

The Importance of Model Thinking

 Posted on 14 June 2012 by [cjf](#)



Models can help us understand, predict, strategize, and re-design our worlds. This is the profound lesson from [Scott E. Page's](#) engaging on-line [Coursera](#) offering on [Model Thinking](#). I was particularly interested in this 10 week course because [Buckminster Fuller](#) instilled in me a deep appreciation for models. With this course, Scott Page reinforced and enhanced that appreciation in spades. Also, like Bucky, Page makes his penetrating approach accessible to a very broad audience. This is a great course for anyone with even rudimentary algebra skills.

In addition to reviewing the course, I will also suggest that **model thinking** is a new more incisive kind of science. This approach and its nascent toolkit for understanding, decision-making, prediction, strategy, and design is vitally important for practitioners of all types. Model thinking may be just the type of tool humanity needs to solve some of its thorniest problems. As such its arrival into broader consciousness is not a moment too soon!

So if you want to be out there helping to change the world in useful ways, it's really really helpful to have some understanding of models.
— Scott E. Page

Why Model Thinking

There are many ways to model the world. One of the most popular is with proverbs or short pithy sayings (our modern media seem to particularly love this deeply flawed “sound bite” approach to knowledge). As Scott Page points out, there are [opposite proverbs](#) too. For instance, the opposite of “nothing ventured, nothing gained” is “better safe than sorry.” Proverbs and their more elaborate cousins, allegories, can model or represent the world with persuasive stories, but they provide little discerning power and little basis for deeper understanding. In contradistinction, *model thinking* with its greater concern for precision can help us more carefully distinguish a complex of important factors with their interrelationships and behaviors. Therein lies its power!

Is intuition sufficient? No! [Philip Tetlock](#), [Robyn Dawes](#) and others have demonstrated that simple naive models outperform experts of all stripes. In 1979 Dawes wrote a seminal paper, [The Robust Beauty of Improper Linear Models in Decision Making](#), which showed the effectiveness of even “improper” linear models in outperforming human prognostication. Tetlock has made the most ambitious and extensive study of experts to date and finds that crude extrapolation models outperform humans in every domain he has studied.

That is not to say that models are “right”. Page emphasizes that all models are “wrong” too! Which leads to his most profound insight in the course: you need **many types of models** to help think through the logic of any given situation. Each model can help check, validate, and build your understanding. This depth of understanding is essential to make better decisions or predictions or build more effective designs or develop more effective strategies to achieve your goals.

Is intuition important? Yes, absolutely! The *many model thinker* relies upon intuition to select and critically evaluate a battery of models or to construct new or modified models when appropriate. These models help test our intuition. Intuition helps tests the models! Writing out a model often identifies facets and elements of the situation which intuition misses. Intuition is essential to find the aspects of the models that are a bit off the mark — and all models are a bit off. Model thinking is not “flying on instruments” or turning control over to mathematical or computer models. Instead it is about evaluating and comparing diverse models to test, build, fortify, and correct our intuitions, decisions, predictions, designs, and strategies.

Fascinating Models

Page’s course is filled to the brim with fascinating models! One of the first models Page introduces is [Thomas Schelling’s segregation model](#) which represents people as agents on a checkerboard. We discover deep and unexpected insights about how people sort themselves into clusters where everyone looks alike, for example, the segregation of neighborhoods based on race, ethnicity, income, etc. It is the first of many [agent-based models](#) to be discussed.

Page’s lectures are filled with the wonder of discovery (another trait he shares with Buckminster Fuller). We learn that seemingly elementary topics like aggregation or simple addition hold unexpected surprises. However, I was disappointed that Page didn’t use Bucky Fuller’s definition of “synergy” as the “[behavior of whole systems unpredicted by the behavior of their parts taken separately](#)” to provide an explanation for the limits of aggregation. Page’s treatment is excellent. Perhaps I am a bit too fond of Bucky’s “synergy” especially considering the fact that it urgently needs to be rescued from its current hackneyed and misleading usage.

Another really important (and fun) model helps us distinguish between luck and skill. We are surprised to learn that results among the highly skilled are mostly determined by luck! Pages’ related videos on randomness are helpful in understanding the [important notion of uncertainty which I’ve discussed before](#).

