Let Global Public Play with Science

Abstract

Humanity should steer the future by making it practical for anyone and everyone to play, tinker and dream with science. The ability to play, dream and tinker with a number of sciences put the power of digital information technology (IT) in a large number of inspired hands and committed minds who could not help but deliver the bewildering changes that define our digital present – a present characterized by the flood of digital innovations that earlier generation would have surely labeled as miraculous.

While IT is the clear leader and has sprinted ahead on the shoulders of a few of the vast number of available sciences, it is now imperative to put the power of every other science also in the hands and minds of the global public so that the motivated and inspired can play, dream and tinker also with these sciences to unleash similar high volumes of ingenuity that can lead to exponential progress on humanity's most vexing and intransigent problems, ranging from water security and energy sufficiency to protection from earthquakes and hurricanes.

Access to this ability to play, dream and tinker with science must be global and unrestricted as intransigent challenges know no boundaries and do not come in only one version e.g. drinking water shortages have a markedly different profile in different locations and water shortage is only global in the sense that it occurs in many places around the globe. Simply speaking, the global differences are so many and exist in so many varied combinations that a custom remedy is the right answer for virtually every instance of the same-sounding intransigent challenge. As science is the only true constant because nature's rules don't change, making every science globally accessible in usable form is the prudent and only way to steer the future.

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Let Global Public Play with Science

"*War*," said Georges Clemenceau, France's President during World War I, "*is too serious a matter to entrust to military men*." In a similar vein, but not with the same exclusionary action that Clemenceau intended for the French military, science too has reached the summit that proclaims it as being too serious to entrust exclusively to scientists.

Science has undergone a paradigm shift in the last four decades. Prior to these times, science became the underpinning of a majority of human progress – in medicine, energy, water, agriculture, entertainment and more – mostly through the exclusive efforts of scientists and other closely related members of the scientific community. During the recent four decade period, however, after the sciences underpinning digital information technology (IT) were placed in the

hands of non-scientists, the kind of human progress these non-scientists unleashed is bewildering in impact, amount, scope and reach while also being orders of magnitude more significant than contributions from the scientific community to human progress in the same period.

The paradigm shift in science advancing human progress is in the inclusion of non-scientists to do the progress-expanding work that scientists were relied upon for ages: use science to make the world better and avoid potential catastrophes. Explaining why natural events happen and relating them to their causes is still firmly the purview of scientists and the scientific community.

This paradigm shift is huge in potential for its fuel is not just the narrow scientific community alone anymore but now includes the overwhelmingly hoards of untrained, unknown and uninitiated dreamers, mostly but not exclusively young, who through diligent efforts to realize their dreams have already trumped experts, experience, tenure, the rules of our parents and well-established and widely accepted thinking in many industries. The global public is firmly in the driving seat, as scientists were yesterday, of the charge to shape the future of human progress with science once they have in their hands nature's rules of consequence: what cause is responsible for a result and under what circumstances.

This paradigm shift of a global public creating humanity's future could be slowed but cannot be halted and must, in fact, be encouraged. Pandora's Information Technology (IT) box has been open far too long and gained so much global exposure and support, it is now impossible to shut down or limit in any way, by anyone, even any government entity. The IT juggernaut will continue in the foreseeable future to churn out more bewildering changes and impacts to more industries simply because more inspired minds continue to be added to those large numbers already playing and tinkering with IT to realize their unique dreams.

What's needed from the scientific community now is simple: Open Pandora's box of energy, food and every other science for the waiting hoards of dreamers chomping at the bit to assign challenges to the pages of history and to transform our world into one of their design and choosing.

How should humanity steer the future?
Humanity should steer the future by making it practical for the global public to play, dream and tinker with all sciences.

