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Conceptual Spiral

I

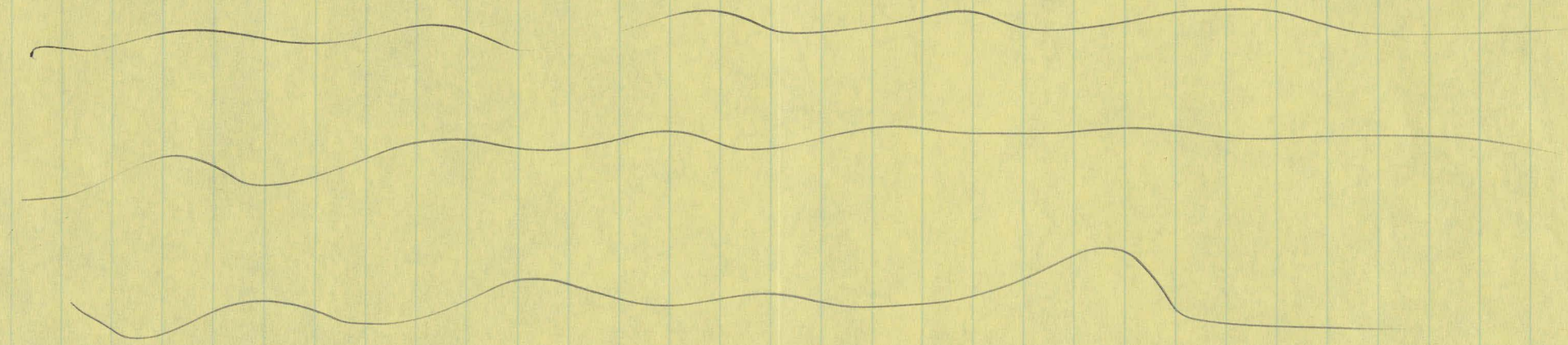
For Openers

let's reexamine our abstract

? — What do we find — ?

XII

Key Passage



~~Ex~~ III

? — Why is this passage key — ?

- Because it suggests a general way by which we can deal with the world around us

. More specifically we shall show that:

- By exploiting the theme contained within this passage and by examining the practice of science/engineering and the pursuit of technology we can evolve a conceptual spiral for comprehending, shaping, and adapting to that world.

IV

Now

If the practice of science/engineering and the pursuit of technology are going to be the key for unveiling this "conceptual spread",

...we should ask ourselves:

In speaking of science, engineering and technology what do we mean?

V

Simple-Minded Message

- Science can be viewed as a self-correcting process of observation, hypothesis, and test.

whereas

- Engineering can be viewed as a self-correcting process of observation, design, and test

while

- Technology can be viewed as the wherewithal or state of the art produced by the practice of science and engineering

VI

? — Raises Question — ?

What has the practice of science, engineering and the pursuit of technology given us or done for us ?!

VII

Examples from Science

Some Outstanding Contributors	Contributions
• Isaac Newton (1687)	• Exactness/predictability via laws of motion/gravitation
• Adam Smith (1776)	• Foundation for modern capitalism
• A.M. Ampere/C.F. Gauss (1820's/1830's)	• Exactness/predictability via electric/magnetic laws
• Carnot/Kelvin/Clausius/Boltzman (1824/1852/1865/1870's)	• Decay/disintegration via second law of thermodynamics
• Faraday/Maxwell/Hertz (1831/1865/1888)	• Union of electricity/magnetism via field theory
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• Gregory/Mendel (1866)	• Inherited traits via his laws of genetics
• Henri Poincare (1890's)	• Inexactness/unpredictability via gravitational influence of 3 bodies
• Max Planck (1900)	• Discreteness/discontinuity via his quantum theory
• Albert Einstein (1905/1916)	• Exactness/predictability via his special/general relativity
• Bohr/de Broglie/Heisenberg/Schrödinger/Dirac/etc (1913/1920's ...)	• Uncertainty/indeterminism in quantum physics
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• Claude Shannon (1948)	• Information theory as basis for communication
• Crick/Watson (1953)	• DNA spiral helix as the genetically coded information for life
• Lorenz/Prigogine/Mandlebrot/Feganbaum/etc. (1963/1970's ...)	• Irregularity/unpredictability in non-linear dynamics
• G Chaiten/C. Bennett (1965/1985)	• Incompleteness/incomprehensibility in information theory

