

Evolutionary Epistemology*

**A Personal View of John Boyd's
“Destruction and Creation”
... and its centrality to the ...
OODA Loop**

Franklin C. Spinney

V2.61 (Mar 2020)

* Although I came up with this title on my own, it turns out that I am not the first to use this term, as I explain at this link: <http://slightlyeastofnew.com/tag/chuck-spinney/>.

Disclaimer:

This Presentation Represents *My Interpretation* of John Boyd's September 1976 Paper.

(It was prepared after Colonel Boyd's Death and has been Updated by some of His Subsequent Work as well as those of Chet Richards and Myself)

While I Worked Closely With Col. Boyd and Helped Him to Produce this Paper,
It is His Creation and My Role Was that of an Understudy.

Consequently,

Any Misrepresentation of Boyd's or Richard's Inputs are Mine Alone and
This Briefing Should Not Be Considered a Definitive Description of Boyd Work.

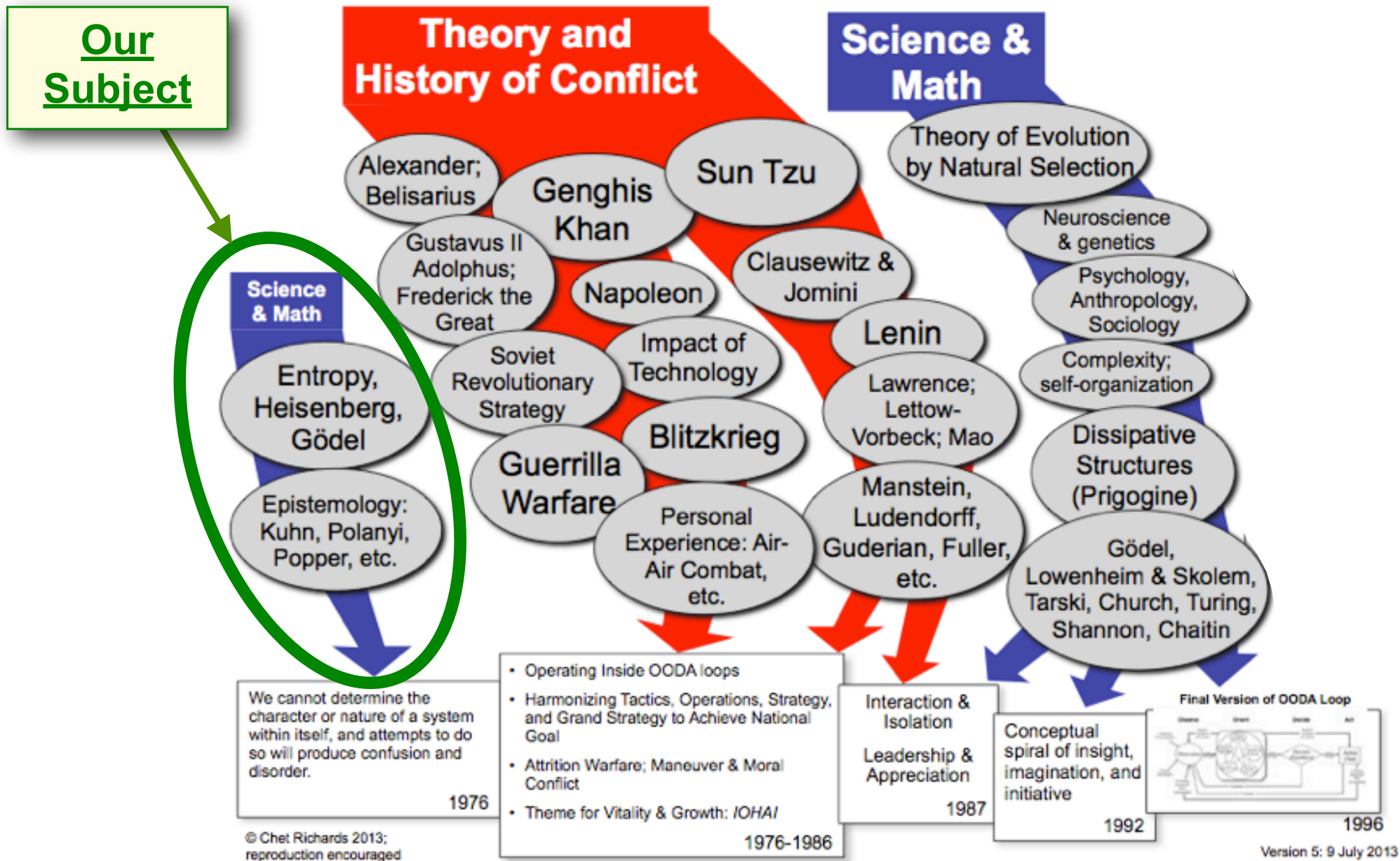
**“Machines don’t fight wars,
people do and they use their minds”**

Colonel John R. Boyd (USAF Ret.)

As far as I can recall, I never heard Col. Boyd
say this before he wrote the D&C paper
... and D&C is about ...

The Mind.

Vector of Boyd's Work: 1976 - 1996



Modified from Chet Richards' original, see <http://fasttransients.files.wordpress.com/2010/03/originsofjohnboydsdiscoursefigure1.pdf>

Aim:

**To Understand How the MIND Evolves an Interior Mental Orientation
(or Changing Constructs of Meaning or what Thomas Kuhn called “Paradigms”)**

... that Permit ...

Individuals and Groups to Cope With Changing External Conditions

(i.e., with a Changing Environment)

Point of Departure: Why Do We Make Decisions?

Biological Imperative Creates Purposive Behavior (i.e., GOAL Striving):

- To Survive on our Own Terms ... or put another way,
- To Increase Our Capacity for Independent Action.

Environment (Limited Resources and Skills)

- Real World Constraints Limit Capacity for Independent Action and Threaten Survival.

Implication:

Combination of Goal Striving & Scarcity Sets the Stage for COMPETITION Among Individuals and Groups as they Struggle to OVERCOME Environmental Constraints.

Consequence:

To Survive and Grow Relatively Free of Debilitating Constraints, Individuals and Groups MUST MAKE DECISIONS and TAKE ACTIONS To Overcome Physical Obstacles and Social Competitors.

Focus:

**How Do We Generate the Mental Concepts Needed to Support this
Decision-Making Activity?**

... Put Another Way ...

How Do We Evolve Mental Concepts to ...

