Dimensions of Change: Measurements for a Metaverse

- How quickly we’re progressing
- How far apart we are in defining “success”

Peter Coffee, VP for Strategic Research
@petercoffee
Reading *Snow Crash* is a matter of cultural literacy

“A metaverse is a network of virtual worlds – in futurism and science fiction, often described as a universal virtual world facilitated by VR and AR headsets. The term has its origins in the 1992 science fiction novel *Snow Crash.”*

– en.wikipedia.org/wiki/Metaverse

“I began to ask myself what would have to happen to make 3D graphics technology as cheap and ubiquitous as television was at the time. Some kind of mass market application seemed to be the answer.”

– Neal Stephenson

www.axios.com/metaverse-creator-neal-stephenson-facebook-name-change-a4259282-5016-4c67-a7ae-b0eb381a7773.html
Technology paves the road – but does not propel the car

Who will get to sell what, to people whose reality they have the power to define?

Peter Coffee @petercoffee · 3h

The Metaverse is enabled by tech, but will be driven by forces of who gets to sell stuff to people whose beliefs they can influence. Spend 17 minutes envisioning how those interests might interact/evolve.

- AmazonBay vimeo.com/8995197
- Googlezon youtube.com/watch?v=OQDBhg...
The metaverse *can* be meaningful, useful, and likely...if...

Of the Gartner “Top Technology Trends for 2022,” is there even one of these that is *not* a crucial enabler for a metaverse?

Something that does for the walled gardens of VR and AR what the Web did for the walled gardens of CompuServe and AOL?

Something that represents and facilitates our health, wealth, education, recreation, livelihood, and other institutions and processes?
Thinking about our progress, though, raised two concerns

Definition of “distance” from success

Goodhart’s Law →
(When a measure becomes a target, it ceases to be a good measure)
The Zettabyte Era is a period of human and computer science history that started in the mid-2010s: an age of growth of all forms of digital data that exist in the world, including the public Internet and also other forms of digital data such as stored data from security cameras or voice data from cell-phone calls. It is estimated that in 2012, upwards of 1 zettabyte of data existed in the world; in 2020, more than 40 zettabytes.

*10^{21} bytes

-- en.wikipedia.org/wiki/Zettabyte_Era
Data fabrics: because knowing is harder than “thinking”

“Data quality matters. The team used an off-the-shelf algorithm to do image segmentation and object detection, but to get the AI to classify those objects it had to develop a bespoke dataset: millions of images of things that float in the sea, from buoys to boats to crab pots, taken in all kinds of weather and lighting conditions, to train it.”

What an autonomous ship named Mayflower can teach us about building better A.I.
Cybersecurity: more than permission management

"A Tesla mobile app that allows owners to enter and start their cars suffered an outage that locked some owners out of their cars on Friday. The outage affected owners on several continents, and appeared to last several hours."

"Two popular open-source packages were recently sabotaged with mischievous commits: their creator added code that made them malfunction. Time for Ver.2 of XKCD's "Dependency"? With "thanklessly maintaining" appropriately revised?

"Approximately 17,000 Java packages in the Maven Central repository were found to contain the vulnerable log4j-core library as a...dependency. Additional packages...contain vulnerable Log4j code within the artefact itself."
Cybersecurity: more than permission management

Or—more likely—a wide variety of nasty computer viruses. If Hiro reaches out and takes the hypercard, then the data it represents will be transferred from this guy’s system into Hiro’s computer. Hiro, naturally, wouldn’t touch it under any circumstances, any more than you would take a free syringe from a stranger in Times Square and jab it into your neck.

“Cybercriminals tamper with both digital and physical QR codes to replace legitimate codes with malicious codes,” the FBI said in a statement Tuesday. “A victim scans what they think to be a legitimate code but the tampered code directs victims to a malicious site.”

– king5.com, 19 January 2022
Privacy-enhancing computation

"Matter devices can operate entirely locally over Thread and Wi-Fi... That means if your internet goes down, your smart home will still work... Local control is a significant step in maintaining privacy in the smart home."

"Because privacy costs money, privacy has become a defining marker of class... The poor used to be invisible – now they're among the most easily seen segment of society."

