



Laws of Exponential Growth

Technology, Privacy, and eCommerce



Lawyers learn the law in law school. But “the law” is limited in scope. Many laws exist beyond the confines of the civil and criminal codes. The laws of physics and arithmetic predate the laws of man and largely drive the laws of technology with which lawyers should become familiar.

Moore’s law is widely recognized. The number of transistors in a dense integrated circuit doubles approximately every two years. In the popular consciousness, Moore’s law tends to be understood to stand for the exponential growth of computing power. Computing power is not alone.

Koomey’s law holds that the amount of battery required for a fixed computing load will fall by a factor of two every year and a half. Kryder’s law projects the exponential decrease in storage costs due to rapid increases in magnetic storage, which drives densities. Nielsen’s law posits that connection speeds double every 21 months. And Metcalfe’s law states that the value of a telecommunications network is proportional to the square of the number of connected users of the system — i.e., the value of the network multiplies with each additional participant (think Facebook, Twitter, Instagram).

In short, the laws of technology paint a picture of world with more powerful computers (Moore) that require less battery (Koomey) to communicate across faster (Nielsen) and therefore more valuable (Metcalfe) networks to generate ever more information that gets cheaper and cheaper to store (Kryder). Sound familiar? Consider that today’s average law school graduate would not have been able to get an iPhone when they entered college because the first iPhone went on sale in June 2007.

None of these laws of technology are inviolate, nor will they hold forever. But they are the foundation of a world that is progressing in ways that are often hard to comprehend, let alone appreciate. And they project a future where technology increasingly augments human work, if not substitutes for it entirely. Indeed, talk of the virtues of using technology to leverage existing talent is based on the

implicit comparison to a world where the only option to increase output is to add headcount. The advantages of technology over headcount begin with Brooks' law.

Brooks' law, in its most succinct form, observes that "Nine women can't make a baby in one month." That is, there is a certain point at which complex endeavors — gestation, programming, lawyering — are too difficult to divide and delegate as discrete tasks. The concept comes from *The Mythical Man-Month* in which the eponymous Fred Brooks detailed how increasing headcount can result in negative returns (i.e., adding manpower to a late project makes it later).

Ramp-up time is the first pillar of Brooks' law and comports with the lived experience of most lawyers. The deeper into a case or transaction, the more labor intensive it is to bring a new person up-to-speed. Often it is more efficient for the people with the complete picture to work overtime on a project than it is to add a new team member. But even where ramp-up time can be minimized, additional headcount increases coordination costs.

Where Metcalfe and his law speak to the increased value each node brings to a telecommunications network, Brooks' law looks at same combinatorial explosion as a productivity-limiting factor for a working unit. The single person law department has zero internal communication channels. The two person department has one communication channel (A-B). The three-person department has three communication channels (A-B, B-C, C-A). With a five-person department, the number of channels hits 10. At 10 people, its 45 channels, and at 50 people, its 1,225 communications channels. While the growth isn't quite exponential (technically, it's a polynomial), it is explosive. Each additional person makes it harder to communicate and therefore harder to collaborate. This overhead is one reason that a department can often realize more gains from increasing the productivity of existing personnel than adding headcount.

Productivity gains do not need to be driven by improved efficiency. People can work harder or longer. But there are physical and psychological limits on how much harder and longer a human person can work. Computers, too, have limitations. But, unlike the static capacity of carbon-based lifeforms, the scope and strength of silicon keep expanding at the same time that it becomes less expensive. The case for adding technology rather than people to your legal department will therefore become more compelling as technology improves and humans don't.

In my next column, I will explain why the foregoing can lead to an overly-simplistic worldview where too much money is wasted on technology.

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