Ask Marilyn

Say that a woman and a man (who are unrelated) each has two children. We know that at least one of the woman's children is a boy and that the man's oldest child is a boy. Can you explain why the chances that the woman has two boys do not equal the chances that the man has two boys?

My algebra teacher insists that the probability is greater that the man has two boys, but I think the chances may be the same. What do you think?
—Michelle Minikel, Brookfield, Wis.

It's a boy!

Or is it?

What are

the odds?

I agree with your algebra teacher. The woman may have at least one boy in the three following ways: 1) older boy, younger girl; 2) older girl, younger boy; or 3) older boy, younger boy. But the man's children may be distributed in only *two* ways: 1) older boy, younger girl; or 2) older boy, younger boy.

So the chances are only 1 out of 3 that the woman has two boys, but the chances are 1 out of 2 that the man has two boys.

So What's the Question?

The answer was "The Nuclear Arms Race." Here are some of your questions:

"What's the name of the world's biggest demolition derby?"
—C.T. Lofgren, San Diego, Calif.

"What's the only race in which all the spectators lose too?"
—Gary Anderson, Dallas, Tex.

"Other than the human race, what race constitutes the greatest danger to the environment?"
—Thomas Patton, Glenview, Ill.

"What term do extraterrestrial observers use when referring to us Earthlings?"
—Susan Moyer, San Antonio, Tex.

Ready to try another one?
The answer is: "The Law of Gravity."

If you have a question for Marilyn vos Savant, who is listed in the "Guinness Book of World Records" Hall of Fame for "Highest IQ," send it to: Ask Marilyn, PARADE, 711 Third Ave., New York, N.Y. 10017. Because of volume of mail, personal replies are not possible.

BY MARILYN VOS SAVANT

Ask Marilyn®

Dec 1, 1996

You have followed in the footsteps of an ignorant algebra teacher.

Michelle in Wisconsin recently wrote: "A woman and a man (who are unrelated) each have two children. At least one of the woman's children is a boy, and the man's older child is a boy. Can you explain why the chances that the woman has two boys do not equal the chances that the man has two boys? My algebra teacher insists the probability is greater that the man has two boys, but I think the chances may be the same." You agreed with the algebra teacher.

This illustrates one of my favorite theories. I submit that woman's intuition—used successfully by Michelle—is often a process of subconscious reasoning that bypasses the right-brained analysis that is typical of male argument. I love your column; I also love to argue about it.
—Russell Bell, Palisade, Colo.

Then you'll love my reply. What selective logic! Because you believe the reader is correct, you assume she used woman's intuition to arrive at a correct answer, that I used male right-brained analysis to arrive at an incorrect answer (or that my woman's intuition took a powder) and that the algebra teacher is a typical wrong-headed male (or a woman who didn't use her woman's intuition). But you are not alone in disagreeing:

For you to come up with an answer contradicting common sense suggests that you approached this problem by trying to back up the algebra teacher. It is often easier to explain a wrong answer than to find the right one. But I find an attitude in which the voice of authority outweighs common sense troubling.
—David Wetta, Norman, Okla.

It matters not whether the boy was firstborn or lastborn. Each parent had one additional child. The probability that that child is male or female has no relationship to other things mentioned. That probability is a fact of nature. Your statement is nonsense. You've disappointed many of us in a way only an apology can cure.
—Phil Wallace Payne, Lompoc, Calif.

I have a BA from Harvard, an MBA from the University of Pennsylvania Wharton School, a math SAT score of 800, and a perfect score in the Glazer-Watson critical thinking test, but I'm willing to admit I make mistakes. I hope you will have the strength of character to review your answer to this problem and admit that even a math teacher and the person with the highest IQ in the world can make a mistake from time to time.
—John Francis, Newton, Mass.

I do make mistakes from time to time—which I always announce—but this isn't one of those times! The original answer is correct. Here's further explanation:

Families with two children can be distributed in the following ways. Each way is equally likely.