- **Identify WHAT Decisions and Actions are Necessary or Appropriate?**
- **MONITOR the Effect of Actions to Support Subsequent Decision-Making Activities?**

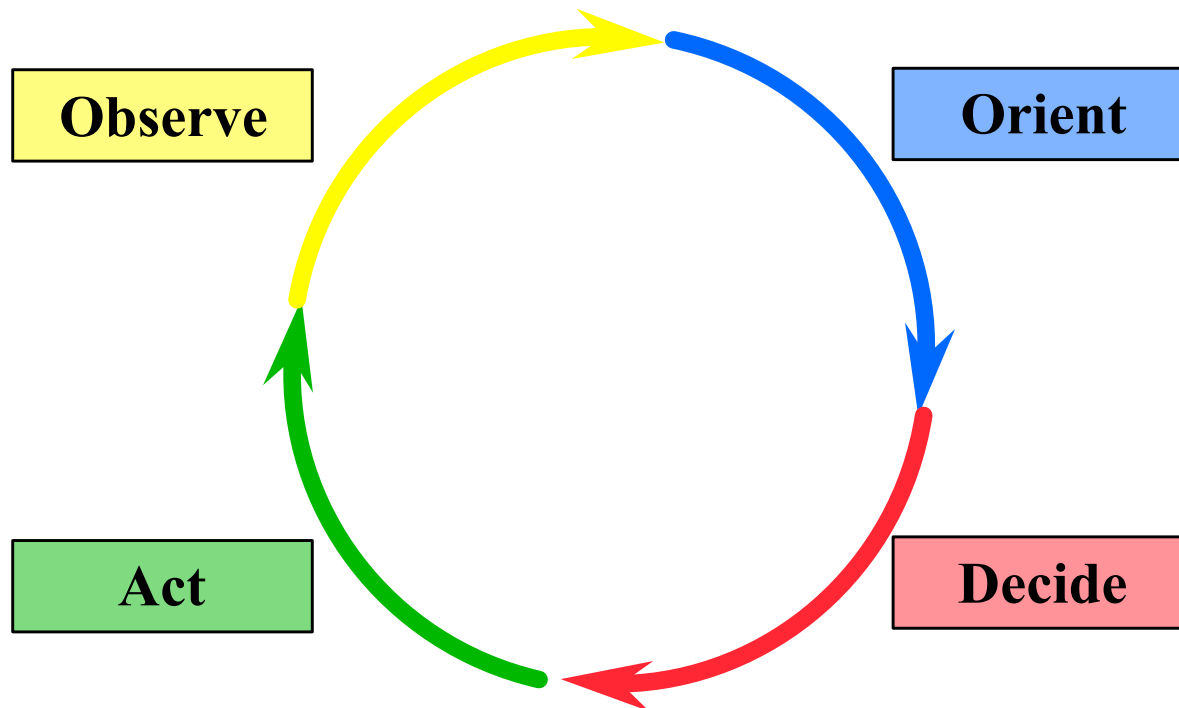
Simplistic Answer

We Use a Sensor System to Observe Events in the External Environment.

We Orient Ourselves to the Meaning of those Observations.

We Decide and We Act

... and then We Observe the Effects of that Action and Recycle



But there is a Problem With this Simple Portrayal

Any Ideas?

Problem With Simplistic Answer

All Observations of the External World are Filtered Through the Cognitive Apparatus of the Observer
... and therefore ...

Observations Cannot be Separated From the Various Interior Mental Processes of Each Observer

Implication

Any Description of a Complex Reality Can Be Viewed
Through a Variety of Mental Concepts that Individuals & Groups Use to Represent Observed Reality
(i.e., the Multitude of Different Perspectives Which Make Up One's Mental Orientation.)

Question:

**How Does One Evolve a Relevant Orientation for
Apprehending the Complexity of Observations in the Real World?**

There are Two Ways for Evolving and Manipulating Mental Concepts to Represent Observations

Analysis

**Breaking Down a Comprehensive Whole into its Constituents
and the Relations Among those Constituents.**

(Deduction, Differentiation, Destruction)

Synthesis

Starting With Parts and Building Toward a Comprehensive Whole.

(Induction, Integration, Construction)

Analyses & Synthesis

Interplay of Observations & Orientation

An Introduction to the Dialectic Nature

Understanding and Creativity:

Understanding -- Analysis of a Pre-Existing Domain:

- **Pyramids and the Question of Multiple Perspectives**

Creativity -- Analyses & Synthesis:

- **Boyd's Thought Experiment: Example of a Destructive Deduction and the Creation of New Domains**

Historical Example

- **The Evolution of Cosmology**

ANALYSIS

Understanding in the Context of a Single Domain

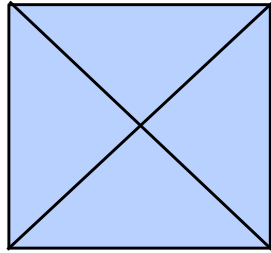
Focus of Effort

We Gather *Variety of Observations* About a Single Domain,
Break Down & Correlate these Observations from a *Variety of Perspectives*

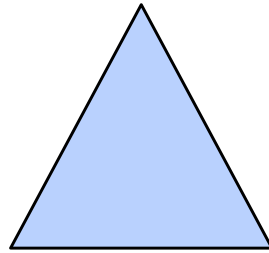
... and ...

Combine these Correlated Perspectives into a Comprehensive *Description* of that Domain.

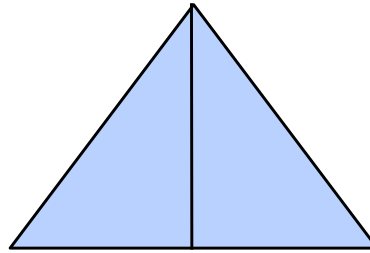
What is a Pyramid?



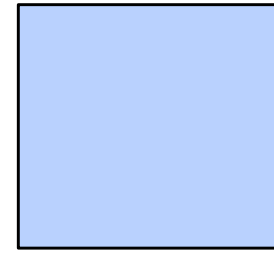
Top



Side



Corner



Bottom

To Understand a Pyramid,

**The Observer Analyzes it From Multiple Perspectives and
Correlates & Combines the Relationships Among Those Perspectives.**

Point:

**Dissection & Re-Assembly Can Produce A Richer Understanding,
But the “Constrained Integration” Always Takes Us Back to the Same Pyramid.**

CREATIVITY

Boyd's Thought Experiment:

Replacing an Existing Order With a New Order

Imagine Four Separate Images (or Domains):

Each Image is a Pre-Existing Whole With a Unique Identity

(i.e., There are NO Relations Among the Domains)

