



A City Hall rally to support a limit to the number of Uber drivers on the streets of New York City, on July 20, 2015. (Photo by Spencer Platt/Getty Images)

FROM ATOMS TO BITS TO ATOMS: FRICTION ON THE PATHWAY TO THE DIGITAL FUTURE

The maturation of the IT Revolution is best measured by the radical, discontinuous decline in the cost of digitizing hitherto physical processes into computer algorithms. That reduction in cost is not only calculable in time and money. Perhaps most important, the need to “think like a computer” in order for a user to make the computer run a program has disappeared, as computing resources have become ever more abundant, enabling more and more software layers of abstraction to insulate users from the digital hardware by creating an ever more accessible environment.

The decline in such frictions not only benefits users. The combination of free, open source software and rentable cloud computing resources has also reduced the cost of developing digital services. These services now span an ever-growing range: from information discovery and retrieval through purchases of all manner of consumer goods to 3D-prototyping, by way of an array of two-way marketplaces exemplified by Uber and Airbnb. In each case, work previously done by human beings in physical space has been transformed into coded instructions executed by a digital machine.

When a search is conducted on Google, the work of finding relevant information by consulting physical repositories of information, with or without the additional work of a librarian, has been replaced: atoms have become bits. When a consumer buys a book on Amazon, massive economies of scale are deployed to reduce the aggregate work previously distributed across multiple supply chains: atoms have become bits. When a designer uses a software program to specify the characteristics of a prototype for submission to a 3D printer, the work of hand-crafting a model has been replaced: atoms have become bits. When one of many customers requests transportation through Uber or overnight accommodation through Airbnb and the request is fulfilled by one of many possible suppliers, the work of matching demand and supply has been radically reduced: atoms have become bits.

To the extent that delivery of the service remains within the digital domain, consumption of the service is as technically free of friction as its development and deployment. And this friction-free mode of consumption is most likely to be available when the speed and ease of service delivery for the consumer is so much greater than the existing version that essentially it represents an entirely new service.

Such is a Google search, for example, compared with visiting a library or the exchange of text messages versus postcards or the enjoyment of digital entertainment. But these examples should suggest immediate caveats. The Great Fire Wall of China demonstrates

that restrictions on digitally delivered services can be imposed by political authority. And, in order that consumption of digital entertainment be rendered as easy as touching a screen, years of litigation followed by years of negotiation were required.

The latter example demonstrates the fundamental point. To the extent that the digital service disrupts an existing service delivered through conventional means, its providers are bound to encounter frictions of all sorts. The return to the disrupters will be constrained by failure to recognize and negotiate these impediments. To the extent that the service is delivered beyond the digital domain and “virtual space” becomes geographically local, bits are converted back to atoms and frictions are bound to exist.

Purchased car rides and rented overnight beds, for example, have each accreted an eco-system of practices through generations, even centuries. And the frictions generated within each eco-system will be as disparate as is each local distribution of economic and political power and each local set of social and cultural norms:

- Economic Frictions: Just because each local market is subject to the same disruptive competition does not mean that existing service providers will be displaced with equal ease. In relatively more concentrated markets, for example, oligopolistic service providers have more to lose and greater resources with which to resist.
- Regulatory Frictions: Market imperfections are more resistant to competitive disruption when they have been embedded in regulations. But by no means are all such regulations the result of greedy rent-seekers co-opting the political process for their own advantage. There are evident social benefits that explain why taxi drivers should be specially licensed and required to carry more insurance and why hotel operators should be required to meet fire regulations.
- Cultural Frictions: A prime example is represented by the extreme range of responses to Uber’s penetration of different local markets reflected in the extent to which it is subject to regulatory restrictions, up to and including outright bans. The most strategically important of all potential frictions lies in the grey area surrounding the status of an individual service provider, from independent contractor to full-time employee. Resolution of that uncertainty case-by-case is a function of cultural values embedded in historical legal doctrine and current political pressures, as well as the balance of economic interest and resource.

