1.5 Why we have trouble thinking complexity

There are several common “ways of thinking” that lead to inaccurate mental modeling of complex situations. Here are the top seven.

1. Our natural reflex when faced with something we don’t understand is to take it apart. Do you remember Descartes, analysis and the scientific method? Analysis breaks systems, and yet complexity emerges from the interconnection between variables. Complex situations and systems of variables need to be studied in their entirety.

2. We tend to have a narrow view of cause and effect. Ever since childhood we have acquired simple, one way, linear cause and effect thinking through easy to understand experiences. If you go outside in the rain without an umbrella, you get wet. If you touch a stove, you burn your hand. Causality is right here and now. Reasoning this way gives us an event-oriented view of the world where we look for a cause that is close by in both space and time. Have you ever noticed when you read the newspaper or watch the news that a lot of attention is given to individual events, news “chunks” and sound bites but not much time is spent explaining the background or the history behind the event? Events get our attention. In complex situations causes may come from an entirely different part of the system and may lie far back in time.

3. We tend to see causality in straight lines rather than in loops and prefer linear cause-and-effect theories to explain behavior. We see this straight line thinking whenever lists of factors or key variables are given to explain some phenomenon. Let’s test this out. What determines academic success? Most of us would write down a list of factors such as good teachers, good parenting, high motivation and a good classroom environment. But why stop at a list? Parenting may influence, motivation and the behavior of students in class, motivation and behavior may improve the quality of teaching, teaching may in turn effect motivation and we all know that motivated students create a great classroom environment. Causality exists in loops, not just in straight lines. Feedback loops are a key driver of complexity.

4. When we study a problem or a situation we tend to draw on our preferred area of expertise. In fact, our education has often encouraged this. Many school programs are divided into different subject matters, “tracks”, “majors” and specializations that favor the development and mastery of disciplinary expertise. Over time, we figure out the areas that we are “best at,” and then concentrate on these. We end up seeing the world divided into fields, some of which we like others which we avoid. The problem is that variables and relationships in complex situations may concern multiple disciplines. Let’s make one thing clear, though. We definitely need specialists. They help us understand causal mechanisms. However, relying on expertise reasoning alone discourages inter-disciplinary curiosity and leads to a narrow selection of variables to include in our mental models.

5. We prefer using quantitative data and often exclude non-physical, qualitative realities. Often our formal models only include things that we can measure and we exclude what we call “softer” variables, such as motivation, trust, knowledge and skills. Edward Deming, the father of the post-war production quality movement and strong advocate for the use of statistics and quantitative data in management recognized that “the most important figures that one needs for management are unknown or unknowable, but successful management must nevertheless take account of them”: customer satisfaction has a multiplier effect on sales, pride of workmanship, training, supervision and

teamwork between engineers, production, sales and the customer all effect quality and productivity. We will see that while some variables can't be measured, they can be quantified.

6. We tend to ignore that variables have levels that rise and fall over time. They accumulate and dissipate. As a result we have trouble anticipating delays and understanding non-linear relationships. These difficulties are so prevalent they have been given names such as "stock and flow failure" and "linear thinking".

7. We tend to avoid thinking about the unintended consequences or side effects of our actions. Think about the verbal phrase in English, to throw away. Where is "away"? In the world we live in there is no such thing as side-effects. There are only effects. There are no unintended consequences, there are only consequences. Recently the University of Vermont banned the sale of bottled water on its campus to reduce waste from single-use bottles. Researchers found that over the following year, single-use plastic bottle waste actually increased as students increased their consumption of other bottled beverages. We can again see here how using a mapping approach helps see, anticipate and possibly avoid problematic unintended consequences.

When confronting complexity we need to develop some new thinking habits. We will identify these in our next unit.