



# The Future Cybersecurity Landscape

John Ellingson, CTO, QWERX

Tuesday, 28 February 2023



A Word From Today's Chairman

**Mike Wardle**  
CEO & Head of Indices  
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# Today's Agenda



- 15:00 – 15:05 Chairman's Introduction
- 15:05 – 15:25 Keynote Presentation – John Ellingson
- 15:25 – 15:45 Question & Answer



## Today's Speaker

**John Ellingson**

CTO  
QWERX





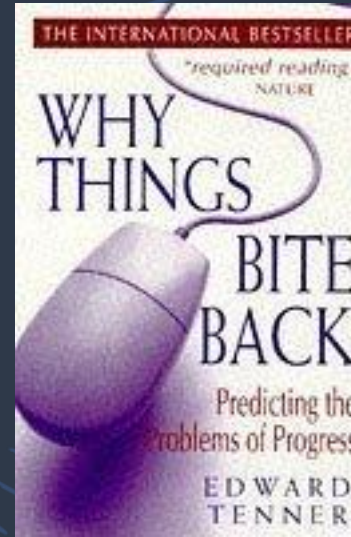
FS Club



# THE FUTURE CYBERSECURITY LANDSCAPE WITH QUANTUM COMPUTING A CAUTIONARY TALE

HELLO QUANTUMIANS  
GOODBYE NEWTONIANS

# A CAUTIONARY TALE



## Why Things Bite Back: Technology and the Revenge of Unintended Consequences

The self-cancelling, self-frustrating side of human ingenuity, and what to do about it.

- [https://www.edwardtenner.com/why\\_things\\_bite\\_back\\_\\_technology\\_and\\_the\\_revenge\\_of\\_unintended\\_consequences\\_21108.htm](https://www.edwardtenner.com/why_things_bite_back__technology_and_the_revenge_of_unintended_consequences_21108.htm)