Thus, speed bumps are encountered on the way to the fully digital future, speed bumps that represent history asserting itself. This is where the technically brilliant and innovative founders of the digital services are at a serious disadvantage. It is understandable that those who know they are inventing the future should have minimal, if any, concern for understanding what has gone before. Taking seriously the historical evolution of taxi or hotel regulations may appear as irrelevant to a digital disrupter as would mastering the Ptolemaic model of the universe to a 21st century cosmologist. But ignoring them may carry very large costs.

Multi-billion dollar valuations of “Unicorn” digital service providers with no stated intention (and limited likelihood) of achieving profitability in the foreseeable future have become common, rationalized by the potential to dominate an incalculably large market. But these valuations eventually will require rationalization in traditional terms, through calculation of net present value by discounting expected future cash flows. In this model, the rate at which those future cash flows are discounted and the time over which they are discounted matter as much as the magnitude of the future cash flows themselves.

Any incremental uncertainty in this calculus expresses itself in a higher discount rate, reducing the net present value of the same future cash flow. Any extension of the time over which future cash flows will be realized also expresses itself in a lower net present value. The existence of frictions when bits are turned back into atoms necessarily adds uncertainty and delays realization. And the consequences are cumulative: the higher the discount rate the greater the cost of delay. Thus, \$10 to be received 3 years hence is worth \$6.58 today at 15% and only \$5.79 at 20%. If it is not expected to be received for one additional year, at 15% the present value drops to \$5.72 and at 20% to \$4.82.

Of course, this fine calculation of net present value is profoundly misleading. Valuing ventures at the frontier involves layers of uncertainty which are overcome, in the first instance (if they are overcome at all), by a collective willed suspension of disbelief otherwise known as a “bubble.”

I have examined the Unicorn Bubble at some length, an unprecedented phenomenon as institutional investors put valuations on private companies above those of comparable public companies without access to the liquidity offered by the public equity market: <http://www.forbes.com/sites/valleyvoices/2015/05/28/unicorns-why-this-bubble-is-different/>. Here, the point is this: the Unicorn Bubble is not only threatened, as every bubble is, by the inevitable increase in the supply of wannabe Unicorns. It is also threatened by cumulative evidence that realization of the incalculable returns from digitizing the economy of atoms is subject to impediments that are literally mundane, the frictions of the economic, political and cultural world that exists and has existed and will exist.

The most successful digital disrupters have come to recognize this, sometimes the hard way. To achieve their potential growth and ultimate profitability depends on taking these impediments seriously and learning how to address them effectively. Unfortunately for those who believe we have entered a libertarian golden age, freed by digital technology from traditional constraints on market behavior, firms successful in disrupting the old physical economy will need to have as a core competency the ability to manage the political and cultural elements of the eco-systems in which they operate, as well as the purely economic ones.

They would do well to consider the history of the American telephone industry, which passed through a stormy and destructively competitive maturation, characterized by fierce contention with local, state and federal authorities, until in 1913 Theodore Vail negotiated the settlement that ratified ATT’s unique place in the American political economy. Vail’s successful reading of the contending interests and forces - cultural and political as well as economic - established “Ma Bell” as the universal service provider and ATT’s Bell

Labs as a distinctively powerful engine of innovation for some 75 years. (See Robert MacDougall, *The People's Network: The Political Economy of the Telephone in the Gilded Age* [University of Pennsylvania Press, 2013]).

Today's valuations of Uber and Airbnb and many another Unicorn are not based on their proprietary technology. These valuations reflect the possibility of establishing a "natural monopoly," with consequent monopoly profits, based on business model and network effects not unlike that of ATT in telephony. As was the case with ATT, establishment and maintenance of such monopolies will depend on earning the tolerance of the stakeholders in the relevant eco-system.

In short, the longer term, sustainable value of those disrupters that succeed in closing the loop from atoms to bits and back to atoms will depend as much on successful application of lessons from the humanities (history, moral philosophy) and the social sciences (the political economy and sociology of markets) as to mastery of the STEM disciplines.

PUBLISHED JULY 30, 2015 ON FORBES.COM