VIII

Examples from Engineering

Some Outstanding Contributors	Contributions
Savery / Newcomen / Watt (1698/1705/1769)	Steam engine
George Stephenson (1825)	Steam railway
H Pixii / M.H. von Jacobi (1832/1838)	AC generator / AC motor
Thomas Davenport (1834)	Battery powered electric motor
Samuel Morse (1837)	Telegraph
J N Niepce / J.M. Daguerre / Fox Talbot (1839)	Photography
Gaston Plante (1859)	Rechargeable battery
Z. Gramme / H. Fontaine (1869/1873)	DC generator / DC motor
Nikolas Otto (1876)	4 cycle gasoline engine
Alexander G. Bell (1876)	Telephone
Thomas A. Edison (1877)	Phonograph
Thomas A. Edison (1879)	Electric light bulb
Werner von Siemens (1879)	Electric locomotive
Germany (1881)	Electric metropolitan railway
Charles Parsons (1884)	Steam turbine
Benz / Daimler (1885/1886)	Gasoline automobile
N Tesla / G. Marconi (1893/1895)	Wireless telegraph
Thomas A Edison (1894)	Motion picture projector
Rudolf Deisel (1897)	Deisel locomotive
Italy (1902)	Electric railway

IX

Examples from Engineering

Some Outstanding Contributors	Contributions
Wright Brothers (1903)	Gasoline powered airplane
Christian Hülmeyer (1904)	Radar
V. Paulsen / R.A. Fessenden (1904/1906)	Wireless telephone
John A Fleming / Lee De Forest (1904/1907)	Vacuum Tube
Tri Ergon / Lee De Forest (1919/1923)	Sound motion picture
USA - Pittsburg - KDKA (1920)	Public radio broadcasting
American Car Locomotive (1925)	Diesel electric locomotive
J. L. Baird (1926)	Television
Warner Brothers (1927)	Jazz singer / sound motion picture
Germany / USA (1932/1934)	Diesel electric railway
Britain / USA / Germany (1935-1939)	Operational radar
Germany / Britain / USA (1935/1936/1939)	Television broadcasting
Hans von Ohain / Germany (1939/1939)	Jet engine / jet airplane
Eckert / Mauchly (1946)	Electronic computer
Bardeen / Brattain / Shockley (1947)	Transister
Ampex (1955)	Video recorder
J Kilby / R. Noyce (1958/1959)	Integrated circuit
T. H. Maiman (1960)	Laser
Philips (1970)	Video cassette recorder
Sony (1980)	Video camcorder

X

? — Raises Question — ?

. . Looking at the past via the contributions these people have provided the world: What can we say about our efforts for now and for the future? . . .

XI

Critical Examination

XII

Grand Message

- Any coherent intellectual or physical systems we evolve to represent or deal with large portions of reality will at best represent or deal with that reality incompletely or imperfectly.
- Moreover, we neither have nor can we create beforehand a supersystem that can forecast or predict the kind of systems we will evolve in the future to represent or deal with that reality more completely or more perfectly.
- Furthermore, such a supersystem can neither forecast nor predict the consequences that flow from those systems that we create later on
- Going even further, we cannot determine or discern the character or nature of such systems (super or otherwise) within themselves.

which imply that

XIII

Grand Message

- People using theories or systems evolved from a variety of information will find it increasingly difficult and ultimately impossible to interact with and comprehend phenomena or systems that move increasingly beyond and away from that variety -- that is, they will become more and more isolated from that which they are trying to observe or deal with -- unless they exploit the new variety to modify their theories/systems or create new theories/systems.

XIV

? — Raises Question — ?

What does all this suggest ?

XV

Impression

While we can comprehend and predict some portions of the everchanging world that unfolds before us other portions seem forever indistinct and unpredictable.

XVI

? — Rather Question — ?

Very nice, but what does all this have to do with our ability to thrive and grow in such a world that is seemingly orderly and predictable yet disorderly and unpredictable ?

XVII

Comment

- To get at this question let's take a closer and more general look at what science, engineering, and the pursuit of technology produce and how this is accomplished.