In the context of this essay
- *Future* refers not to a common circumstance or a single solution intended for everyone's use or otherwise determined to be in the best interest of everyone. Instead, *future* is about conquering the particular vexing and intransigent challenge that makes life better at an individual and personal level with the definition of "better" being the one in the eyes of

the individual seeking betterment. Thus, while it is easy to proclaim that drinking water sufficiency will lead to better lives for everyone if everyone everywhere can harvest water vapor from the air they breathe, it is more important and relevant to underpin each local solution on the sciences that can not only deliver safe water in the largest amounts but also comply with local economic, social and cultural norms that the local community wishes to prevail.

- Steering, the act that makes real a desired outcome, is the many millions of separate, individually initiated actions that move the ship of humanity to a better place. Like it was done for digital information technology, steering is only possible when a plethora of relevant sciences are readily accessible and usable so that the global pubic can choose between different sciences even when constrained by a single circumstance.
- Global Public refers to simply anyone and everyone, with the connotation that the less skills that are necessary to play with science, the easier it will be for everyone to make the future they desire happen and happen quickly e.g. everyone grows up with the knowledge that light travels in straight lines and when it cannot, then a darkened area (a shadow) appears. Shedding light where it is needed by rearranging whatever is blocking light falling where it is needed is an action virtually anyone over the age of ten can use to further the cause of having sufficient light
- Science is the name on the door of the closet within which humanity collects everything we know about consequences in nature: the cause(s) of a clearly visible result along with a definition of the circumstances under which a result is most assured and how this assurance changes as circumstances change,
- Playing is simply the act of trying different options. The broader the menu of sciences that can be accessed and used, the richer the play
- Humanity is not some third entity like a system or a policy or an organization; it is you the reader of this essay; me the writer of this essay; it is each of us without any plural connotation. Humanity's hands are your hands and mine. Humanity's mind is your mind and mine.

Steering the future with science reminds us of the words King George VI used on September 3, 1939 to boost morale and resolve of all his subjects in the global British Empire at Britain joining World War II: "*for the sake of all we hold dear …. the task will be hard … but we shall prevail*".

Foundational Change in Thinking
"*Insanity*" was defined by Albert Einstein as "*doing the same thing over and over again and expecting different results*." As this is truly the case, something different is required to herald and justify a rosy future instead of the proliferating doom and gloom prophecies. Luckily, the IT hoards that have so widely and globally transformed so much of our world for the better, point

the way to a foundational change in thinking: a change in the answer to a simple but age-old question that we still regularly ask: *"Whom and How to trust with Knowledge?"*

Humanity has struggled with this question for a long time. The first documented thinking on an answer to this question can be found in Nicolaus Copernicus' 1543 AD manuscript titled *De revolutionibus orbium coelestium* that justified his offer of an alternative model of the universe – a solar-centered universe – to replace Ptolemy's (circa AD 90-168) definition of our universe as an earth-centered universe. In this manuscript, Copernicus refers to the Pythagorean (circa 550 BC) philosophy that cautions "*Knowledge is too dangerous to entrust with the rabble of humanity.*"

Not surprisingly, this answer has controlled much of humanity's thinking for over 2500 years. However, occasionally and with some regularity, non-believers have surfaced, some with the profit motive in mind, others for recognition while still others wanted to make a difference in humanity's lot. A non-believer by the name of Thomas Edison, surfaced in 1890, who choosing "to stimulate countless innovations by others' liberally shared the science that made it possible for literally anyone to make, use or provide electricity to everyone else, while enriching the value of his patents and gaining worldwide recognition and attention.

Another non-believer who shared what science knows about how nature works was George Eastman: In the pursuit of profit, he manufactured a camera, The Brownie Camera, released in 1900, that transformed photography from an exclusive skill to every person's playful pastime.

The latest to see the value in sharing all research, including scientific research, with the global public is the University of California: In August 2013, the University announced it would "*give out its research for free.*"

Science is just life by another name for the global public
Popular stories involving apples aside, it was only 328 years ago when Newton stepped forward, in 1686, and became the first person to point out that gravity is a force and explained his ideas on how gravity works. 229 years later, Albert Einstein corrected Newton's views on gravity, 99 years ago, and showed that it really could not be a force and is, instead, the result of warping of *spacetime* which he defined as a unique union of *time* and of *space*. The whys and wherefores of this on-going scientific query only concern a few and are known to these select few of humanity: the scientists and researchers in those fields of science impacted by Einstein's *spacetime* concept.

