

S-Curves

Written by Konstantin Balashov

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Short-term curves are mostly linear, but on the long run they all S-shaped.

Examples? Sure! Airplane speed since 1903, animal population size in a new area, your salary...

Why do you need to understand why? To plan your future strategically.

When system has plenty of resources, and the goal is growth, system expands exponentially. Why? Do you remember the story about a Millionaire? He got an apple, sold it, purchased two, sold them purchased four, and so on,

then his grandma died, and he inherited some millions.

Suppose, he did not have a grandma. Series of 1-2-4-8-16 is, in fact, exponential function



Figure 1. Let's pretend, this is exponential function (not really, but close enough). X axis is

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time, Y - some
quantification of system development level.

It is hard to find perfect exponential growth, just like perfect motion without friction. However, some real curves go up quite steep. Going up cannot last forever. You either run out of cheap apples, or people fed up and demand a discount, and growth slows down.

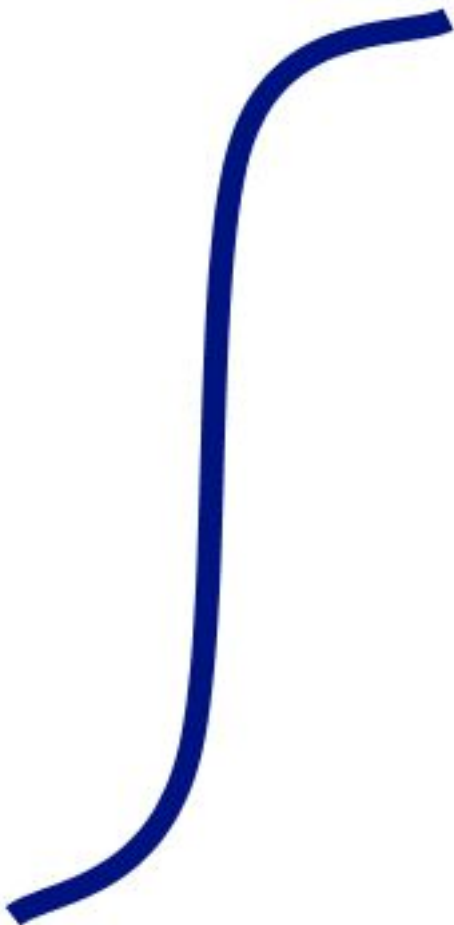


Figure 2. S-curve, somewhat similar to letter S

Finally, system starts to degrade (It is not cool to sell apples for no profit or even loss)

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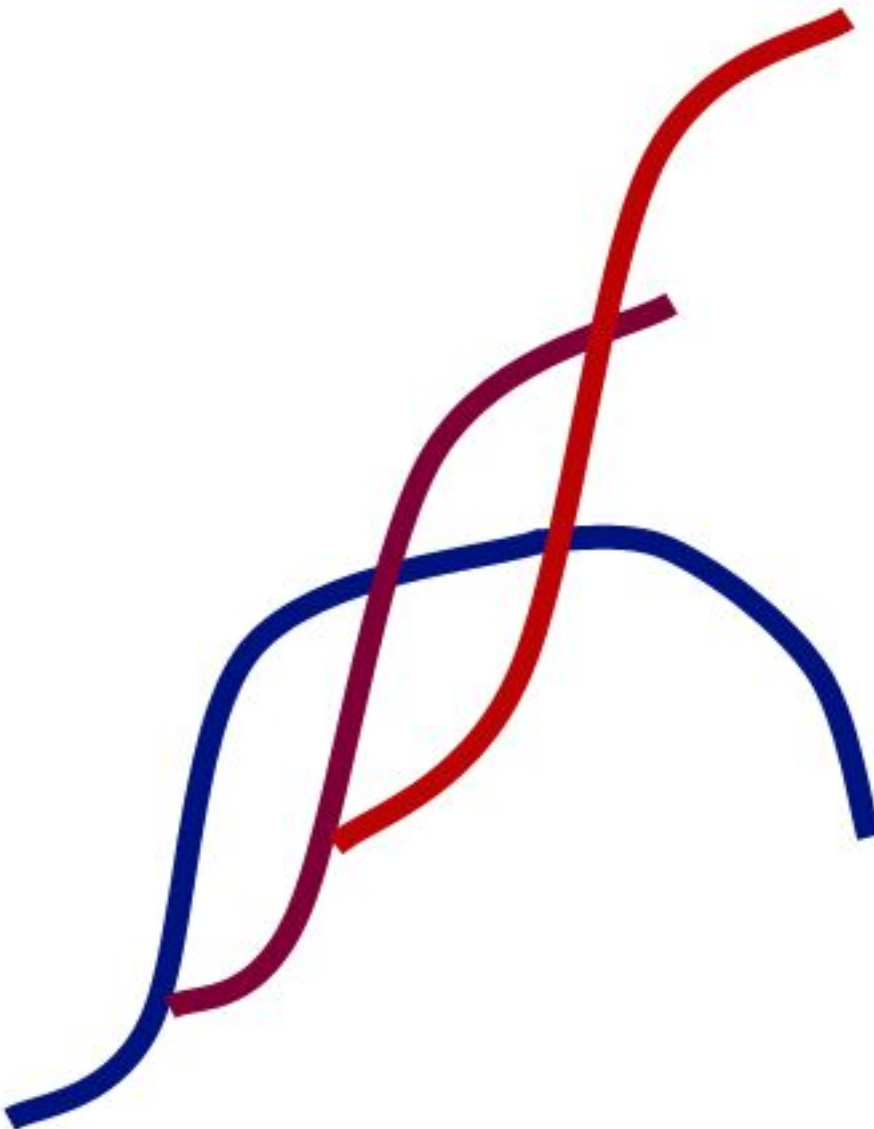
In a real life, resources run out not because they are get used by the system, but rather because a new system show up and outperform and outcompete the old one.