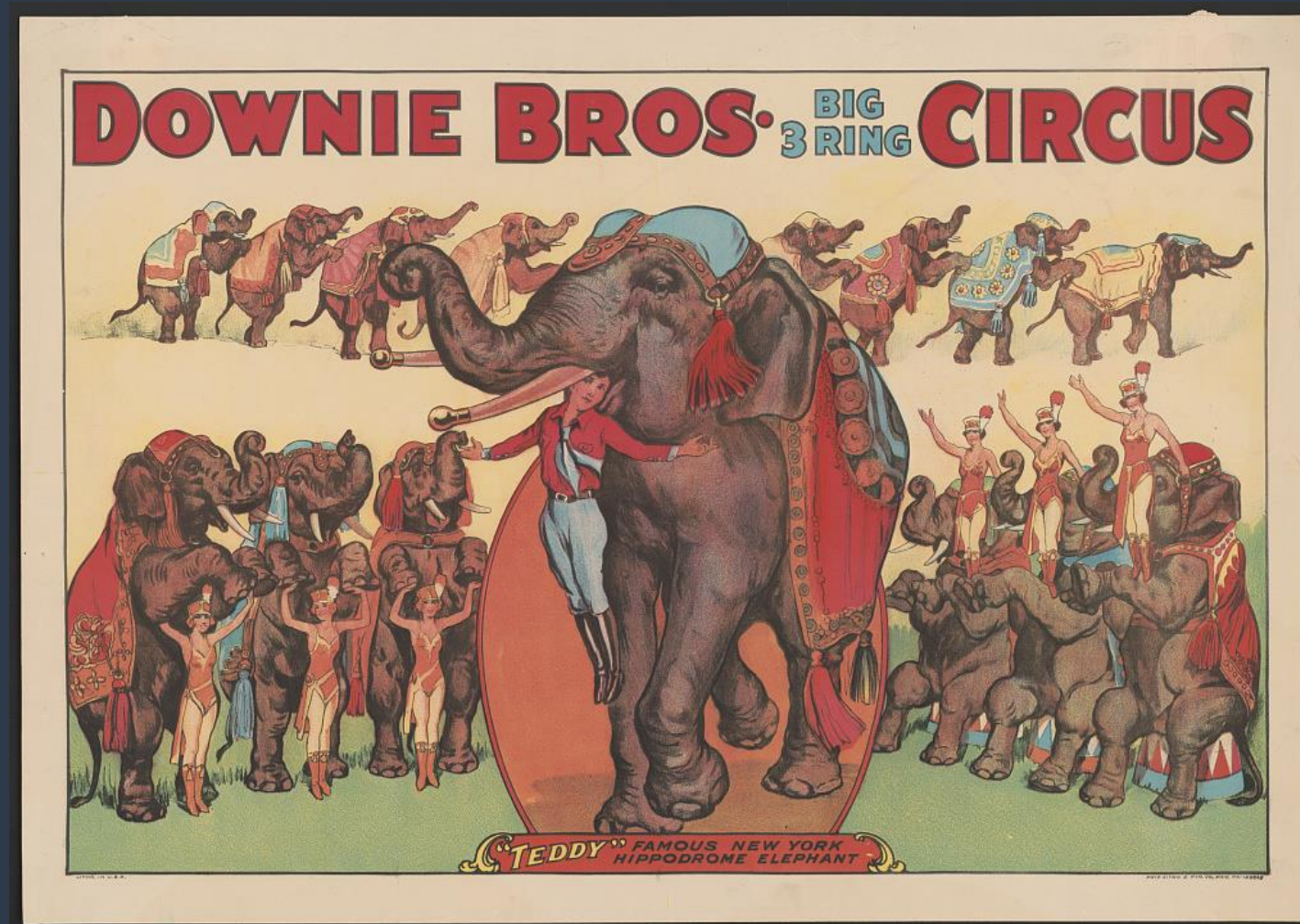
# UNINTENDED CONSEQUENCES

An illustration of two men. The man on the left is wearing a dark suit and has his right fist raised. The man on the right is wearing a blue shirt and has his right fist raised. Two red arrows point from the text towards the men: one points to the man in the suit, and the other points to the man in the blue shirt.

Edward Tenner writes about the revenge effect in technology in his book, *The Revenge of Unintended Consequences*. He points out specifically that security is an example of where we can see the revenge effect. *“Security is another window on revenge effects. Power door locks, now standard on most cars, increase the sense of safety. But they have helped triple or quadruple the number of drivers locked out over the last two decades— costing \$400 million a year and exposing stranded drivers to the very criminals the locks were supposed to defeat.”*

