



Businesspeople often react with skepticism to formal models. I suspect that part of that is due to a feeling that models somehow discount the value of our experience and intuition. After all, we know that all models are wrong. They're abstractions of reality.

Nevertheless, I'd like to make the case for why you should use formal models. While all models are wrong, the use of many models is useful. Models are useful because they can help us understand complex systems characterized by reinforcing and balancing feedback, such as our businesses.

The understanding that comes from playing with formal models helps us make clear, testable inferences regarding causation. They sharpen and extend our intuition. Ultimately, models help us make more robust decisions that result in more effective actions. In short, using models can make our lives better.

Our intuition can tell us the direction of effects. For instance, we intuitively understand that increasing advertising expenditures is likely to cause an increase in sales. Models can supplement our intuition by revealing the shape and form of those effects.

For instance, a model borrowed from immunology can be used to help anticipate the impact on sales of the reinforcing feedback that characterizes word-of-mouth marketing.

To put models in perspective, consider the hierarchy of wisdom.

Data consists of raw, un-coded events, experiences, and phenomena. Data lacks meaning, organization, or structure. Observing that rain is falling on your head is data.

Information names and partitions data into categories. The total amount of rainfall during the month of July in Bozeman, Montana, is information.

Knowledge is understanding correlative, causal, and logical relationships. Knowledge organizes information. Understanding the relationship between rainfall in July and hop yields is knowledge. Knowledge is often expressed in the form of models that explain and predict. For example,  $E=mc^2$  is a compact expression of our knowledge of a key aspect of the physical universe.

Wisdom is the ability to identify and apply relevant knowledge.

Not every model is appropriate to every task in a complex world. The tool needs to fit the job. Wisdom requires many-model thinking. Using a variety of tools in combination allows you to accomplish complex tasks better and more easily.

In the context of business, we often think of models as tools for making predictions. However, prediction is but one of the uses of models.

Scott Page, a professor at the University of Michigan, says models can serve seven different functions. We can use them to reason, explain, design, communicate, act, predict, and explore. He summarizes these functions with the acronym "REDCAPE."



To reason is to identify conditions and deduce logical implications. The inferences drawn from formal models are conditional. Without such constraints, we lose ourselves in competing proverbs. Are two heads better than one, or do too many cooks spoil the broth?

Most of what we know is true only under certain circumstances. The square of the hypotenuse is equal to the sum of the squares of the other two sides only in the case of a right triangle. Models are valuable in part because they help reveal the conditions under which results hold true.

To explain means to provide testable explanations for empirical phenomena. Models make key assumptions explicit and, therefore, testable. When data contradicts our assumptions, we re-orient our thinking, re-assess our decisions, and re-direct our actions faster than might otherwise be the case.

Designing means choosing features. We can use models to contemplate the implications of our choices.

In most cases, translating knowledge into effective action requires the cooperation of others. Models can help us communicate what we understand and know.

Models help us make sense of the world in order to make decisions that result in actions that will deliver desired results.

Of course, models are very frequently used to make predictions. Prediction is different from explanation. Deep learning algorithms can yield useful predictions but offer little in the way of explanation. They are often a proverbial black box.

In business, one of the most overlooked uses of models is to explore possible futures. Most of us readily embrace the value of creating prototypes of our products. In contrast, we're much less apt to play with models that might help us shape our business strategies.

An effective model must be communicable and tractable. That is, it must be amenable to analysis. No matter how elegant your logic, your spreadsheet won't be very useful if nobody can understand or manipulate it.

The right balance between fidelity and tractability will depend on the primary purpose of the model. Reasoning, explaining, communicating, and exploring benefit from simplification. Predicting, designing, and acting can benefit from high-fidelity models. As a rule of thumb, the more data we have, the more granular we can make our model.

To facilitate communication and collaboration, we encourage using visual models and representations whenever possible. That's why the BPMN visual process modeling language is so useful.

To sum up, wisdom is the ability to apply relevant knowledge. Knowledge often takes the form of models. Grappling with complexity requires many-model thinking. One tool does not fit all. Models can be used for several purposes. Remember REDCAPE: reason, explain, design, communicate, act, predict, and explore. There is a constant tug-of-war between tractability and fidelity. The right balance is determined by data availability and the model's



primary purpose. Finally, represent your models with pictures and movies rather than words and walls of numbers.