"There's nothing sinister about putting payments into a messaging app, and @SignalApp is not alone... What sets Signal's effort apart is the combination of end-to-end encryption in messaging and a cryptocurrency with privacy features designed to make any transactions anonymous."

"In the US, the addition of payment functionality probably gives anti-encryption forces their best chance, as the First Amendment has never protected the anonymity of the movement of money."
Cloud platforms and processes

Peter Coffee @petercoffee · Sep 5, 2021

"With this new family of solutions, Heng was able to analyze Cassini phase curves and infer that the atmosphere of Jupiter is filled with **clouds** of large, irregular particles... It opens up new ways of interpreting data that were previously infeasible."

phys.org
New mathematical solutions to an old problem in astronomy
For millennia, humanity has observed the ch...

economist.com
Will the cloud business eat the 5G telecoms industry?
As AT&T and Verizon launch 5G this month, two huge industries collide

“You working with Fisheye?” Ng says, lighting up a cig. The smoke swirls in the air ostentatiously. It takes as much computing power realistically to model the smoke coming out of Ng’s mouth as it does to model the weather system of the entire planet.
Composable applications enable design for agility

If we spend two years deciding the dimensions of a pyramid...
Composable applications enable design for agility

If we spend two years deciding the dimensions of a pyramid...

...it gets awkward to change our minds as soon as we’ve barely started
Composable applications enable design for agility

If the situation turns out to require a cube...

...it’s always going to show that wasn’t “the plan”
Composable applications enable design for agility

Anticipating need for change...

...leads to design for recomposability
Composable applications enable design for agility

Static connections grow with \((n^2-n)/2\): unscalable, ungovernable, unevenolvable
Composable applications enable design for agility

Repurposeable APIs lead to linear, rather than quadratic, complexity growth
Decision intelligence aids in navigating new situations

“Game-tree complexity describes the size of the space of possible game paths. Go, an extremely complex game, has a complexity of 170. Our sailing problem has a game-tree complexity of nearly 2900.”

“Our team used deep reinforcement learning to teach the AI bot how to become a professional sailor. Ultimately, there were a thousand bots running in parallel, learning from each other.”

“The turning point came about eight weeks later: the bot started beating the sailors in the simulator. Soon, the sailors were learning maneuvers from the bot.”

Autonomics and hyperautomation enable global scale

Autonomic Computing helps to address complexity by using technology to manage technology. The term autonomic is derived from human biology. The autonomic nervous system monitors your heartbeat, checks your blood sugar level and keeps your body temperature close to 98.6°F without any conscious effort on your part. In much the same way, self-managing autonomic capabilities anticipate IT system requirements and resolve problems with minimal human intervention. As a result, IT professionals can focus on tasks with higher value to the business.

Autonomics and hyperautomation enable global scale

...but “we can do this with AI” is a premature notion of what tech and law are ready to do

**Short Title(s) as Introduced**

Healthy Technology Act of 2021

**Official Titles**

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**Official Titles - House of Representatives**

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**Official Title as Introduced**

To amend the Federal Food, Drug, and Cosmetic Act to clarify that artificial intelligence and machine learning technologies can qualify as a practitioner eligible to prescribe drugs if authorized by the State involved and approved, cleared, or authorized by the Food and Drug Administration, and for other purposes.
IN THE HOUSE OF REPRESENTATIVES
SEPTEMBER 30, 2021
Mr. SCHWEIKERT introduced the following bill; which was referred to the Committee on Energy and Commerce

A BILL

To amend the Federal Food, Drug, and Cosmetic Act to clarify that artificial intelligence and machine learning technologies can qualify as a practitioner eligible to prescribe drugs if authorized by the State involved and approved, cleared, or authorized by the Food and Drug Administration, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the “Healthy Technology Act of 2021”.

SEC. 2. PRESCRIPTION OF DRUGS BY ARTIFICIAL INTELLIGENCE OR MACHINE LEARNING TECHNOLOGIES.