Skier on Ski Slope

Chair Lifts Skis
People Mountains
Chalets Snow

Speedboat

Sun Boat
Water Skier Outboard Motor
Life Vest Water

Bicycle

Chain Seat
Handle Bars Sidewalk
Child Wheels

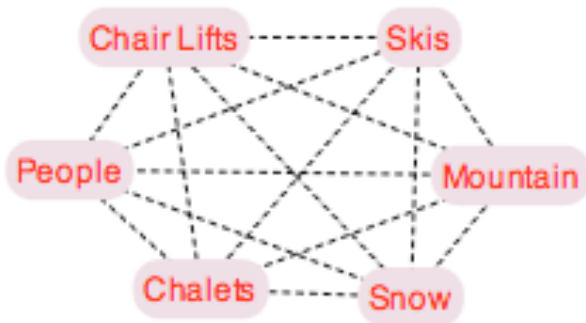
Toy Tank

Turret Boy
Green Paint Tank Treads
Toy Store Cannon

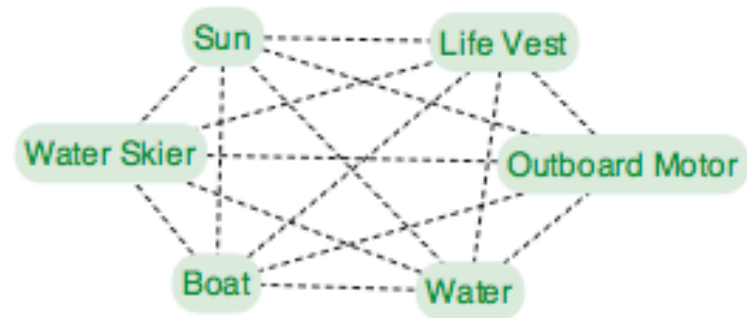
Analysis (Deduction):

Each Image is a Domain that Can Be Understood in Terms of Its Parts and the Relations Among the Parts (e.g. like the Pyramid!)

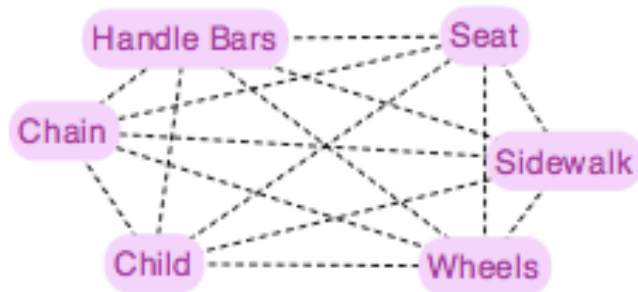
Skier on Ski Slope



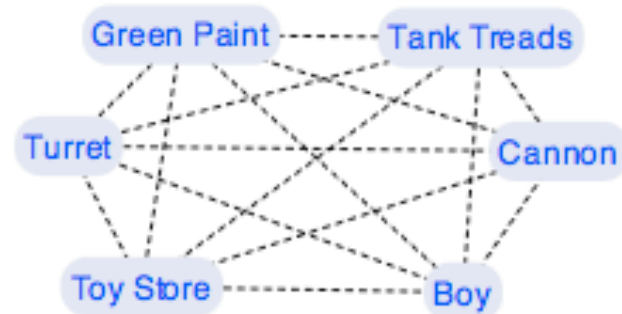
Speedboat



Bicycle



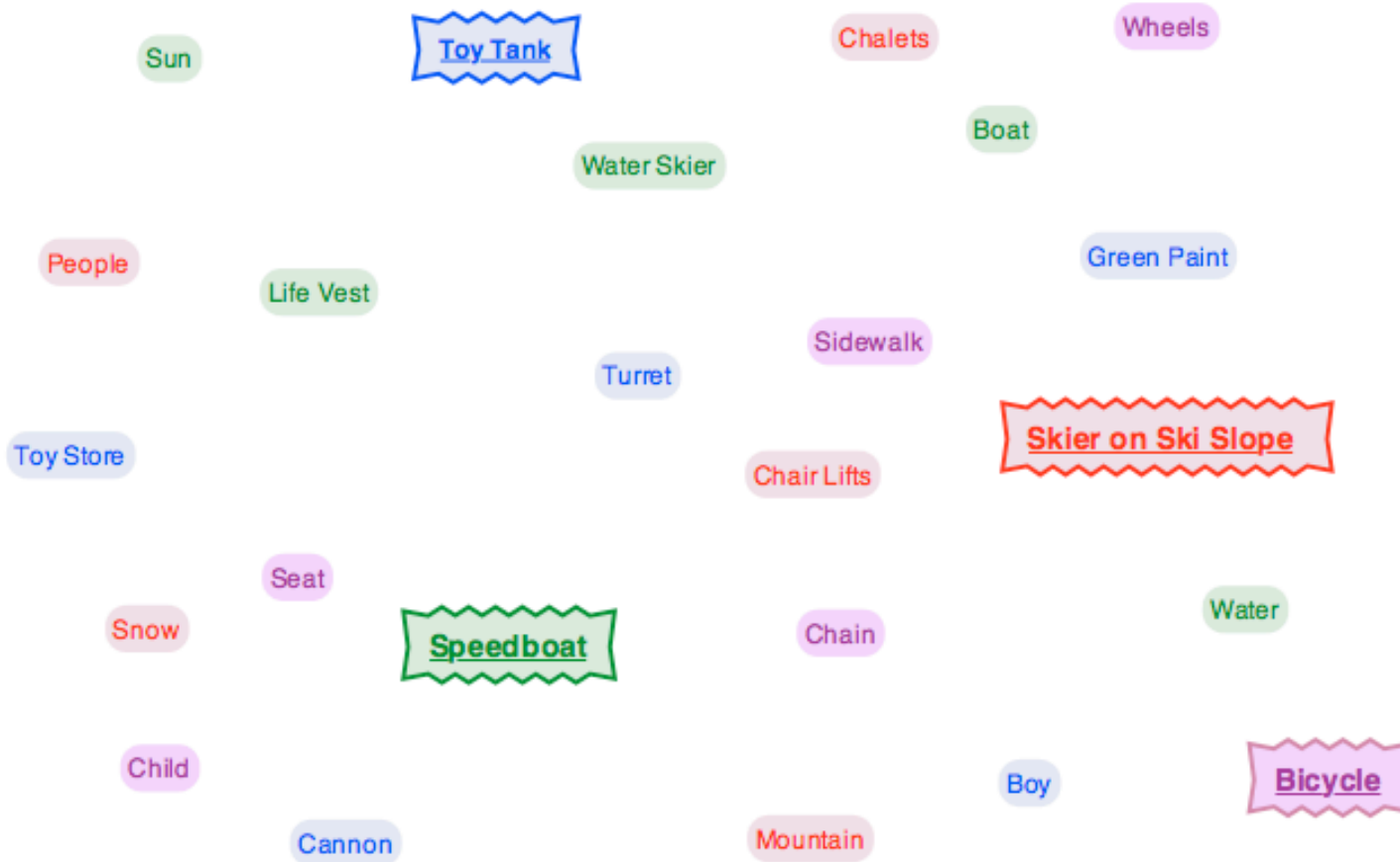
Toy Tank



Let's Shatter the Correspondence Between the Parts and the Domains

Analysis (Cont.)

Let's Shatter the Correspondence Between the Parts and their Domains



But Something is Not Quite Right with this Picture
Any Ideas?

Analysis or Deduction
(cont.)