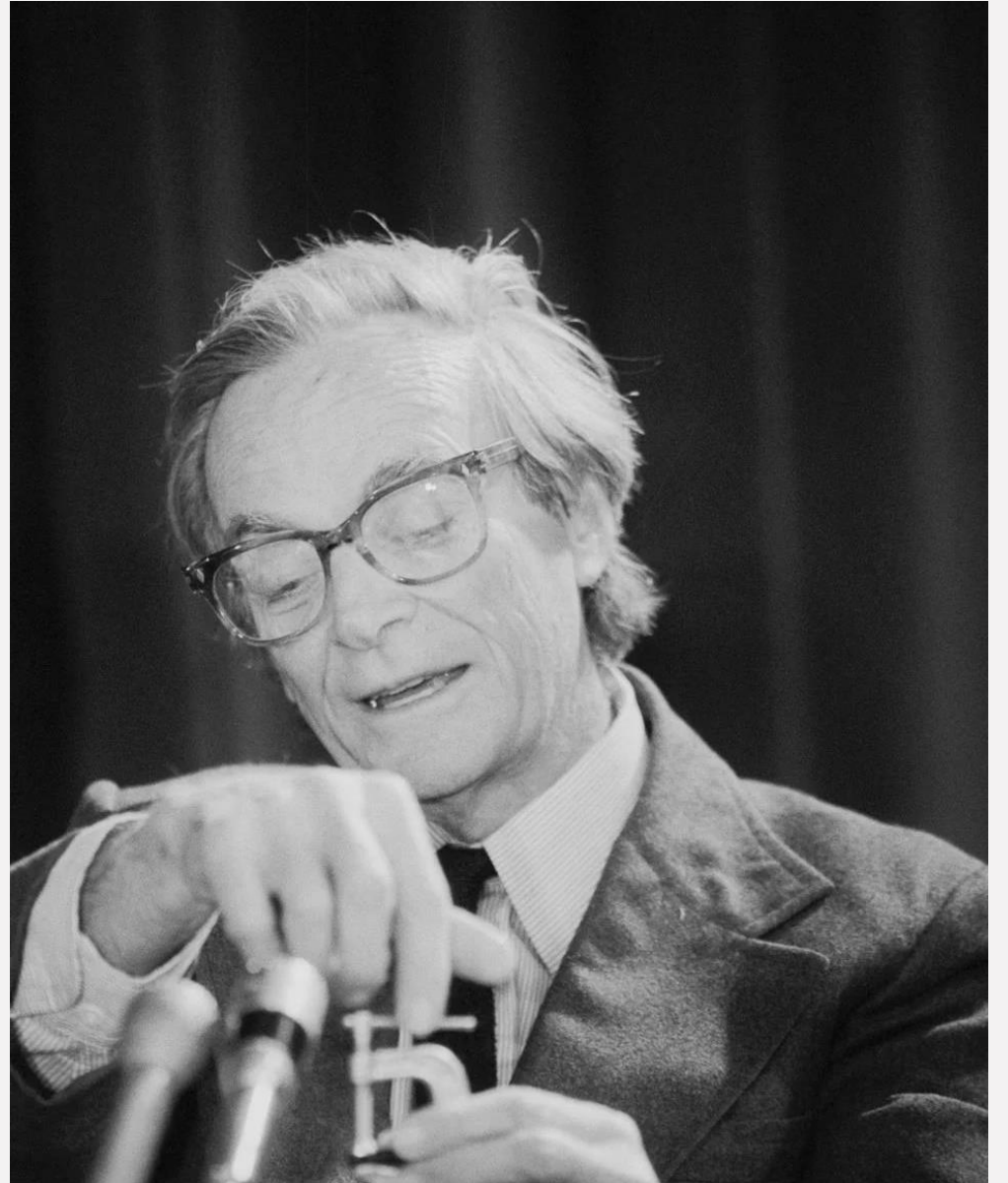


Most of my career I've been the guy with the shovel following the elephants!



# O-RINGS & THE CHALLENGER

It was the O-Ring that was meant to seal the joint that could not expand fast enough on the cold morning of the Challenger launch that allowed the burn-through that caused the disaster.



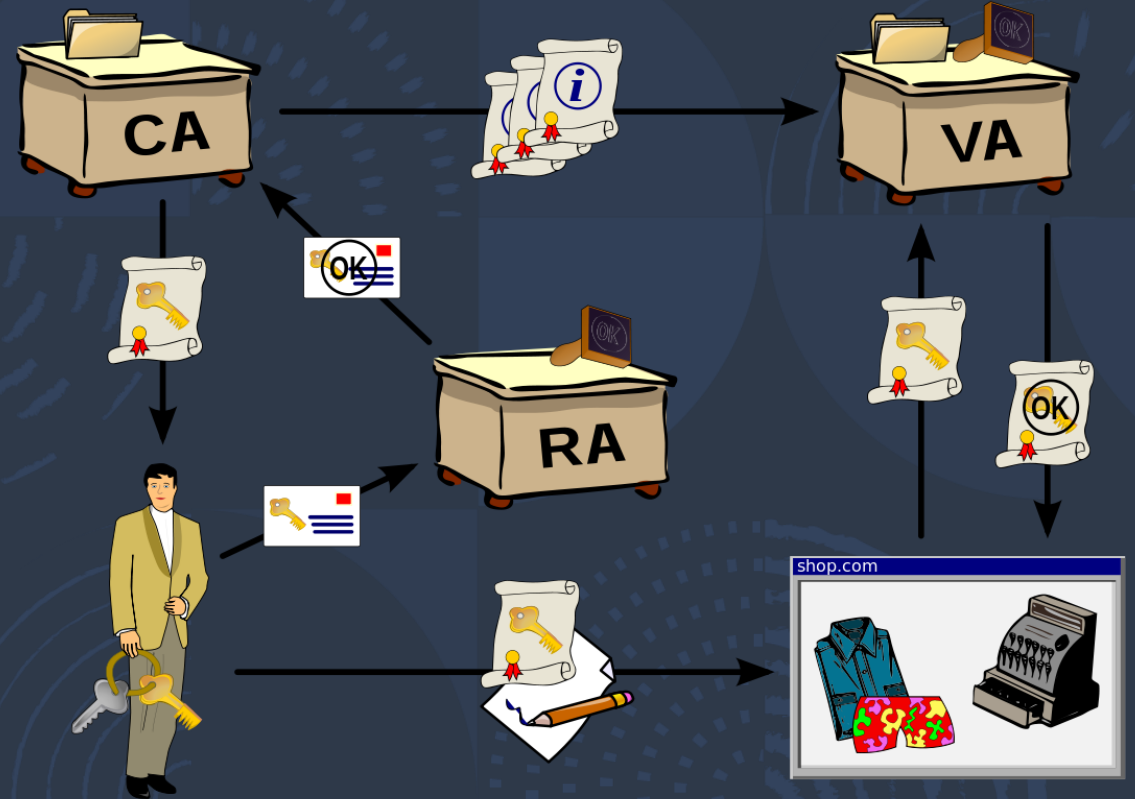
# THE INVENTION OF THE SHIP

With the invention of ships, we also got the invention of the shipwreck!