The global public, meanwhile, has been comfortably dealing with gravity ever since the first of our modern human species – *Homo sapiens* – arrived on Earth, an estimated 200,000 years ago. In the nearly 199,675 years between *Homo sapiens'* arrival and Newton's stepping forward, the global pubic learned about gravity, not as a force, but as a natural occurrence where humans and

all other things fall down to the ground every opportunity they get. In fact, a human newborn figures this out as soon as it learns to walk. It is irrelevant and unnecessary to know why falling to the ground happens i.e. how does it matter to a global public if a force is responsible for dropping you to the ground or something called *spacetime* brings everything back to the ground.

Even the learned of their day – the scientists of earlier times – didn't worry why things dropped except that they always and predictably do.

Long before Newton's *Philosophiæ Naturalis Principia Mathematica* ("the Principia") was first published on 5 July 1687, learned individuals – the scientists of their day – were attempting, in their own ways, to better life using the dependable fact that things fall to the ground. Galileo Galilei, for example, with timekeeping on his mind in 1602, was studying how a weight swinging freely at the end of a rod (a pendulum) might be of help. It's interesting that a long time before Galileo got interested in pendulums, the common hunter-gatherer had figured out that the fact that everything ended up on the ground could be used to strike a prey from a distance and the same fact would enable more recent human sapiens to entertain themselves before an audience with a game of catch. While Galileo was struggling with weights and rod lengths, ordinary people had already figured out how far things could be thrown depending on weight and severity of intended damage.

The intent to study nature for humanity's benefit didn't, of course, begin with Galileo. The Chinese Han Dynasty scientist, Zang Heng, had developed, in the 1st century, a pendulum-like device to support the Emperor's command to protect his subjects from earthquakes. This urn-shaped device had a series of levers that when disturbed would release a small ball and orient its fall into one of eight receptors each representing the eight points of a compass. The receptacle the ball fell into indicated the direction in which the earthquake had originated. Zang Heng had figured out how to use gravity without knowing why it existed or how it worked by simply using the result it always caused.

There are even more examples from history of humanity – both science literate and illiterate – displaying such an amazingly wide range of ingenuity based solely upon a few results that nature continuously reminded them about. During the Renaissance, for example, Galileo's forbearers had large pendulums constructed for use as power sources to drive manual reciprocating machines such as saws, bellows, and pumps. Even Leonardo de Vinci had made many drawings of the motion of pendulums, without realizing its value in timekeeping.

As history clearly proves, humanity's drive for knowledge – especially that explains why nature works the way it does – was directed frequently to serve up ways to have better lives by figuring out how to protect from potential catastrophes or find ways to make life easier. The bottom line was always to use nature's offerings in ingenious ways that were remarkably different when they

came from different individuals. Imagine what remedies can result from 7 billion people passionately driven and playing with science!

Science is, thus, just another name for life in the minds of the global public that includes, of course, each and every member of the scientific community. For the global public to effectively play dream and tinker with science, ordinary people must know the result-cause relationship and when it works best, when it works not as well and when it doesn't work at all. Scientists don't really need to make public why a result-cause relationship exists and why, in certain circumstances, it doesn't.

Getting the global public playing with science
The phrase "make it and they will come" is probably a very familiar one. Unfortunately, its drawbacks regularly make the news. Fortunately, however, this phrase precisely states how to have a global public playing with science.