- Furthermore, suspecting that these practices and pursuit are not wholly accidental, nor obvious, and that they seem to charge us in some ways, let's also examine what keeps the whole enterprize going and how this enterprize affects us personally.

XVIII

In other words in order to gain a richer image of science, engineering, and technology we will address the following questions:

- What does science, engineering and technology produce?
- How is this accomplished?
- What is the driving mechanism that keeps the process alive and ongoing; or put another way what phenomena sustains or nourishes the whole enterprise?
- Finally, how does this enterprise of science engineering and technology affect us personally as individuals, as groups or as societies?

~~XX~~ XIX

First of all

? — What does Science, Engineering and Technology produce — ?

If we examine the contributions from the practice of science and engineering and generalize from their individual contributions what do we see? We see new ideas, new materials, new systems, new processes, new etc.

In other words

Science, engineering, and technology produce change via novelty.

XX

? —— How is this Novelty produced —— ?

- To examine novelty we speak of it in terms of those features that seem to be part of that novelty. In other words, we reduce a novel pattern down to some features that make up that pattern. Different people in examining such a pattern may see differing features that make-it-up. In other words, there are different ways by which a pattern can be reduced hence the possibility for differing features or parts. Regardless of how it comes out we call this process of reduction: analysis

- Pushing this process even further we can reduce many different patterns to parts that make-up each pattern and use these parts, or variations thereof, to make a new pattern. This is done by finding some common features that interconnect some or many of these parts so that a new pattern -- whether it be a new concept, new system, new process, new etc. -- can be created. We call this process of connection: synthesis

- Now if we test the results of this process with the world we're dealing with, we have an analytical/synthetic feedback loop for comprehending, shaping and adapting to that world.

XXI

Pulling all this together we can say that

Novelty is produced by a mental/physical feedback process of analysis and synthesis that permits us to interact with the world so that we can comprehend, cope with, and shape that world as well as be shaped by it.

which carries us to the question

? — What is the driving mechanism that keeps the process alive and ongoing — or put another way — what phenomena sustains or nourishes the whole enterprise? — ?

- One thing is clear: If our ideas and thoughts matched perfectly with what goes on in the world; and if the systems or processes are designed performed perfectly and matched with what we wanted them to do; what would be the basis for evolving or creating new ideas, new systems, new processes, new etc.? The answer: There wouldn't be any!

In other words

- The presence and production of mismatches are what sustain and nourish the science-engineering-technology enterprise, hence keep it alive and ongoing — otherwise there is no basis for it to continue.

XXIII

Very Nice
but

? — How does this enterprise of Science, Engineering and Technology affect us personally as individuals, as groups, or as societies ? — ?

- As already shown the practice of science/engineering and the pursuit of technology not only change the physical world we interact with — via new systems, new products, new etc. — but they also change the mental/physical ways by which we think about and act upon that world.

In the sense

- The practice of science/engineering and the pursuit of technology permits us to continually rematch our mental/physical orientation with that changing world so that we can continue to thrive and grow in it.

Put simply

- The enterprise of science, engineering, and technology affects us personally as individuals, as groups, or as societies by changing our orientation to match with a changing world that we, in fact, help change.

XXIV

? —— Raises Question —— ?

What bearing does all this have
on
Winning and Losing ?

XXV

Illumination

Novelty is not only produced by the practice of science/engineering and the pursuit of technology; it is also produced by the forces of nature, by our own thinking and doing as well as by others; and it is produced continuously, if somewhat erratically or haphazardly. Now in order to thrive and grow in such a world we must match our thinking and doing, hence our orientation, with that emerging novelty. Yet, any orientation constrained by experiences before that novelty emerges (as well as by the O and H message discussed earlier) introduces mismatches that confuse or disorient us. However, the analytical/synthetic process, previously described, permits us to address these mismatches so that we can rematch, thereby reorient our thinking and action with that novelty. Over and over this continuing whirl of reorientation, mismatches, analysis/synthesis enables us to comprehend, cope with, and shape as well as be shaped by novelty that literally flows around and over us.