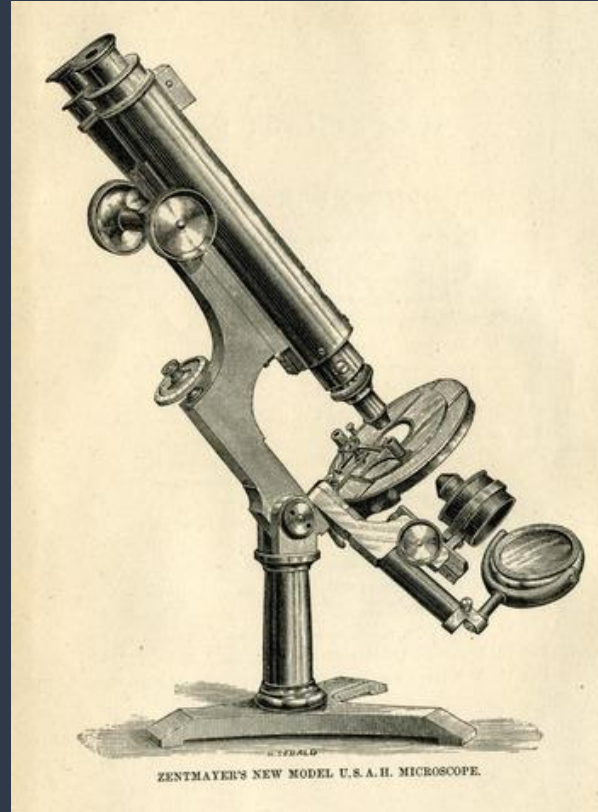


# PUBLIC KEY INFRASTRUCTURE

With the invention of PKI, we also invented the stolen credential and the massive data breach.



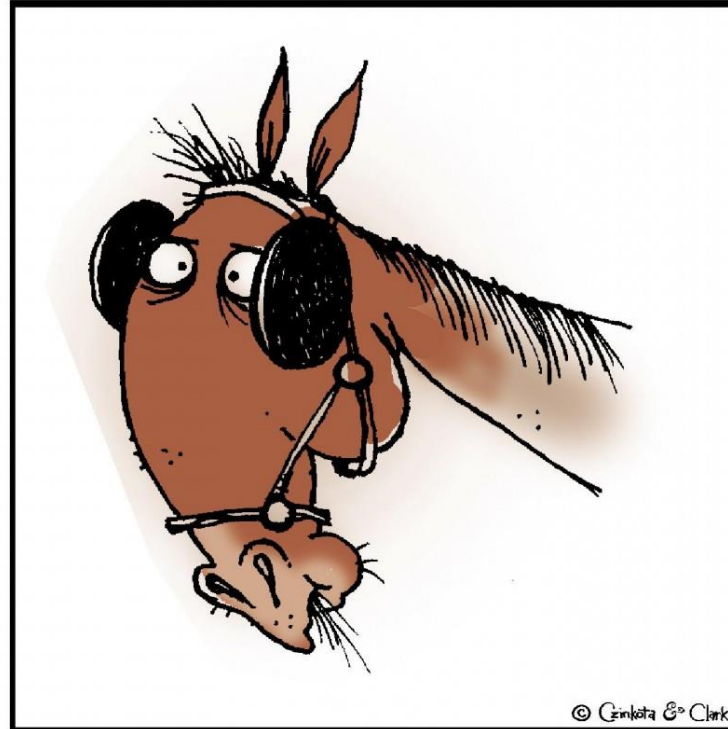
# FOCUS



Systems don't only operate as intended - but everyway possible.

