubris and pomposity, "We have our 'unexplained phenomena.' "

The class was united in a light chuckle and I smiled in satisfaction. I mentally chalked up another victory in my relentless pursuit of the union of education and entertainment. Glancing at the clock, I noted that only a few minutes remained in the hour, further pleased that my timing was still impeccable.

"Well, I hope you've enjoyed today's segue on unexplained mysteries of science. For Wednesday's lecture, please read chapter six in your text. We will be discussing the Hugh Everett Many Worlds theory. Remember, every possible universe, no matter how unlikely, exists somewhere, even one where there is a surprise pop-quiz, so make sure you come prepared . . ."

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