3.1 Levels, thresholds and tipping points

We have seen that complexity arises when people and things interconnect and interact. We need to add two more details to our picture of a system for it to be really complete: accumulations and nonlinearities. We will explore accumulations in this unit and nonlinearities in the next.

Accumulations are sometimes called stocks, levels or reservoirs. In our class we will use the word "stock". The word differs between the disciplines but the idea remains the same: the amount, quantity or level of a variable matters. Pause and think about this idea for a minute. How does the amount of money you have in your bank account influence your spending habits? How does the amount of love you feel for someone influence your behavior towards that person? How does your level of motivation influence how productive you are at work? And how does your weight influence your dieting and exercise behaviors? Each of these variables is a stock: it accumulates.

Let's illustrate why accumulations matter. Imagine you have just come back from a nice relaxing holiday, you are full of energy and bounce and someone speaks to you in a very unpleasant way. You look a little surprised and then smile and respond politely. If the same thing happens a few months later after you have been working hard and are feeling exhausted, do you think you would react the same way? Probably not! The only difference here is your level of energy. When your energy level is full, your reaction is different to when it is empty. Your level of energy is a stock.

Accumulations of things, whether they be physical in nature, such as populations of people, reservoirs of water, piles of cash or cubic meters of air pollution or non-physical such as product quality, anger, hunger, self-esteem, commitment and trust all lie at the heart of systems.

Business managers unknowingly spend most of their time managing stocks. When they take decisions to increase market share, shareholder value or share price, or improve brand image and staff morale they are in fact managing stocks. All balance sheet items are stocks: debts, assets and equity all accumulate over time.

Of course, not all variables accumulate. The trick is identifying the variables that do and those that don't. Stocks can be measured at a point in time; they are not measured over time. For example, the number of cookies in your stomach are a stock, but the number of cookies you ate this past hour are not.

Ok, but why should we care about stocks? Well, there are always stocks inside our systemic structures and their level will determine the way the system functions.

For example, imagine you are driving to work on a crowded highway, you are running late and someone pulls out in front of you and cuts you off. That's annoying, right? We can show this as part of a feedback loop.

Your reaction will depend to a large extent on your own state of mind at the time. If you were feeling calm and relaxed and your stress level was low, then you may let this event go by without reacting. If you were already feeling stressed then this action may be just enough to make you react a little violently. In fact, researchers have found that road rage is often a response to the stresses of urban living.

What is important here is your level of stress. If it is low, then your reaction will be different than if it is high. There is a threshold level. When we reach and go beyond that level we say that we have been "pushed too far", "pushed over the brink" or "enough is enough!" It's the "straw that breaks the

camel's back", or as the French would say "the drop that makes the vase overflow". In some systems, such a level may be a tipping point, beyond which a significant and often unstoppable effect or change takes place. We've all heard of people "snapping" at some point, right?

We can show this accumulation in our systemic structure as a box, filling up like a bathtub or a reservoir with more and more stressful experiences and emptying with stress relieving experiences. The inflows and outflows into the stock are drawn as a pipe and tap. The stock acts as a buffer to any outside shocks or actions. The time it takes the stock to reach a critical or threshold level may create delays in a systemic structure.

By describing stress as a stock we can now see that annoying driving behaviors don't determine our reaction as we previously thought, but rather they contribute to increasing our level of stress. It is not the stressful event itself that provokes a violent reaction, but rather the level of our stock of stress.

We can represent the relationship between the level of stress and the strength of the reaction on a chart. If we plot the cause, "level of stress" on the horizontal axis and the effect, "strength of reaction" on the vertical axis, we can see that the relationship between the two variables takes on an "S" shape: the strength of reaction remains low until you reach a level of stress where it rapidly increases. This point is a threshold where you say "enough is enough". This is a non-linear relationship which simply means that it cannot be drawn as a straight line.

Once we identify the key stocks in our system, we are getting at the heart of causality. This is operational thinking at work. The next step is to understand how different levels of a stock affect its relationships with other variables within a systemic structure. We'll explore this further in our next unit.