A number of considerations, all seeds of tremendous discord that can raise insurmountable obstacles, make this phrase especially relevant:
-   Who in the global public should be first in line to play with science?
-   What current disadvantage or vulnerability ranks higher and why?
-   What is the order in which sciences are to be put in the hands of a global public? Does ease of science accessibility or some other attribute determine the priority for different sciences?
-   How short a time is best for getting the global public playing with science? Expecting a global public playing with science overnight isn't, of course, at all realistic. Neither is a wait time that is multiple generations long.
-   How can humanity get the global public playing with science? What role do policies, community activities, peer pressure play?
-   How much must humanity expect to invest in this endeavor? How is payback assured? Is any payback assured?

As we will all probably agree, the questions are endless in number and new ones will keep surfacing as more individuals get involved and more situations require attention.

The solution to such a quagmire is a simple one, proven to work time and time again! This solution starts with each member of the scientific community: Scientists must individually put their science within reach of the global public in a form novices can use as they see fit.
If examples are needed to make science usable, here are two:
-   *Lego Mindstorm*™
    Sets of components, which fitted together make a model of a real object, have been around forever. The *Mindstorm*™ kits from *Lego* enable anyone to make customizable programmable robots that can move and see. These kits got youths, teenagers and adults

playing with sciences underlying sight and motion. Most importantly, a player could build the specific models that Lego released these kits to make but also models of their own design and choosing. Designing robots that, within reason, can be built with the sight and sound capabilities included in a kit is the real value of these kits. Of course, combining multiple kits adds capabilities to make fancier and fancier robots.

- Consumer IT Infrastructure
  The computers, storage devices, optical scanners and printers are just a few devices that enabled self-expression in a number of ways. The 3D-printer only now approaching price points of a mass market add the capabilities, within reason, for anyone to manufacture a physical object of their design. Of course, this infrastructure is optimized for information management, sharing and manipulation and cannot make energy, water or any other resource.

Science is, after all, just the name of the closet we hold all our knowledge on natural consequences i.e. the relationship of a result to its cause, a result that is true under a defined set of prevailing circumstances or environmental conditions. With the right science in hand imagine individuals harvesting water vapor indigenously to meet their drinking water needs, much in the same vein as anybody can today generate electricity simply by turning a crank with their hand!

Welcome, Rosy Future
The phrase "Hurry up and wait" is all too familiar to anyone who has worked for a global multinational or was job hunting in the recent global economic downturn. Letting the global public play, dream and tinker with science will, at first blush, feel no different. Rest assured, the promise of making science widely available will be realized in short order because of one common human desire that everyone everywhere is driven to quench: the desire to make their local world better and avoid catastrophe for their progeny, their kin and their local community. Satisfying this desire is, after all, why movements like "*#8 wire*" exist in New Zealand, "*Jugaad*" is celebrated in India, "*jua kali*" is common in Kenya, the Chinese are proud of their "*zizhu chuangxin*" and Brazilians hold precious their "*gambiarra*" – all names for local resourcefulness and ingenuity. What might these billions make true when they have access to knowledge hidden in the closet called science, but now available for the taking and even in forms that make it easy for, literally, anyone to use to benefit themselves and the tiny part of the world they exist in?

This desire for a better life takes shape, of course, differently in the minds, hearts and hands of different people. Thus, there will be outcomes that seem unremarkable or unimportant or especially unworthy of the science whose discovery swallowed a lifetime spent writing also-ran proposals, running into what turned out to be only blind alleys and dodging all kinds of disappointments. Who could predict what David, of David and Goliath fame, would end up achieving with an ordinary slingshot? What if the following kinds of statistics could only be found in history books: Once 600 million people didn't have enough to eat, 7 million died in

2012 due to indoor and outdoor pollution, 800 million lacked any access to safe water and 2.5 billion never got enough safe water, 1.3 billion people lived without electricity, 2.6 billion used biomass to cook with, 4 billion lived on less than US $4 per day.

Science in the hands of hoards of unknowns inspired for their own personal reasons to make a difference in their world and motivated to realize the difference urgently, is the tsunami humanity direly needs to unleash. Humanity can succeed at this by steering the global public to play, dream and tinker with science.

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