2.7   Putting the pieces together: multi-loop structures

Complex, difficult to understand behavior emerges out of the combination of reinforcing and balancing feedback loops. The effects of a change in one variable cascade through tangles of interconnected loops, positively or negatively feeding back into the same variable. If there is a time delay between the causes and the effects then it becomes almost impossible to predict outcomes as we won't know whether an effect will be dampened before it has had the chance to get amplified or not.

When positive and negative loops are combined, a variety of patterns are possible. The most commonly observed pattern is an s-shaped curve where a positive feedback loop leads to initial exponential growth, and then a negative feedback loop takes over and dampens the growth.

Let's take an example from the news. I found this article on bloomberg.com entitled "Netflix Plunges on Forecast for Weakening Subscriber Growth". Netflix is an Internet television company that is today present in 190 countries and makes money by selling subscriptions to streamed proprietary and third party content. We can see from this chart taken from the article that growth in the company's subscriber base has increased strongly since June 2014 as the company continued to expand internationally.

Netflix has driven its growth through strong marketing actions that account for around 12% of revenues per year. We can draw the reinforcing loop behind this growth: the performance variable is "new subscribers" and the growing action is "marketing actions". We should perhaps include an intermediate variable to show that marketing actions are funded with "revenues" generated through subscriptions. This loop is the main engine that drives growth and it is a good starting point for our modeling.

The company also uses revenues to partially finance the production of content, such as television series and full-length movies. In its Q1 2016 letter de shareholders the company explained that it is "investing about 5% of our cash content budget in original films". We can draw a link from "revenues" to a new variable called "exclusive content". Popular content such as "House of Cards" and "Orange is the new black" that can only be seen on Netflix has increased the appeal of its services and driven new subscriptions. We can show this as a link from "exclusive content" to "new subscriptions". As it takes time to write and produce new content there is a time delay along this link. There are now two loops. The second loop is also a reinforcing loop. We can see its reinforcing action when we walk through the loop and tell its story. As revenues increase, more investment can be made into new exclusive content which after a short delay increases new subscriptions and revenues. An increase in revenues feeds back to increase revenues even more. If you are not sure whether a loop is a reinforcing or balancing loop then you simply need to count the number of negative polarities. If there is an odd number, it is a balancing loop otherwise it is a reinforcing loop.

Netflix recently forecast a 50% fall in the recruitment of new international subscribers for the second quarter of 2016. According to the article, the company hasn't reached its full potential in a number of countries as TV shows and movies aren't available in local languages. Payment methods are also limited to international credit cards. The company admits that it has "lots of work to do to make Netflix more relevant market by market".

What could explain the fall in recruitment of new subscribers? One explanation is that as the company recruits new subscribers and increases its subscriber base and market share, it becomes

harder and harder to recruit new customers. The size of the market acts as a limit towards which the company's subscriber base tends. Here the market size is the number of households in each overseas market that is interested in watching streamed content in English. This limiting, goal-seeking behavior is typical of a balancing loop that we can now add to our model. We can count an odd number of polarities in the loop which means that any increase in a variable feeds back to be counterbalanced by a decrease in that same variable.

When growth slows, levels off and then falls, we know that loop dominance has shifted from the reinforcing loop to the balancing loop. This looks to have happened at the end of Q1 2016.

The company also acknowledged that it faced increasing competition from other streaming services such as Amazon's recently announced Prime Video service. As a market grows, other competitors are attracted to the market and compete for market share. We can add this second balancing loop to our model.

The difficulties that Netflix is facing can be described with four loops: two reinforcing loops that drive growth and two balancing loops that are slowing the company's expansion. A manager's job is not just to keep the reinforcing loops turning, but it also involves identifying the negative feedback loops that are acting as brakes on growth and finding ways of weakening or eliminating their influence.