

# The S-Curves of Sinks, and Technology

*by Espen Andersen*

Joe Speyer <<http://www.advance.uconn.edu/1998/981013/10139803.htm>> was the father of a friend of mine and a great character. A chemistry professor at the University of Connecticut, he was, reportedly, famous for asking tricky questions of students wanting to take his class. One question, for instance, was "what would happen if you took a large bucket of water and poured it into the toilet bowl?" For all their mathematical or scientific learning, many students had not figured out how a toilet worked. This was not because they couldn't understand it -- it is not **that** hard -- but because it never had occurred to them to look into how a toilet works. Why is the water level where it -- indeed, why is there water in the toilet bowl in the first place? And how come the drainpipe has that funny S shape -- under the sink as well?

The reason I am thinking about toilets at the moment is that a few days ago I was teaching a class on basic strategic management. I had asked the students, as an assignment, to analyze the market for inkjet printers. In this market, as anyone with a cheap printer knows, the HPs and Lexmarks of the world give away the printers and fleece you on the ink cartridges. The students were asked to investigate what options the inkjet manufacturers had in protecting this rather profitable racket -- after all, it is color ink that keeps HP in the black, if you pardon the pun.

When it came time to discuss the assignment in class, my first question was "Now, how does an inkjet printer work?"

It turned out that out of a class of about 130 students at a master level in business, only 3-4 had bothered to look into how inkjet technology works, and none of them had thought about what it was about the technology that enabled the companies to follow such a strategy. After all, Laserjet printers don't operate on the same business model: In that market you pay a much higher price for the printer, and much less (at least per page printed) for the ink (or, more precisely, powder.)

The answer lies in that inkjet printers (or, at least most of them) spit heated ink onto paper through many tiny holes. Each hole is addressable and controlled by a tiny chip which connects to the printer itself through a proprietary interface. There are no moving parts, and the holes are liable to clogging with increased use. The laser printer, on the other hand, has a rotating, light-sensitive drum in the printer itself, which picks up ink powder a precisely directed laser beam has been shone on it -- or more specifically, on the areas of the drum that is supposed to pick up the ink. The ink is then transferred to the paper, heated to make it sink into the paper fibers, and you have a printed page. (This is rather nicely explained at [www.howstuffworks.com](http://www.howstuffworks.com))

The upshot is that for inkjet printers, the printing technology itself is very cheap and can be put on the ink cartridge. That is not possible, or at least not economically viable, on a laser printer, since the light-sensitive drum is large, expensive and has many moving parts. Consequently, a laser cartridge is really not much more than an ink container, whereas the inkjet cartridge, at least in principle, **is** the printer itself.

The inkjet print head is hard to copy, lends itself to (in most people's and increasingly in the courts opinion, misguided) intellectual property protection, and to

endless product variation. Once constructed, it is very cheap to produce, and you can play the Gillette give-away-the-razor-and-rake-it-in-on-the-blades strategy. (Or, for that matter, the elevator and elevator maintenance game.)

Now, you might have many quibbles with both my description of the technology and my conclusions about its importance for business strategy analytics. There are inkjet cartridges where the chip is not on the cartridge, but in the printer, and there are experiments with throwaway light drums in lasers. The pricing model in the laser market may be an artifact of the more sophisticated demand of the customers (laser tend to be bought by businesses, who look more closely at operating costs than first investment) or because the first laser printers were very expensive and the razor-and-blade model never took hold. But that is not my point.

My point is that, even for someone without knowledge of the inkjet market itself, it would be very easy to understand the underlying dynamics of the market if he or she understood how the technology worked. The attractive business model of the inkjet market is tufted on some rather precarious technological assumptions -- one of them being that it is too hard to create a cheap and long-lasting print head, sell the printer at a decent rather than subsidized price, and start to compete on operating cost. After all, color lasers are now down at \$500 and various courts around the world are eyeing the hook'em now, fleec'e'm later inkjet strategy with critical eyes.

Anyway, leave that be. Why had nobody even asked themselves the question - how does a printer work, anyway? I was surprised enough that I asked the students how many of them knew why the drainpipe under the sink has an "S-curve" in it. About 10 out of 140 students dared raise their hands, and some of them thought it was because this was a convenient trap for small and valuable lost items, such as jewelry. Less than 3% of the students knew the real reason why there is a curve.

(I, naturally, assume the august readers of this worthy publication know this, but just in case: The curve in the drainpipe is there to block the smell of sewage. The water trapped in the curved part of the pipe blocks air passage, and is continually refreshed every time we run water in the sink or flush the toilet. If you want to appreciate the importance of this feature, try scooping out the water from the toilet bowl, or go on a three-week summer holiday, enough time to let the water in the toilet bowl evaporate...)

Anyway, during a break in the lecture I went for a coffee, and mentioned the incident to a colleague. He said he once had taught a marketing class, where the problem discussed was how it was hard to sell microwave ovens when the technology was new. Consumers were reluctant to use microwave ovens because they thought the "rays" could harm them. The students snickered at this, so he asked "so, how does a microwave work?" None of the students knew.

(Of course, again, I assume you know. If not, the short explanation is that a microwave works by sending electromagnetic microwaves into food. The waves (by changing the magnetic polarization) excites the water and fat molecules -- essentially shaking them very fast. And heat is, by definition, moving molecules. The microwaves do not escape the microwave because it is lined with metal (a "Faraday cage" which traps the magnetism) and because there is a switch that turns off the power when you open the door.

Nobody can understand how all technology works. But it always surprises me how so many people can go through life in delightful ignorance, not only unaware of why their car moves forward or there is sound in the radio, but not even being curious about it. It is not hard to find out how things work. Gone are the days of wiring diagrams and complex mathematical formulae. You can find excellent explanations, helpful graphics and animation schemes describing how many common technologies work.

But no. People want to press a button and just have it done. And therein lies the problem. If you don't know how things work, you don't know what is hard. So you invest in natural language systems (speech recognition has been a promising technology for 30 years) or systems that can predict the stock market. Or you go out and spend a fortune on pyramid schemes or magnet therapy. And wander through life, "mouth agape in doltish wonder," to quote Paul Fussell.

Dorothy Parker said: "The cure for boredom is curiosity. There is no cure for curiosity." The problem is that not enough people suffer from curiosity, but instead accept the world as it is, without wondering (and, eventually, learning) how it really works.

That being said, my wife has a knitting machine, and I cannot for the life of me figure out how it works...

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