This new system initially less efficient (like first steamers were slower that sail boats, first transistors were slower than vacuum tubes).

After while it becomes more efficient and displaces the old one.

Displacement (and bend of S-curve) is caused by lack of resources.

When there is no shortage of resources, both curves go up together.



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Figure 3. S-curves displacement

How it looks like in a real life? There are few successful systems, and many dead-ends.

Dead-ends are the blue curves on figure 4.

Red envelope curve is level of industry development. On the short run it looks linear, but on the long run it has S-shape too.

For instance, envelope curve for computer performance covers cogwheels-relays-vacuum tubes-transistors-microchips-microprocessors, and still goes up exponentially.

There are many speculations about Moore law future. Of course, the curve will bend at some point, the only question is - when?

The other way around, each S-curve is just an envelope for lower level curves.

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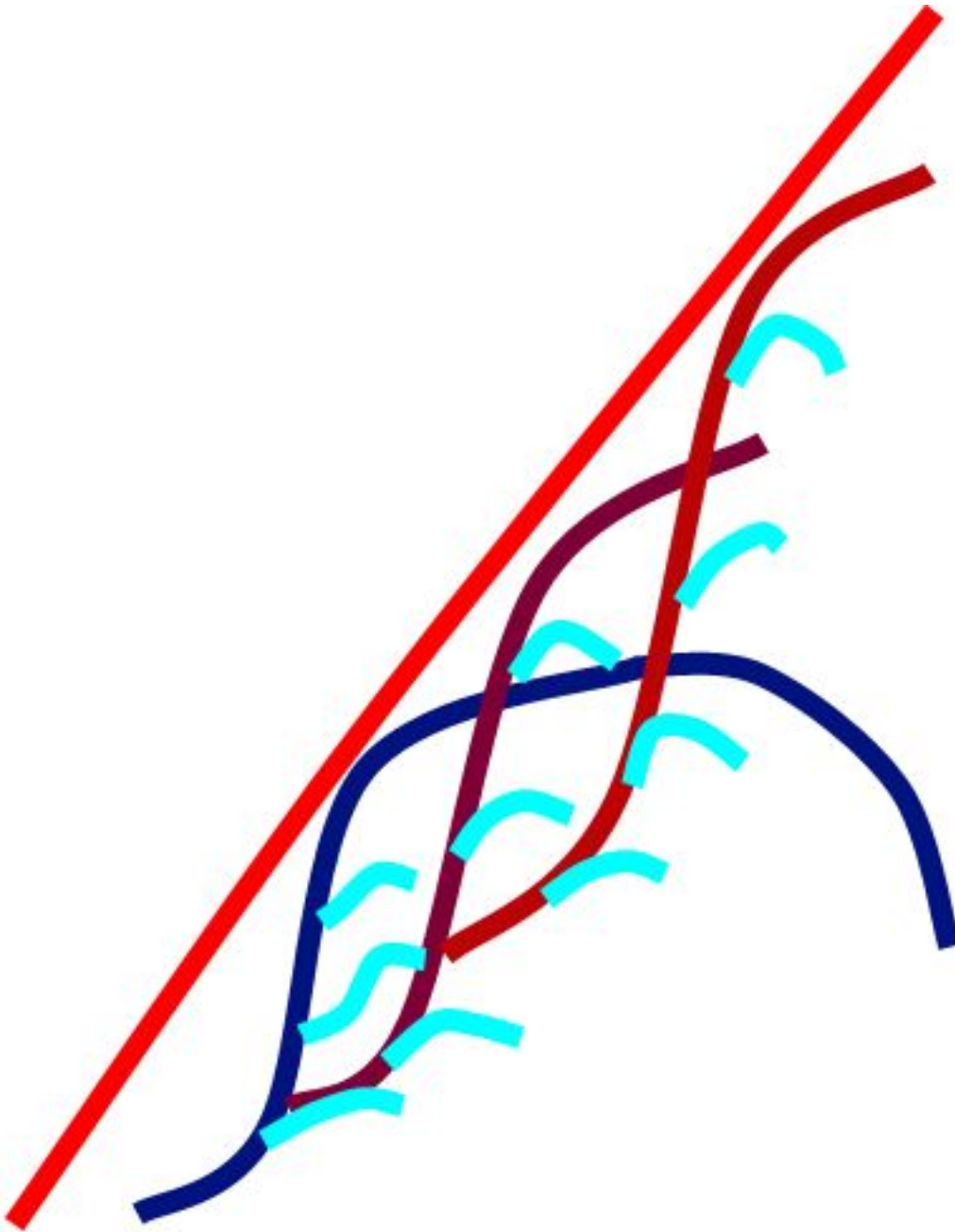


Figure 4. Dead-end S-curves and envelope curve