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# ON SPINNING AND TOPPLING COINS

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DID MARTIN GARDNER  
CHANGE HIS MIND?

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CHANGE HIS MIND?

IF SO... THAT'S OK!

Jim Weinrich

I'LL BET YOU DIDN'T KNOW  
1992 (*The Physics Teacher* magazine)



## Physics Trick of the Month

### The Biased Penny

I'll bet you didn't know that if you spin a shiny new U.S. penny on a glass table top (the surface *must* be glass), when it stops spinning it will fall tails about eight out of ten times. The probability varies slightly with each penny. I assume this is because when the Mint stamps pennies out of zinc sheets, be-

fore coating them with copper, an im-perceptible bias occurs on the rims.

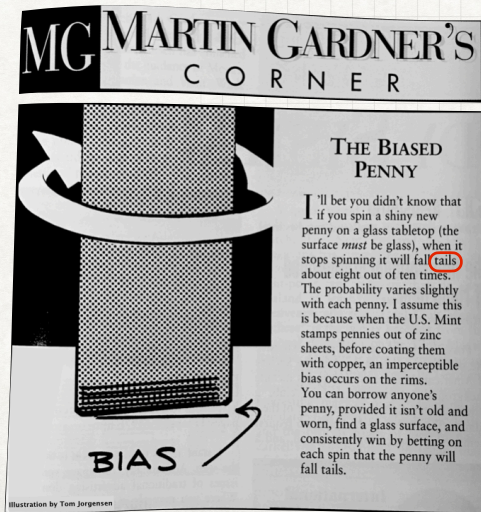
You can borrow anyone's penny, provided it isn't old and worn, find a glass surface, and consistently win by betting on each spin that the penny will fall tails.

**Martin Gardner**, Hendersonville, NC  
28739



## I'LL BET YOU DIDN'T KNOW

1996 (Magic Magazine)



## I'LL BET YOU DIDN'T KNOW

1997 and 2011

### The Biased Penny

I'll bet you didn't know that if you spin a shiny new U.S. penny on a glass or plastic tabletop, when it stops spinning it will fall heads up about 8 out of 10 times. I assume this is because when the Mint stamps pennies out of zinc sheets, before coating them with copper, an imperceptible bias occurs on the rims.

You can borrow anyone's penny, provided it is a new one, find a perfectly smooth surface to spin it on, and consistently win by betting on each spin that the coin will fall heads up.

A more striking way to demonstrate the tendency of new pennies to fall heads up is to balance 10 of them on their edge. Give the table a strong blow to make the coins topple. You'll find that a majority of the pennies, at times all 10, will fall heads side up.

## I'LL BET YOU DIDN'T KNOW

1997 and 2011

- In both books, he added a new claim that involved toppling a penny balanced on its edge.
- Here he also said the bias was toward heads.
- He seemed to assume that the physical mechanism would be the same for both toppling and spinning — namely, a bias in the edge.

### The Biased Penny

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## SUMMARY

1992 - PRESENT

- 1992: Martin Gardner says 80% tails (physics magazine).
- 1996: He says 80% tails (magic magazine).
- 1997: He says 80% heads (games and puzzles book).
- 2011: He says 80% heads (games and puzzles reprinted).
- Sometime along the way, "the Internet" happened, and now it seems that everyone says that spinning pennies fall tails up 80% of the time.
  - Many, MANY websites say this is because the heads side is heavier.
  - They rarely mention a bias in the edges.

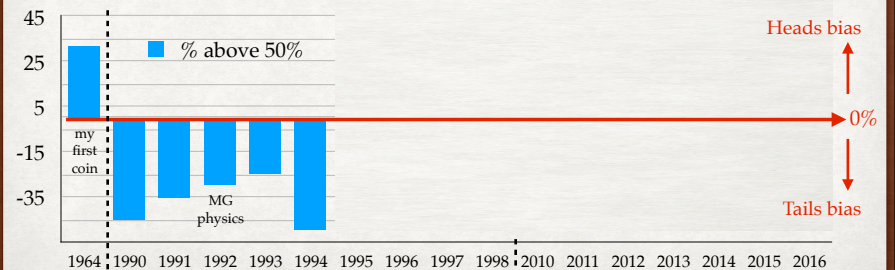
# I'LL BET YOU DIDN'T KNOW

## MY DATA

- The first time I read Martin's book, I pulled a penny out of my pocket, and it contradicted what Martin had said.
  - But it was an old, brown penny from 1964.
- Once I started teaching statistics, I found that spinning pennies in class was easy to turn into a class project.
- Statistics-class pennies showed no bias, or Martin's bias of 20/80, or the opposite bias of 80/20.
- And I found that Martin's change of mind could possibly have been based on actual data!