# BLINDERS

The International Daily Iconoclast by Czinkota & Clark

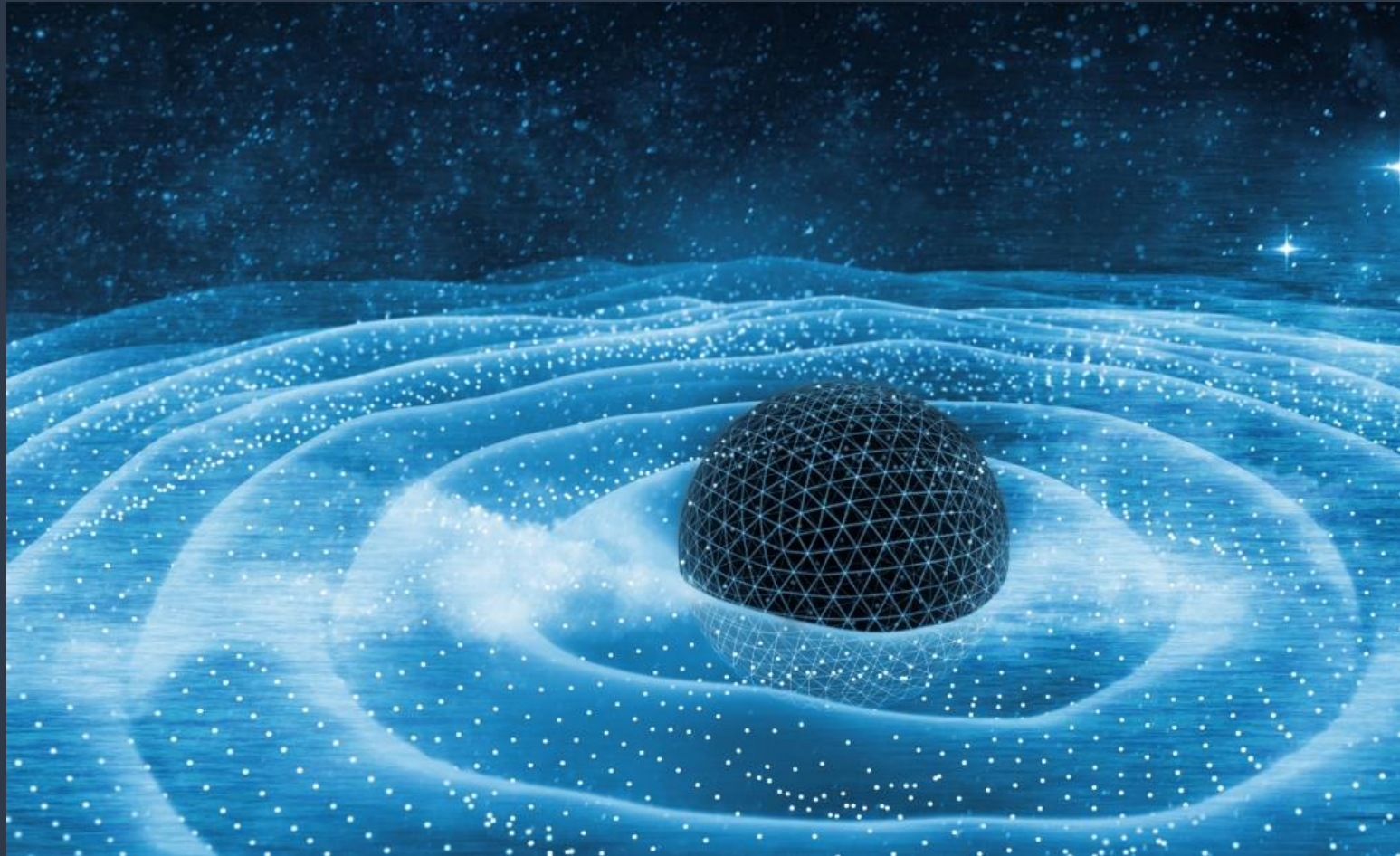


© Czinkota & Clark

**Blinders provide focus, but also limits.**

When making big changes, keep the blinder off!

# A Sample Use Case - Securing Communications in Quantum Space





# IS ANYONE BREAKING ENCRYPTION KEYS?

I could not find a single attack in which the attacker attempted to break cryptography by cracking the encryption key!



**Quantum-Proof  
Encryption Algorithms**





1



Malware

2



Web-based attacks

3



Phishing

4



Web application attacks

5



Spam

# TOP 15 CYBER THREATS



6



DDoS

7



Identity theft

8



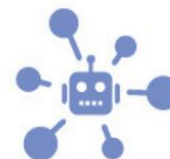
Data breach

9



Insider threat

10



Botnets

11



Physical manipulation,  
damage, theft and loss

12



Information leakage

13



Ransomware

14



Cyberespionage

15



Cryptojacking

# Attack Surface

Network  
insecurities

Software bugs

Physical security  
loopholes

Social  
engineering-prone  
people

Open ports

Weak protocols

Insufficiently  
secured in-  
house-developed  
applications

Vulnerable  
commercial  
programs (e.g.,  
WordPress, etc.)

Rogue or  
dissatisfied  
current and  
former  
employees

Openly displayed  
login credentials  
(e.g., username-  
password  
combinations on  
sticky notes, etc.)

