

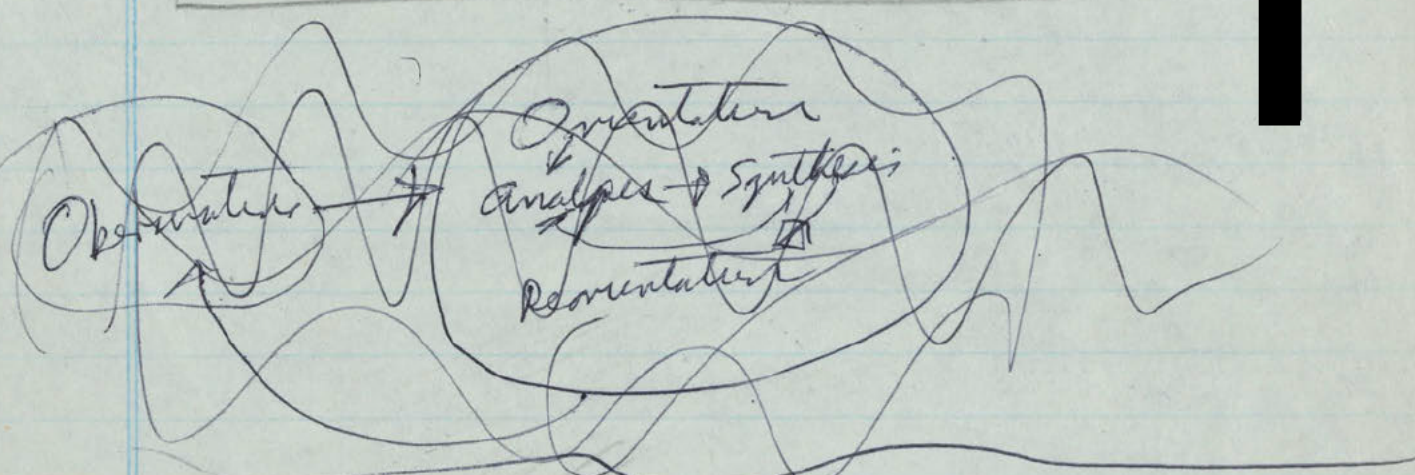
Attali, Jacques

Mellennun - Winy/over
in Army Hall Bldg

Jim Currie Sr.

Eric Press Systems Inc.

12 [redacted]
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Telephone

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also

5 line operation

[redacted] [redacted]
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[redacted] [redacted]

Ideas

- Closed form vs open ended mathematical solutions.

-- Closed form related to inanimate phenomena
-- ~~open~~ Living or animate related to open ended changing solutions -

- Wave theory or probabilistic waves associated with laws of amplification & cancellation or positive vs negative reinforcement seem ~~applicable~~ applicable to my analytic/synthetic methods of investigation
-- particularly in the relation ~~at transition~~ ~~or~~ nonrelation of information from different historical eras, or different domains, or different intellectual disciplines

- Chaitin's Proof that a theorem cannot have more ~~informal~~ information than the axioms from which it was derived seems similar to the idea that my model cannot have more information than the ~~former~~ domain from which it was derived; or ~~that~~ the statement derives from 16th & the second law cannot have ood

Gl Dick Szafranski

AWC/DFW/Rm 150

Channatt, Arch

Maple APB

Cort, Ken Hale # Mike Vriesenga

Dec - Dinner

Wed

9 Dec - Symposium

thurs

authorized 4.90% Discount
\$ 135.40

8.10

\$ 143.10

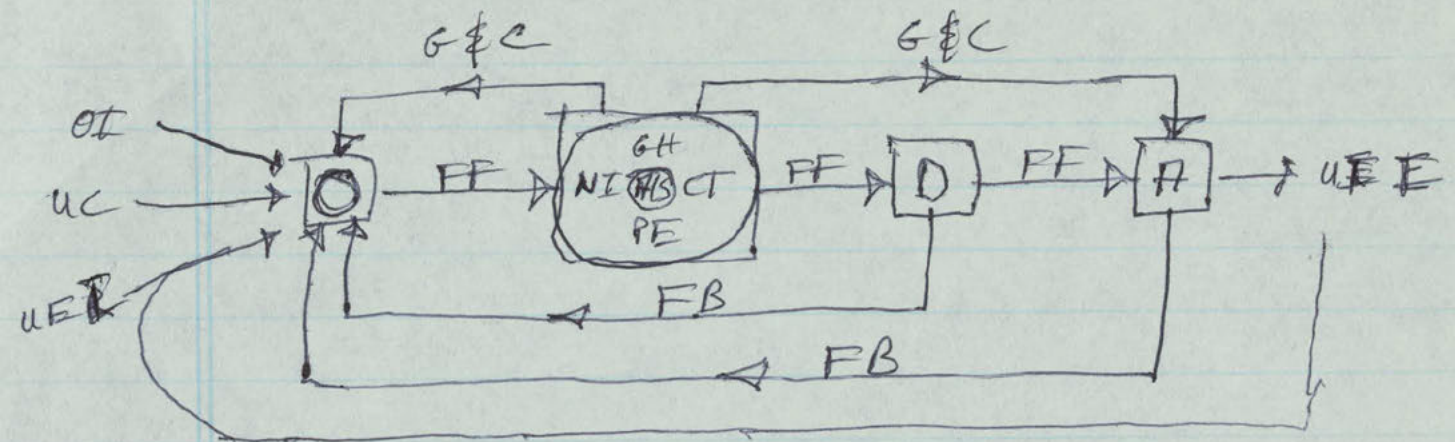
Dana Ritter

William Morrow & Co.
Special Sales

Elaine Grossman

Jason Glasbow

Mr. James Booth



- Now if we let $D = H$ & $A = T$ Then the above loop represents the self-correcting scientific process,
- OR if let $D = D^{\text{origin}}$ & $A = T$ Then the above loop represents the self-correcting engineering process

Point: The 3 processes above are nothing more than variation on the same theme.

The second term in every case is the self-organizing or self-organizing part whereas the fourth term is the place where natural selection takes place.

Compression made possible by the several of sameness, redundancy, regularities, common qualities, ... hence constraints or invariances that make symmetries as well as compression possible.

date / info / knowledge / understanding

June 16 & 17, 1994 → Spacecast 2020

- I Spacecast 2020
— Theme Global View / G-Reach / G-Power
- II Info / Cyber / Net War or Conflict
Question: What is the Purpose / Aim / Goal of such a War?
- III Regular War / Guerrilla War
Question: What is the Purpose / Aim / Goal of this kind of War?
- IV How do such Wars / Conflict fit into Spacecast 2020's Theme GV / GR / GP?
- V Point: Do the ~~WAR~~ Purposes / Aim / Goals play into one another? If so, how?
- VI Put another way: What should be ~~there~~ ^{our} Purpose / Aim / Goal behind GV / GR / GP or put another way

Why do we want GV / GR / GP

Most Important

2nd GO in the OODA loop

WMM / WMM

MM

AF/CCX ush DC 20330
Rm 4E 941

~~My Joe Wood / Gen McPeak~~

Also

+ Don

Waterman

Frank
Klotz

22 NOV USAIR [1631] Sandy arrive at 1300 WPR
6 DEC. USAIR Leave at WPR

Col Ray Bishop

Grant Hammond

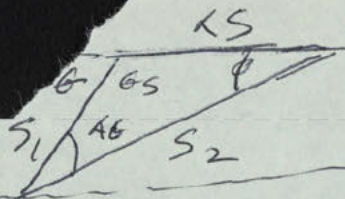
AWC/DFN/Rm 153

Chennault Circle

Hammond MFB

36112
-5000

tele #



$$\frac{\sin \theta_s}{S_2} = \frac{\sin \theta}{S}$$

$$\text{hence } \boxed{\sin \theta = \frac{S_2 \sin \theta_s}{S}}$$

Now let $\theta \rightarrow 0$ so that $\Delta \theta = d\theta$

then! $S_2 \rightarrow S$ becomes dS

$S_2 \rightarrow S_1$ hence becomes S

$$\text{therefore } \boxed{\sin \theta = \frac{dS \sin \theta_s}{S}}$$

$$\text{since } \sin \theta_s = \sin \theta \text{ at } \theta = 0$$

$$\text{since } \frac{d \sin \theta}{d\theta} = 1 \text{ when } \lim_{\theta \rightarrow 0} \left[\frac{\sin \theta}{\theta} \right] = 1$$

$$\text{then } d\theta = \frac{dS \sin \theta}{S}$$

$$\text{therefore } \frac{d\theta}{dt} = \frac{dS/dt \sin \theta}{S} = \frac{V \sin \theta}{S}$$

$$\text{hence } \boxed{\theta = \frac{V \sin \theta}{S}}$$

$$dS = \frac{d\theta}{dt} = V_s - V_r \cos \theta$$

$$\frac{S}{\theta} = \frac{V_s - V_r \cos \theta}{V_r \sin \theta}$$

$$\frac{dS}{d\theta} = \frac{S [V_s - V_r \cos \theta]}{V_r \sin \theta} \quad \left[\frac{dS}{S} = \left[\frac{V_s}{V_r \sin \theta} - \frac{\cos \theta}{\sin \theta} \right] d\theta \right]$$

$$\ln S = \dots$$

- ⑬ Huxford, Miyamoto "The Book of Five Rings" (Translated by Thomas Cleary, 1993), 1645
- ⑩ Liddle, David "The End of Physics - The Myth of a Unified Theory", 1993
- ⑪ Mäurer, Klaus "Thinking in Complexity - The Complex Dynamics of Matter Mind & Mind", 1994
- ⑥ Gell-Mann, Murray "The Quark and the Jaguar - Adventures in the Simple & Complex", 1994
- ⑨ Kelly, Kevin "Out of Control - The Rise of Neo-Biological Civilization", 1994
- ⑦ Goodstein, Brian "How the Legend Changed its Spots - The Evolution of Complexity", 1994

~~Complexity~~

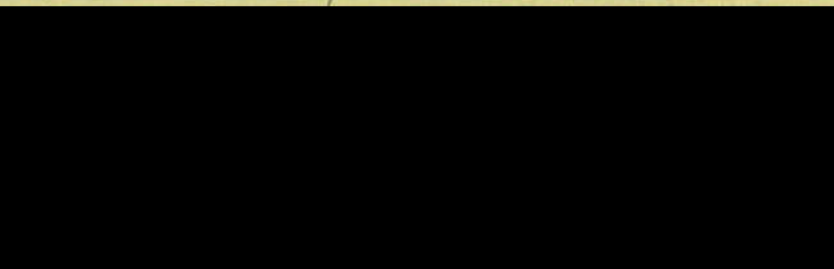
- ④ Casti, John L. "Complexification - Explaining a Paradoxical World thru the Science of Synergetics", 1991
- ③ Casti, John L. "Searching for Certainty - What Scientists can learn about the future", 1990
- ② Campbell, Donald T. "Evolutionary Epistemology",
- ⑤ Crick, Francis "The Astonishing Hypothesis - The Scientific Search for Soul", 1994
- ① Borrolo, John "Pat in the Sky - ~~Creating~~ Thinking, and Being", 1992

~~Extinction~~

- ⑭ Ramp, David M. "Extinction - Bad Genes or Bad Luck?", 1991
- ⑬ Rose, Steven "The Making of Memory - From Molecules to Mind", 1992
- ⑧ Hart, Jeffrey "Empiricism, Metaphysics and the Recovery of the Whole", 1988
- ⑬ Woodcock, Richard & Davis, Monte "Catastrophe Theory - The Revolutionary New Way of Predicting Sudden Change", 1978
- ⑫ Mayr, Ernst "The Growth of Biological Thought" (Chapter 1, 2 & Epilogue), 1982

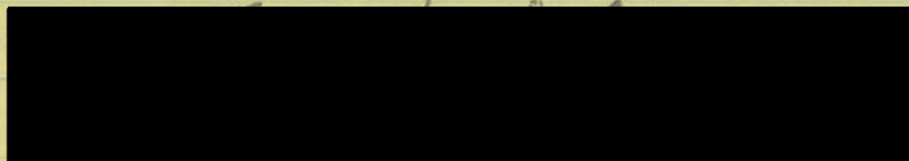
Productivity Press

Mr. Stanley J. Boliver



~~Productivity~~ Productivity Press

Mr. J H Huang



7 May 95

7 May 95

Learning - Unlearning - Relearning

Couple - Decouple - Recouple

Wired - Unwired - Rewired

VIP

Hard wired
Tightly coupled

Loosely wired
Loosely coupled

Relate to [synchronizations] vs [harmonization]

Connect - Disconnect - Reconnect

Hard wired partially wired unwired

- A/S o o o

- Many-sided implicit & references o o o

- OODA loops

- Bear associated with [GH], [CT], [PE]

- Initiator associated

- Output cannot have more info than the sources from which it was evolved

- Generalizing energy, the second law, & chaos work suggest that an evolved system cannot have more energy/info than the source from which it was born - in other words no free lunch.

W

* • Tight/loose coupling

* • Closed/open systems

• Quantum Tunneling

• Non-Categoricalness

U Principle
&
Lorenzen/Schulze

* • Second Law of Thermot $\rightarrow$ Macro

* • Uncertainty Principles $\rightarrow$ Micro

Hawking

* • Uncertainty/Incompleteness

• Coevolution

• Many-sided ~~& ref~~ ^{implicit & ref} process

• D/S

• ~~OOAA~~

1 • Undecidability / Incompleteness Theorem

3 • Uncertainty Principle

~~• Second Law~~

2 • Non-Categorical theorem

4 • First Law of Thermodynamics

5 • Second Law of Thermodynamics

6 • Quantum Tunneling

9 • Closed & open systems

10 • Tight & loose coupling (within system)

11 • adapted & adaptive

7 • Formal & Informal Systems

8 • Explicit & Implicit Systems

• AIS

• Many Sided approach X refer — — —

• OODH

Capt Phil Rogers

Furthermore
we

- ① • One cannot determine the character/nature of a system within itself. Moreover attempts to do so lead to confusion & dissonant efforts.
- ② • Our mental/physical initiatives & responses - as filtered through our genetic heritage, cultural traditions, & previous experiences, tend to be constrained by these influences.
- ③ • Our genetic heritage, cultural traditions, & previous experiences ^{act as filters to} ~~constrain~~ constrain (as well as our fears & desires) ~~to~~ our mental/physical initiatives & responses to an uncertain everchanging environment change & instability.
- ④ • Any theory or system we evolve cannot have more information than the sources from which it was derived.