Section 503(b) of Federal Food, Drug, and Cosmetic Act (21 U.S.C. 353(b)) is amended by adding at the end the following:

“(6) In this subsection, the term ‘practitioner licensed by law to administer such drug’ includes artificial intelligence and machine learning technology that are authorized pursuant to a statute of the State involved to prescribe the drug involved; and

“(A) authorized pursuant to a statute of the State involved to prescribe the drug involved; and

“(B) approved, cleared, or authorized under section 510(k), 513, 515, or 564.”.
Distributed enterprises require trust-free shared truth

Distributed ledgers give us resilient, distributed peer-to-peer systems and ability to interact with peers in a trustless, auditable manner.

Smart contracts allow us to automate complex multi-step processes. We get to automate time-consuming workflows in new ways, achieving cryptographic verifiability, as well as significant cost and time savings in the process.

Median frequency of core business practices

- 2018 top economic performers
- 2021 average response
- 2021 top-decile tech-endowed companies

Monthly or faster
- Use scenarios to time and size potential shifts in industry economics
- Evaluate profit pools based on competitive-landscape shifts
- Evaluate portfolio for opportunities to add/divest businesses, in light of digital
- Reallocate capital expenditures across business units
- Use rigorous process to defund underperforming digital initiatives

1Frequencies shown are the median values from a histogram, which was constructed by assigning “daily” responses a value of 0; “weekly,” 1; “monthly,” 2; “quarterly,” 3; “annually,” 4; “every few years,” 5; and “never.” 6 The question also asked about the frequency of evaluating M&A opportunities as part of every strategy-setting discussion. These responses are not shown because M&A typically requires a longer time frame than the other operational practices tested, often due to regulatory reasons.

2Respondents of 2018 survey who say their organizations have a top-decile rate of organic revenue growth (ie, of 25% or more in past 3 years) relative to other respondents; n = 138.

3Companies with a top-decile tech endowment are those where respondents strongly agreed with at least 7 statements (out of 13 total) about the role of technology in their organizations’ strategies and the overall role of technology in their organizations; n = 158.

McKinsey & Company
Don’t make the mistake of thinking this is recreational

Organizations with world-class digital capabilities release and refresh digital applications much faster than competitors.

<table>
<thead>
<tr>
<th></th>
<th>Traditional</th>
<th>Leading</th>
<th>World-class</th>
<th>Why it matters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to market</td>
<td>1–2 years</td>
<td>2–6 months</td>
<td>8–12 weeks</td>
<td>To compete for consumers on the basis of new tech functionality</td>
</tr>
<tr>
<td>Release frequency</td>
<td>1–4 per year</td>
<td>1–4 per month</td>
<td>10–50 per day</td>
<td>To test and refine the customer experience</td>
</tr>
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</table>
The one with the tightest OODA* loop – wins

“I can drill down into any deal’s dynamics, down to the level of a single Account Executive and how their attainment is today.

“I look at my accounts receivable, and where our cash collections are.

“At the end of the quarter – we’re a Fortune 500 company, but I’m on my phone at night with my CEO and my Vice Chairman, in different parts of the world, understanding exactly where things are at.

“Imagine what I have at my fingertips compared to what I had in years gone by.”

– Mark Hawkins, then CFO, Salesforce (Dreamforce 2017)

* Observe, Orient, Decide, Act
Our feedback loops need to include the hard stuff

If this were about small numbers of precise measurements, anyone could do it
Dislodging the Suez Canal Ship Said to Need at Least a Week

Assessment already diverged
4 days ago

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Cheniere and Shell oil tankers change course to avoid Suez Canal as ships divert routes
2 days ago

Piracy fears mount as ships take long way around Africa to avoid blocked Suez Canal
2 days ago

Here's how a long shutdown of the Suez Canal might roil the global economy
2 days ago

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The New York Times

Ship Stuck in the Suez Canal Is Free: Live Updates
Aided by the moon and the tides, the giant container ship was wrenched from the shore on Monday afternoon, six days after blocking the vital...
1 hour ago
Existing management operating models are no longer supporting managers effectively... Revenue assumptions, often worked to two-decimal points, are not relevant in an historic contraction. Reports are outdated before they reach senior managers." @McKinsey

"Pandemic data can take different presentation formats that steer...toward different perspectives...plagued by time lags, which decouple actions from observable consequences. It exhibits exponential growth, a concept many struggle to understand...a perfect storm of confusability."

