Assumptions are repulsive, especially about gravity

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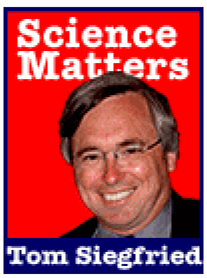
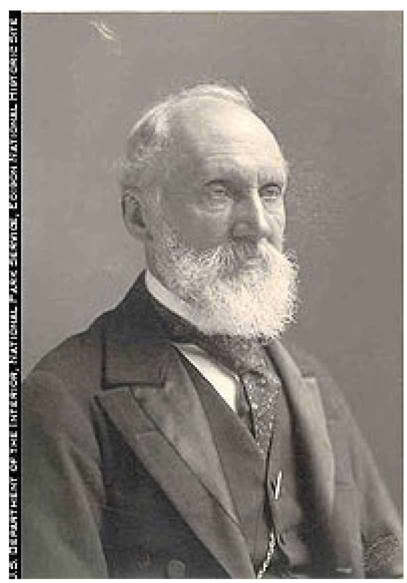
It's a terrible mistake, journalists are taught from their youth, to assume anything. If somebody says "what goes up must come down," you should check it out.

You're supposed to find out the facts, and take nothing for granted. There's even a crude joke about what an assumption makes u and me -- you can figure it out if you know how to spell assume.



Scientists, on the other hand, make assumptions all the time. One of the best ways of finding out new things is to assume that some things are true and see where they lead.

After all, many calculations require data that isn't easy to acquire. That's the basis of another old joke about how a physicist would calculate methods of improving milk production at a dairy farm. "To start," said the physicist, "assume a spherical cow." Assuming a spherical shape makes the calculations a lot easier.



There's nothing wrong with this approach, as long as you know what you're doing. But some other assumptions often used in science are a bit more dangerous -- the assumptions that scientists don't even know they're making.

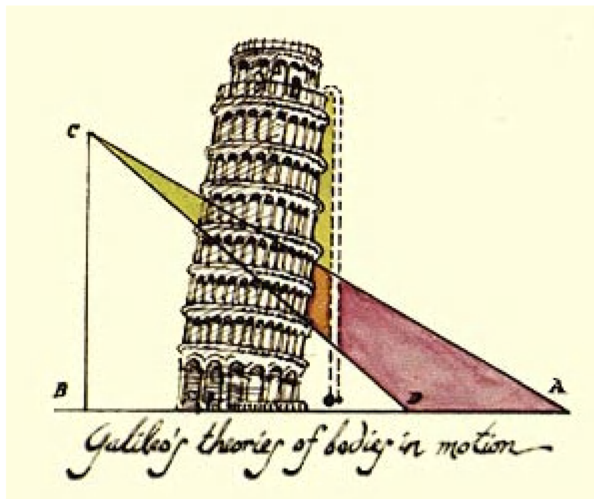
When an assumption is clearly stated at the outset, it's easy to go back and check to see if that assumption skewed the results. But when the assumption is invisibly ingrained into the scientist's mind, a seemingly certain conclusion may actually be fatally flawed.

Photo of Lord Kelvin from National Historic Site (NPS)

A famous example from the 19th century afflicted Darwin's theory of evolution, which requires hundreds of millions of years for natural selection to drive the origin of the Earth's diverse repertoire of species. Lord Kelvin, Great Britain's foremost physicist, calculated that the Earth was in fact much less than 100 million years old, based on the amount of heat emanating from the planet's interior. His math accurately described how long the Earth could have been cooling from the time of its birth as a molten mass of rock.

Kelvin turned out to be dramatically wrong, however, because his calculations implicitly assumed that the Earth contained no continuing source of internal heat. After radioactivity was discovered, it soon became clear that Kelvin's calculations were no longer meaningful. The Earth was, in fact, billions of years old, and Darwin's evolution had all the time it needed.

Today physicists worry that another previously unstated assumption might prove wrong, requiring a thorough rethinking of the nature of the universe. It has to do with evidence that most of the matter in the universe is too dark to see. The logical explanation for this "dark matter" is that it consists of some new kind of subatomic particles, waiting to be discovered.



Challenging assumptions in the 16th century: Galileo puts one of Aristotle's "laws" of nature to the test. Drawing from NASA

But that conclusion, along with many other supposed "facts" about the cosmos, depends on the belief that space consists of only three dimensions (that is, you can move only in combinations of three directions, or a position can be specified with only three numbers, like latitude, longitude and altitude). New theories indicate that space may consist of additional dimensions, not accessible to sight or sound. These extra dimensions might even be home to parallel universes, containing matter that would exert a gravitational influence on our universe. If so, the "dark matter" may not be new particles at all, but rather simply the effects of gravity from matter in our parallel universe neighbors.

Fantastic discoveries can be made by exposing hidden assumptions that are steering scientists in the wrong direction. Such assumptions are hard to find, though -- the whole point is that they go unstated because they're so "obvious" that nobody ever questions them. Such as the obvious fact that gravity is always attractive.

Electric charges can be positive or negative. Opposite electric charges attract each other; like charges repel. Gravity, on the other hand, seems to be always attractive -- all masses move toward each other. Apparently all matter has a positive gravitational charge, and like gravitational charges attract. If there was such a thing as negative mass, it would behave in the opposite way and push away all ordinary matter, a prospect that most physicists find repulsive -- except for Sabine Hossenfelder.

She proposes that for every kind of positive-mass particle known to nature, there could exist a negative mass partner, identical in all respects except reacting in the opposite way to a gravitational field.

For almost 2,000 years it was assumed that the sun and planets rotated around the earth. Drawing of Aristotle's theory from NASA

Such anti-grav particles' only interaction with ordinary matter would be by way of the gravitational force, notes Hossenfelder, of the University of California, Santa Barbara. "It is therefore naturally very weak, explaining why we have not seen any anti-gravitating matter so far," she writes in a paper to be published in Physics Letters B.

On a Web page explaining her paper, she points out that their repulsive nature guarantees that anti-gravity particles would be hard to find. "If there is anti-gravitating matter, it would not stay here. It would move away as far as possible," she writes.

It's probably a long shot, but if they exist, anti-grav particles might help explain what happens when matter is very dense, as in the big-bang birth of the universe, or even answer riddles about the universe on the biggest scales of size. Anti-gravity particles would not be trapped in black holes, paving the way for interesting new science fiction movie plots. And such particles would, of course, go up but never fall back down.

At least that's what you'd assume.

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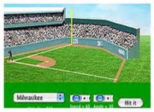

[Virtual Science!]

[Tom Siegfried]