Limitations

- As we have shown, our genetic heritage, cultural traditions, & previous experiences act as filters to ~~constrain~~ our initiatives & responses for coping with change & uncertainty.

- Even worse, we cannot determine the character/nature of a system within itself. Moreover, attempts to do so lead to confusion & disorder.

~~As a point of fact~~ at best
1. Even if we go outside, a system or schema cannot have more information than the sources from which it was derived or created.

More ~~abstractly~~ ^{concretely} ~~specific~~ appropriately -

- In our ~~flat~~ ^{complex} world of friction & entropy, a system or schema cannot have as much information as the source ~~from~~ which it was derived or created.

Special Salesperson

~~Enclosed~~ I request you send me ten (10) copies of Joseph J. Romm's book "The Once & Future Superman".

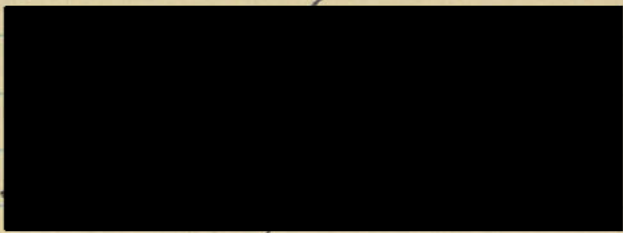
Enclosed you will find a check for \$143.10. At an authorized 90% discount this amounts to \$135.00 together with plus \$8.10 shipping/express cost.
Thank you

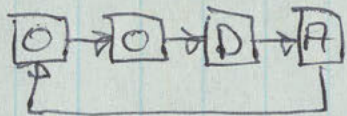
John R Boyd
JRB

William Morrow & Co.
Special Salesperson

~~Enc~~

My address

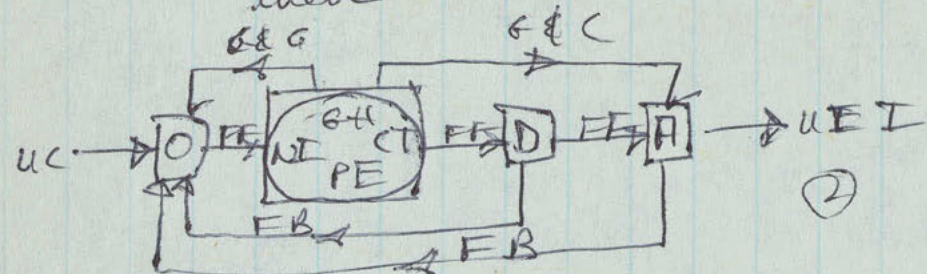
John R Boyd




①

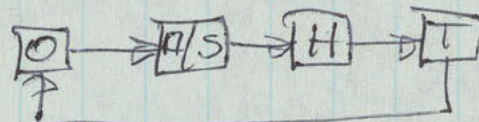
Since 2nd O includes
GH, CT, PE, etc

then

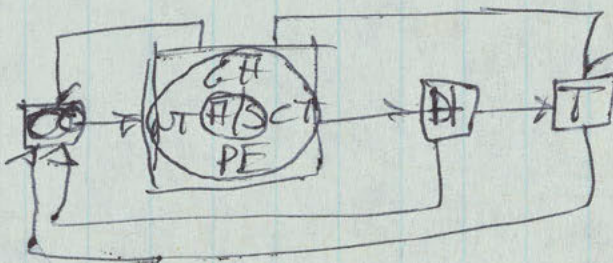


②

③

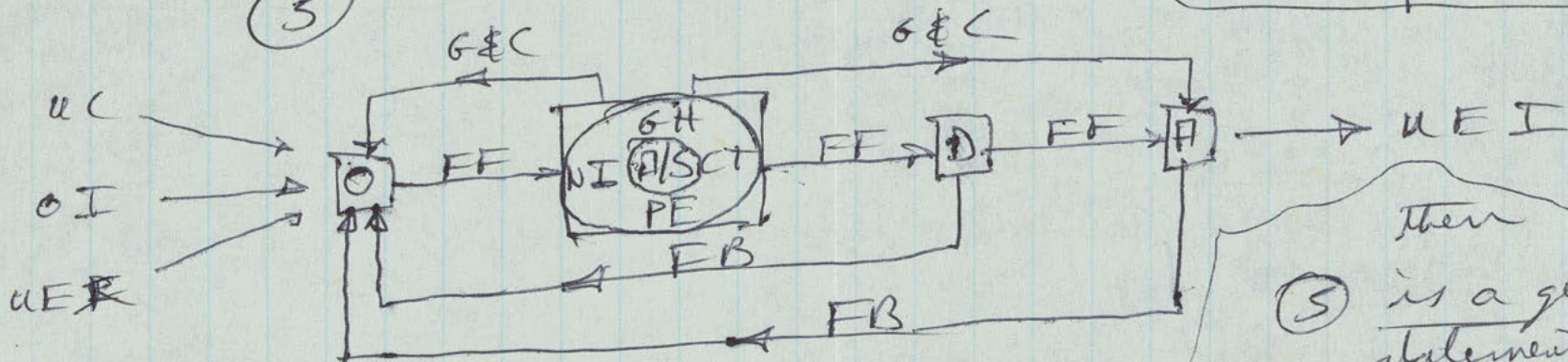


④



Now if we let D be H, R, etc
& A be T, I etc

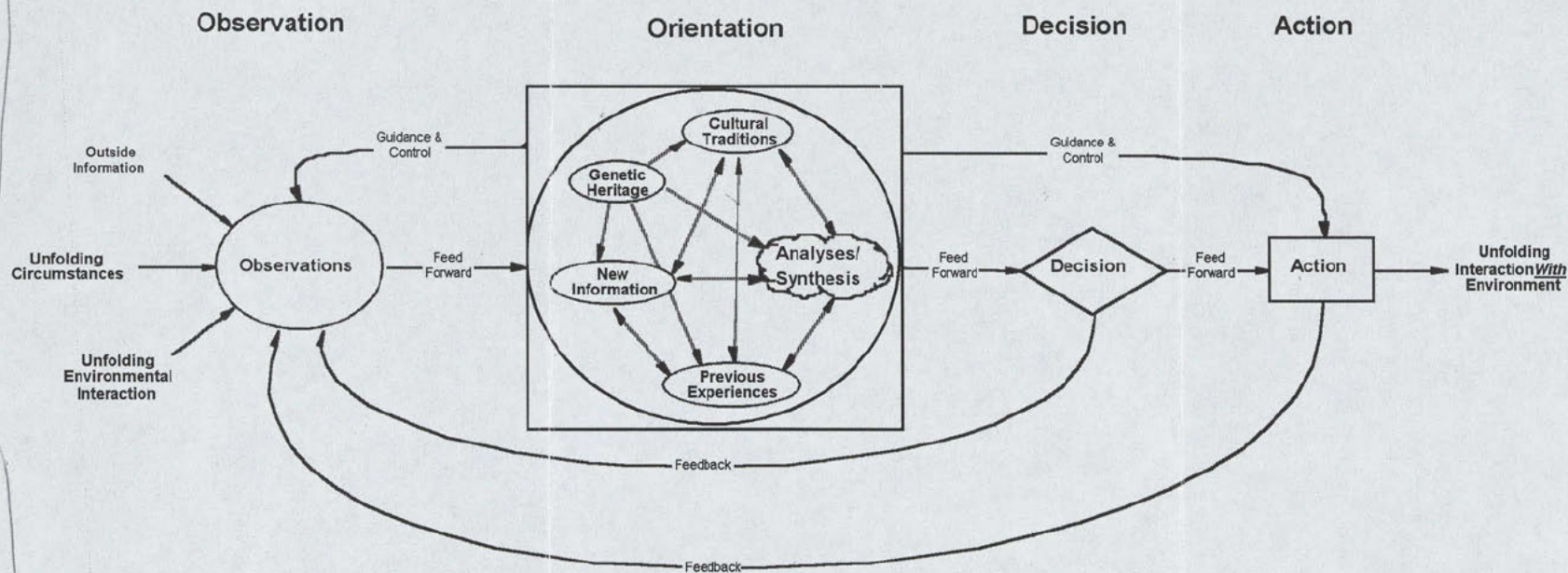
⑤



then

⑤ is a general
statement for
dealing with reality

The OODA "Loop"



also
 We can let D be H or C or R or 006
 and A be T or P or E or 005

In if this is so then this ~~loop~~ ^{human} ~~applies~~ ^{conceptual} "loop" can be
 used to ~~represent our simplified representation~~ ^{represent our} ~~processes~~ ^{processes} p/s possible

* R-To-A Tactics

(S) 1954 • - ACM - 1957

• AAS - 1960-64

} 6 yrs - 2 yrs

* Energy Maneuverability Concept

(S) 1962 • EM - 1964-65

• EEM - 1968

• MMC - 1970-72

} 18 yrs - 8 yrs

* Competing, Cooperating, Scheming

(S) 1976 • POC - 1976-86

• OOC - 1982-87

• TSG - 1986-87

} 11 yrs - 11 yrs

* Comprehending, Shaping, Adapting

(S) 1976 • D&C - 1976

• CS - 1990-91

• W - 1991 (Oct 91)

• ES(W) - 1992

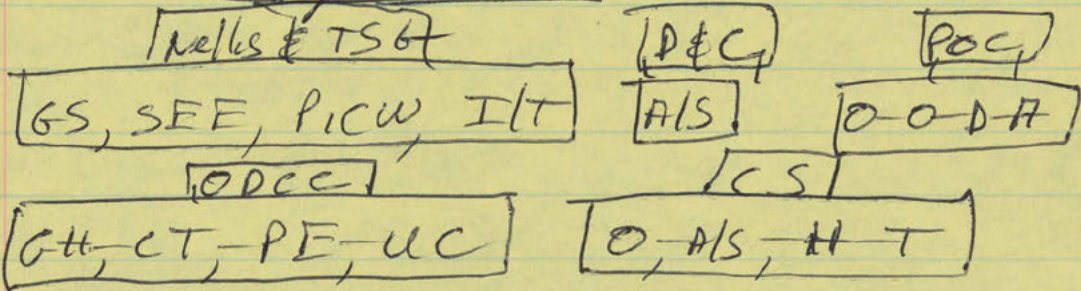
} 15 yrs - 3 yrs

32 yrs - 16 yrs

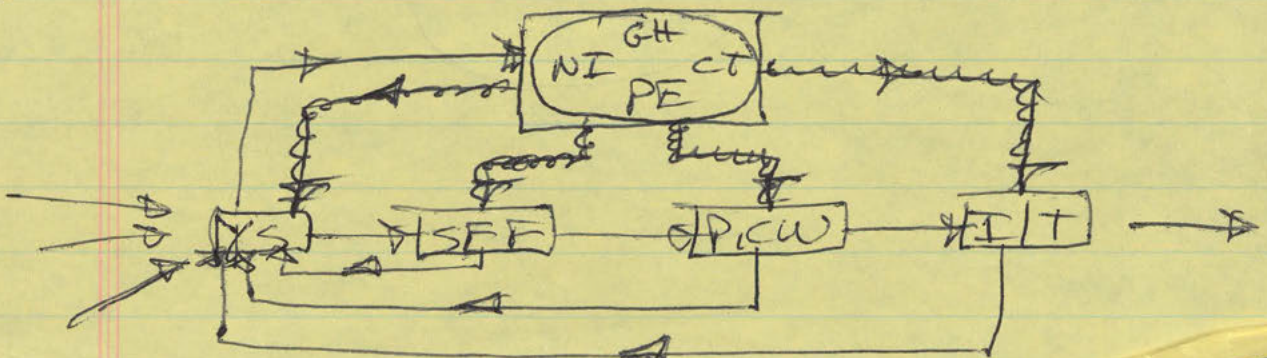
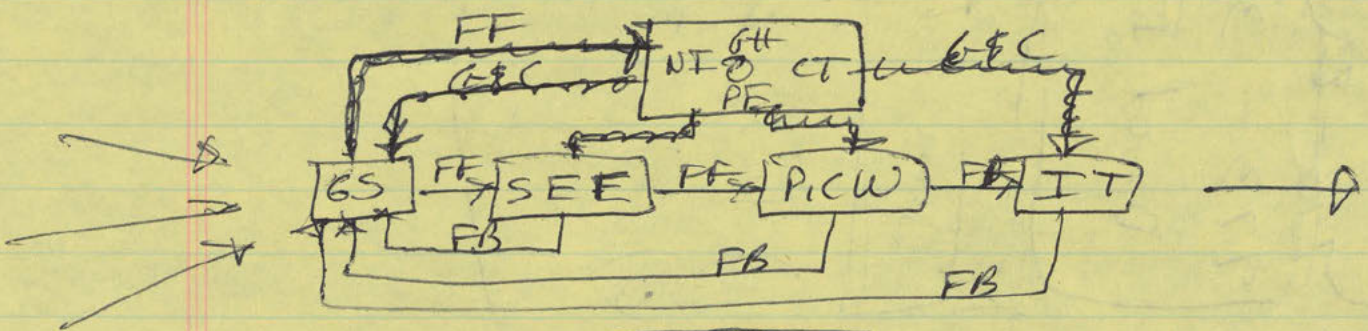
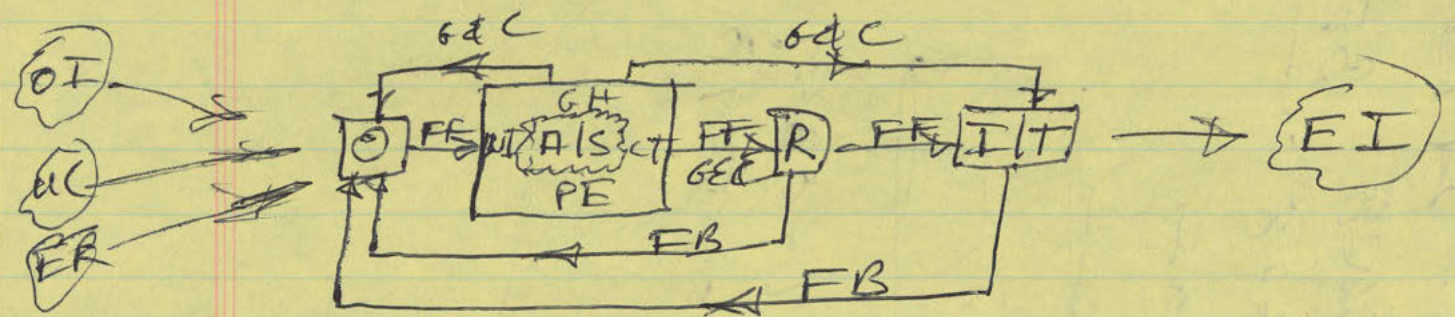
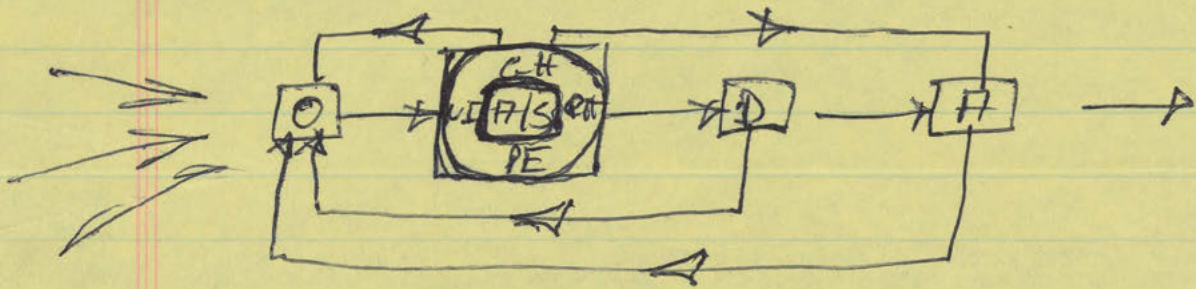
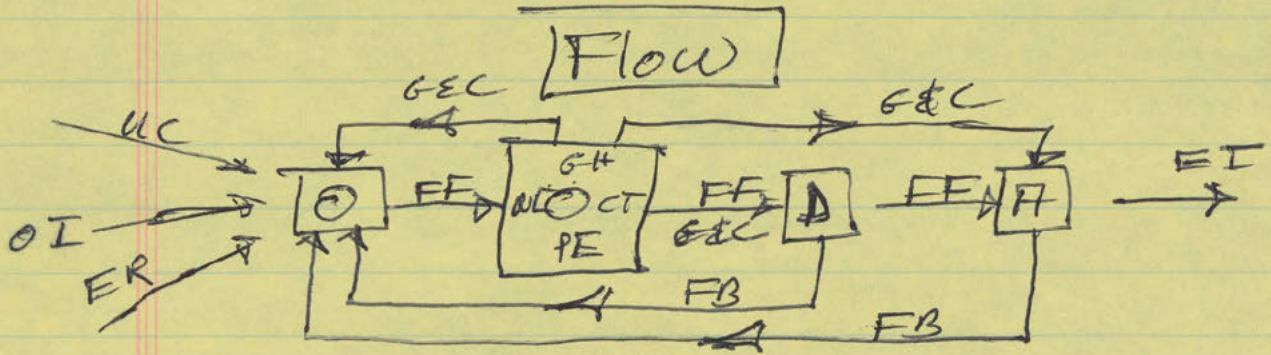
[1954 -> 1992] = 38 yrs