We may be Thinking of the “Parts” Outside their “Boxes”

... But ...

the Legacy of those “Boxes” are Still Influencing What We See

More Abstractly:

The Pre-Existing Domains are Still Constraining
Our Orientation and Imagination

Let's Shatter the Correspondence Among the Parts
and the Legacy of their Domains

Result: A Destructive Deduction

Uncertainty & Disorder in the Place of Meaning & Order

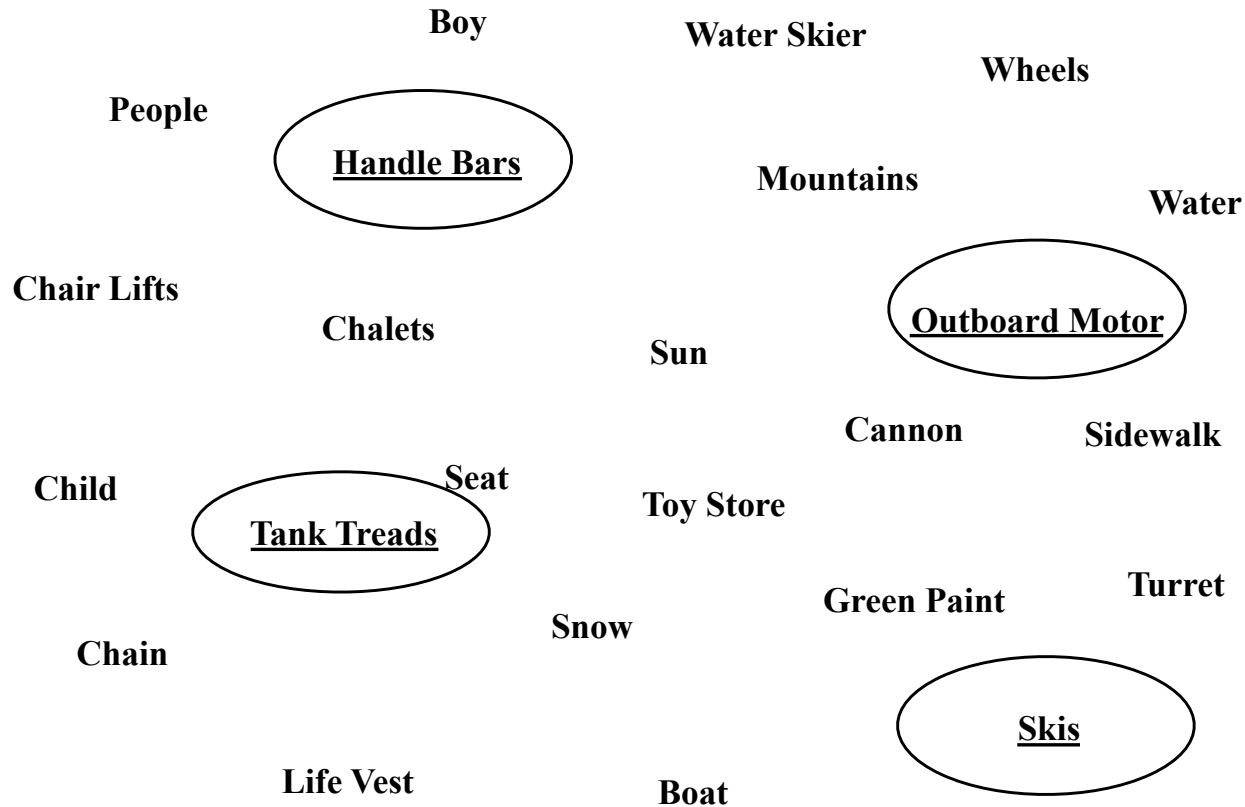
Boy Water Skier Wheels
People Handle Bars Mountains Water
Chair Lifts Chalets Sun Outboard Motor
Child Seat Toy Store Cannon Sidewalk
Chain Tank Treads Snow Green Paint Turret
Life Vest Boat Skis

**How Do We Construct Order and Meaning Out of this Mess?
Which Brings Us to Step 3 -- i.e. Synthesis**

**We Can Synthesize a New Domain If We Can Find
Common Qualities & Connecting Threads, Attributes, or Operations
Among Some of the Constituents Swimming in the Sea of Anarchy.**

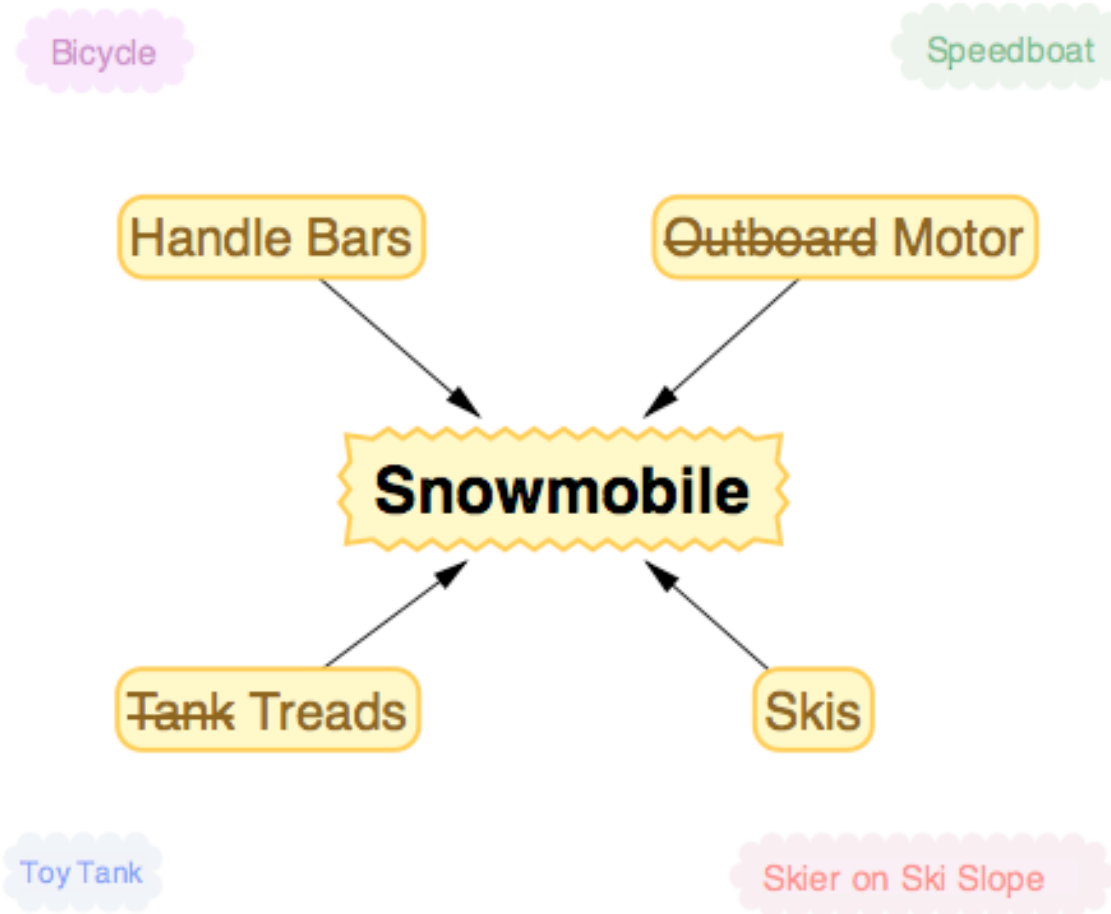
Boy Water Skier Wheels
People Handle Bars Mountains Water
Chair Lifts Chalets Sun Outboard Motor
Child Seat Cannon Sidewalk
Tank Treads Toy Store
Chain Snow Green Paint Turret
Life Vest Boat Skis

