On the Benefits and Hazards of Models

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This essay is important because some people in positions of authority will often use something called a model to tell those of us in positions of ignorance that the solution being offered is the only one we can accept. They tell us it is science.

For all the non-geeks out there, I will make this simple.

A model is nothing more complicated than a mathematical relationship between two cases. Well, a simple one is anyway.

To illustrate, if two twins grow at exactly the same rate and reach their adult height at the same time, the relationship between their two heights at any point in time is x=y. They are the same.

Two ball bearings dropped off a building would have the same relationship, provided that they are the same weight and shape. That's just physics.

See? It's easy.

In practice, the model is used to predict things. So, if we drop one ball bearing off of a building and watch it fall, we can predict that the second, third, fourth, and fifth (et cetera) ball bearings will fall the same way provided that they are the same weight and shape.

The time to reach the ground is the model outcome. The weight and shape of the ball bearing are what we call variables.

Still, it is pretty easy.

It really is, or should be, easy. It is just math and physics. What makes it hard is that math, physics, and models have rules. Some people don't like to play by the rules - but that is another essay.

So, the rule in model making is that the mathematical relationships and the outcome must be 1.) Calibrated, 2.) Verified, and 3.) Validated.

Uh oh. Big words. Not to worry, the ideas behind them are small.

Calibrated just means that the measurements used in the model are tested to make sure that they are the right values to use in order for the model to reproduce the observed real world situation.

Verified just means that someone checks the math in the model to make sure there are no mistakes.

Validated is often the hard one. Validation means that the math is the right math to use.

Remember that the goal is to make a model give us the same outcome as what we observe. So, when we watch the ball bearing fall off the building and model that, the math in the model needs to put the ball bearing in the street at the same time that the real ball bearing hit the street.

In simple terms, the model needs to match the outcome of the events used to create the model in the first place.

Oh, my. It seems we are done already! Models are simple. Using models is not. We are told that the models say that our climate is out of control, the manatees will all be dead in a few short decades, flood insurance rates need to be high because all of our homes will flood every ten years or so, and that video games make us kill people. None of these models are calibrated. Some are verified (there are no math errors), and none are validated.

None of the outputs reproduce the data used to create them.

It is not all nonsense, however. Some are getting better. The one we are subjected to most often is a set of models called the 'spaghetti models' which are used to predict hurricane tracks. Looking at all the tracks together, we get a rough idea of where the storm is going. Looking at each one alone, they seldom agree.

I will close this essay with the statement that models are not science. Math is science. Physics is science. Being able to properly accumulate data is a skill used in science.

Using model output to convince people that there is some danger or threat that only a politician can save us from is not science. It is baloney.

One model that may be useful here is the one that predicts that baloney will make you fat and stupid. The only cure is to exercise the mind. Read the label on the baloney and it will make you appreciate real meat. It is the same with models.