1992
1954
38

Key Ideas



Flow



any physical or
any system or concept that

any system concept or scheme we put
together cannot have more energy or
information than the systems or sources
from which we draw upon

~~any~~ ^{any} systems or sources from which we
draw upon must have more information
than the

at best

Any evolved system scheme ~~must be~~
cannot have more energy or information than
the systems or sources from which ~~that~~
it was evolved.

In a perfect world any ~~newly~~ newly created
systems cannot have more energy or
information ~~than~~ than the systems or
sources from which it was evolved.

In the or real world any newly created
(designed) system or system we
design or create cannot have as
much energy or must have less energy
or info than the source from which
that it was created

In a perfect world a system or scheme
cannot have more information than
the sources() from which it was
~~create~~ derived & created (extracted)

In our real world a system or scheme
cannot have as much information
as the sources from which it was
derived & created (extracted)

Art Richards

[REDACTED]

Stimly Baker

[REDACTED]

I • SpaceCast 2020 ~~What~~ have we
~~provided~~? When are we ^{going}?,
When are we going,
What do we want from it

II • Info/Cyber/Net War or Conflict



What is the Purpose/Aim/Goal of
such a War?

III • How does such a War/Conflict fit into
SpaceCast 2020?

IV • Point: Do the Purposes/Aims/Goals play
into one another? If so, how?

V • Put another way? What should be our
Purpose/Aim/Goal for SC 2020?

- "Descent into Hell"
by Charles Williams
- "Gods Fifth Column"
by William Berkebile

A# • Input - Store - ^{process} transform - output

C • Collect - Correlate - Compress - Transmit

B • GS - [SEE - PICW] - [H] [H]

A • Gather - Store - Transform - emit/append

P	•	O	-	O	-	D	-	A
	•	O	-	A/S	-	H	-	T
	•	O	-	A/S	-	D	-	T
	•	O	-	A/S	-	C	-	P
	•	O	-	A/S	-	R	-	Exhibit

$$S = V dT$$

$$\frac{dw}{w} = dt$$

$$dS = \left(\frac{V}{w}\right) dw = \frac{V dw}{(SFC)(D)} \quad w$$

$$dS = \frac{V(w)dw}{(SFC)(D)w} = \left(\frac{V}{SFC}\right)\left(\frac{L}{D}\right)\frac{dw}{w} \quad \frac{\#}{sec} \frac{w}{w}$$

$$S = \left(\frac{V}{SFC}\right)\left(\frac{L}{D}\right) \ln \left[\frac{1}{1-\eta} \right] \quad SFC \frac{\#}{sec} \frac{w}{w}$$

LT Col G-I W. Iso

$$SFC = \frac{\#}{sec} \frac{w}{w}$$

FRX # (619) 725-9249

$$SFC = \frac{1}{1}$$

Science - - The practice of reducing mismatches ~~with~~ ~~and~~ between images & reality by trying to evolve images that correlate with reality.

Politics - - The practice of fabricating mismatches between images and reality while trying to make it appear otherwise.

Chet ~~Richert~~
1631 Riverview Rd.

Richert

Apt 308

Deerfield Beach, Fl. 33441

0039-556-203

The Cackoo's Egg
Clifford Stoll

Harvour
Hacker



Contented 1283 ~~ft~~ Lander

Cont 1283 @	1200	FT L
	1334	8D
183	1500	Hacker
	1552	S Apr 8D

Rental



Post Michael P. Ivanovskij

Mindy ben Meimachar

Meimachar

#30

* Key ingredients for CS & A

- A/S
 - Many-sided implicit X reference o o o
 - OODA loops
-

* Constraints on above

→ GH, CT, PE.

- you can't get something for nothing
 - Without constraints, no focus & direction
-

John Boyd

FXI+G/Arthur
21 MARCH 94

USA TODAY • TUESDAY, MARCH 15, 1994 • 3C

THE SEARCH FOR PEAK PERFORMANCE

The mind holds secrets beyond the zone

Elongated time turns fast action into slow motion

By Dick Patrick
USA TODAY

When Michael Jordan hit seven three-pointers in a row, when John Olerud hit above .400 into August and when Joe Montana led another late rally, they were in the zone, in the flow, in the groove.

But there's another special stage that can be reached.

Opinion researchers at the Gallup Organization, who have interviewed athletes extensively, and psychologists have named it elongated time — the ability to see fast-moving events in slow motion.

For those who can't hit the three, a nasty slider or a secondary receiver, the sensation is similar to being in a car accident and experiencing fast-moving events in a slow-motion, dreamlike manner.

Researchers have overwhelming anecdotal evidence about elongated time.

It's a feeling Pat Haden relished and why the ex-NFL quarterback and current CBS radio and TNT TV announcer enjoys super-slow replays. It brings back the feeling of a two-to four-second play seeming to take a minute.

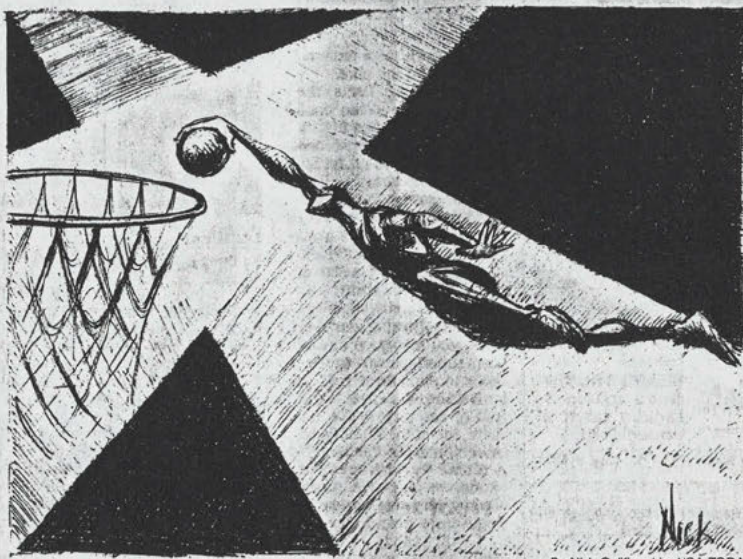
How others experience it:
▶ Jordan: "The rim seems like a big ol' huge bucket."

▶ The Toronto Blue Jays' Olerud: "When things are going well, there seems to be more time to react to a pitch. And it doesn't matter what that pitch is. It's just that it feels like you have more time to react."

▶ The New York Knicks' John Starks: "It's like you see something just before it really happens."

Perhaps the most vivid account of elongated time is provided by Haden, a lawyer and Rhodes scholar.

"It's difficult to articulate because it's amorphous," says Haden, a former Los Angeles Rams quarterback. "You



By Nick Galifianakis, USA TODAY

sensed all five senses — well, maybe not smell — working, like you're on alert. You can feel every step as you come away from center. In the pocket, it seemed like you saw 150 yards of the field. The receiver was bigger than life — you didn't see the defenders. The ball felt great in your hand — you had a great grip on it.

"It was sensual. After the play, you realized you'd had it and wished you could have it on the next third-and-8. If it had happened all the time, I'd have been Joe Montana."

Montana says he doesn't experience slow motion, though he does "get a feeling something good's going to happen." Wayne Gretzky, another athlete known for his vision, claims he doesn't experience unusual sensations.

So what's going on? No one's sure exactly, but most think it's neurologically based.

"Our speculation is that the eye turns on and off 16 times a second," says psychologist Don Clifton, chairman of Gallup Inc. and the man who came up with the term "elongated time"

about 10 years ago. "Those with elongated time can take maybe 50-60 pictures. I think they have nerve tracks that can actually do it."

Gary Fitzsimmons, assistant general manager of the National Basketball Association's Cleveland Cavaliers, studied the subject: "At certain times, all players have it. But what is the consistency? What separates the guys who are all-stars from the superstars? It's probably consistency on how often this happens."

The implications are interesting. If it can be increased or learned, an athlete's effectiveness could greatly improve.

But there are differences of opinion if the ability to experience elongated time can be learned or enhanced.

"It happens when it happens," says Bob Rotella, a sports psychologist best known for his work with golfers. To think about it would discourage its occurrence.

But Rick McGuire, a former Rotella student and now a sports psychologist and women's track coach at the Univer-

sity of Missouri, thinks athletes can facilitate elongated time:

"If it can be experienced by people, then it can be prepared to be experienced by people. Some people say this can't be controlled; I say we haven't looked far enough, long enough, hard enough, smart enough. But I can flat-out promise you I'm looking. We're working at it."

McGuire's preparation of athletes goes beyond the practice of visualization. He stresses conjuring up sights, smells, sounds, tastes and feelings of peak performances, including experiences of slow-motion perception. He also emphasizes the importance of the athlete's positive self-image.

In competition, McGuire says, "He'll push the button, the program will play and it will feel easy. Gosh, it sounds simple, doesn't it?"

"I absolutely promise you we don't have it all figured out. If we did and could pre-create it on demand, we wouldn't be talking now."

Contributing: Bill Althaus, Mel Antonen

Brain waves might provide key evidence

Lawrence Moten and Licious Jackson had some unusual sessions in preparing for the college basketball season. The two Syracuse players took jump shots with electrodes attached to their heads.

They were part of an experiment, conducted by sports psychology assistant professor and ex-Syracuse assistant basketball coach Barry Copeland.

The object: to discover if "flow," or peak performance, is associated with a particular type of brain wave. According to Mihaly Csikszentmihalyi, author of *Flow: The Psychology of Optimal Performance*, it's not clear if elongated time is a product or condition of flow.

There are four primary brain wave levels: beta, a state of consciousness that exists, for example, as people are speaking; alpha, a level of alertness slightly less than beta; theta, drowsiness; delta, deep sleep.

"If you look at the research in the area," Copeland says, "there's an indication that when athletes are playing in a state of flow, there's a higher relationship to alpha brain waves than other stages."

In other words, for an athlete to excel at a repetitive task, such as shooting a basketball, it might be best to have a relaxed concentration, instead of being hyper-alert.

Copeland charted shooting streaks and brain waves. For example, if Moten was on a hot streak, Copeland tried to determine if the player was in an alpha or beta state. The pilot study was inconclusive, and Copeland wants to test it on a larger sample.

If a flow-alpha connection is proved, the next step would be finding methods to promote alpha states and, thus, peak performance. "This is futuristic," Copeland says. "This needs more research. But it's neat."

— Dick Patrick

A Turnaround Primer

By PETER F. DRUCKER

American Express, General Motors, Westinghouse, IBM — all have shaken up their top management to bring about a "turnaround." Predictably, their plans also include immediate cuts in the work force. For a short time, costs are likely to go down and profits and share price to go up. But a year or so later, each company will be no better off than it was before, and then it will surely announce another layoff. Similarly, every one of these companies now promises a turnaround through "re-engineering" operations. The re-engineered operations do indeed improve, often greatly. Yet the company's overall performance improves little, if at all. Why is this so?