I was particularly interested in Page’s lecture on *tipping points* where a small change produces large effects. Page and his colleague PJ Lamberson recently wrote a [paper on Tipping Points](#) which models them as discontinuities. Page emphasizes that tipping points should be distinguished from exponential growth which is often erroneously imputed to have a tipping point.

Another fascinating topic on which Page has done pathbreaking research is the development of models to show the efficacy of diversity in problem-solving. I enjoyed finding and perusing [the paper on diversity by Lu Hong and Scott E. Page](#). The presentation in the course was simpler. Page is a gifted teacher who can explain sophisticated cutting edge research with concrete clarity.

It intrigued me that Page’s research concerns such elementary yet pervasive models. Model thinking is a young discipline that is proving itself ripe for breakthroughs that can inform our basic understandings in profound ways. I found all of Page’s models thoroughly fascinating!

A New Kind of Science

[S]cience is basically culture's answer to the big problem of epistemology, which is how can we know anything at all.

—[Stephen Stearns, Yale Biologist](#)

The standard view of modern science is given by the [hypothetico-deductive model](#) which posits that scientists propose hypotheses which are tested by experiments as part of a contest of alternative ideas to choose a winner which is dubbed Scientific Truth. In my study of science and engineering I have been repeatedly surprised at the unreasonable efficacy and perspicacity of “inferior” theories. For example, even though Newtonian mechanics is replaced by Einstein and Quantum as Truth, physics still teaches Newton and engineers still use it. Even though we have known for more than 2000 years that Earth is spherical, carpenters continue to use Euclidean geometry instead of the theoretically better spherical trigonometry. Why are such “improper” models so profoundly useful?

Scott E. Page's idea of the many model thinker provides the crucial insight: by exploring several models, critiquing them, finding each models' limits, its strengths and weaknesses, we build and deepen our understanding. In this way model thinking may be a new kind of science which places the emphasis on development and comparison of models which explore a subject from many perspectives and many levels of abstraction. It could be that the center stage of science is a dynamic dance where many models express their unique insights while challenging us to see how and when to integrate them with other models to compose new dances and new insights.

It could be that each of the many models reveals parts of the truth. Perhaps, only an ever-expanding integration of multiple models can approximate truth. Ephemeral “truth” may simply be the best current synthesis of our collection of partially overlapping, partially contradictory, and profoundly interacting models.

The principle of multiple model thinking has an important historical precedent in T. C. Chamberlin's **method of multiple working hypotheses** (see my essay on [Scientific Understanding](#) for a longer discussion of Chamberlin's work).

In the use of the multiple method, the re-action of one hypothesis upon another tends to amplify the recognized scope of each, and their mutual conflicts whet the discriminative edge of each. The analytic process, the development and demonstration of criteria, and the sharpening of discrimination, receive powerful impulse from the co-ordinate working of several hypotheses.

[T. C. Chamberlin, The Method of Multiple Working Hypotheses, 1890](#)

The important thread of *modelability* in Buckminster Fuller's [Synergetics](#) provides another deeply important role for a science of model thinking: to foster vital discussions with the whole of society. Science, technology, the arts, and culture are all changing our world in profound ways. Model thinking is a powerful way to engage the whole of humanity in a more incisive discussion to better understand how our complex world works. It provides a basis to make better decisions, project future trends, strategize and re-design our worlds to solve Humanity's problems. As such Scott E. Page's *Model Thinking* course is a beacon of light!

Comprehension of conceptual mathematics and the return to modelability in general are among the most critical factors governing humanity's epochal transition from bumblebee-like self's honey-seeking preoccupation into the realistic prospect of a

spontaneously coordinate planetary society.
—R. Buckminster Fuller, [Synergetics 216.03](#)

Reflections on the Course

Scott Page does something extraordinary in this course: he strives for and succeeds in providing a conceptual, clear, and concrete introduction to formal models. His gifted exposition, broad comprehensive perspective, and infectious sense of wonder inspired me to want more. Conceptual, clear, and concrete are also the values I took from Bucky's *Synergetics*. In *Synergetics*, we often [build geometrical models](#); in Page's course we "run the numbers" and write out elementary arithmetical and algebraic relationships. Both can be appreciated conceptually without much math. But both require effort to master and appreciate in depth. Both reward the diligent student. Both are incomplete and challenge the attentive student to ask more questions and dig deeper.

