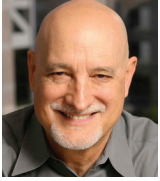


Engineering vs. Management

Do you like being right or like being effective? The answer may indicate which path is best for you.

BY STEVEN CERRI



Engineers and scientists spend four to eight years or more in college learning that the universe will give up its secrets if we are but smart enough. We

learn that when the universe gives up its secrets, the answers aren't left to interpretation. The universe doesn't give different answers depending on blood-sugar levels, mood swings, or political positions. The universe, generally speaking, is constant, predictable, even if unforgiving.

The second law of thermodynamics, or a computer programming language, or Newtonian physics are not ambiguous. They are not filled with uncertainties (not withstanding Heisenberg's Uncertainty Principle). As engineers and scientists, there is "correctness" to our work. Our questions

path of scientific discovery and engineering development. It requires that we are right and unambiguous and that we are able to predict with certainty, sometimes with life and death in the balance.

A Different Calling

On the other hand, managers and leaders realize that when it comes to dealing with managing and leading people, there are often many ways to achieve a specific outcome. Managers never have "enough" information. They never have the confidence afforded by the equation $F = ma$. Managers constantly function in a fuzzy zone where making the best approximation possible is the norm.

While engineers function with variables that have stability, managers function with variables called "people" and "circum-

stances." So the engineer in you sees this as relatively straightforward. You determine the distances along various possible routes. You determine the changes in elevations along each route. You determine fuel consumption as a function of speed, elevation, and incline of the road. There are many parameters you will take into account and with all these parameters as input variables and one locked outcome variable (fuel consumed), you can uniquely determine the path that will consume the least amount of gasoline. Period. That's the engineer's point of view. The engineer looks at the problem and attempts to squeeze all the uncertainty out of the calculation.

Now here's what the manager in you has to deal with: the weather is going to be unpredictable; it's impossible to determine with any certainty what the weather will be like along your route, and therefore you don't know the atmospheric density, and therefore you can't predict your mileage per gallon of gasoline with any degree of certainty; and there will definitely be variability of fuel consumption per mile based on the weather and atmospheric conditions.

You likewise can't predict what roadwork will take place en route. There may be significant delays along the way that are completely out of your control.

Also, you can't predict what the traffic will be on the roads you might travel. Will the traffic move at a constant pace or will it vary? Should you stay on freeways or on highways or take a few back roads?

In the end, with all the variables that cannot be quantified with certainty, you determine that there are four possible routes. Within certain limits of probability, they each could produce a minimum consumption of fuel, but there is no way to be certain which route will produce the minimum beforehand.

The engineer in you has determined the least expensive route in relation to fuel consumed. The manager in you has determined that there are three additional routes

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have one answer and one answer only. And if at first there are several answers to one question, we merely change the question so that only one variable is under consideration and, therefore, only one right answer can emerge. $F = ma$ and $E = IR$ don't vary if two variables are known; the third is uniquely defined.

This certainty allows us to predict the future. It allows us to place spacecraft in orbit and humans on the moon. It allows us to determine the size of beams and cables for a bridge and to develop circuits, chips, and cell phones. Our understanding allows us to predict the outcomes of our creations. This "problem solving" process is the juice that motivates us through our careers. It's the juice that allows us to devote long hours to studying and working; sometimes alone and sometimes with others.

This is proudly called the scientific method or the creative process. It is the

stances." These variables are often unpredictable, variable, and uncertain.

While engineers usually have one foot on the ground as they lift the other to step forward, managers often have both feet off the ground as they jump to the next location on the path to achievement of the outcome.

And while, for the engineer, the next step may be defined unambiguously, for the manager there are many directions in which to jump and many possibilities for dealing with a management situation and still achieving the desired outcome.

An Example

Let's look at a simple example. Assume you want to drive from New York City to San Francisco and you want to do it using the smallest amount of gasoline. The one variable you are concerned about is fuel consumption, not the cost of the fuel used, but the volume of the fuel.

that might result in minimum fuel consumption. Once on the trip, you may even want to be flexible enough to change routes depending on weather, road conditions, and traffic. The true answer won't be known until you complete the trip, if even then.

So which route do you select? Almost any of the four will do. So pick...based on what?