After decades of expansion, many big businesses are indeed overstaffed — even more so in Japan and Europe than in the U.S. And since companies tended to grow overhead as fast as sales — and often much faster — a good many operations are indeed in need of restructuring. Research, engineering, customer service, accounting, marketing, clerical work — all need to be re-engineered to be freed from diversions and busy-work, to be focused on their key tasks, to be organized around the flow of the work and the flow of the information. Yet, however badly needed, neither layoffs nor re-engineering are likely to restore an ailing company to health. A company beset by malaise and steady deterioration suffers from something far more serious than inefficiencies. Its "business theory" has become obsolete.

Changing Basic Assumptions

Every business, in fact every organization, operates on such a theory — that is, on a set of assumptions regarding the outside (customers, markets, distributive channels, competition) and a set of assumptions regarding the inside (core competences, technology, products, processes). These assumptions are usually taken for holy writ by the company and its executives. It is on them that they base their decisions, their actions, their behavior. The longer such a business theory works, the more it pervades the organization.

But, as an old proverb has it: "Whom the gods want to destroy they send 40 years of success." For a business theory is not a law of nature. Eventually it becomes inappropriate to the realities of the market and technology. Then long-successful companies — especially big ones — begin to deteriorate. They lose their bearings. And the only thing that can effect the needed

turnaround is rethinking and reformulating the company's business theory and repositioning the business on a new set of assumptions.

The diagnosis is fairly simple. Whenever a business keeps on going downhill despite massive spending and heroic efforts by its people, the most likely cause is the obsolescence of its business theory. This diagnosis becomes a virtual certainty if (a) the malaise follows long years of unbroken success (GM's case), or if (b) newcomers to the industry flourish while the long-time leaders are fading. Examples are Wal-Mart's prospering while Sears declines; discount "clubs" prospering while department stores flounder; regional banks prospering while Citibank lurches from one "unpleasant surprise" to

made fully effective. But as soon as the questions I just described are being asked, the turnaround has begun. And then it often proceeds with stunning speed.

Asking these questions immediately makes possible effective action. Re-examining an ailing company's business theory almost always shows right away that the best resources are misinvested. People, knowledge, money are committed to things that should be stopped or sharply curtailed. Some of these will be things that should be done — but by other people and by another company. Other things have outlived their validity and productivity. Yet others should never have been done at all — typically, things into which the company rushed in reaction to malaise and decline. Getting rid of these things will not,

exploited. They are "almost successes": activities that aim at building a different tomorrow but are instead misused to keep yesterday alive a little longer. But tomorrow is then always being sacrificed on the altar of yesterday.

The best example is an old one: the attempt of the founder of IBM, Thomas Watson Sr., in the early 1950s to keep the punch card alive by selling it as an accessory to the then-new computer — with strict injunctions to his salespeople *never* to push computers if doing so would endanger getting a single punch-card order. (Fortunately for IBM, the Justice Department at that very instant filed an antitrust suit that forced the company out of the punch-card business; otherwise IBM would surely have gone the way of the punch card.)

Gambling on the New

Typically — as was the case with IBM's punch card — yesterday's product, technology or customer service is the "cash cow." But hanging on to it invariably stunts the new, promising business or product that is alive and growing. The turnaround thus always involves a big gamble. But while hanging onto the old will soon destroy the company, gambling on the new is a rational risk, based on a valid business theory and justified by the successes (e.g., the four performing stores in the department-store chain) that are already basing their practice on the new theory.

The years ahead will be years of rapid changes — in technology, in markets and market segmentation, in consumer values and consumer behavior, in finance, in political and geographic realities, in economic and trade policies. They will, therefore, steadily make existing theories of the business obsolete. In fact, the most probable assumption is that no currently working business theory will be valid 10 years hence — at least not without major modifications. And yet few executives accept that turning around a company requires fundamental changes in the assumptions on which the business is being run. It requires a different business.

And it is not only businesses that will have to learn to turn themselves around. Almost any large organization will find itself stagnating, frustrated, ailing — none more than government. Almost every large organization will have to rethink its business theory.

Mr. Drucker is a professor of social sciences at the Claremont Graduate School in California.

Drucker on Management

A company beset by malaise and steady deterioration suffers from something far more serious than inefficiencies. Its "business theory" has become obsolete.

the next; Japanese and Koreans steadily gaining market share while Dutch electronics giant Philips slides ever deeper into the hole despite brilliant technological achievements.

To start the turnaround thus requires a willingness to rethink and to re-examine the company's business theory. It requires stopping saying "we know" and instead saying "let's ask." And there are two sets of questions that need to be asked. First: Who are the customers and who are the noncustomers? What is value to them? What do they pay for? Second: What do the successes — the Wal-Marts, the regional banks, and so on — do that we do not do? What do they not do that we *know* is essential? What do they assume that we *know* to be wrong?

These are always very unpopular questions, particularly in a business that has had long years of success, which may explain why so many of the successful turnarounds are initiated by new top managements recruited from outside the company, if not from outside the industry. Yet, unless these questions are asked — and asked seriously — there will be no turnaround.

It may take a good long time — sometimes years — until the new business theory has been formulated, tested, accepted and

by itself, generate new growth. But unless they are gotten out of the way, the company will have neither the vision nor the energy nor the resources to do the right things, the things that will produce results and growth.

The next step in a turnaround is to find what works in the business and to build on it. Even in a very sick company there are islands of strength.

Of 29 stores in an ailing department-store chain, for instance, 25 were hemorrhaging. Four stores, however, were doing well. But no one had paid attention to them. Everyone dismissed their performance as an "accident" or an "exception." Everybody was desperately busy working on the "problems." But the four stores performed because they had — half-knowingly — repositioned themselves on a new business theory that was in line with market realities. These stores did not have the answers. But they had answers. And answers of this kind are exactly what an ailing company needs to become success-focused again instead of problem-focused. They enable the company to take chances again, to be innovative, to take leadership.

In the typical turnaround situation the central challenges are, however, neither things to be abandoned nor successes to be

Maj. Clay Bosler

7755, Rm 244

AWC/AP

OODA Loops

Anytime Fri or Wed PM.

21/9/93

1 Dinner = \$ 5.95
Tip = 1.25
Total = \$ 7.20

22/9/93

Lunch = \$ 2.25
Dinner = ~~10.95~~
= 9.95
Tip = 1.50
\$ 13.70

Room consumables
4 x ginger ales
3 x wine

24/9/93

Lunch = \$ 2.25
Dinner = 7.95
Tip = 1.50
Total = \$ 11.70

Tuesday

280

9¹⁰ / 1141

CSAIR

280

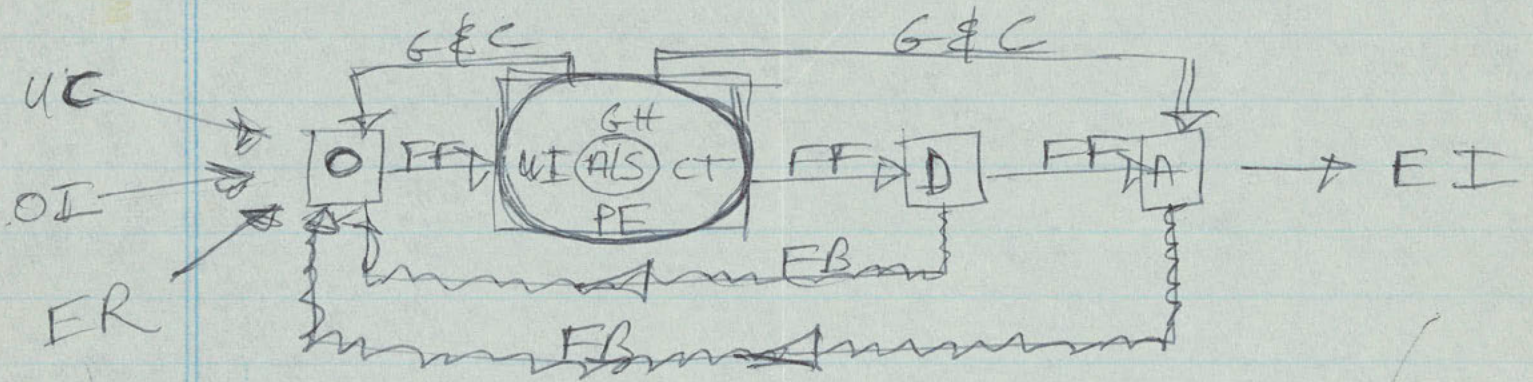
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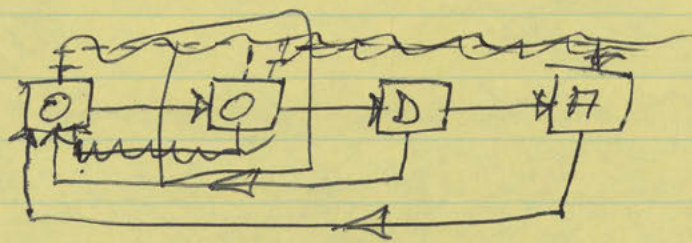
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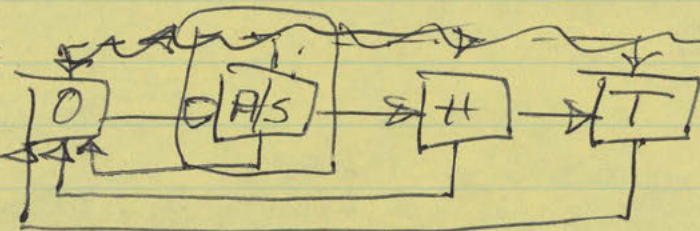


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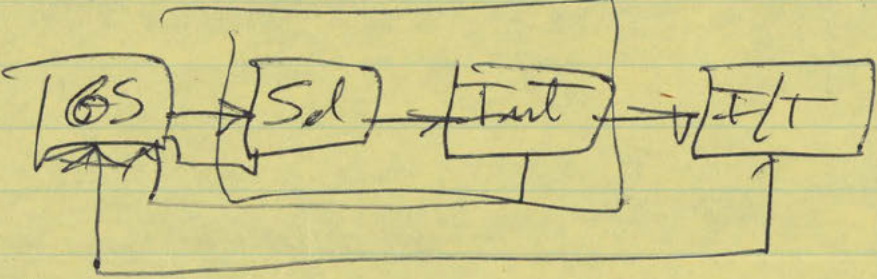
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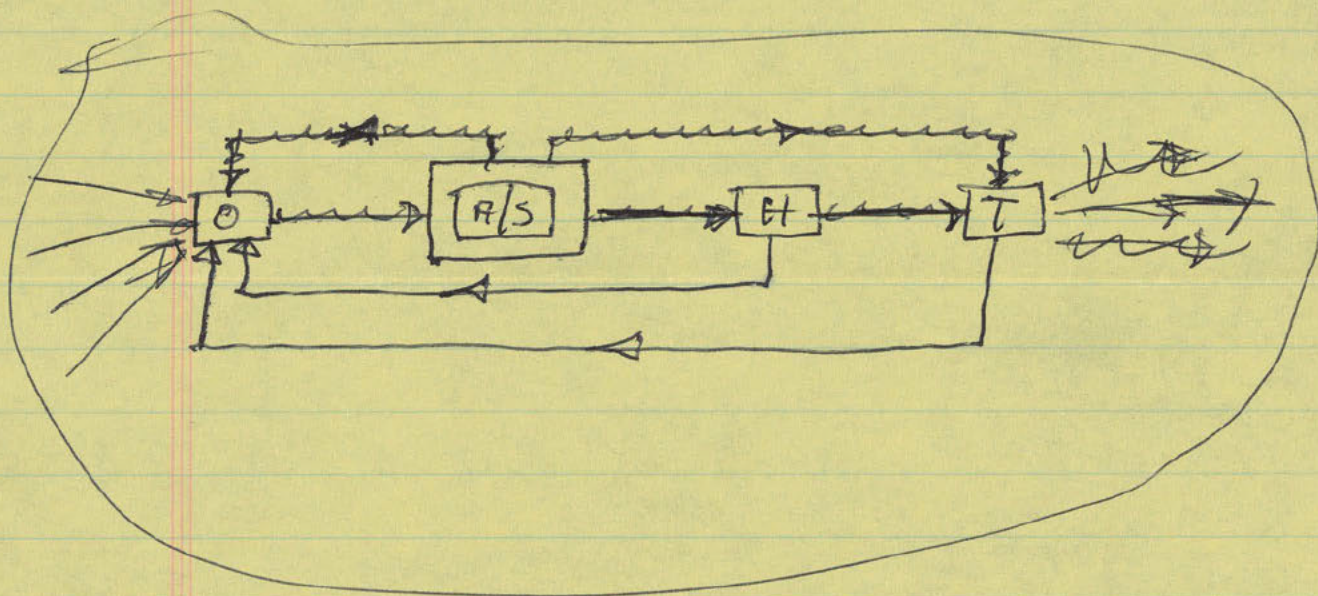
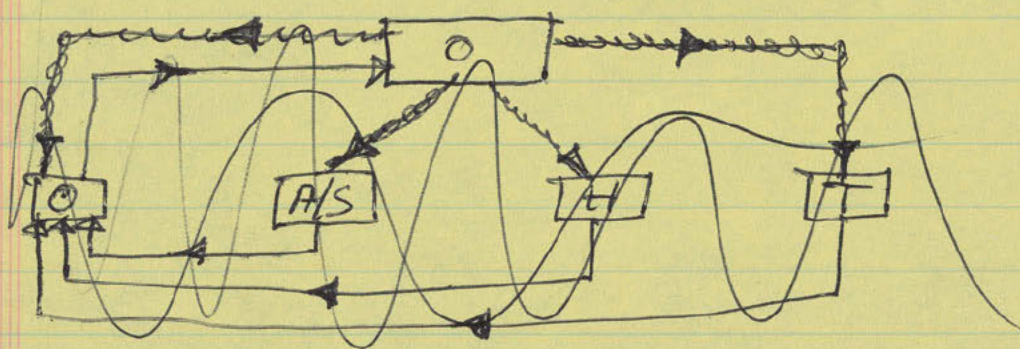
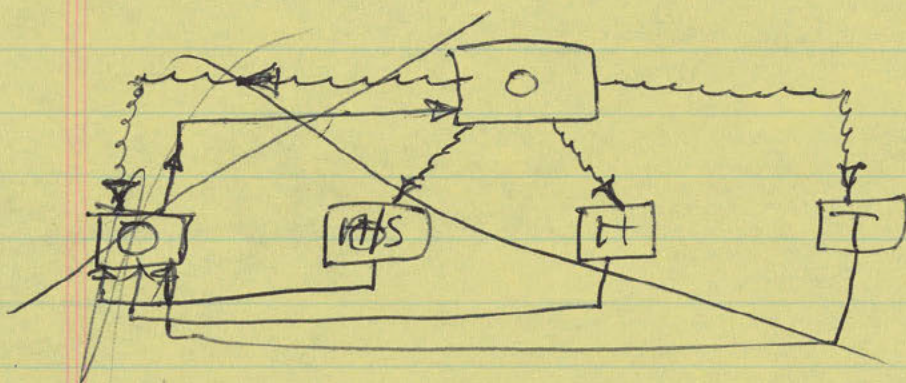