**Let's Try Again,
Does Anyone See Any
Common Qualities & Connecting Threads, Attributes, or Operations
in this Sea of Anarchy?**



A New Domain or Concept Description

Created by Linking Previously Unrelated Constituents

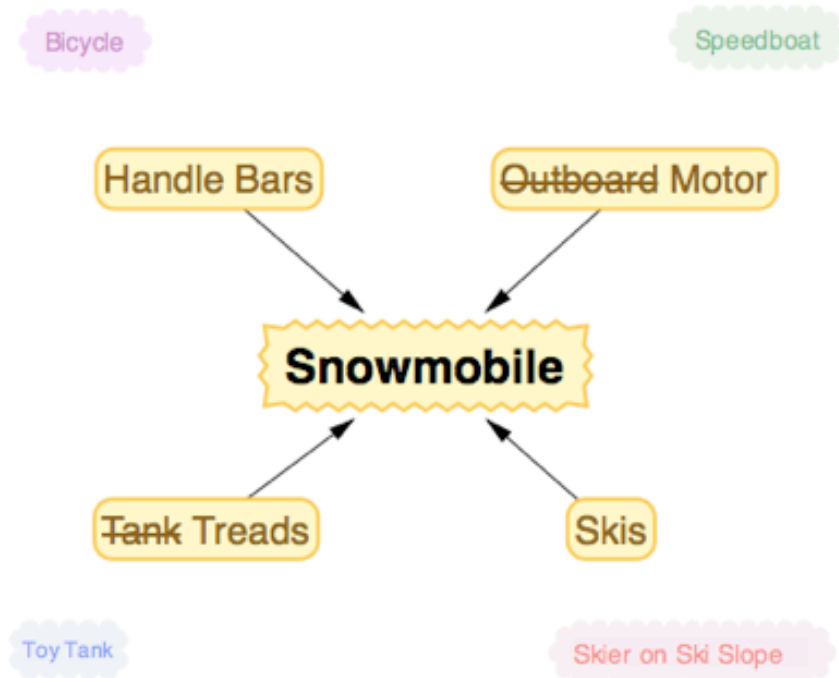


!! ... Caution ... !!

Not Every “Snowmobile” is a Brilliantly Successful Innovation

A New Domain or Concept Description

Created by Linking Previously Unrelated Constituents



Forgotten Syntheses
With Similar Ingredients
(except skis)



It never hurts to remind ourselves that,
Most “New Concept Descriptions” or “New Startups”
Do Not Work So Well in the Real World.

**To be Viable and Remain Relevant,
The New Description of Reality Must be Continuously Refined
by Checking & Verifying Its -**

- **Internal Consistency and Reversibility**
- **Match-Up With External Reality**

... But ...

**As the Focus of Effort Turns Inward to Refine the
Precision or Subtlety of Both Observations and the Concept Description,
The Newer Level of Precision/Description Will Eventually Exceed the Original Precision**

... and when this occurs ...

**We Should Expect to See Mismatches and Inconsistencies Between the
Newer, More Precise Observations and the Concept Description of those Observations.**

Why Will Mismatches Emerge?

**If We Assumed Otherwise, It Would be the Same as Saying
Newer, More Precise or Different Observations and Interactions.
Would Always Combine
to Produce the Same Synthesis as the
The Older, More Primitive Observations and Interactions.**

Perhaps a Real-World Example Will Help to Clarify this Crucial Point.

Caveat: The following example was constructed after Col. Boyd's death. Any errors are Chuck Spinney's alone.

Evolution of Our Mental Orientation to Celestial Observations (140 AD to 1905 AD)

Music of the Spheres → **Celestial Clockwork** → **Space-Time-Mind**

Claudius Ptolemy (circa 140 AD) and the Music of the Spheres

- **Earth is Center of a Universe Made Up of 8 Spheres Which Rotate Around the Earth.**
 - ✓ Outer Sphere Holds the Stars, Which Rotate in Perfect Circles Around the Earth
 - ✓ Each of the 7 Inner Spheres Holds a “Planet” (i.e., the Moon, Sun, Mercury, Venus, Mars, Jupiter, and Saturn) Which Moves Rotate Smoothly Around the Earth But Along a Complex Path traced by one or more Epicyles [along a path traced by rolling a smaller circle on the circumference of the sphere to produce a smooth but complex curvilinear motion]
- **Problem: Although the System of Ptolemy Gave Reasonable Agreement With the Timetable of the Planets, More Precise Observations Called For Changes In or More Epicyles to Maintain the Matchup of the *Concept Description* with *Observed Reality*.**

Result:

**An Ever-Increasing Inward-Focus of Effort
As Astronomers & Mathematicians Struggled to Update Ptolemy’s World View**

... and consequently ...

**By the 1400s, the Increasing Internal Complexity of the Ptolemy’s System Had
Fatally Weakened its Intellectual Coherence and
Set the Stage for a New Synthesis.**

The Destruction of the Ptolemaic Orientation - Key Precursors

Copernicus (1473-1543) - Simplification via Paradigm Shift

- **Contribution:** Greatly *Simplified* the Mathematical Description of the Universe by Assuming the Sun to be the Center of Rotation. **Problem:** Assumed (Erroneously) that Orbits of Planets Were Perfect Circles. His Predictions Did Not Match All Detailed Observations, so He Could Not Get Rid of All Epicycles.

Tycho Brahe (1546-1601) - Increased Precision of Observations

- **Contribution:** Extraordinary Astronomer -- Assembled Vast Data Base of Very Precise Observations (W/O Telescope & Did Not Accept Copernicus' Theory).

Johann Kepler (1571-1630) - Matchup via Precise Mathematical Description

- **Contribution:** Used Brahe's Data & Own Observations to Convert Copernican System in to an *Precise Mathematical Map* of Planetary Motion based on *Three Laws of Motion*. (orbits = ellipses, equal area sweeping/time, and $(\text{year})^2 = K(\text{distance from sun})^3$).

Galileo (1564-1642) - Mathematical Precision, Experimental Method, Basis in Physics.

- **Contribution:** Experiments Established the Modern Foundation for the *Mechanics of Motion*
 - ✓ Invented Use of Pendulum as Precise Instrument to Measure *Time*.
 - ✓ Proved Falling Objects Accelerate at a Uniform Rate, Regardless of Mass ($d=1/2at^2$).
 - ✓ Inertia - Proved Moving Mass Will Keep Moving Until Some Force Acts to Stop It.
 - ✓ Used Telescope to Postulate "Divine Clockwork" (Rotation) of Jupiter's Moons.