1) older = boy, younger = girl
2) older = girl, younger = boy
3) older = boy, younger = boy
4) older = girl, younger = girl

In real life, 50% of these families (the first two groups) have a child of each sex, 25% (the third group) have two boys, and 25% (the fourth group) have two girls. The woman in question—with at least one boy—must be in one of the first three groups. But only one of those three groups (No. 3) has another boy. So the chances that she has another boy are 1 in 3. It's different for the man whose older child is a boy. He must be in one of only two groups—the first or the third. One of those two groups (No. 3) has another boy. So the chances that he has another boy are 1 in 2.

If the first child is a boy, will the second child be one too? Readers argue about logic and common sense.

SO, WHAT'S THE QUESTION?

The answer was "The Rings of Saturn." What's the question?

"What could the best man not find on the Roman god's wedding day?"
—Joe Sinkey, Athens, Ga.

"What do you count to learn the age of the sixth planet from the Sun?"
—Jill Roberts, Tampa, Fla.

"What preceded the invention of the answering machines of Saturn?"
—George McCahey, Carol Stream, Ill.

"What were left in the tub after the sixth planet took too many long meteor showers?"—Mike D., Staten Island, N.Y.

Ready to try another one?
The answer is: "Unidentified Flying Objects."

If you have a question for Marilyn vos Savant, who is listed in the "Guinness Book of World Records" Hall of Fame for "Highest IQ," send it to: Ask Marilyn, PARADE, 711 Third Ave., New York, N.Y. 10017. Because of volume of mail, personal replies are not possible.

I'm stunned at your abandonment of good sense in your response to a reader who wrote: "A woman and a man (unrelated) each have two children. At least one of the woman's children is a boy, and the man's older child is a boy. Do the chances that the woman has two boys equal the chances that the man has two boys?" You said it's more likely the man has two boys. I can only conclude that you felt your readers were getting frustrated by your superior abilities, so you decided to raise our collective self-esteem by exhibiting the logical skills of a second-grader who has had too many turns on the teeter-totter.
—Matthew Zik, Yorktown Heights, N.Y.

You make very few mistakes, which you always announce. I'm waiting patiently.
—Eldon Moritz, Arlington, Tex.

Then you're in the minority, Eldon. Everyone else is waiting *impatiently*. But the original answer is correct. Here's why:

There are four different (but equally likely) ways for a family to have two children:
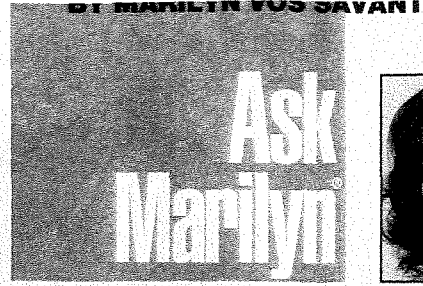
No. 1: older = boy, younger = boy
No. 2: older = boy, younger = girl
No. 3: older = girl, younger = boy
No. 4: older = girl, younger = girl

Since in this problem both the man and the woman have at least one boy, we can eliminate the last group, because there are no boys among them. This leaves three groups:

No. 1: older = boy, younger = boy
No. 2: older = boy, younger = girl
No. 3: older = girl, younger = boy

The woman in question has at least one boy, so she might be a member of any of those three groups. But only one of those groups (No. 1) has *two* boys. So the chances that she's a member of group No.1 are 1 in 3.

But the man's older child is specified as a boy, so in his case we also can eliminate group No. 3, because there the older child is a girl. This leaves the following two groups:

No. 1: older = boy, younger = boy
No. 2: older = boy, younger = girl

Again, only one of those two groups (1) has two boys. So the chances that the man is a member of that group (No. 1) are 1 in 2.

And here's one more letter that shows why this subject is a very serious one, despite the fact that we've had so much fun with it:

A problem about birth order is a good way to see the laws of probability at work

You're right about the boy-girl puzzler! I have a Ph.D. in nuclear engineering from U.C. Berkeley and formerly managed a group that performed probabilistic safety analyses of nuclear power plants. We often spent days mulling over the arrangement, condition and function of equipment, or the role of people properly following procedures, or the correct interpretation of descriptive statements, in order to best assess each foreseeable possible sequence of events. Life is ever interesting. I love your column.
—Jennifer L. Adams, Fairfield, Conn.

For the Earth to make a complete rotation every 24 hours, it has to travel about 1000 mph. But when I put my hand out of the car window at even 60 mph, it's almost blown off. How can we stand on Earth and not feel the 1000 mph winds?
—Don Strader, Jacksonville, Ill.