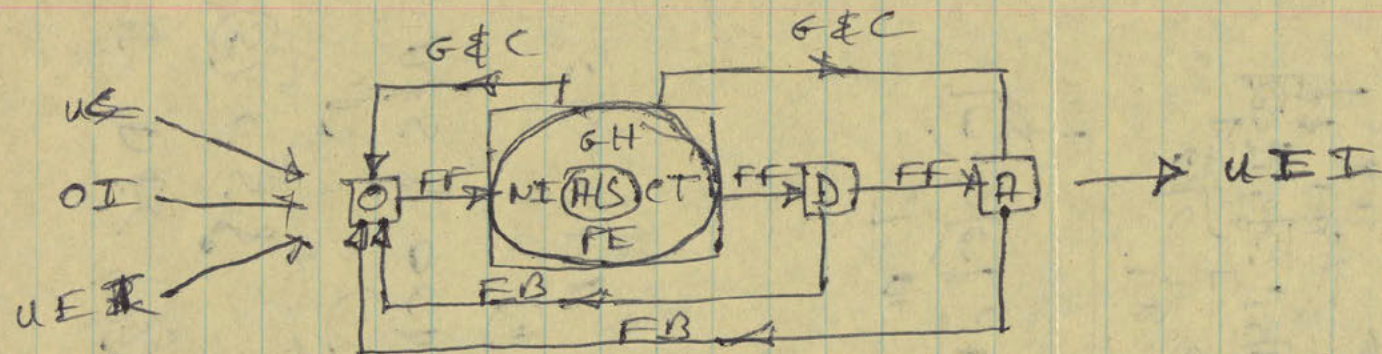
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Changey Reality and Novelty

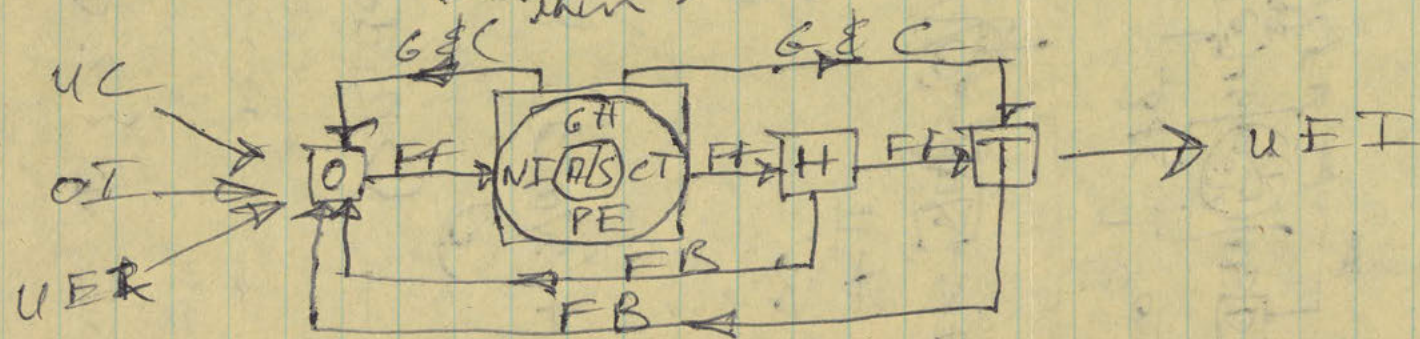
U, E Reality





Now if we let

$$\begin{matrix} D = H \\ \& \\ A = T \end{matrix} \Rightarrow \boxed{OODA} \& \boxed{OASHT} \text{ are two birds of a feather}$$





AIR FORCE UPDATE

FOR SENIOR AIR FORCE LEADERS

Secretary of the Air Force
Office of Public Affairs
Washington D.C. 20330-1690

Flexibility and Airpower

by

Gen. Merrill A. McPeak
Air Force Chief of Staff

*Presented at the Air Mobility Command Dining In
Scott AFB, Ill., June 12, 1993*

The Bible speaks of three virtues: faith, hope and charity. They are not accorded equal rank; it says, "And the greatest of these is charity." We know that airpower also has virtues — certain valuable and, in combination, we believe, unique characteristics — speed, range, precision, lethality, flexibility. These are all marvelous features for combat forces to possess, but I'm convinced that, like the saving graces of the scriptures, they should not be regarded as equals; for the greatest of airpower's virtues is *flexibility*.

We've all known this for a long time. When I was in a squadron we shrugged off the inexplicable changes masterminded by teenage staff officers up in wing. Our ability to comply was easy to explain: "Flexibility is the key to airpower." We said it then and I'm sure it is said, still, today. But when we think hard about flexibility, try to define it, measure it, figure out how to improve it, we come to realize how slippery a concept it is.

Exactly what is flexibility? The quality itself is not defined in the Joint Chiefs of Staff dictionary of military terms. Our own doctrine manual, Air Force Manual 1-1, includes a few words about flexibility/versatility, for some reason linking these two characteristics and asserting that, together, they constitute one of seven "tenets of aerospace power." The doctrine author describes this tenet briefly: "The ability to concentrate force anywhere and attack any facet of the enemy's power." Somehow this doesn't add much to our understanding, in part, I suppose, because we all can imagine forces being concentrated and attacking at a point of our own choosing in a very inflexible way, as with the Charge of the Light Brigade or the murderous, brute force assaults persisted in by the allies during the first world war.

My conclusion is that, unless we've thought long and hard about it, most of us probably could not give flexibility a good, crisp definition, any more than we could quickly produce a clear meaning for the set of concepts wrapped up in the motto, "centralized command, decentralized execution," another icon in our small pantheon of household gods. No criticism is meant here. At our best, we are not a doctrinaire outfit. Odds are most of us would say of flexibility, "I know it when I see it," and go back to trying to get on the flying schedule.

Well, I checked, and there's no tail number with my name beside it tonight, so I might as well take a crack at defining the term. For openers, flexibility is the capacity to adjust to changing circumstances. But that's not all it is. To help get a grip on the entire concept, let us turn to John Boyd, who, as you

probably know, has proposed the concept of the OODA loop as a way to think about problem solving in a dynamic environment. OODA is an acronym for observation, orientation, decision, action, the four problem-solving steps we go through.

Now, three of these OODA loop elements are quite unremarkable. We can easily grasp the idea of observation, of decision, of action. We sense a problem, make a choice, act on it. Very simple. In fact, these concepts correspond one-to-one, can be mapped directly onto attributes or qualities we seek in our people. Observation, to intelligence; decision, to leadership; action, to courage.

But, what about this other "O," orientation? What does it mean? What does it map to? Boyd uses the example of the F-86 in Korea. This aircraft was in some important respects inferior to the MiG-15, but its powered controls gave it a much faster roll rate. Accordingly, it had the crucial advantage of being able to realign its guns much more quickly in any dogfight. Of course, a dogfight involves a series of OODA loops on both sides, with lots of fast transients in the loops. The F-86's roll rate advantage meant it could operate consistently inside the bandit's OODA loop time cycle. This fact had both offensive and defensive consequences. In the defense, it meant we could quickly counter enemy moves. In the offense, it meant we could ourselves generate rapidly changing combat conditions. And here we come to a very important point. Flexibility has both of these two aspects: It is first the capacity to respond well to changing circumstances, an important but somewhat passive virtue. For me, it is the active aspect, the ability to shape change, to make it work for you, that separates flexibility from mere adaptability.

I believe that we can regard this composite quality, the ability both to create change and to reorient on the new set of conditions constantly presented in any dynamic environment as a technically better description of what we mean when we say "flexibility." In the OODA loop formulation, then, orientation corresponds with, or can be mapped directly onto, the quality of flexibility.

Moreover, I put it to you that, over the long run, the other qualities, intelligence, leadership and courage, are about evenly distributed in the world's population. Don't get me wrong. America will always produce smart, brave airmen. But we should never stake our country's fate on the notion that we are inherently smarter, or braver, or more gifted leaders than will be put forward by potential adversaries. On the other hand, the way our society works, my guess is we may be able to sustain a long-term competitive edge in flexibility. In my view, therefore, our best bet is to leverage this cultural strength, to aim at building an Air Force that orients better, to build the most flexible Air Force possible.

So, you see why I wanted to talk about flexibility tonight. I spend adverbs like they were my own money, and I say flexibility is *critically* important. The first reason is that, like it or not, things *do* change. The environment *is* dynamic. Plans change. The "good guy-bad guy" lineup card changes. Technical capabilities change. Although we sometimes act as though they were immutable, even doctrine and employment concepts change. At the beginning of the 1967 War, Israel attacked Egyptian aircraft parked in the open. The world observed and reoriented. The Warsaw Pact decided to build aircraft shelters; NATO reacted with a shelter program of its own. Israel had used up a concept. In exactly this way, events consume alliances, plans, technology, doctrine.

So things change and today the rate of change is accelerating. Technology provides perhaps the most convincing evidence of this fact. It is possible to argue, for instance, that by about 600 B.C., at the latest, humankind had already invented and was using the military hardware — the sword, lance and shield — that was to dominate warfare for about the next 2,000 years. To illustrate the point, when Alexander the Great first crossed into Asia Minor he is said to have been given as a gift some body armor of Trojan War vintage. This would have made it about 900 years old. We are told that he

subsequently wore this armor into battle. Apparently, no one considered this remarkable at the time. Today, we cannot imagine that weaponry would evolve at such a slow pace. (I admit that I recently piloted a C-141 that had 32,000 flying hours, but even it was well short of 900-years old!)

So, our technical environment is dynamic to a degree different from anything in human experience. But that's not the only variable in the equation.

The political context for using force is also changing quite rapidly. The Russians call Desert Storm "the first modern war." That's a very nice usage, but I wonder whether instead it may not be "the last ancient war;" ancient in the sense that it involved a rather traditional cross-border aggression, clearly defined objectives on each side, straightforward employment of conventional forces, and so forth. All this is very different from the variety of jobs your Air Force is finding for itself today. The drug war, operations in Somalia and Bosnia, the two nasty little Desert Storm clean up details, nothing here that bears much resemblance to the Cold War circumstances that shaped our Air Force over its first 40 years. But it is from these new, non-traditional challenges that our future tasking will spring.

Finally, as an added complication, we are getting smaller quite quickly. The budget is heading south, taking Air Force formations with it. Some have therefore suggested a "divestiture" strategy — that we figure out which functions are "core" to the Air Force and give up everything else. For my money, that just won't work. We are the air force of first and last resort for the United States, and for that matter, others, as well. The air forces of other countries or other services can specialize, become "niche" air forces. We cannot. We're never sure what the president will ask us to do. In the end, our residual force must be able to respond to a very wide range of demands across the entire spectrum of tasking in air and space, from global situation awareness, to theater conventional operations, to humanitarian airlift, to whatever.

So, flexibility is important — increasingly important as the pace of change quickens, as the variety of tasks we undertake widens, and as resources available to us are reduced. But we have not been standing still. We've been working to increase our flexibility in several ways.

The first effort has been to improve organizational flexibility. That I put organization first will surprise no one. The question of how to organize human activity to achieve particular results has always fascinated me. Immediately after becoming chief, I kicked off "The Year of Organization," and we are still adjusting to the rather substantial changes called for as we restructure to the objective Air Force.

As you may know, the air staff has underway a total reform of Air Force regulations. I won't go into all that, except to point out that we recently produced in the new format a policy directive on organization, PD 38-1. Let me cite just a few lines from it.

Under the heading of desired characteristics in Air Force organizations, we find:

"Mission orientation: Organizations should have a reason to exist and should be designed to achieve the (desired) outcome..." Organizations should have a reason to exist! Some pretty advanced stuff, here.

"Decentralization: Organizations should be designed so that lower echelons can achieve objectives without needing continuous control from above." Is this great policy, or what?

And, finally, "Flexibility: Organizations should be capable of adapting rapidly to changing external circumstances."

Okay! That's what we've been talking about.

The point of all this is we have a philosophy, an attitude, from which we are confident will spring organizational designs that make flexibility possible. We therefore require as a matter of policy that our organization be streamlined, delayed, decentralized, that we do not build inflexibility into our structure.

But we've gone beyond this to try to shape organizational change. There are many examples of this, but perhaps the best has been the creation of composite wings at bases where there had not before been a mix of equipment types. We've taken some criticism for this, which I have discounted because it comes from people who have no real appreciation of the greatly increased flexibility that is built into the wing by putting air capabilities together in this way. The theme here is that we are not merely adapting to change. Our reorganization effort shows the active face of flexibility. We are setting the agenda, shaping change, causing change.

In my second year, "The Year of Training," we took up the task of trying to enhance the flexibility of a wonderful resource — our people. Most of the effort involved improvements in training, but a very important initiative reworked the job classification system. In the process, we made a sizable reduction in the number of enlisted occupational specialties. Henceforward, our people will be more broadly used and accordingly must be more comprehensively trained, less specialized.