Music of the Spheres → **Celestial Clockwork** → Space-Time-Mind

Newton's Grand Synthesis (Snowmobile)

Copernicus

Galileo

Orbital Dynamics
(Kepler's 3 Laws)

Mechanics:
Newton's 3 Laws of
Motion

Universal
Law of Gravitation
 $F=G(m_1m_2)/R^2$
[1687]

- 1. Inertia
- 2. $F=ma$
- 3. Action & Reaction

Brahe Kepler Galileo etc.

More Precise
Observations

Infinitesimal Calculus
Invented by Newton

Result:

*An Elegantly Simple, Mechanical Orientation that Predicted
The Motion of Planets with Stunning Accuracy.*

Music of the Spheres → **Celestial Clockwork** → **Space-Time-Mind**

**Newton's ORIENTATION Shaped Observations & Experiments for 200 Years
As Scientists Turned Inward to Flesh Out Newton's Paradigm**

**Newton's ORIENTATION Also Helped to Shape an Explosion in Technology.
New Technology Led to More Precise Instruments and More Subtle Observations.**

Experimental Evolution:

**Inward Focus & More Subtle Observations Set the Stage for Eventual
Mismatches Between Newton's Predictions & Experimental Observations**

**Perhaps the Most Spectacular Example is the
Michelson-Morley Experiment**

Music of the Spheres → Celestial Clockwork → Space-Time-Mind

The Michelson-Morley Experiment & the Search for More Precise Measurements (1881-1887)

Albert Michelson Constructed an Interferometer as a Tool to Permit More Precise Measurements of Speed of Light:

Measures the Differences in Light Waves by Measuring
The Size and Number of Black and White Bands (Interference Fringes)
Which Appear when Light Waves Get Out of Step (or Phase) with Each Other.

Aim of Experiment:

Use Interferometer to Measure Speed of Earth through the “Ether” by Comparing
The Difference between Speed of Light in Direction of Motion
to Speed of Light Perpendicular to Motion

The Newtonian Orientation Depended on at Least Two Universal Constants:

1. **Gravitation** -- *Explicit*
2. **Time** -- *Implicit*: a Consequence of the Inertial Frame of Reference (Fixed Relative to the Stars) Which Permitted *Galilean Transformations*.

**Michelson's & Morley's Assumptions AND Predicted Observations
were *Shaped* by the Newtonian Orientation):**

- Ether is the **inertial medium** in space that carried both lights waves & earth
- **Galilean Transformation** =>
 - Speed of Light in Direction of Earth's Motion = speed of light + earth's speed
 - Speed of Light Perpendicular to Earth's Motion = speed of light

Experimental Results:

**Actual Observations Incompatible With the Predicted Observations
of the Newtonian Orientation!**

1. **No Interference fringes Appeared**, Which Implied (Incorrectly) the Earth was not Moving (Relative to the Ether or the Inertial Frame of Reference).
2. **Speed of Light + Any Other Velocity = the Speed of Light** (Inconsistent with Inertial Frame of Reference and Galilean Transformation)

Music of the Spheres → Celestial Clockwork → **Space-Time-Mind**

Einstein's Synthesis: The Special Theory of Relativity

**Einstein Resolved the Anomaly by Changing
the Universal Constants in the Newtonian Orientation**

Two Universal Constants:

- Gravity (Like Newton)
- Speed of Light (In Place of Time)

Result - A New Orientation!

... i.e., a New *Snowmobile* ...

- **Galilean Transformation Replaced by Lorentz Transformation** -- a Moving Object Will Appear to Diminish in Length in the Direction of Travel as its Velocity Approaches the Speed of Light or Moving Clock Will Appear to be Running more Slowly
- **Equivalence of mass and energy** ($e=mc^2$ and Phenomenon of Mass Increasing as its Speed Approaches the Speed of Light).
- **Universe Must be Thought of (Mind) as a Continuum of Spatial and Temporal Distance.** (The Measure of Separation Involves Spatial and Temporal Terms.)

Generalization

Each New Synthesis
Shapes the Nature of Future *Observations*
as well as the Research Program for Developing the *Concept Description*.

-- On the Other Hand --

The Evolution of Cosmology from
Ptolemy to Einstein Shows How the
Interplay of Observations *and* Orientation Produces a
Never Ending *Cycle* of *Increasing Mismatches, Destruction, and Creation*.

Yet over time, our **Orientation** to the world
changes in a *non-cyclical* way.

**While Historians (esp. Kuhn) Have Recognized this Pattern,
Boyd Went Further by Arguing that there are
Theoretical Reasons Why the “D&C” Cycle is
an Inevitable Fact of Life**

Theoretical Reasons for Eventual Mismatches

Godel's Proof

- **Any Consistent System of Axioms is Incomplete--i.e., It Contains True Statements that Can Not Be Deduced from the Postulates that Make Up the System.**
- **Generalization: Even Though a System May be Consistent, Its Consistency Can Not be Demonstrated Within the System (Must Appeal to Systems Outside It).**