Reused or  
recycled  
passwords

Unmonitored use  
of social media  
and unprotected  
personal devices

**We have an opportunity to take a fresh look at how we do things.**

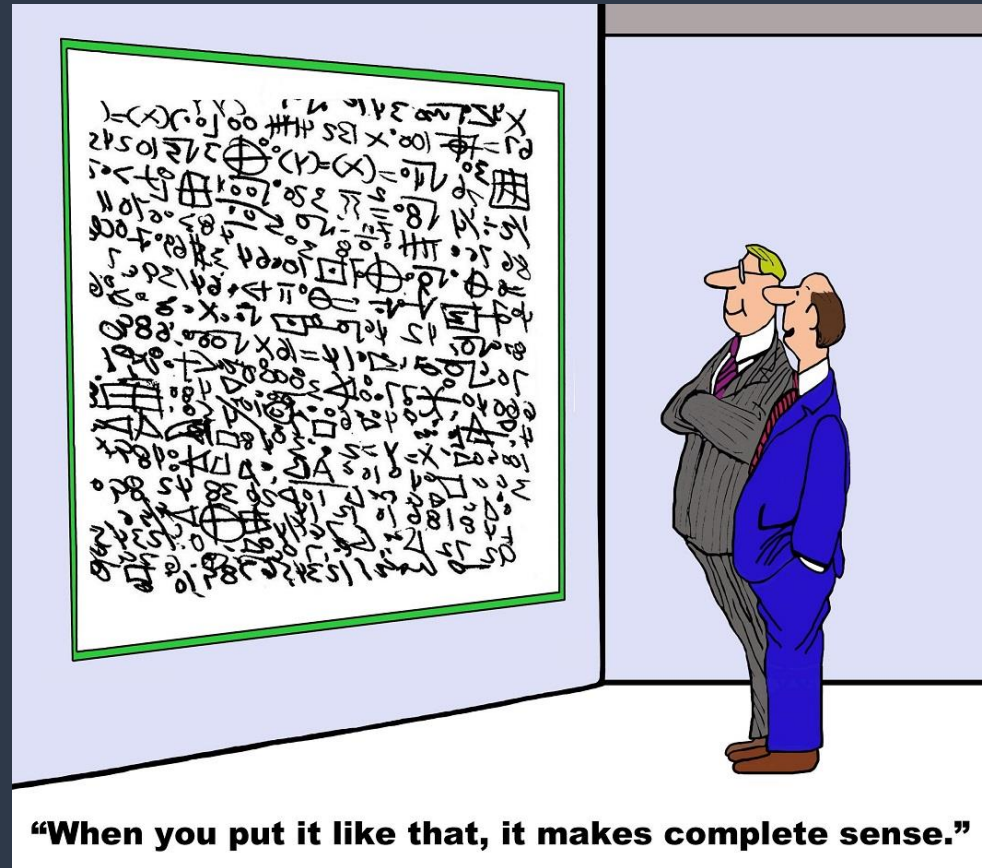


# DO WE REALLY NEED ALGORITHMS?

$|D(T, \epsilon, a, b)| \leq 2$   
 $\varphi(\sigma_1 t) \varphi(\sigma_2 t) = \varphi(\sqrt{\sigma_1^2 + \sigma_2^2} t)$   
 $\varphi(u) = \frac{\sum_{k=1}^{\infty} p_k^* \log_2 \frac{1}{p_k}}{\sum_{k=1}^{\infty} p_k^*}$      $(i \epsilon \sigma_k^2 = \lambda; c i \epsilon$   
 $\eta_1 = \sum_{k=1}^n a_k \xi_k$      $\log \varphi(u) = -\frac{\sigma^2 u^2}{2}$      $i^2 = -1; j^2 = -1; k^2 = -1$      $\lim_{n \rightarrow \infty} \frac{\binom{2n}{n+c}}{\binom{2n}{n}} = e^{-2c}$   
 $y = \phi(x) = \frac{1}{\sqrt{2\pi}} \int_0^{\infty} e^{-\frac{t^2}{2}} dt$      $S(\alpha, \tau) = \frac{2}{\pi} \int_0^{\pi} \frac{\sin \alpha t}{t} dt$      $P(\eta_{\infty} < x) = F(x)$   
 $S_n = A_n U_n A_n$      $W_k = \binom{n}{k} p^k (1-p)^{n-k}$      $P(\eta < y | \xi = x) = \sup_{\gamma, c, y, c \in \mathbb{R}} P(\eta < y | \xi = x)$   
 $|A_n| = \frac{n!}{2} \left| \int_{|x|>A} f(x) \log_2 \frac{1}{f(x)} dx \right| < \epsilon$      $g^{-1} \cdot g = e$      $f(t|y) = \frac{2e^{-\frac{t^2}{2}}}{\sqrt{2\pi}} \left( \frac{e^{-\frac{t^2}{2}}}{1 - \frac{t^2}{2}} \right)^{\frac{1}{2}}$      $\lim_{n \rightarrow \infty} \frac{\sum_{k=1}^n \frac{\epsilon_k}{n}}{\sum_{k=1}^n \frac{1}{n}} = \frac{\sum_{k=1}^n \epsilon_k}{n}$   
 $\int dG_k(x) \geq \frac{1}{2} \sum_{k=1}^{\infty} e^{-\frac{k^2 \pi^2}{2}}$      $\prod_{i=1}^{n-1} H_i; \bigcup_{i=1}^{n-1} X_n$      $f_n(t) = \frac{2^{n-1} e^{-2t}}{(n-1)!}$      $H_r(x) = \frac{G_r(x)}{1+G_r(x)}$      $U_n^+ = \binom{2n}{n} - \binom{2n}{n-c}$   
 $\int_{-2t}^1 f_n(u) f_n(t-u) du = \frac{2^{n+1} e^{-2t}}{n!}$      $\lim_{t \rightarrow \infty} (e^t) = 0$      $\lim_{n \rightarrow \infty} \frac{f_n(u)}{n} = p_k$      $R = \int_{-\infty}^{\infty} \varphi(t) dt$   
 $\log \varphi(t) = i \gamma t - c |t|^\alpha [1 + i \beta \frac{t}{|t|} \omega(t, \alpha)]$      $B(u) = \sum_{k=1}^r \Psi^*(b_k u)$      $C_{iv} = \sum_{j=1}^n a_{ij} b_{ij}$      $C_n(x) \geq \frac{n!}{\prod_{k=1}^n n_k(x)!}$      $\frac{\sin t u}{t u} [\varphi(t) e^{-itx} + \varphi(-t)]$   