There will be a whole series of changes to skill training and professional military education, including, for instance, the requirement for everybody to cycle back through technical training at mid-career. These changes mean our people will be better trained, no doubt about it. We can expect them to have a deeper understanding of their jobs. But they can also be expected to possess a broader range of skills. In other words, they will be more flexible.

So, we have not been on autopilot lately. An interlocking set of reforms is underway that will give us a better organizational structure and people better prepared both to respond to and to create change.

Of course, 1993 is "The Year of Equipping the Air Force." Here, it will be a little harder, I think, to score quickly. Quite frankly, we are saddled with an equipment acquisition process that is so bad it tends to throw even the occasional bright spots into shadow. The C-17 is a good example. This aircraft will carry twice the cargo of the C-141 into three times as many airfields as are available to the C-141. That, of course, would increase tremendously the flexibility of our mobility forces. The issue now is whether we will field the C-17, or whether it will evaporate in the friction generated by our way of buying military hardware.

But the fact is that our acquisition system, bad as it is, has often produced equipment of great inherent flexibility, which we subsequently were unwilling or unable to exploit. Why did it take us 30 years to install cargo rollers in the KC-135? What's the rationale for fielding the B-1 and B-2 without the capability to deliver precision-guided conventional munitions? Why are we only now thinking about putting high-speed anti-radiation missiles on the F-15C? These are human failures, failures of the imagination.

And so I turn, finally, to this most important point: All our efforts relating to the organization, training and future equipage of the Air Force may be accepted and instituted and will make no difference whatever if, when the time comes, we do not think about and use our forces in a flexible way.

For about the last 500 years — that is, over the period during which the principal implements of war have relied on chemical, rather than animal, energy sources — war at the top end has involved a contest

between systems. To beat a system, it is necessary to direct against it another system either more powerful or more flexible. Often, our first impulse is to try to overpower. The appearance of the U-boat in the North Atlantic at the beginning of World War II meant the Allies had to form up shipping in convoys. For a while at least, the convoy system beat the U-boat system. But note what was given up in this approach. Individual ships could not leave port when they were ready; they waited for the convoy. They could not sail at their best speed, plot the course they thought right, zig and zag as they wished. They did what the convoy did. They traded flexibility for power, the strength of numbers.

We took much the same approach in bomber employment. Early on, we found that bombers had to be grouped in large formations to survive German defenses. Thus, we integrated, days in advance, the planning and operations of many bomber bases, and eventually fighter bases, too, as we were forced to adopt fighter escort. As you might expect, this sort of integration is the enemy of flexibility. We were not able to take full advantage of the high cruising speed of our bombers. The sedate pace imposed by formation maneuvering constraints actually helped solve the problem for German fighters and anti-aircraft artillery. We settled into a sort of attrition war as prolonged and deadly and indecisive as anything on land.

It is interesting to read an account of these operations in our doctrine manual. Volume II has an essay titled "Aerospace Power Capabilities." This essay cites our World War II experience, "when more than 1,000 bombers launched from dispersed airfields in England, concentrated their striking power over targets on the continent, and then returned to their separate bases." Unhappily, a great many of them did not return. Perhaps by mistake, this awful experience appears in our doctrine manual under the heading of flexibility.

By the way, fighter operations in the second world war did retain much of their flexibility because they did not have to be so highly integrated into more powerful systems. Aircrews sent in pairs or in easily maneuvered small formations were able, with comparatively little outside assistance, to search for, find and destroy targets wholesale. We all know the devastating impact this had on German ground forces, isolating and breaking up some of the best units ever seen in battle.

However, in the decades since World War II, even our fighter force has become increasingly dependent on a variety of supporting systems — electronic warfare, the airborne warning and control system, reconnaissance and so forth. We ought to be concerned about this. The initial "alpha" packages of Desert Storm — those we flew before we could be fully confident of air superiority — were choreographed down to the last detail. The clockwork precision of these first few days was really remarkable, considering the weather, the number and variety of sorties flown, and the fact that the air forces of eight other coalition nations, plus our own Navy and Marines, all had to be orchestrated. It puts to shame [General Helmuth Karl] von Moltke's mobilization and deployment of Prussian troops against the French in 1870, when a million reservists and horses and thousands of tons of supplies had to be delivered to predetermined jump-off points in a short period of time. Careful planning meant that contest, too, was decided almost before the first shot was fired. But it is said that the Franco-Prussian War, like the world war a generation or so later, was inevitable, the momentum irreversible, once mobilization had been ordered. It wasn't simply that no adjustment, no fine tuning was possible; it was an all-or-nothing proposition. The Prussians lost even the flexibility to stop the conflict short of actual hostilities. We should remind ourselves from time to time that our alpha packages, these great "gorillas," also involve a tradeoff of flexibility.

Don't get me wrong; there is a time and place for careful scripting, and the first days of Desert Storm were a good time and place. We were marvelously successful. Moreover, and most important, we

But if this nation lasts another thousand years, as we pray it will, we can be sure of contests that will be much closer calls. When this happens to us, what will be important is our ability to combine organization, training, hardware and doctrine into a single decisive whole that is flexible enough to respond in relation to the specific enemy and circumstances and purposes at hand; to adapt to change, to shape change, to compel change. ... I give you flexibility, the key to air and space power.

[illegible]

By the way, if you are interested in the way the world is changing, you will find it interesting to read the book "The World is Changing" by the author of "The World is Changing" (1990). The book is a collection of essays by various authors, including the author of "The World is Changing" (1990). The book is a collection of essays by various authors, including the author of "The World is Changing" (1990). The book is a collection of essays by various authors, including the author of "The World is Changing" (1990).

However, in the early days of the war, the situation was not so favorable. The Japanese had been one of the main forces of aggression in the Pacific, and their attacks on Pearl Harbor and the Philippines had been a major blow to the United States. The Japanese had been able to capture many islands in the Pacific, and they had been able to establish a strong base of operations in the Philippines. The United States had been able to repel the Japanese attacks on Pearl Harbor and the Philippines, but the Japanese had been able to capture many islands in the Pacific, and they had been able to establish a strong base of operations in the Philippines. The United States had been able to repel the Japanese attacks on Pearl Harbor and the Philippines, but the Japanese had been able to capture many islands in the Pacific, and they had been able to establish a strong base of operations in the Philippines.

Telecom in morning

14/5/93

To Talk in Spring by contribution

cooperation with competition

Informal more influential than formal
- why -

-- Formal rules ^{rule} ~~are~~ constants with due process while

-- Informal rules have rewards as well as constraints and are not hindered by due process

Pathology of logical typing ^{narrow vs wide}

-- parts ~~or~~ whole

-- specific vs more general

-- local vs " "

(esp) low end vs higher level freedom -
- action -- associated with no constraints vs higher level freedom -
- action associated with introduction of constraints

& why

Survival of whole as well as members that make up whole

[Moral]

Codes of Conduct or Standards of Behavior that ~~endanger our individual freedom of action~~ permit us to survive one constraint that permit us to survive as individuals, as well as, with each other, hence permit us to survive (over)

as individual, as well as within a large
group or society

THE SCIENTIFIC ADVISOR
U.S. ARMY TRAINING AND DOCTRINE COMMAND

7 May 91

Mr. Boyd,

For your information
and file.

Don Stung

10 Feb 1981

Army War College

19 Nov 80

War - - End of Wars

- Paul Seabury & Angelo Codevilla

- Conceptual Spiral expands upon ~~these~~ ideas in D&C and reveals the ^{feedback} ~~the~~ ~~things~~ and action processes we go through to deal with an unfolding, evolving reality that is uncertain, ever-changing, unpredictable.

- ^{and} surfaces the ~~key~~ ^{intuitive} ~~processes~~ ^{feedback} circular processes we go ~~through~~ ^{through} to deal with an unfolding, evolving reality that is uncertain, ever-changing, unpredictable.

we generate that make evident point us to deal with as well as make evident, an unfolding, evolving reality that is uncertain, ever-changing, unpredictable.

we generate that make evident as well as point us to deal with an unfolding evolving reality that is uncertain, ever-changing, unpredictable.

- Conceptual Spiral expands upon the ^{concepts} ~~ideas~~ in "Destruction of Civilization" and surfaces the ^{intuitive} ~~processes~~ circular processes ~~that~~ we generate to deal with an unfolding, evolving reality that is uncertain, ever-changing, unpredictable.

• Conceptual Spiral ~~expands upon~~ surfaces the circular processes that we generate to make evident as well as permit us to deal with an unfolding, evolving reality that is uncertain, everchanging, unpredictable

• Conceptual Spiral surfaces the circular processes that we go through ^{which permit us to make} that permit us to make evident as well as deal with an unfolding, evolving reality that is uncertain, everchanging, unpredictable

• Conceptual Spiral surfaces the circular processes that we go through that make evident the unfolding, evolving reality and permit us to deal with an unfolding, evolving reality that is uncertain, everchanging, unpredictable

• Conceptual Spiral surfaces the circular processes that permit us to make evident as well as deal with an unfolding, evolving reality that is uncertain, everchanging, unpredictable

"Conceptual Spiral" is especially upon the ideas in "Deduction & Election", surfaces those circular processes that permit us to make evident as well as deal with an unfolding, evolving reality that is uncertain, everchanging, unpredictable.

3 Nov 92

Jim

Enclosed is a copy of the "Conceptual Spiral." I think you will find it interesting.

For context, I intend to make "Destruction & Creation" (D&C) and Conceptual Spiral (CS) a foundation for my ongoing work; a foundation for vitality & growth -- or more precisely and formally a "Foundation for Comprehending, Shaping & Adapting within an Unfolding, Evolving Reality that is Uncertain, Everchanging, Unpredictable."

As a consequence, I recommend you read D&C then read CS because, taken together, they represent a foundation for the "Implications" that follows in: "Patterns of Conflict," ~~Organic Design~~ (POC), "Organic Design for Command & Control" (ODCC), "The Strategic Game of ? & ?" (TSG), and a new presentation I am tentatively calling "Interconnections" (I).

Having digested D&C and CS you will then be able to better appreciate what's going on in POC, ODCC, TSG, and how everything plays together.

In any case after you have gone thru D&C and CS give me a call for any comments or questions you may have.

Jim

P.S. Before reading D&C and CS read the "Abstract in a Discourse on Henry & Lucy"

For
Benny Wall

{ 3 - Questions - }

Dear Claude

- Does everything ^{that} Clausewitz says fit today's world
- Does everything that Sun Tzu says fit today's world
- Does that Tomassi

• etc etc etc

[Point]

- What ^{portions} ~~part~~ of Clausewitz, Sun Tzu, Tomassi, can we use today

Daniel Cloyd / Bob Hansen

~~Change of name~~

202-324-4570

Robert S. Hansen

FBI Room 4058

Wash D.C. 20535

Range: $ds = v dt$ $\frac{dw}{dt} = w$

hence $dt = \frac{dw}{w}$, therefore we have

$$ds = v \frac{dw}{w}, \text{ therefore we can}$$

rearrange so that $ds = \left(\frac{v}{w}\right) dw$

Note that $\left(\frac{v}{w}\right) = \frac{ft/sec}{ft/sec} = \frac{ft}{ft}$

In other words $\left(\frac{v}{w}\right)$ represents the distance traveled per fuel expended

However we can push this argument a bit further.

$$S = \left(\frac{V}{SFC} \right) \left(\frac{L}{D} \right) \ln \left(\frac{W_5}{W_5 - \Delta W} \right)$$

Since $W_5 = W_2 - \Delta W$ we can write
 Now if we divide numerator and denominator by W_5

$$S = \left(\frac{V}{SFC} \right) \left(\frac{L}{D} \right) \ln \left(\frac{1}{1 - \frac{\Delta W}{W_5}} \right)$$

Since $\Delta S = \left(\frac{V}{\dot{a}} \right) dW$ lets relate $\dot{a}$ to
 In other words for any engine if we
 pump up the $\dot{a}$ goes up. Likewise if we
 reduce T , $\dot{a}$ reduces. Knowing this let's
 define $SFC = \frac{W}{T}$ where SFC equals

specific fuel consumption. Knowing this
 lets stuff this into the above ΔS expression
 where we now know $\dot{a} = (SFC)(T)$
 hence!

$$\Delta S = \frac{V}{(SFC)(T)} dW$$

Knowing that $T = D$ in cruise lets rewrite
 once again:

$$\Delta S = \frac{V}{(SFC)(D)} dW$$

Now lets bring in the weight of RK by

$$\Delta S = \left(\frac{V}{SFC} \right) \left(\frac{W}{D} \right) \frac{dW}{W}$$

Now in cruise $W = L$ so lets rewrite
 again:

$$\Delta S = \left(\frac{V}{SFC} \right) \left(\frac{L}{D} \right) \frac{dW}{W}$$