And don't forget that the Earth is also traveling around the Sun, and that our solar system itself is speeding through space. How in the world can we ever hold onto our Easter hats? Because the Earth's atmosphere—like everything else here—is held onto the planet by gravity, so it rotates along with us. It's when we travel *within* the atmosphere that we can feel blown away.

When I visited Niagara Falls at age 16, the American side of the Falls was turned off for cleaning. Nobody believes me. Can you help?
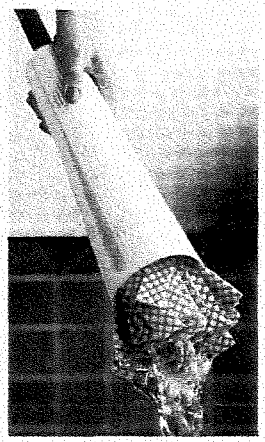**—Darcey Brady Wade, Mapleton, Ill.**

It's true! (Well, almost.) The river that feeds the Falls is divided by Goat Island into Horseshoe Falls (on the Canadian side) and the American Falls (on the U.S. side). By the time you were 16—which must have been in 1969—so much erosion of the Falls had occurred that the river was temporarily diverted from the American side so the situation could be studied. What a time to visit! But at least you can tell people that you witnessed the worst possible moment to try to go over Niagara Falls in a barrel.

BY MARILYN VOS SAVANT

Ask Marilyn

I will never read your column again.
—Eric Gatterdam,
Tucson, Ariz.

I have lost nearly all my faith in you.
—Douglas Kraft,
Notre Dame, Ind.

I can only conclude that you are not woman enough to face the truth and admit your mistake. You are highly intelligent, and that is an admirable quality, but high intelligence coupled with an unwillingness to admit a mistake is unforgivable.
—Leonard Haefele,
Overland Park, Kan.

It really puzzles and frustrates me that, despite your great perspicacity, you are unable to see that your answer to the "man and woman each with two children" problem is wrong.
—J.H. Wuller, St. Louis, Mo.

You are wrong. This is borne out by the application of Bayes' rule to the probability structure you imposed, and in the inner refinement functionality as given in the Dempster-Shafer theory of evidential reasoning.
—Dave Ferkinhoff,
Middletown, R.I.

I was horrified to read that one of your few supporters was an engineer responsible for assessing risks in the operation of nuclear power plants. I sometimes wonder why critics of IQ testing don't point to some of your work as vivid examples of the vast difference between IQ and logic.
—Robert Williamson,
Knoxville, Tenn.

As an anti-nuclear activist, I find it both scary and humorous that a person with a Ph.D. in nuclear engineering who once managed the performance of probabilistic safety analyses of nuclear power plants thinks you are correct.
—Ben Davis Jr.,
Sacramento, Calif.

I guess the real hope is that the nuclear engineer wasn't paying very close attention when she offered her assent, or else the next problem will involve three-eyed children.
—Jason Zeamon,
White Bear Lake, Minn.

That question about a woman and a man, each with two children, is causing controversy again. But this time our women readers are asked to participate, and $1000 is on the line.

I am writing to the Nuclear Regulatory Commission to suggest that any power plants approved for operation by Jennifer Adams be closed immediately.
—Russell Redgate,
Marstons Mills, Mass.

This is not going to go away until you admit that you are wrong, wrong, wrong!!!
—Pearl Meibos,
Salt Lake City, Utah

You are not the only genius to base logic on a faulty major premise. Einstein did it more than once.
—Margaret-Mary del Tufo,
North Myrtle Beach, S.C.

Even the Bulls lose one every once in a while.
—Chris Rowley, Frisco, Tex.

I will send $1000 to your favorite charity if you can prove me wrong. The chances of both the woman and the man having two boys are equal.
—Eldon Moritz,
Arlington, Tex.

You're on, Eldon! If you are wrong, you'll donate $1000 to the American Heart Association. If I'm wrong, I'll donate $1000 to that association. Rather than explain my reasoning again, let's just put it to the test. Here's the original problem:

"A woman and a man (unrelated) each have two children. At least one of the woman's children is a boy, and the man's older child is a boy. Do the chances that the woman has two boys equal the chances that the man has two boys?"