 $\int_{-\infty}^{\infty} e^{-\frac{u^2}{2}} du = \sqrt{2\pi}$      $F(x) = \left( \frac{1}{\sqrt{2\pi}} \right)^{-1} \left| \int_{-\infty}^x e^{itx} dF(x) \right| \leq \int_{-\infty}^x e^{-\nu x} dF(x) = \varphi_S(\nu)$      $g^{-1} N_g = \{g^{-1} n_g | n \in N\}$      $Q = F^{-1}(C_q)$      $q_n(x) = \frac{p_k^*}{\sum_{j=1}^n p_j^*}$      $PCT_2 =$   
 $\prod_{m=1}^r |\Gamma_r| \Gamma_{m-r}$   
 $|X \cup Y| = |X| + |Y| - |X \cap Y|$      $\lim_{n \rightarrow \infty} \frac{1}{n} \ln \binom{n}{k} = \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}}$      $P_n(k) = \frac{C_n}{2^n}$      $P(\limsup_{n \rightarrow \infty} \frac{\ln n}{2n \log \log n} \leq 1) = 1$      $(q_n) = 1 - \sqrt{1 - e^{-2t}}$   
 $f: X \rightarrow X \cap W$   
 $Q(x) = \int_A f(x) dP$      $f(x) = -\log_2 \left( \frac{\sum_{k=1}^n p_k^* \log_2 \frac{1}{p_k}}{\sum_{k=1}^n p_k^*} - \left( \frac{\sum_{k=1}^n p_k^* \log_2 \frac{1}{p_k}}{\sum_{k=1}^n p_k^*} \right)^2 \right)$      $f_g(u_i) = f\left(\sum_{j=1}^{dim V_i} a_{ji} v_j\right) = \sum_{j=1}^{dim V_i} a_{ji} \left(\sum_{k=1}^{dim V_k} b_{kj} w_k\right) \frac{(2 \epsilon_k)}{2^{\epsilon_k}} \approx \frac{1}{\sqrt{2\pi} \epsilon_k}$   
 $q\left(c^{-x} \sqrt{\frac{1-q}{nq}} - 1\right) = x \sqrt{\frac{q(1-q)}{n}} + o\left(\frac{1}{n}\right)$      $\prod_{k=1}^r \left[ g_k \left( \frac{t}{\sqrt{16k}} \right) \right]^{N_k \alpha_k} = e^{-\frac{t^2}{2}}$      $P_{jk}^{(m)} = \sum_{r=0}^m P_j^{(r)} P_k^{(m-r)} \frac{1}{2\pi} \int_{-\infty}^{\infty} \text{Re} \left\{ \varphi(t) \frac{e^{-ita} - e^{-itb}}{it} \right\} dt$   
 $\liminf_{N \rightarrow \infty} \int_{-\infty}^{\infty} f_N(x) dx \geq \int_{-\infty}^{\infty} f(x) dx$      $M((\delta_j - 1)^2) = \int_{-\infty}^{\infty} (x-1)^2 e^{-x} dx$      $\lim_{N \rightarrow \infty} \int_{-1}^1 f_N(x) \log_2 \frac{1}{f_N(x)} dx = \int_{-1}^1 f(x) \log_2 \frac{1}{f(x)} dx$      $P(\text{low}) \geq \frac{C_q}{\log N}$   
 $D^2(J_n) \leq \frac{k}{n} + 2k \left( \frac{1}{2} \sum_{k=1}^n R(k) \right)$      $\det(M') = \det(M) + \det(M^*) = \det(M)$      $\ln(xy) = \frac{1}{2\pi} \left[ \sqrt{2} e^{-\frac{x^2}{2}} - e^{-x^2} \right]$      $M(\epsilon_n, \epsilon_m) \leq C_2 \sqrt{\frac{n}{m-n}}$

