Timing Matters: Tackling Intractable Problems

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If you were at least five years old on 20 July 1969, then you know exactly where you were when Neil Armstrong became the first human to walk on the moon. With that act, America won the space race.

Safely going to and returning from the moon was a long-term goal that required solving a myriad of related technical problems. It took concerted resolve to overcome this heretofore intractable scientific problem of huge proportion, exemplifying James A. Michener’s astute observation: “There are no insoluble problems, only time-consuming ones.”

Taken collectively, Armstrong’s trip to the moon is a case study of applying the right solutions to the right problems at the right time.

Untimely Solutions
The real-estate adage is it’s all about location, location, location. For inventions, it’s all about timing. Unfortunately, solutions don’t always appear at the right time.

A crater near the moon’s north pole is named after Charles Babbage, an English Newtonian physicist and mathematician with a philosophical bent. Babbage conceived an “analytical engine” in 1876—and although it wasn’t constructed until after he passed away, this mechanical tool embraced all the concepts necessary to enable electronic data processing some six decades later. These concepts included the notion of programming.

A Babbage contemporary and collaborator, Augusta Ada King, was an equally gifted mathematician with a penchant for wine and betting on horses. She’s widely considered the first computer programmer, in an era predating stored programs in electronic computers. Although the overall solutions eventually proved right, they arose well before the problem was considered tractable. This, plus Babbage’s overbearing ways, led to skepticism among investors of the time. It was a premature solution to a problem whose value had yet to be established.

Untimely solutions are actually rather common. A way of detecting this phenomenon involves analyzing delayed article citations following an initial discovery. For example, radio astronomy became prominent in the 1940s, when amateur astronomer Grote Reber published his “radio maps” of the galaxy.

However, in 1933, Karl Jansky of Bell Telephone wrote that radio static emanating from space interfered with transatlantic telephone lines. At the time, most scientists dismissed the article, believing that space-borne signals were far too weak to affect cables. Beliefs in 1933 simply didn’t congeal with the otherwise accurate findings, accepted finally in 1944.

A more famous example of premature findings involves biology. Gregor Mendel discovered the particulate nature of heredity in 1865. Involving unconventional statistical techniques and notions contrary to existing beliefs on anatomy and physiology, this notion had to wait 35 years for rediscovery. After the turn of the century, microscopic evidence confirmed Mendel’s findings and use of statistics became commonplace in biology. Suddenly, Mendel’s discovery became widely cited and served to expand related concepts in biological journals.

These are vivid examples of the right solutions appearing at the wrong time. More recent examples include the field effect transistor invented in 1926, before the availability of silicon planer technology; sound on film invented in 1890, well before audio amplifiers; and MP3 technology prior to sufficient storage mechanisms. It’s also possible for new solutions to overtake former solutions. For example, GPS makes the trusty compass nearly obsolete and further relegates the sundial to the ancients. Likewise, the slide rule has joined the abacus among museum holdings as the digital
computer becomes ever smaller and more mobile.

**Post Moonwalk Innovation**
Smaller, more mobile computers represent yet another significant breakthrough. There can be no question that technology and the burgeoning social network revolution it has spawned are significant trends. Unlike Neil Armstrong’s lunar triumph, however, the nature of the underlying problem solving has changed dramatically. While the solutions are indeed timely, they’re no longer driven by a larger, long-term priority, as was the case in the race to the moon.

Rather, today’s tools have evolved from multiple short-term gains, largely governed over time by Moore’s Law. It’s relatively straightforward, in retrospect, to trace the emergence of mobile apps and social media based on the fits and startups of new companies over the past four decades. This history of post moonwalk innovation has been fueled by gains in free enterprise. Success and failure are often measured in a fickle short-term venture capital environment. There’s no end in sight, but there’s also no lofty goal on the horizon. As Marshall McLuhan noted: “We shape our tools, and forever there-after they shape us.”

**A New Approach**
Mark Newman’s new textbook, *Networks, An Introduction* (Oxford University Press, 2010), empirically classifies types of networks, ranging from technological and social networks to information and biological networks. Each type further decomposes into subcategories. The book then progresses into network theory, computational network algorithms, network models, and, finally, processes on networks. The processes section addresses network resilience, epidemiological behavior, network dynamics, and advanced search. As the book cascades deeper into the mathematical nature of networks, it revitalizes the formerly premature notion of graph theory and embodies concepts related to the newly emergent fields of complexity and chaos.

It’s doubtful such an insightful book could have been so masterfully compiled even a decade ago. It took the microminiaturization of technology, the expansion of shared memory and the emergence of network theory to allow such an extensive compendium. In fact, the recent explosion of insight into complexity, chaos, and networks couldn’t have caught fire had it not been for the evolution of technology.

In true “McLuhanesque” fashion, the technology has become essential to the exploitation of the phenomena it spawns. Moreover, the evolving technology clearly contrasts and challenges the Newtonian principles that have governed western scientific thinking for centuries. It opens up practical nondeterministic and nonreductionist views of irrefutable nonlinear realities. In so doing, it shows the way to new forms of algorithms that address significant and timely problems. Indeed, the technology we have spawned has opened doors to a new science that even greatly amplifies Stephen Wolfram’s declaration of a broad “new kind of science.”

Thus, while technology relentlessly moves forward, it changes forever the ways we view our world. Superficially, we’re increasingly global citizens of Facebook and technological advancement and its full implications. By making it our goal to overcome these problems over time, we can address them as scalable solutions emerge that don’t detract from fundamental societal rights and privileges.

More importantly, other network issues loom on the longer-term horizon that demand resolution and the commitment to follow through. Population growth threatens sustainable resources. Well under 1 percent of the earth’s water is renewable and potable, and the distribution of water is uneven and variable. Water sustainability becomes a catastrophic issue for two-thirds of the world population by 2025 and already exhibits chronic hot-spot problems.

Likewise, sufficient useful crop-land will fall short of sustainable levels by 2050. Air quality

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continues to deteriorate as pollutants continue to plague industrialized population centers. At any time, we sit on the cusp of a runaway epidemic and loss of good health worldwide. Global weather severity is worsening, whether it’s man-made or cyclic in nature. These issues, and many others, threaten global stability at best and survivability at worst. They require holistic yet still immediate, timely solutions. Our response thus far, however, brings to mind the old, cynical joke, “We solved our problem by noon and will work on world hunger after lunch.”

T he fact that we got a man on the moon by focusing on an intractable problem, bringing human ingenuity to bear, displays the art of “what is possible.” Thereafter, we freewheeled into a treasure trove of new knowledge and insight.

The grand challenge is whether we can harness our energies to resolve those intractable problems that realistically threaten human-kind. Einstein noted that we can’t solve the problems we face using the same kind of thinking used to create them. Again, Michener gently reminds: “There are no insoluble problems, only time-consuming ones.” And the clock is ticking.

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References

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