Upon integration

$$S = \left(\frac{V}{SFC} \right) \left(\frac{L}{D} \right) \left(\ln \frac{W_5}{W_5 - \Delta W} \right)$$

$$\frac{\Delta W}{W_5} = \frac{\text{weight of fuel}}{\text{start weight}}$$

$$\text{hence } \frac{\Delta W}{W_5} = \text{fuel fraction}$$

$$\Delta K_1 \neq \Delta S \neq \Delta K_2$$

$$\text{Let } \Delta S \rightarrow 0$$

$$\text{Let } \Delta \theta \rightarrow 0$$

$$\text{then } \Delta K_1 \rightarrow 0$$

$$\Delta S \rightarrow 0$$

$$\Delta K_2 \rightarrow 0$$

then

$$\frac{\Delta K_1}{R} \rightarrow \frac{\Delta S}{R} \rightarrow \frac{\Delta K_2}{R}$$

$$\text{hence } \Delta \theta \rightarrow \Delta \theta$$

$$\text{and } \boxed{\tan \Delta \theta = \sin \Delta \theta = \Delta \theta}$$

$$\lim_{\theta \rightarrow 0} \left[\frac{\sin \theta}{\theta} \right] = 1$$

Hence

$$\lim_{\theta \rightarrow 0} \left[\frac{\cos \theta}{1} \right] = 1$$

$$\text{I } \tan \Delta \theta = \frac{\Delta K_2}{R}$$

$$\text{II } \Delta \theta = \frac{\Delta S}{R}$$

$$\text{III } \sin \Delta \theta = \frac{\Delta K_1}{R}$$

By inspection:

$$\Delta K_1 < \Delta S < \Delta K_2$$

therefore

$$\frac{\Delta K_1}{R} < \frac{\Delta S}{R} < \frac{\Delta K_2}{R}$$



hence

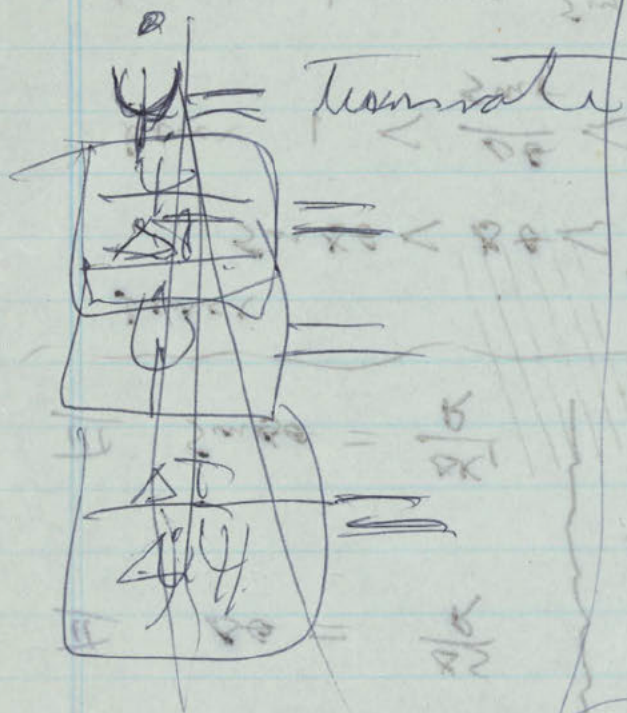
$$\sin \Delta \theta < \Delta \theta < \tan \Delta \theta$$

$$\text{hence } 1 < \frac{\Delta \theta}{\sin \Delta \theta} < \frac{\tan \Delta \theta}{\sin \Delta \theta} = \frac{1}{\cos \Delta \theta}$$

$$\text{hence } \cos \Delta \theta < \frac{\sin \Delta \theta}{\Delta \theta} < 1 \quad 1 = \frac{\sin \theta}{\theta} = 1$$

$$\text{let } \Delta \theta \rightarrow 0$$

$$\text{then } \cos \Delta \theta \rightarrow 1 \quad \text{hence } \frac{\sin \theta}{\theta} = 1$$



$$\left[\frac{\partial \phi}{\partial V} \right]_{P_S, F_S} = 0$$

$$\left[\frac{\partial \phi}{\partial V} \right]_{P_S, F_S} < 0$$

$$P_A' < P_2 < P_A$$

of polymer:

point

means we have a maximum turn rate for any $[P_S, F_S]$ combination

$$\left[\frac{\partial K}{\partial V} \right]_{P_S, F_S} = 0$$

$$\left[\frac{\partial N}{\partial V} \right]_{P_S, F_S} = 0$$



$$\frac{K}{P_A} \rightarrow \frac{K}{P_2} \rightarrow \frac{K}{P_A}$$

then

$$P_A \rightarrow 0$$

$$P_2 \rightarrow 0$$

$$P_A' \rightarrow 0$$

$$P_A \rightarrow 0$$

$$P_2 \rightarrow 0$$

$$P_A' \neq P_2 \neq P_A$$

Juana Etter

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$$\frac{1}{3/4} = \frac{4}{3}$$

$$1.333$$

$$\text{hence } S = \left(\frac{V}{SFC}\right) \left(\frac{L}{D}\right) \ln \frac{1}{1 - \frac{\Delta W}{W_S}} = \frac{1}{1/2} = 2$$

$$S = \left(\frac{V}{SFC}\right) \left(\frac{L}{D}\right) \ln \left(\frac{1}{1 - \eta}\right)$$

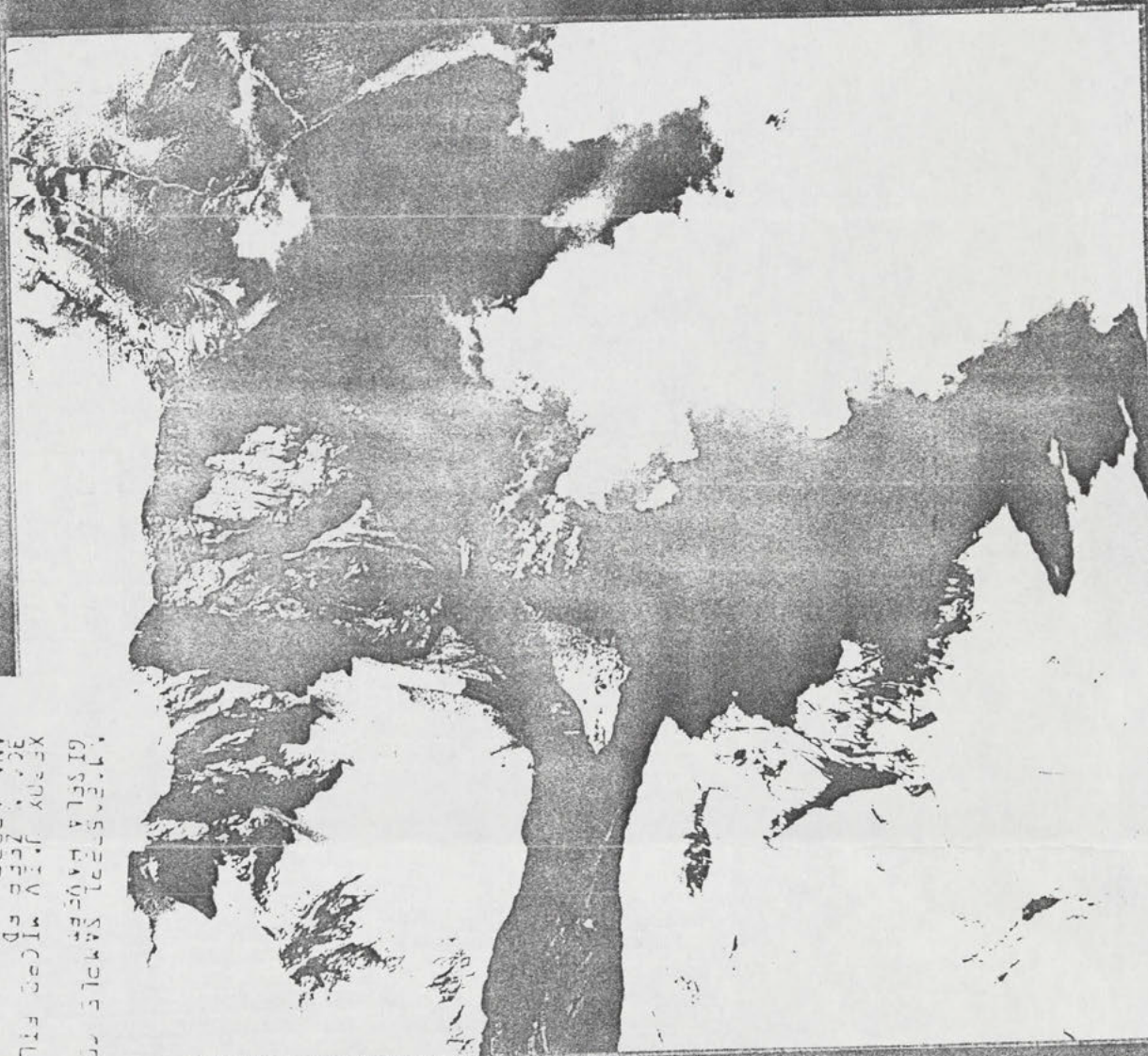
So

range is dependent upon (SFC) , air efficiency $\left(\frac{L}{D}\right)$,
and η as well as upon speed!

nature

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PREDICTING VOLCANIC ERUPTIONS

TEXTBOOKS SUPPLEMENT

1. E. S. 271 Sample copy for J. J.
G. S. 271 Sample copy for J. J.
XEROX J. J. V. 271 Sample copy for J. J.
J. J. V. 271 Sample copy for J. J.
J. J. V. 271 Sample copy for J. J.

IN
PROPERTY
1
II
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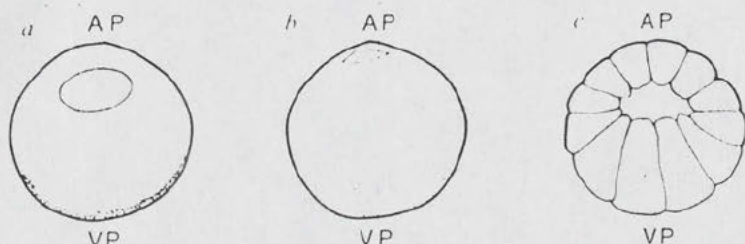


Fig. 2 Diagrammatic representation of *in situ* hybridization of a Vg-1 probe to *Xenopus laevis* sections from oocyte (a), unfertilized egg (b) and early blastula (c). Stippling, regions where hybridization occurs; AP, animal pole; VP, vegetal pole. (From ref. 6.)

embryos that have long been sought. Such determinants are presumed to give vegetal cells the property of forming gut, and animal cells that of forming epidermis. As far as mesoderm formation is concerned, it could be that vegetal cells also contain stored mRNA encoding inducing molecules (FGF, Vg-1?), and animal cells could contain stored receptors, or their mRNAs. Because animal cells become responsive to mesoderm induction at the 32/64 stage¹¹, this could be when the receptors are deployed. It is even possible that at the equator some cells would have both receptors and inducers, and hence would induce themselves to become mesoderm. Formally, this would be equivalent to mesoderm formation by an intrinsic determinant, but by the same mechanism as mesoderm formation by cell interaction.

Future prospects

The next task is to establish whether FGF and Vg-1 mRNAs and their encoded proteins are active in the embryo. This will involve expressing them in the wrong cells, and also attempting to suppress their

normal function. The latter experiments would show if these mRNAs have an indispensable function in mesoderm formation. In this regard, it is tragic that *Xenopus* is not only unamenable to genetic analysis, but also (unlike *Drosophila*) that it contains a system which prevents antisense RNA from inhibiting translation of its complementary mRNA¹². □

1. Bender, W. & Peifer, M. *Cell* **50**, 519–520 (1987).
2. Steward, R. *Science* **238**, 692–694 (1987).
3. Greenwald, J. *Cell* **43**, 583–590 (1985).
4. Whetton, K. A. *et al.* *Cell* **43**, 567–581 (1985).
5. Kimelman, D. & Kirschner, M. *Cell* **51**, 899–877 (1987).
6. Weeks, D. L. & Melton, D. A. *Cell* **51**, 861–867 (1987).
7. Vincent, J.-P. & Gerhart, J. C. *Dev Biol.* **123**, 526–539 (1987).
8. Dale, I. & Slack, J. M. W. *Development* **100**, 279–296 (1987).
9. Slack, J. M. W. *Nature* **326**, 197–200 (1987).
10. Rebaghiati, M. R. *et al.* *Cell* **42**, 769–777 (1985).
11. Massague, J. *Cell* **49**, 437–438 (1987).
12. Jones, I. A. & Woodland, H. R. *Development* **101**, 23–32 (1987).
13. Woodland, H. R. *Bioess. Rep.* **2**, 471–491 (1982).
14. Kao, K. R. *et al.* *Nature* **322**, 371–373 (1986).
15. Jones, I. A. & Woodland, H. R. *Development* **101**, 567–563 (1987).
16. Rebaghiati, M. R. & Melton, D. A. *Cell* **48**, 599–605 (1987).

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Mathematics

The ultimate in undecidability

Ian Stewart

"Is mathematics", said David Hilbert, "there is no *ignorabimus*... We must know, we will know." Like many a statement made by an ageing scientist of immaculate reputation, this one was completely wrong. Within a few years Kurt Gödel had demonstrated that within any formal system of arithmetic there are true theorems that cannot be proved, and propositions whose truth is undecidable. Indeed, it is impossible to prove that the axioms for arithmetic are not self-contradictory.

Gödel's ideas led to a new branch of mathematical logic, the theory of undecidability. Now Gregory Chaitin, of the IBM Thomas J. Watson Research Center, has proved the ultimate in undecidability theorems (*Advances in Applied Mathematics* **8**, 119–146; 1987, and *Algorithmic Information Theory*, Cambridge Univer-

sity Press, 1987), that the logical structure of arithmetic can be random. His methods are a fascinating fusion of mathematical logic and computer science. In particular, Alan Turing's analysis of the logical structure of the computational process, fundamental to both areas, plays a key role.

Hilbert emphasized the need to base the logical foundations of mathematics on a formal system of explicit assumptions, or axioms. All mathematical theorems should be logical consequences of these axioms. An analysis of the laws of deduction should lead to rigorous proofs that every true statement has a proof, and that the formal laws of arithmetic are not self-contradictory.

Gödel demolished Hilbert's programme using a clever reformulation of the hoary logical paradox 'this statement is false'. He used a coding method to model the

logical structure of an axiom system for arithmetic, within arithmetic itself. With this as an intermediary he constructed a statement in arithmetic which, interpreted via the code, effectively says 'this statement has no proof'. If the statement is true, then as it says, it has no proof. But if the statement is false, then it does have a proof — and that means it must be true.

Chaitin replaces the black-and-white dichotomy of truth versus falsehood by a scale of shades of grey, representing the computational difficulty of a proof. Instead of asking 'is this statement true?' he asks 'how complicated must a proof be?'

Information theory

The rigorous techniques for Chaitin's approach come from algorithmic information theory. An algorithm is a well-defined computer program, a list of instructions in a formally defined language. Information theory is the study of the information content of messages. One unit of information is a bit (binary digit), and a single bit provides the information to answer a single yes-no question. A message containing n bits of information can decide between 2^n equally likely possibilities. So, assuming rain or shine is equally likely, the message 'it is raining' conveys one bit of information, whereas 'it is Friday' conveys $\log_2 7 = 2.8$ bits. From Chaitin's viewpoint, Gödel's proof takes a very natural form: the theorems deducible from an axiom system cannot contain more information than the axioms themselves do.