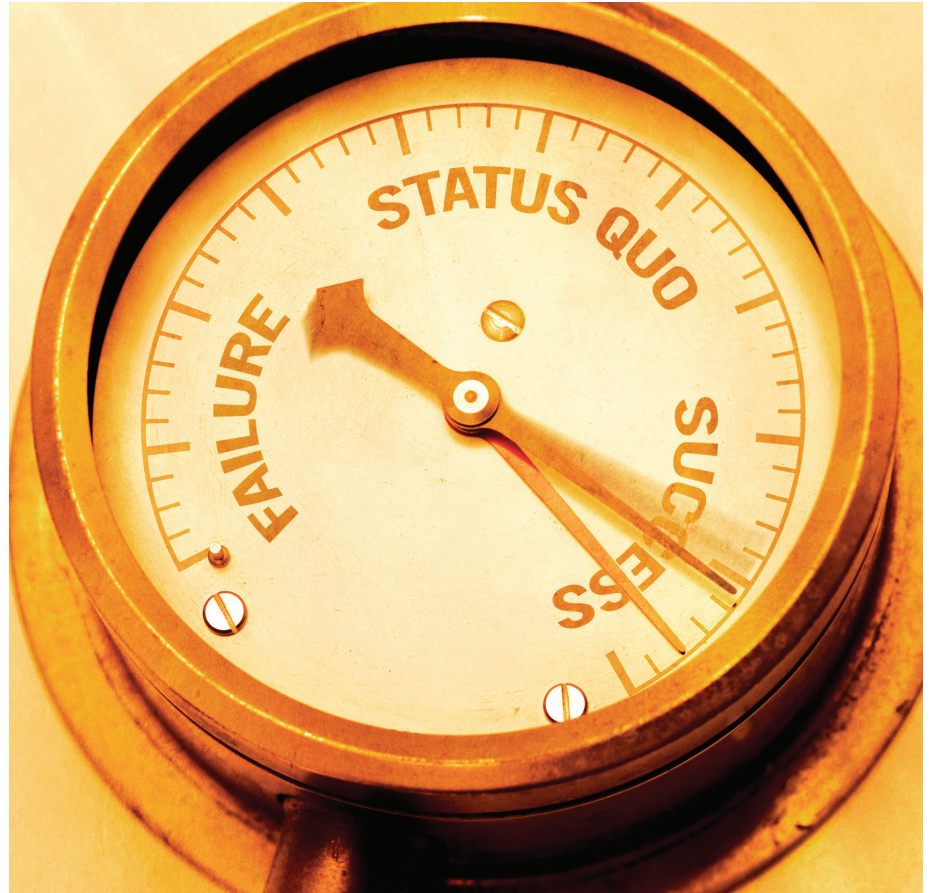
This is how managers deal with a trip from New York City to San Francisco. How comfortable are you with the engineering approach versus the management approach? Since managers and leaders are often more interested in being effective, they have to conclude that any of the four paths is "right." Within certain limits, all four routes will deliver minimum fuel consumption, but which one will deliver the lowest is no longer the only question. Any of the four will satisfy the manager's goal of being effective and arriving in San Francisco on a "minimum" amount of fuel. Regardless of which of the four paths is taken, the engineer in us will never know if the route taken was "optimum." The other three will never be taken and, therefore, we will never know for certain.

The engineer and the scientist are focused on being right and looking for the answer. The manager and the leader are focused on being effective and having an answer that works. These are two different worlds. Not only are they different ways of acting, they are different ways of thinking and being, as well.

Most engineers and scientists do not understand this as they embark on their transition to management. They are often doomed to management challenges and frustrations because they believe that, as managers, they must seek to be right; they must seek to find the right answer in a given management situation. Their managers want them to get the job done.

Asking Different Questions

There is one more important point that most engineers do not understand as they move into management. The questions asked by the engineer versus the manager regarding



a situation are different. For the engineer, the question is, "How do I drive from New York City to San Francisco on the least amount of gasoline?"

For the manager, the question is, "How do I drive from New York City to San Francisco knowing what I know and not knowing a lot of other parameters and still minimize my gasoline consumption with a level of probability significantly less than 100% while selecting a route that gets me to my destination?"

Engineers who are new managers don't usually change their "questions" when they become managers. They ask the same questions in the same way when they are managers as they did when they were engineers. Big mistake.

In the Final Analysis

The world of engineering is driven by an attempt to squeeze uncertainty and ambi-

guity out of a given situation. Management, on the other hand, accepts and embraces uncertainty and ambiguity in an attempt to achieve an outcome that can be arrived at via a number of different paths.

Engineers remove uncertainty as much as possible because that is what engineers do. Managers embrace a level of uncertainty and ambiguity because that is what managers do.

Which path can you walk with comfort?

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