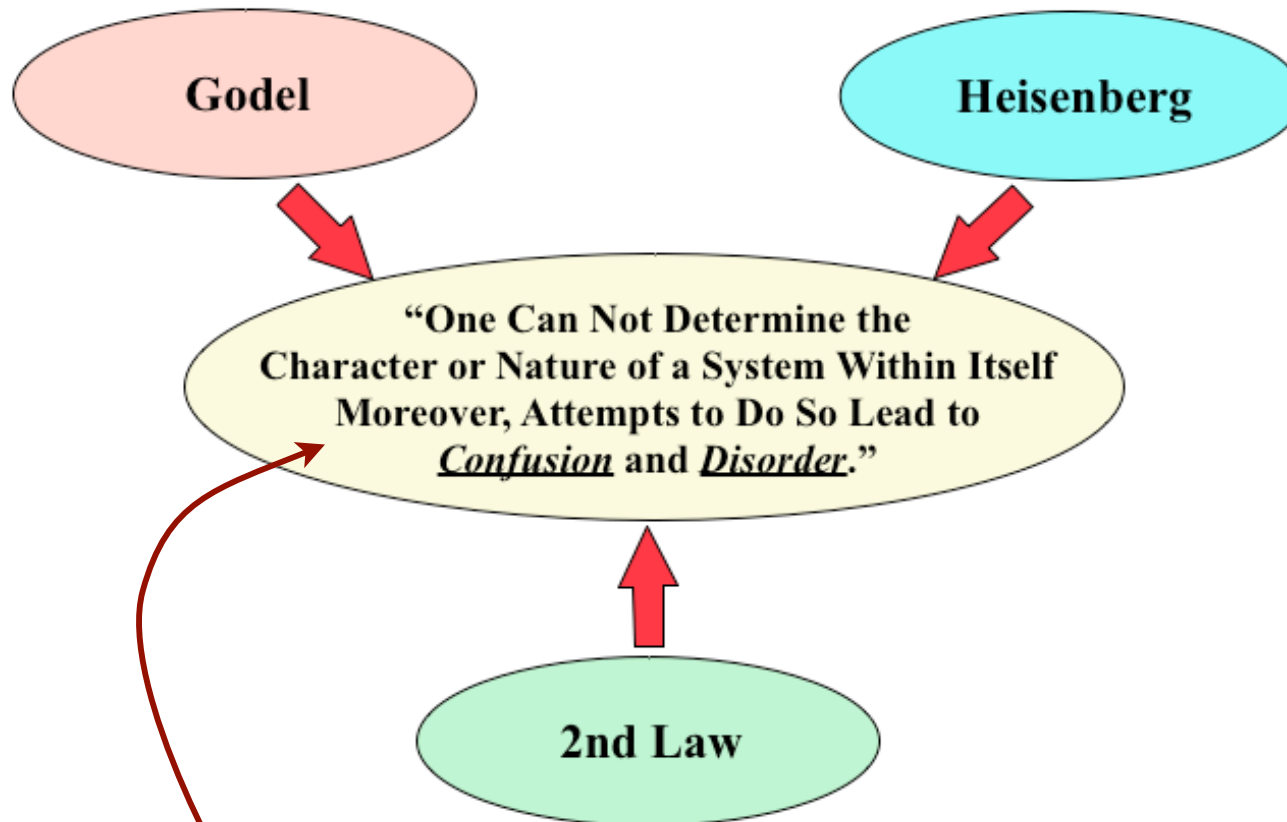
Heisenberg

- **Can Not Simultaneously Determine Position and Velocity of a Particle.**
- **Generalization: When the Precision of the Observer Approaches the Precision of the Observed, the Observer Perceives Uncertain or Erratic Behavior.**

2nd Law of Thermodynamics

- **All Natural Processes Create Entropy.**
- **Generalization: Entropy Must Increase in a System that Can Not Communicate in an Ordered Fashion with Other Systems External to Itself**

Boyd's Snowmobile



CS Note: We will see that this statement lies at the center of Boyd's Theory of how the *Mind* works in Competition & Conflict i.e., the OODA Loop

IMPLICATION

The Never Ending Cycle of

Increasing Mismatches, Destruction, and Creation.

Is a Natural Manifestation of a

Dialectic Engine

-- an Analytic/Synthetic Process --

- **Powered by** the Continuous Effort to Survive and Improve One's Capacity for Independent Action
...and ...
- **Regulated by** Alternating Cycles of Entropy Increase toward More Disorder and Entropy Decrease Toward Less Disorder.

Let Us Now Probe More Deeply into the *Nature* of Observations

... and ...

The *Relationship* Between the Observer and the Observed

... and the way we ...

***Synthesize* these Observations into a Useful Picture of Reality.**

Caveat: We are now leaving the confines of Boyd's 1976 paper, what follows is a amalgam of ideas evolved jointly by Col Boyd, Chet Richards, and Chuck Spinney, any errors, however, are Spinney's alone.

Observations Can Be Categorized by the *Interaction* Between the *Observer* and the *Object of Observation*

Basic Assumptions of Different Orientations:

Classical Physics (Newton & Laplace):

- The universe is a system *Reversible Deterministic Events* that exists as an objective reality *Independent* of the Observer. Observations are *events in themselves*, and a complete description of these events is theoretically possible. Uncertainty about the description is, therefore, the result of ignorance. [Bronowski 2: 63-4]

Relativity (Einstein):

- The universe is a system of *Reversible Deterministic Events* that exists as an objective reality, but one's description of that reality is *dependent* upon the position of the Observer in the system. Between each Event and the Observer, there must pass a *Signal*, e.g.,..., a ray of light, which can not be taken out of the observation. The fundamental unit of observation is the *Relation* between the event, the signal, and the observer. Uncertainties about the *system as it is* are the result of ignorance (God does not play dice.), but some events are *unknowable* to man because of the nature of the signal -- e.g., the constant speed of light makes it impossible to apprehend simultaneous events at a great distance. [Bronowski 2: 102-3]

Quantum Mech. & the Principle of Complementarity (Bohr's interpretation of Heisenberg's Uncertainty Relation):

- Events at the atomic level can only be described in terms of *Alternative Possibilities and Relative Probabilities of Occurrence*: Heisenberg showed why it is impossible to make precise, simultaneous measurements of the position and momentum of an electron. Bohr interpreted this result to mean that (1) the *Interaction* between the object of observation (the quantum system) and the observing mechanism is *Non-decomposable*; (2) no single observation or observing mechanism can completely describe the system; and (3), while various observations may describe complimentary portions of the same reality, it is *impossible* to combine them into a single, complete description of the whole of reality. [Prigogine: 222-9; Britannica: V15, 159 & V23, 876]

Natural Science: Evolutionary Biology, Culture, & Epistemology (Darwin, Lorenz, Campbell, Hall, Boyd, etc):

- Events in the external world are perceived through an *Evolutionary Cognitive Apparatus* -- a neurosensory system that acquired its present form through interaction with and adaptation to the *Subset* of events in the outer world which affects *Survival*. Since these sensing mechanisms superimpose *Partial Images* of the outer world on the fluctuating mental states of the *Internal Neurosensory Organization*, it is necessary to *Compensate* for the physiological and psychological mechanisms present in the observer to construct a viable image of reality. [Lorenz 1:1-19, Campbell: 47-89]

Observations Can Be Categorized by the *Interaction* Between the *Observer* and the *Object of Observation*

Summary

Newton & Laplace (and most Defense “Analysts,” Social “Scientists”, & Economists)

- ★ **No Interaction**: Unit of Observation = [Object of Observation]
- ★ Sterile Theory of “Objective” or “Absolutist” Observer in Social Science.

Einstein

- ★ **No Interaction**: Unit of Observation = [Object-Signal-Observer]
- ★ Sterile Theory that Everything is Relative in Social Science.