I said the chances that the woman has two boys are 1 in 3 and the chances that the man has two boys are 1 in 2. The letter-writers agree with me about the man. But they disagree with me about the woman. Instead, they say the chances that the woman has two boys are 1 in 2 (just like the man's chances).

Readers, here's how you can help prove which answer about the woman is correct. To my women readers: If you have exactly two children (no more), and at least one of them is a boy (either child or both of them), write —or send e-mail—and tell me the sex of both of your children. Don't consider their ages.

In other words, it's fine to write if your older child is a boy and your younger child is a girl. It's also fine to write if your older child is a girl and your younger child is a boy. And it's fine to write if both of your children are boys. I need to hear from all of you (but only if you have two children and no more).

We'll publish the results in an upcoming column.

Wild birds lay eggs only once a year. Why do chickens lay eggs year-round?
—Vicki Jaffe, Venice, Fla.

In the past, egg-laying increased in proportion to a farmer's ingenuity. For example, birds are sensitive to the cycle of daylight when they ovulate, so the use of artificial light can increase the breeding season and help cause more eggs to be laid.

Today, your friendly neighborhood geneticist deserves much of the credit, mainly by developing hens with production-line potential, then selling them in ready-to-lay condition. Not that Farmer Brown is uninvolved. If she's a do-it-yourselfer, she will have bought those pullets as hatchlings and immersed herself in all the many means of ensuring that they reach sexual maturity strong and healthy. She also will tailor their nutrition, from optimal-growth feed to egg-production feed.

As a result, while a wild chicken (the Asian ancestor still exists) lays about six eggs a year, a thoroughly modern domestic chicken produces an average of 240 a year.

I know you're not an advice columnist, but I like it when you show people how to use their heads when thinking about problems—even personal ones. My problem is that I'm 35 and have never had a real boyfriend. People tell me I look great, which is why I'm writing:

I sometimes feel like my youthful good looks are being wasted—that the years are going by, and I have no one to share myself with. Is there any way I can reason with myself to make myself feel better about this?
—Melissa J., Wheeling, W.Va.

Your youth and good looks aren't being wasted. No matter how much you're loved, no one else will ever enjoy your health and attractiveness nearly as much as *you* will —and you're experiencing it every minute. Congratulations on having such good luck. (And whether you're alone or not, be sure to take plenty of photos! They will become more precious with each passing year.)

I read that the gene for intelligence is carried on the X chromosome. Since males receive Y chromosomes from their fathers and X chromosomes from their mothers, this means all their intelligence comes from their mothers. Do you have any comment about that?
—Anonymous

Yes. I can't tell whether you're giving mothers credit or blaming them!

WORDTEASER

This week's word is: **LONK**
What's the definition?

A) an English breed of sheep
B) the mating call of a goose
C) to sound a car horn for an extended period of time
D) to hit a comic partner on the head with a rubber mallet

Answer appears in next week's column.

Over a year ago, I submitted my "proof" that your conclusion about the following problem was incorrect: "A woman and a man (unrelated) each have two children. At least one of the woman's children is a boy, and the man's older child is a boy. Do the chances that the woman has two boys equal the chances that the man has two boys?"

A reader confesses an error —and makes a generous donation

You said the chances that the woman has two boys are about 1 in 3 and the chances that the man has two boys are about 1 in 2.

One reader disagreed so strongly that he wrote, "I will send $1000 to your favorite charity if you can prove me wrong. The chances of both the woman and the man having two boys are equal." You accepted the bet and asked readers to take part in a survey of women with two children (no more), at least one of which is a boy (either child or both). The survey showed that 35.9% (about 1 in 3) of the respondents have two boys.

I feel it is my duty to confess to you that I have uncovered the error in my analysis. Although I am not the reader who made the original bet, I have enclosed my personal check in the amount of $1000, payable to the American Heart Association, your favorite charity. Please forward it to them, in your name, with my compliments.
—Gary J. Burke, Pittsfield, Mass.

I'm delighted to know there are people like you in the world, and I'm especially proud that you're among my readers. What an outstanding combination of candor and generosity! You are a treasure. On behalf of the American Heart Association, thank you, thank you, thank you!