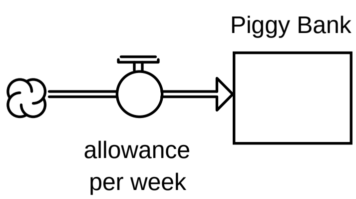
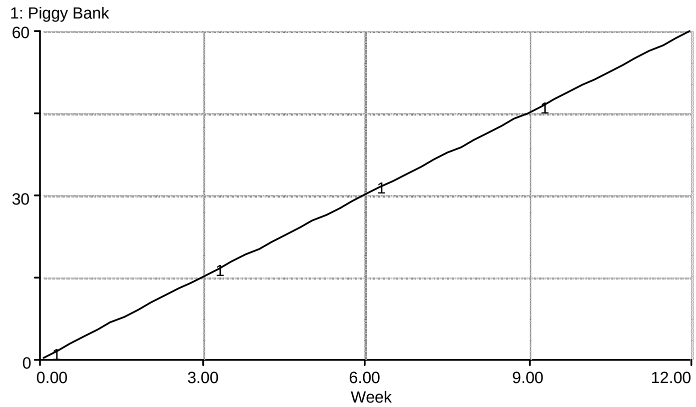
Generic Processes I:
Models Producing Linear Behavior[1]

Generic models usually have fairly simple diagram structures producing a common behavior pattern that is observed in many different situations. By examining the behavior pattern of a specific system and remembering the behavior pattern shown by different types of generic models, we can find clues about the type of model structure needed to represent some new system in which we are interested.

In this first simple model structure there is a stock and a flow, pointing toward or away from the stock. The most important characteristic of this structure type is that the stock value either increases or decreases by a constant value each time period. A typical model of this type is shown:



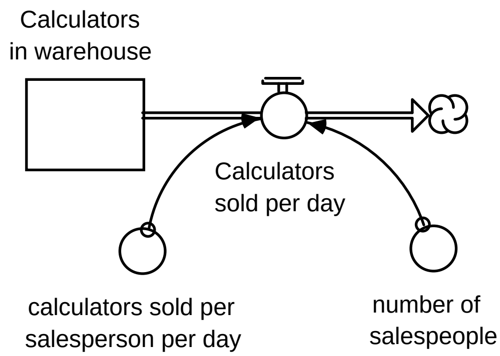


1. The name of this type of model is derived from the shape of the graph. Explain why this generic model produces linear behavior.

In order for a model to be linear, the *rate of change* of the quantity in the stock must be constant. The stock can be increasing or decreasing over time, but it must be changing at a steady and unvarying pace.

[1] This lesson was written by Eileen Rogers.

2. An example of a linear decreasing model could be inventory in a warehouse that ships the same number of items each day. We will assume that this warehouse is going out of business, so no new calculators are being sent to the warehouse.



2(a). Notice that this model has additional components shown as converters. Based on the titles of the converters, *write the equation* that must have been used to calculate the *flow* value in this model. Be sure to include appropriate units.

2(b). Build this model. Set the initial number of calculators to 10,000 {calculators}. Assume there are 20 {salespersons} members of the sales staff and that they each sell 15 {calculators per salesperson per day}. Set the lower limit of the graph to 0 and the upper limit to 20,000. Use Run Specs to set the simulation time to 30 days. *Make a graph* showing the value of the calculators in the warehouse over time.

2(c). How many calculators were left in inventory on the 11th day?

2(d). Now, change your model slightly. A recession has hit and the salespeople can only sell five calculators each day. (Assume for the time being that nobody gets laid off.) Keeping everything else the same (that is, start with 10,000 calculators in the warehouse and 20 salespersons), run the model again and look at the new graph.

How does this new graph differ from the graph produced in 2(b) above? Explain why this difference exists.

2(e). Change the scenario one more time. This time, consider a factory that starts with 20,000 calculators and a sales staff of 20 who each sell 15 calculators a day. What is the major difference between this graph and your first graph?

2(f). Which part of a linear STELLA model determines the "steepness" of the graph of the stock value?

2(g). Which part of the STELLA model determines where the graph will touch the vertical axis?