When nothing is normal: Managing in extreme uncertainty
In this uniquely severe global crisis, leaders need new operating models to respond quickly to the rapidly shifting environment and sustain their...
mckinsey.com

Understanding the presentation pitfalls of data visualization is essential for decision-making in a pandemic. mitsmr.com/3qIE25M
This is why, it’s been said, having “a plan” is over-rated

“Everyone has a plan until they get punched in the mouth.” (Mike Tyson)

“No plan survives first contact with the enemy.” (Helmuth von Moltke*)

More to the point, though:

“Plans are worthless, but planning is everything. You throw the plans out the window...but if you haven’t been planning you can’t start to work, intelligently at least.” (Dwight Eisenhower)

* Technically, “Kein Operationsplan reicht mit Sicherheit über die erste Begegnung mit der Hauptkraft des Feindes hinaus.” (No one ever quotes the whole thing, not even in translation)
It’s not enough to acknowledge that there are zombies

There’s a reason why @Tom_Peters titled his book “Thriving On Chaos,” not “Thriving In Spite Of Chaos” and definitely not “Surviving Until We Fix The Chaos.” The new normal is that there isn’t one. Agility is the only sustainable excellence.

“Chaos” gets a bum rap
Too often labeled as obstacle, rather than opportunity

“No skill is more important than the corporate capacity to change per se. The most urgent task is to learn to welcome—beg for, demand—innovation from everyone. This is the prerequisite for continuous improvement.”

How the zombie apocalypse can help prepare us for real crises
Fictional doomsday scenarios can offer guidance on how to handle a second wave of coronavirus

“As The Walking Dead underlines, even humans who can recognise a zombie are doomed if they fail to prepare for their next encounter with one.”
Adoptions accelerate...

Share of US households using specific technologies, 1860 to 2019

Source: Comin and Hobijn (2004) and others
Note: See the sources tab for definitions of adoption rates by technology.

OurWorldInData.org/technology-adoption/ • CC BY
Adoptions accelerate...

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OurWorldInData.org/technology-adoptions/ • CC BY
Adoptions accelerate – *until they reverse*

Share of US households using specific technologies, 1860 to 2019

Source: Comin and Hoibijn (2004) and others

Note: See the sources tab for definitions of adoption rates by technology.

OurWorldInData.org/technology-adoptions/ • CC BY
Peter Drucker so often says it best:

“If you want something new, you have to stop doing something old.”
What tells us what kind of change is needed, when?

“Every economic era is based on a key abundance and a key scarcity.”
– George Gilder, 1996

“The Gilder Paradigm

A new paradigm is emerging: it will transform the industry and the economy just as sharply as Moore’s Law, when it caused the mainframe market to plunge from 100 percent to less than 1 percent of computer sales between 1977 and 1987. Since 1992, I have been developing this theory and showing the journey toward […]

“If you’re doing things that
• conserve what’s now abundant...
• fail to notice what’s gotten scarce...
• help people cope with a scarcity that no longer exists...

...you’re designing for a past era.

Don’t expect compliments.”
– Me, now
What’s hugely abundant is connection

% of U.S. adults who say they use the internet, by age

- 18-29
- 30-49
- 50-64
- 65+


Pew Research Center

Another exponential abundance: computing power

Note: these are logarithmic vertical scales: a straight line represents exponential growth. (Showing aggregate compute power on a linear scale makes it look as if we started building them in 2005.)

Figure: Projected number of human brains equivalent to global hardware under various assumptions. For brains, 'small' = 3 x 10^13, 'median' = 10^18, 'large' = 10^25. For 'world hardware', 'high' = 2 x 10^20, 'low' = 1.5 x 10^21. 'Growth' is growth in computing hardware, the unlabeled default used in most projections is 25% per annum (our estimate above), 'high' = 86% per annum (the apparent growth rate in ASIC hardware in around 2007).
“The price of computation today is roughly one hundred-millionth what it was in the 1970s, when the first microprocessors became commercially available... between 1950 and 2010 the amount of number-crunching possible with a kilowatt-hour of energy grew roughly a hundred-billion-fold.”