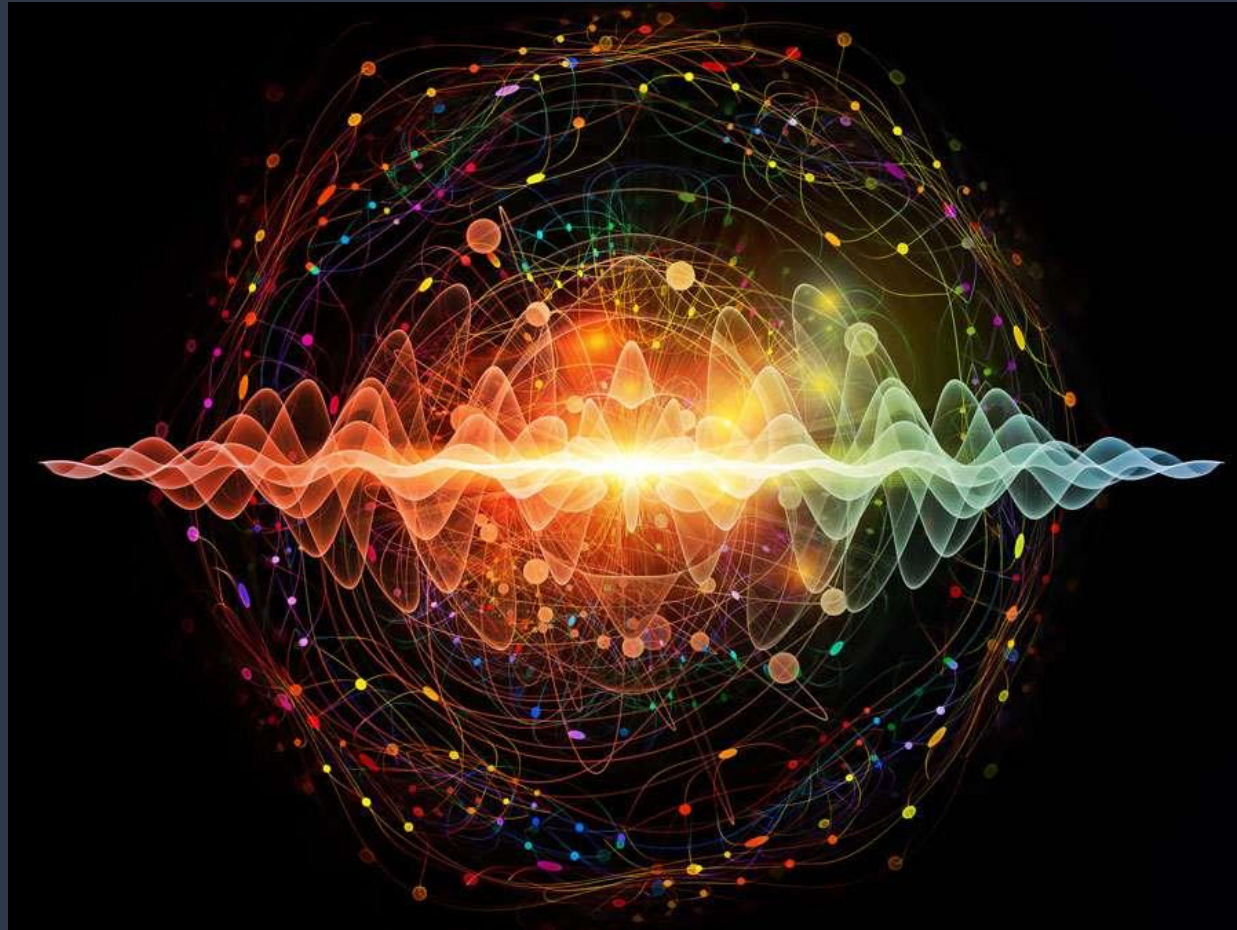
Is there a better alternative?

# KISS



Observing as an alternative to measuring: to avoid a complicated quantum entanglement.

# WHY NOT USE QUANTUM INFORMATION?



John Wheeler postulated that the universe is composed of information.

# WHAT'S NEXT

- WE HAD C3PO
- NOW WE HAVE 3PQE

Probability, Predictability, Precision, Quantum Entropy



# Erwin Schrödinger, alive again





# Contact Information

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# Comments, Questions & Answers



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## Forthcoming Events

- Thu, 02 Mar (11:00-11:45) Employee Share Plans And The Benefits For SMEs
- Mon, 06 Mar (11:00-11:45) Catastrophes – Are They Becoming Too Big To Insure? Are Cats Eating Reinsurers' Lunch?
- Tue, 07 Mar (10:00-10:45) What Is China's Growth Potential After Covid?
- Wed, 08 Mar (12:00-12:45) The Transformative Tree - Pongamia Agroforestry Systems

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Watch past webinars <https://www.youtube.com/zyengroup>