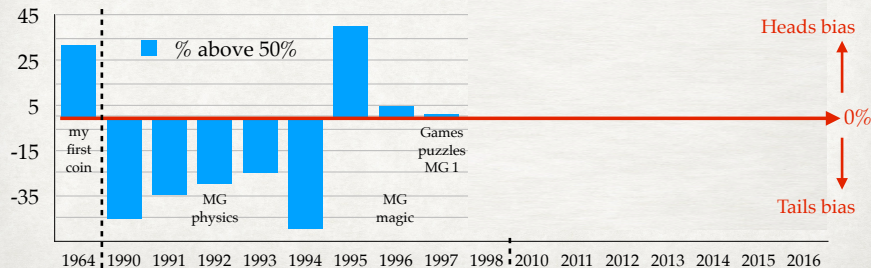
# IT DEPENDS ON THE YEAR

- I obtained pennies from various years, and started spinning.
- And spinning. ☹ AND SPINNING. ☹ ☹ ☹ ☹
- It turns out that there was indeed a tails bias in the 1990s that continued up through 1994.
- Martin was correct in his first column (physics magazine).



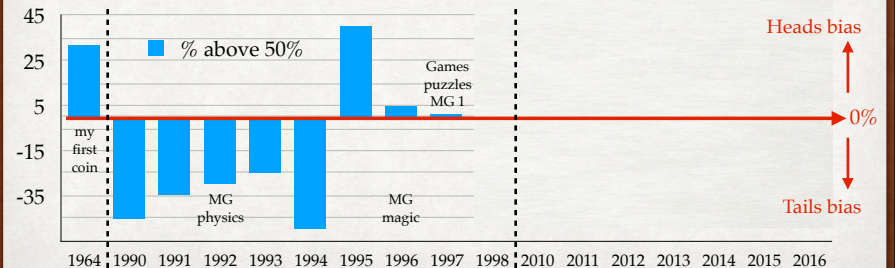
# IT DEPENDS ON THE YEAR

- But something changed in 1995's pennies.
- About then, Martin was presumably writing the book that stated a heads bias (published 1996), not a tails bias.
- And my question to Jim Gardner is:  
You and your brother were too old to be spinning pennies for your dad in the 1990s; do you know how he got the data?



# IT DEPENDS ON THE YEAR

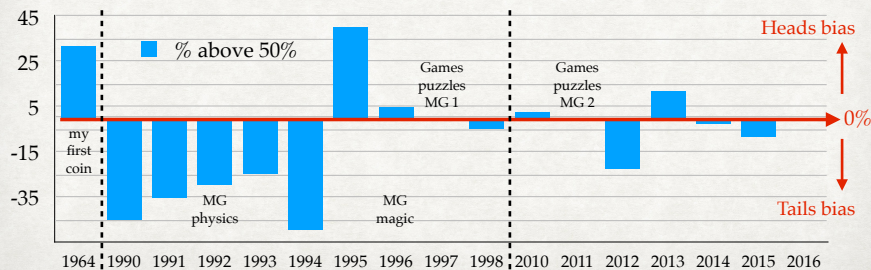
- And what happened thereafter? It evened out!
- Except: in 2012 it restored a tails bias, and...
  - In 2013 it went to a heads bias, and...
  - After that it evened out again.





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## AND FINALLY, THE PHYSICS

- In closing, let me note that the physics of spinning coins is deceptive.
- Do spinning coins usually fall with their heavier side down?



- NO!

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- In closing, let me note that the physics of spinning coins is deceptive.
- Do spinning coins usually fall with their heavier side down?



- NO!
- Physics says that the heavier side should end up.
- Moreover, the heads side of a penny is probably the lighter side — so "the Internet" is doubly wrong.

## AND FINALLY, THE PHYSICS

- And do spinning coins coins with a biased edge usually fall with their narrower side down?

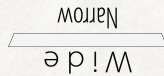


- NO!

## AND FINALLY, THE PHYSICS

- And do spinning coins with a biased edge usually fall with their narrower side down?

• NO!



- Physics says that the narrower side should end facing up.

## AND FINALLY, THE PHYSICS

- Whaaaaaat?
- According to physics, it all depends on where the coin's center of mass is.
- While spinning, the center of mass should be over the point on which the coin is spinning.
- That makes the heavy side end up on top.
- That makes the narrow side end up on top.
- ... Unless I have my physics wrong, which I probably do.

## FINALLY, FINALLY

- Finally finally...
- Is there anybody out there who knows a lot about physics?
- Perhaps we could write a real paper about this? ☺ ☺ ☺ ☺