Perhaps the most original of Chaitin's ideas is an information-theoretic characterization of randomness. Any message can be coded as a series of binary digits 0 or 1. A message consisting of n such digits carries n bits of information. But the information in some messages is compressible, in the sense that it can be encoded in a simpler form. For example, a million-digit sequence of the form 010101...01 can be described in words as 'half-a-million repetitions of 01' and this phrase can in turn be encoded (by a standard computer code such as ASCII) as a sequence of, say, 250 binary digits.

Turing's model of the computational process can be formulated entirely in terms of the manipulation of sequences of binary digits, representing input data, output data or the computer program that is manipulating the data. Indeed, if 'no electrical current' is labelled 0 and 'some electrical current' is labelled 1, this is precisely how a digital computer works. A sequence of digits can therefore be defined as non-random if it can be generated by a computer program consisting of a shorter sequence of digits, and as random if it cannot. In other words, a sequence with a pattern has a compact description, but the most efficient way to specify a random sequence is to list the sequence

itself: its information content is incompressible.

A sequence of digits 0 and 1 can be interpreted as the binary expansion of a real (non-integer) number, by inserting a 'decimal point' (or rather, a 'binary point') in front. Thus the infinite repeating sequence 010101... corresponds to the real number $0.010101...$ in binary; that is $1/3$. A real number is computable if its binary expansion can be the output of a computer program. It is a theorem — at first sight surprising, but true, and even easy — that 'almost all' real numbers are not computable. For example, Turing used an argument that goes back to Georg Cantor to prove the existence of at least one non-computable real number.

The proof is based on the idea that all possible computer programs, each of which must be represented by a finite sequence of digits, can be listed in order. To do this, interpret the program's defining sequence as a whole number, expressed in binary, and arrange these numbers in increasing numerical order. Now assign to each program in this list its output data, a real number expressed in binary. Run down the diagonal of this table of numbers, changing the n th digit in the n th number. The new diagonal is a number that is not on the list, which therefore corresponds to the output of no computer program whatsoever.

Turing machine

Another of Turing's basic discoveries is that it is possible to construct a universal Turing machine — a computer program capable of simulating any other program. Consider the following 'halting' problem for a universal Turing machine: given a particular input, does the computation eventually stop or does it go on for ever? Using the above 'diagonal' argument, Turing showed that the halting problem is logically undecidable.

Correspondingly, Chaitin defines a real number Ω which can be thought of as the probability that a universal Turing machine, given a random program, will eventually halt. It is impossible to compute Ω because its digits solve the halting problem for the universal Turing machine. Chaitin shows that any formal system of axioms can yield only a finite number of (scattered) digits of Ω . Thus Ω is a random real number in the above sense: it has no compact computable description.

The final step is to recast this circle of ideas in terms of whole numbers, rather than arbitrary real numbers. Chaitin does this using 'exponential diophantine' equations. These are equations, to be solved in positive integers, that can be built up from the usual algebraic operations of sums, differences and products, together with exponentiation, x^n .

Over the past two decades, logicians

showing that any computation can be encoded in the set of solutions of some diophantine equation. There is a diophantine formula, for example, to generate the primes. An undecidable computation — such as the halting problem for a universal Turing machine — leads to an undecidable diophantine equation; that is, an equation in arithmetic for which there can be no proof that solutions exist, and no proof that they do not.

Finally, the randomness. Chaitin's main theorem asserts that it is possible to construct a specific exponential diophantine equation, of the form $L(n)=R(n)$, where L and R are functions that depend on a finite number of additional variables, with the following property. The equation has infinitely many whole-number solutions if and only if the n th digit of Ω is 1. Because Ω is random, the question 'does $L(n)=R(n)$ have infinitely many solutions?' has an answer which varies randomly as n takes the values 0, 1, 2, 3, ... in turn.

In the proof, Chaitin constructs an exponential diophantine equation in 17,000 variables, about 900,000 symbols long. Instead of Turing's formulation of computation, he uses a version of the standard computer language Lisp. The practical and theoretical aspects of computation become almost inseparable in this work.

For the foundations of mathematics, and even the philosophy of its application to science, this century has been one of shattered illusions. Cosy assumption after cosy assumption has exploded in mathematicians' faces. The assumption that the formal structure of arithmetic is precise and regular turns out to have been a time-bomb, and Chaitin has just pushed the detonator. His book ends with some speculations on a possible analogy with biological complexity. Resemblances to Deep Thought in Douglas Adams' *The Hitchhiker's Guide to the Galaxy* are strong, but presumably accidental. In the following quotation from Chaitin's book, the phrase 'oracle for the halting problem' boils down to 'complete specification of the number Ω ': 'We have seen that Ω is about as random, patternless, unpredictable and incomprehensible as possible. However, with computations in the limit, which is equivalent to having an oracle for the halting problem, Ω seems quite understandable. ... Biological evolution is the nearest thing to an infinite computation in the limit that we will ever see: it is a computation with molecular components that has proceeded for 10⁹ years in parallel over the entire surface of the earth. ... Perhaps biological structures are simple and easy to understand only if one has an oracle for the halting problem.'

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Daedalus

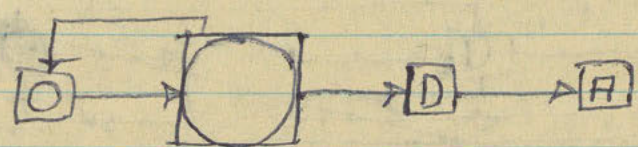
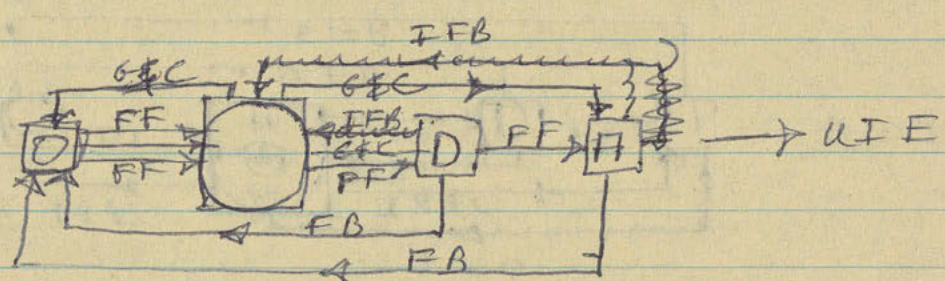
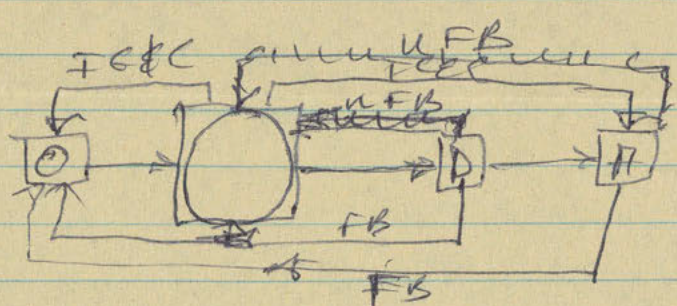
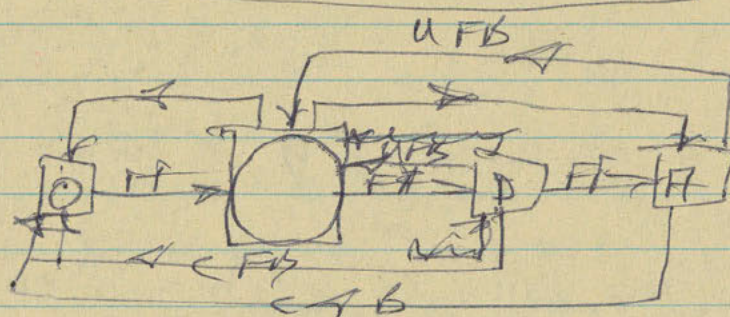
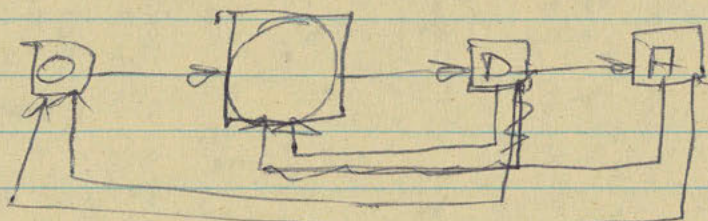
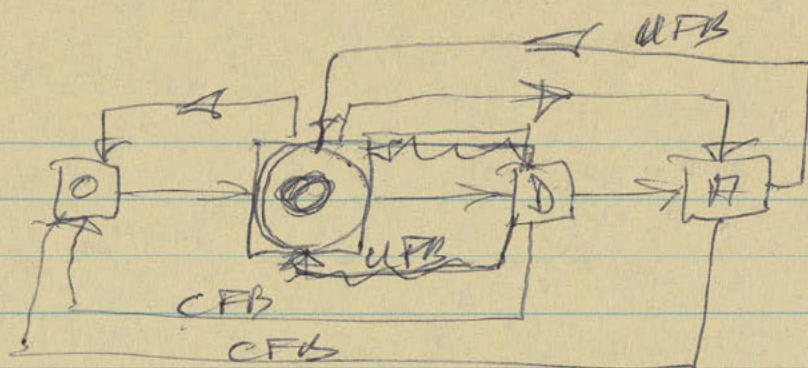
Warm wind

The temperature of the atmosphere drops with increasing altitude. Its adiabatic lapse-rate of $6.5^\circ\text{C km}^{-1}$ is maintained by its turbulence: rising air expands and cools while descending air is compressed and heated. Other gases have different adiabatic lapse-rates. The record is held by xenon, an atmosphere of which would establish a gradient of 63°C km^{-1} .

Daedalus plans to exploit this in a new wind-powered heating system. Imagine, he says, a flexible plastic bag rising a kilometre into the atmosphere, and filled with xenon. The turbulence and buffeting of the wind would soon stir the xenon into full convective equilibrium, when the bottom of the bag would be 63°C hotter than the top. If the top were maintained at local atmospheric temperature by a suitable heat-exchanger, domestically useful heat at about 70°C could be extracted from the bottom of the bag.

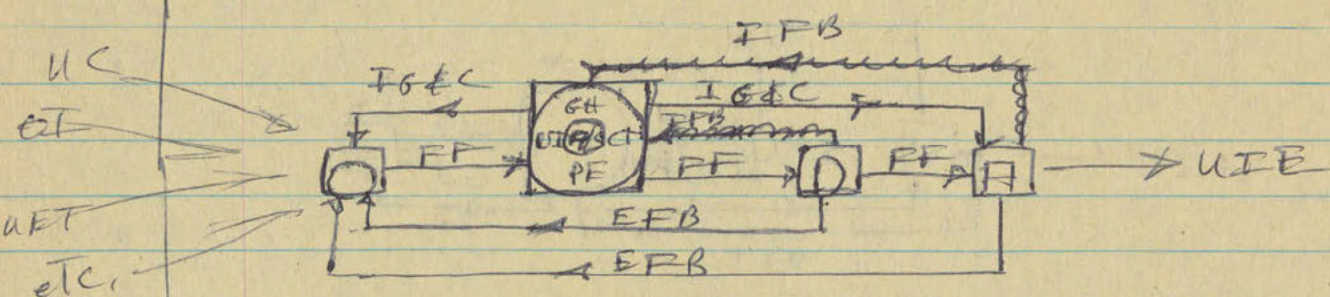
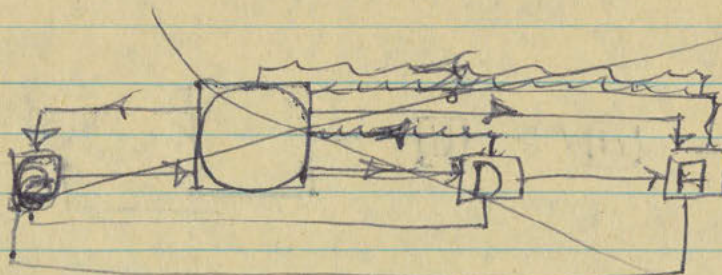
This ingenious scheme extracts energy, not from the 'd.c.' component of the wind, but from its turbulent 'a.c.' component. At ground-level, especially near buildings or in regions of irregular topography, much of the wind's energy is gusty and fluctuating and unavailable to conventional wind-turbines. So the thermal wind-bag has great promise.

There are two main problems. First, a flabby bag a kilometre high is rather an awkward object. Second, such a tall column of a dense gas like xenon would exert greater than atmospheric pressure at its base. This would hold the plastic bag taut, reducing its ability to flap and flex and stir the gas within. Thermal wind-bags only a hundred metres high would be more practical; they could then be anchored to buildings or lattice-towers, or even steep hillsides. If excess base-pressure is then still troublesome, Daedalus will replace his xenon by a mixture of argon and neon with the same density as the atmosphere, but an adiabatic lapse-rate about twice as great: 14°C km^{-1} . All this will reduce the temperature-rise at the bottom of the bag to only a few degrees, so Daedalus plans to multiply it up by regenerative heating. A counter-current heat-exchanger inside the bag will transfer most of the bottom heat straight up to the top again. The convective process will therefore increase the temperature at the bottom still more, and this too will be returned to the top. With a sufficiently high recycle-ratio, any desired temperature could be attained at the bottom of the bag, though with a corresponding reduction of extracted power per effective cycle. Even so, the more the cold wind buffeted your house, the more heat it would unwittingly supply! David Jones



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8 April 92



27 May 31

2 June 6 June - 10

10 Dec 92

These Festings include

- Entropy overload associated with the Second Law of Thermodynamics as well as with the many realizations of uncertainty, irregular, ^{mess} random, unpredictable ~~behavior~~ in mathematics, computer theory and other disciplines - all of which, one way or another, seem to play ~~into~~ ^{into or} the Second Law under the rubric of the S.L.

T-T-D

- ✓ • [Grant # Lee] Extract and [Sharkey's column] to D Moore.
- ✓ • [Conceptual Spread] to Ray Bishop. (J/A 92)
- ✓ • Tell Ben [McPeak's] [deception] or whether he was a copy of ~~the~~ [ES] and [Green Book]
- ✓ • Stuff to Bredechoft -