



AMERICAN WATER

Innovation in a Chaotic World

Future Trends:

Discovery - Vetting - Deployment

Paul Gagliardo

Innovation Manager



Connections

- An “Alternate View of Change”
- Rejects the conventional linear view of historical progress
- Modern world is result of interconnected events
- Each person/group acts as a result of its own motivation
- No concept of what their actions will eventually lead to
- The interplay of these events is what drives Innovation.

James Burke, Science Historian



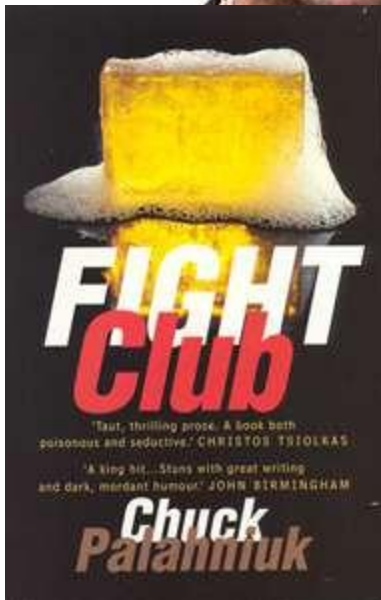
The Act of Innovation

“Innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or a different service. It is capable of being presented as a discipline, capable of being learned, capable of being practiced. Entrepreneurs need to search purposefully for the sources of innovation, the changes and their symptoms that indicate opportunities for successful innovation. “



Peter Drucker, Management Consultant

DISCOVERY



“Our real discoveries come from chaos, from going to the place that looks wrong and stupid and foolish.”

Chuck Palahniuk, Novelist

SUCCESS

“Learning and innovation go hand in hand. The arrogance of success is to think what you did yesterday will be sufficient for tomorrow.”

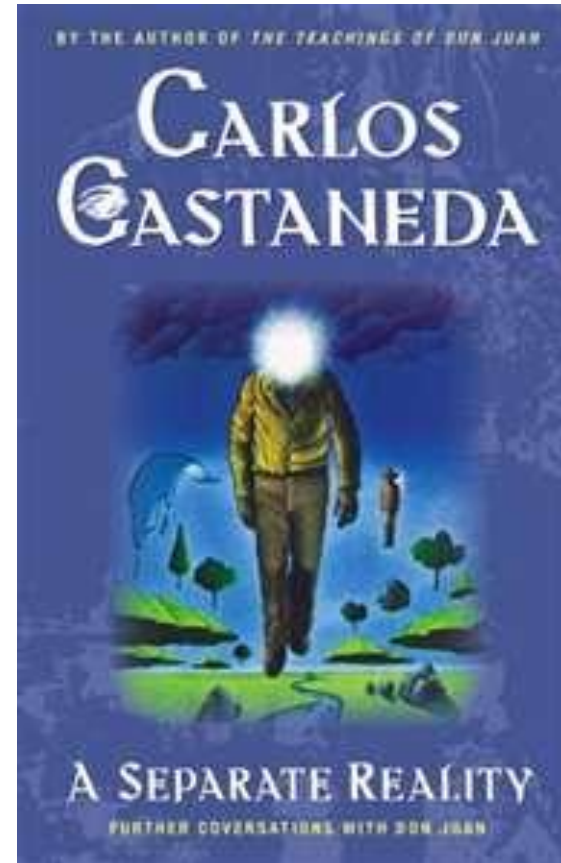
William Pollard,
Physicist and Episcopal Priest



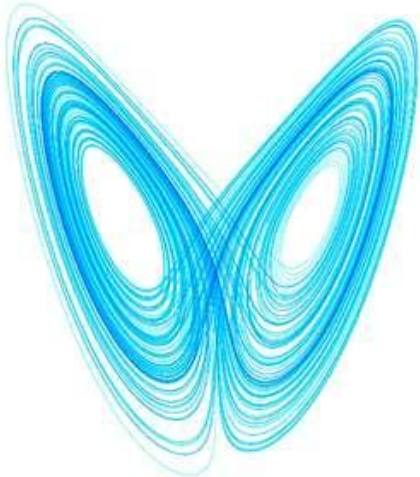
LEARNING

“It is important to do what you don’t know how to do. It is important to see your skills as keeping you from learning what is deepest and most mysterious. If you know how to focus, unfocus. If your tendency is to make sense out of chaos, start chaos.”

**Carlos Castenada,
Anthropologist and Author**



CHAOS THEORY



- Edward Lorenz built a mathematical model of the way air moves around in the atmosphere.
- They did not always change as predicted. Minute variations in the initial values of variables in his twelve-variable computer weather model (c. 1960) would result in grossly divergent weather patterns.
- This sensitive dependence on initial conditions came to be known as the butterfly effect.