Page is effective in developing one's faculty to shift between the conceptual (broadly understandable) and the mathematical (where definitions and manipulations such as algebra predominate). Too often math is taught with too little concern for the concepts and it can become a drudgery of computing. Buckminster Fuller extolled conceptuality when he wrote "[Synergetics makes possible the return to omniconceptual modeling](#)". It is a critical value necessary to help people get access to tools for understanding the complexity of our ever-changing worlds.

This is a profoundly revolutionary course: it makes model thinking accessible to a broad audience with a broad array of conceptual, clear, and concrete models!

How I worked through the course

The videos are dense which is typical for Coursera courses. To ensure my head didn't explode, I watched only 2 or 3 every night. Since each "lecture" consisted of between 4 and 7 videos, it sometimes took me three days to watch a whole lecture. There were two lectures each week. Each day I would also rewatch the videos from a day or two before and take detailed notes. I took a total of 23 pages of handwritten notes. When I finished these preparations I took the weekly quiz. In this way I worked at a steady pace of only 1-2 hours a day (including the first watching, the note-taking, and the quiz-taking).

The quizzes often only took 20 minutes or so to complete (sometimes longer if I had to think about or research something). I insisted on getting 80% or better which meant that I often had to take a quiz twice (the second time usually went quicker). I love that Coursera encourages taking quizzes and exams multiple times. At the beginning of a course, I am often "out of sync" with its style of posing questions. By retaking the quizzes I can work through any cobwebs in my thinking. In hindsight, I wish I had retaken each quiz until I achieved a 100% score. There were always a few questions that challenged me, but overall I found the quizzes and the course to be fairly easy (much easier than the [Databases course](#) that I took last fall).

With each lecture Page also provided additional reading material. I read it all and searched the Net for additional primary sources (for example, I found and skimmed a copy of Schelling's 1971 paper). Admittedly this added another hour or so per day to my time investment. As it turns out, the quizzes only tested what was in the videos, so skipping the readings would probably not affect your score. The readings would benefit those who need to see the material again in different forms or

those who want a little more depth. I loved them, but if you are pressed for time they can be skipped.

I used the discussion forums a bit. They are a valuable resource, but I found them too time consuming. I used them mainly to sample what others were talking about. I really appreciated the work of [Timothy Riffe](#) who put out some code for [R](#) and [Jennifer Badham](#) who contributed to a number of interesting threads and posted her excellent course notes.

My effort was rewarded with a [Statement of Accomplishment for completing the Model Thinking course](#). My heartfelt thanks to Scott E. Page, the University of Michigan at Ann Arbor, and Coursera for their efforts in making this class available. It was exquisite!

Conclusion

I highly recommend this class. If you can spare about 10 hours a week for 10 weeks, this course will significantly improve your ability to use models to deepen your understanding and effectiveness. [Click here to register for the Model Thinking course with Scott E. Page \(next offering is in September 2012\)](#).

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3 Responses to “The Importance of Model Thinking”

1. [cjf](#) on 4 October 2012 at 10:44 am



I gave a presentation on “Synergetics and Model Thinking at the *ReVIEWING Black Mountain College 4: Looking Forward at Buckminster Fuller’s Legacy* conference on Sunday 30 September 2012. Slides are here:

<http://www.cjfearnley.com/Asheville.Synergetics.Model.Thinking.pdf>

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2. [Sasha](#) on 23 October 2012 at 3:28 pm

Hi from Serbia. I was also interested in that coursera course (and still am) but not enough time for all that. 😞



You have some interesting thoughts, will add your blog to my G. reader stream. Cheers.

[Reply](#)

3. [Jim](#) on 16 March 2013 at 12:01 pm



Chris, great to have these summaries. Thanks and kudos for doing them. I love Page’s idea of being a “many-model thinker”.

[Reply](#)

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