XXVI

Now

If we connect this continuing whirl of reorientation, mismatches, analyses/syntheses and the novelty that arises out of it with the previous discussion we can see that we have:

A
Conceptual Spiral
for

- Exploration — Discovery — Innovation
- Thinking — Doing — achieving
- Learning — Unlearning — Relearning
- Comprehending — Shaping — Adapting

Need a
Conceptual Spiral
for generating

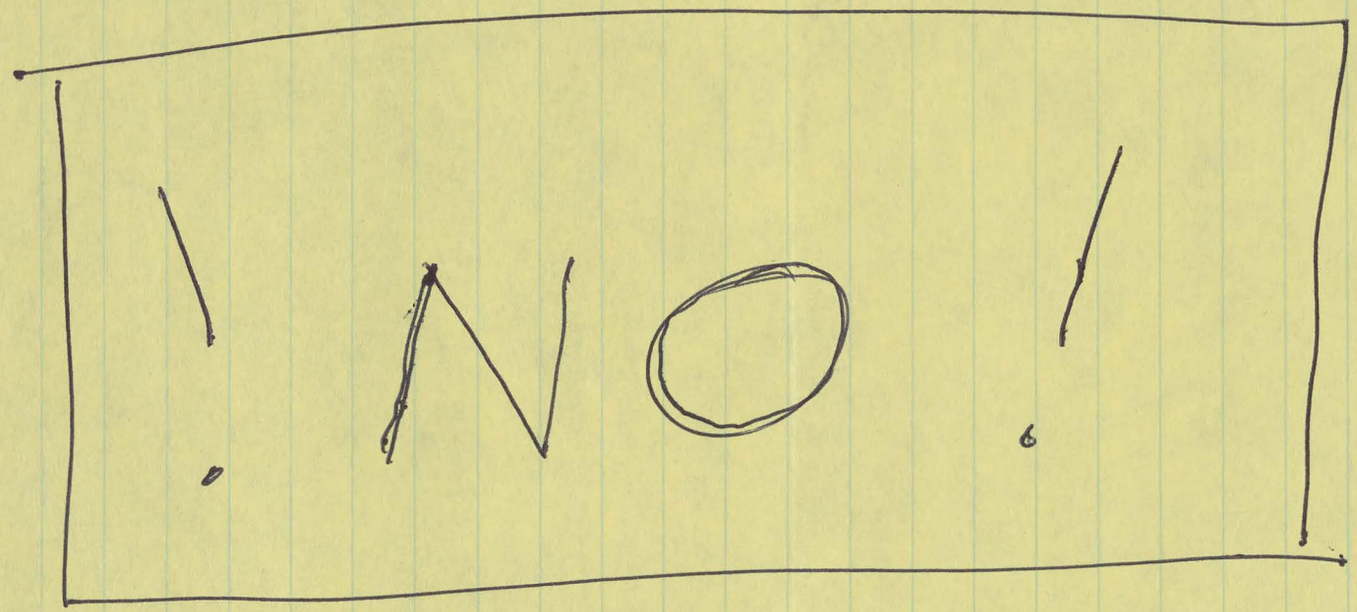
- Insight — Imagination — Initiative

~~XXIII~~ XXVII

which
raises the question

?! — { Can we survive and grow without their abilities? } — ?!

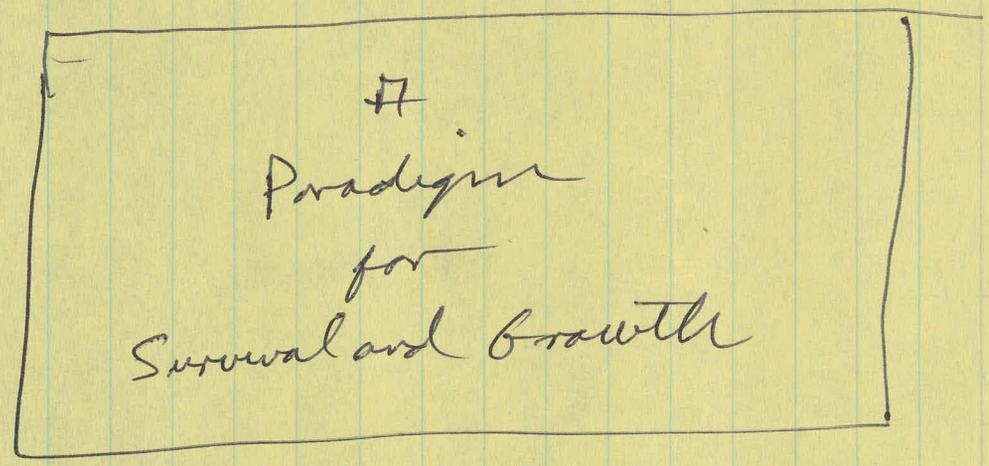
XXVIII



~~XXV~~ XXIX

which suggests

The conceptual spiral also represents:



XXX

Point

Since survival and growth are directly connected with the uncertain everchanging world of winning and losing we will exploit this whirling (conceptual) spiral or orientations, mismatches, analyses/synthesis, reorientation, mismatches analyses/synthesis ... for comprehending, shaping, and adapting to that world and the novelty that arises out of it.

Conceptual Spiral

Conceptual Spiral

VII

Examples from Science

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• Adam Smith (1776)	• Foundation for Modern Capitalism
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• Faraday/Maxwell/Hertz (1831/1865/1888)	• Union of electricity/magnetism via field theory
• Darwin/Wallace (1838/1858)	• Evolution via theory of natural selection
• Marx/Engels (1848+1895)	• Basics for modern scientific socialism
• Gregory Mendel (1866)	• Inherited traits and his laws of genetics
• Henri Poincare (1890's)	• Inexactness/Unpredictability via gravitational influence of 3 bodies
• Max Planck (1900)	• Discreteness/discontinuity and the quantum theory
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~~XXIII~~ ~~XXI~~ XX

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- Now we test the results of this process with the world we're dealing with, we have an analytical/~~the~~ synthetic feedback loop for comprehending, shaping, and adapting to that world

~~XXIII~~ XXII

? — { What is the driving mechanism that keeps the process alive and ongoing -- or put another way -- what phenomena sustains or nourishes this whole enterprise } — ?

- One thing is clear: if our ideas and thoughts matched perfectly with what goes on in the world, and if the systems or processes we designed performed perfectly and matched with ~~and~~ what we wanted them to do what would be the boxes for evolving or creating new ideas, new systems, new processes, new etc.? The answer: there wouldn't be any!

In alternative words

- The presence and production of mismatches are what ~~keep the SET~~ sustain and nourish the SET enterprise here keep it alive and ongoing -- otherwise there is no boxes for it to

continued

~~XXII~~ XXIII

Very Nice
but

? — {How do these Scientific, Engineering, Technology dynamics affect us personally as individuals, as groups, as societies?} — ?

- As already shown the practice of science/engineering and the pursuit of technology not only change the physical world we interact with — via new systems, new processes, new etc — but they also change the mental/physical ways by which we think about and act upon that world

In this sense

- The practice of science/engineering and the pursuit of technology permits us to continually rematch our mental/physical orientation with that changing world so that we can continue to thrive and grow in it,

Put simply

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- George Stephenson (1825)
- Thomas Davenport (1834)
- Nikolaus Otto (1876)
- Werner von Siemens (1876)
- Germany (1881)
- Charles Parsons (1884)

Conceptual Spread

Conceptual Spread

~~XIII~~ XVIII

In other words, in order to gain a richer image of science, engineering, and technology we will address the following questions.

- What does science, engineering and technology produce?
- How is this accomplished the process
- What is the driving mechanism that keeps ~~it~~ alive and organic -- or put another way -- what phenomena sustains or nourishes the whole enterprise?
- Finally, how does the enterprise of science, engineering and technology affect us personally as individuals or groups, as societies?

~~X~~ I

For Geneva

~~For Geneva let take a look at the~~

~~let take a look at these;~~

let's examine ~~our~~;

Abstract

~~XXIII~~ XXII

Point

In comprehending, coping with and shaping the uncertain, ever changing world of learning and leading we will exploit these feedback ~~elapses~~ dynamics of orientation, mismatches, analysis/syntheses, reorientation, mismatches, analysis/syntheses ... to that gives us the agility to create as well as adapt to the novelty associated with uncertainty and change.

Conceptual Spiral

Conceptual Spiral