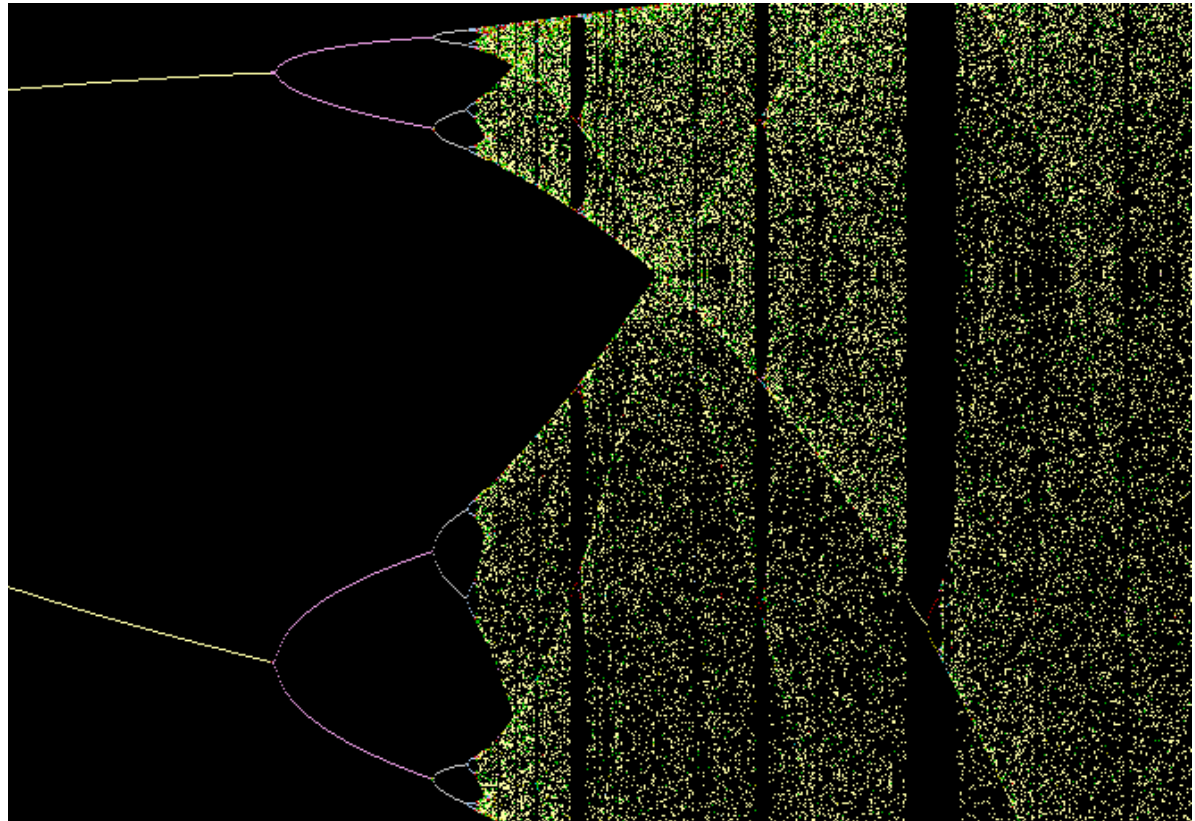
Lorenz Attractor

- Lorenz simplified the analysis to a three equation system, which perfectly modeled a water wheel.
- Result was always a double spiral with two centers.
- Not steady state or periodic.
- Defined the boundaries of uncertainty and unpredictability.



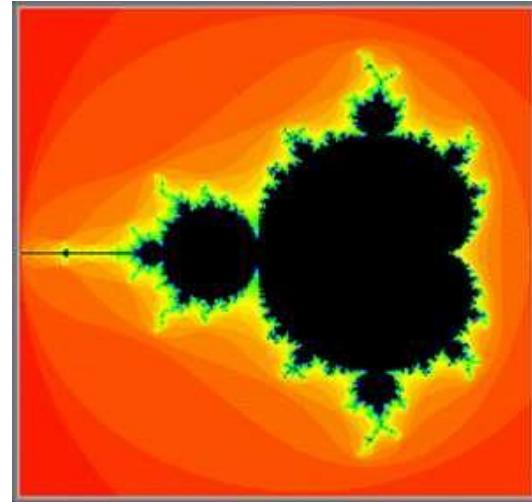
The Onset of Chaos and Self-Similarity

- As population growth rate rises final population jumps between two values.
- Bifurcation continues until chaos appears.
- Behavior prediction is impossible.
- Strips reveal windows of order.
- Graph has exact copies of itself inside the chaotic region.



Fractal Dimensions

- Benoit Mandelbrot analyzed cotton prices and coastline length.
- The numbers that produced aberrations from the point of view of normal distribution produced symmetry from the point of view of scaling.
- Fractal has come to mean any image that displays the attribute of self-similarity





Oder in Chaos

- **Fractal structures have been noticed in many real-world areas, as well as in mathematician's minds. Blood vessels branching out further and further, the branches of a tree, the internal structure of the lungs, graphs of stock market data, and many other real-world systems all have something in common: they are all self-similar.**



The Act of Creation

“Chaos in the world brings uneasiness, but it also allows the opportunity for creativity and growth.”