– The Economist, September 2019
What’s becoming scarce is **human data capacity**

Projected Forgetting Curves

Herman Ebbinghaus
“The Curve of Forgetting”

knowledgeplus.nejm.org/blog/spaced-repetition-the-most-effective-way-to-learn/
What’s becoming scarce is access to human attention

19% of online viewers defect in the first 10 seconds.

“The thrill of finding something new often makes connected consumers jump off one experience into another. The ‘feel good’ neurotransmitter, dopamine, is released when consumers are doing something they find rewarding.”

- dl.motamem.org/microsoft-attention-spans-research-report.pdf
Do 2020’s stories illuminate what’s to come?

The more demanding experiment has barely begun

What many showed in 2020-2021 is that

- Established organizations with...
- ...social networks already in place...
- ...can replatform to physically distributed work...
- ...while operating at extraordinary levels of effort

What most have not yet determined is how

- New talent can be discovered and onboarded
- New relationships, internal and external, can be built
- New lines of business can be developed and launched
- Sustainable effort can deliver satisfactory results

“Just because we’ve managed to weather this storm doesn’t mean it’s an optimal way to work. If you’re in a shipwreck and a piano top floats by, it becomes a lifesaver. But it’s not the way you would have designed a lifesaver.”

– The New York Times, 6 May 2021
What are the measures of the metaverse?
Related question: why do we need a different word than “cyberspace?”

“Cyberspace. A consensual hallucination experienced daily by billions of legitimate operators, in every nation, by children being taught mathematical concepts... A graphic representation of data abstracted from banks of every computer in the human system.”

– William Gibson, Neuromancer, 1984

“Whereas earlier entrepreneurs looked at the Internet and saw a network of computers, Zuckerberg saw a network of people.”

– Lev Grossman, Time, “Person of the Year 2010”
What are the measures of the metaverse?

It’s a place for people, not a virtual colocation of their computers

Economic output: what fraction of global annual value-add is represented by assets in distributed ledgers? Today, ~3%; WEF projects 10% by 2027*

Collaborative time: in 2020, virtual meetings were 48% for technology activities; 32% for education; 26% for health and life sciences

Travel: pre-pandemic, business travel was 26% of total US travel revenue; will return from pandemic’s 89% decline reach as much as 85% of that? (Time, October 2021)

“35% of business travelers said they expect video conferencing to replace about half of routine business travel in the future” (Dan Richards, Worth, August 2021)

* See also meetingoftheminds.org/dates-and-deliverables-from-blockchain-26696
Measure communication: don’t just count messages

The effects of remote work on collaboration among information workers

Longqi Yang, David Holtz, Sonia Jaffe, Siddharth Suri, Shilpi Sinha, Jeffrey Weston, Connor Joyce, Neha Shah, Kevin Sherman, Brent Hecht & Jaime Teevan

“Firm-wide remote work caused the collaboration network of workers to become more static and siloed...may make it harder for employees to acquire and share new information...”

www.nature.com/articles/s41562-021-01196-4
Active platform → agile collaboration + focused automation
“What workers have today... has **low usability**, **low access**, and **low empowerment**. It’s often mostly a jumble of technology that’s not aimed at a coherent employee experience... We have to design a lot more of it today and now for our emerging world of **hybrid work**.”

– Dion Hinchcliffe

83% of users say automation solutions have provided them with the time to take on new, challenging projects

83% of users say automation solutions have provided them with the time to learn new skills

77% of users say automation solutions have provided them with more time to deepen relationships with customers and stakeholders

(Automation Survey, Salesforce Research, October 2021)
It’s not as if we’re rushing this

“By the year 2000, we will no longer commute. We will communicate. We won’t have to travel for business any more – we’ll only travel for pleasure.”

- Sir Arthur Clarke, 1964

“What VR will do is give us a chance to travel where humans could otherwise never go: inside a hurricane, a patient’s brain, a spiral of DNA or a black hole from across the galaxy – journeys millions of us are ready to take.”

- The Economist, 2015
Thank You