Tom Barrett, Mayor Milwaukee

Bisociative Thinking

“The creative act will always operate on more than one plane. This creative instability, in a transitory state of unstable equilibrium (chaos), gives rise to new and startling perceptions and glimpses of reality”

Arthur Koestler, Hungarian Author



Invention



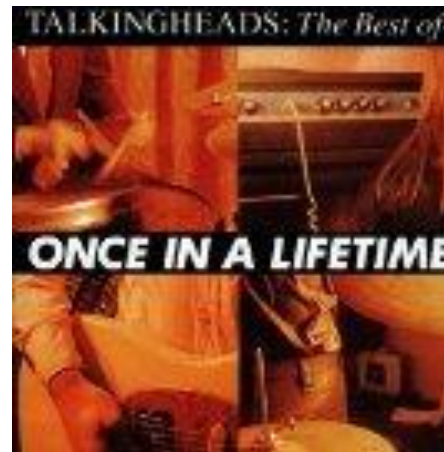
“Invention, it must be humbly admitted, does not consist of creating out of a void, but out of chaos.”

Mary Shelley, Author



Starting Point

**“So, how did we get here?”
David Byrne, Musician**



Our experiences will dictate how we see the world, and thus what we see.



Traits of Innovators

- **Associating** – A broad knowledge base enables new connections
- **Questioning** – Asking why? Why not? And What if?
- **Observing** – Watching behavior closely
- **Experimenting** – Taking risks
- **Networking** – Meeting new people, being exposed to new ideas

The Innovators DNA - Dyer, Gregerson & Christiansen



Chaos in the Water Business (part deux)

- **Supply Insecurities**
- **Maintaining Quality and Reliability**
- **Ageing Infrastructure**
- **Emerging Contaminants**
- **New Regulations**
- **Higher Costs and Lower Demand**



Stakeholders

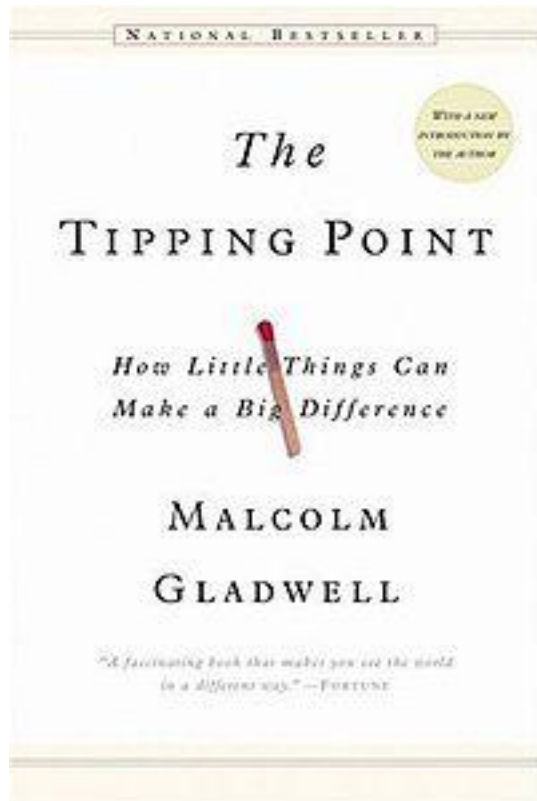
- **Innovators**
- **Inventors**
- **Scientists**
- **Academics**
- **Researchers**
- **Technocrats**
- **Engineers**
- **Venture Capitalists**
- **Regulators**
- **Customers**
- **Utilities**
- **Operators**



Vetting

- **All of the stakeholders have a role to play**
- **Innovations should be analyzed within the multitude of these matrices**
- **Discovering the patterns in this chaotic system will identify the winning innovations**
- **But, what will allow them to catch on, be deployed and revolutionize the industry?**

The Tipping Point



The Tipping Point is "...that time when ideas, products, trends, messages or behaviors reach a threshold and spread like a virus...".

Malcolm Gladwell,
Journalist and Author





Innovation Development Program

- **American Water's role as a Lorenz Attractor:**
 - Collecting information on multiple innovations
 - Analyzing them in the context of multiple variable system
 - Discovering the patterns in the chaos
 - Acting as an Aggregator
- **American Water's role creating a "tipping point"**
 - Champion of the innovation
 - Partnership and Collaboration with the Innovator
 - Early Adopter
 - Water Industry proxy



Enbala Regulation Services

- **First IDP Project**
- **Key Stakeholder Involvement**
- **Business Plan Alignment**
- **Stage Gate Process**
- **Defining “Success”**
- **PJM and FERC Rule Making**
- **Impact on Operations and the Bottom Line**

Bugs, Bytes, Bucks and Basura





The Next Big Things

- **Bugs – Biologics : Organism based treatment and platforms**
- **Bytes – Interoperability : Data and Analytics**
- **Bucks – Asset Management : Extend system life**
- **Basura – Liabilities into assets : Nutrient Recovery, BioEnergy**



Innovation Gap

- Need a lot of data to identify the winners
- Cannot be afraid to fail

“Sometimes when you innovate you make mistakes. It is best to admit them quickly and get on with improving your other innovations.”

Steve Jobs, Innovator



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Questions?

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