Heisenberg & Bohr

- ★ **One-Way Interaction**: Process of Observation Shapes the Object of Observation
- ★ Units of Observation =[Alternative Possibilities & Relative Probabilities]

Darwin ---> Lorenz ---> Boyd (inter alia)

- ★ **Two-Way Interaction**: Observing Apparatus Shapes and is Shaped By the Object of Observation and the Interaction of Environmental Pressure (Co-Evolution)
- ★ Units of Observation =[Subset of External Events Which Affect the Observer’s Survival]

Let's Bring these Ideas Together

to understand what Boyd was getting at, when he said,

*“Machines don't fight wars,
people do and they use their minds”*

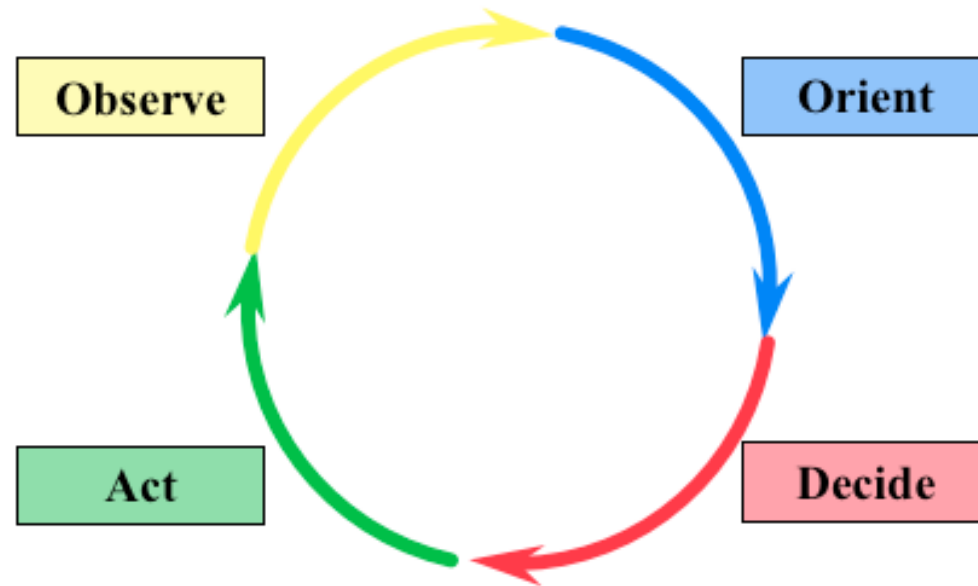
... and ...

One Can Not Determine the Character or Nature of a System Within Itself

... Moreover ...

Attempts to Do So Lead to Confusion and Disorder.

The Simple Mechanistic Interpretation of the OODA Loop Misrepresents Boyd's Ideas



Because
Our Discussion of the Relationships Among
Analyses & Synthesis and **Observation & Orientation**
Shows that **ORIENTATION** is Crucial to the OODA Loop.

... and ...

This Mechanical Cycle says **Nothing** About the Importance of **Orientation**

Orientation Shapes

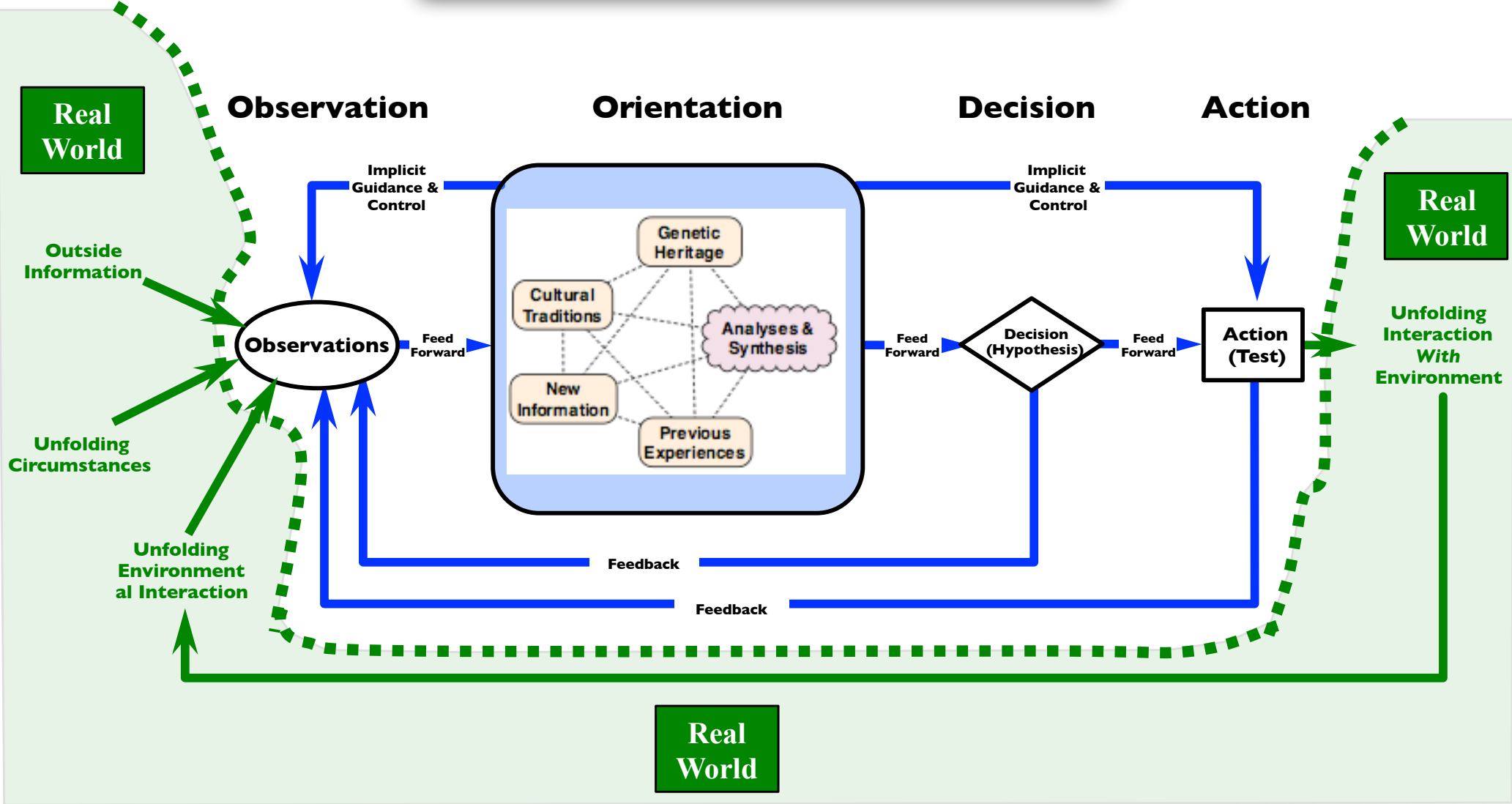
“How” we see ... as well as ... *“What”* we see

... and ...

“How” we see *“Evolves”* over time.

Which Brings Us To

Boyd's OODA "Loop" Sketch*



Let's Examine Some Implications of his Idea:
(Remember - This Diagram is merely an illustrative Abstraction!)

* Note: This is a cleaned up version of a sketch jointly drawn in the late 1980s by John Boyd, Chet Richards, and Chuck Spinney. It is Boyd's depiction of an OODA loop.

The following charts describe parts of the OODA Loop model and how it interacts with the external environment. They have been jointly evolved by Chet Richards and Chuck Spinney from time to time after Colonel Boyd's death.

Readers interested in taking these ideas further should read **“Boyd's OODA Loop”** by Chet Richards which can be downloaded at this link:
<https://slightlyeastofnew.com/439-2/>

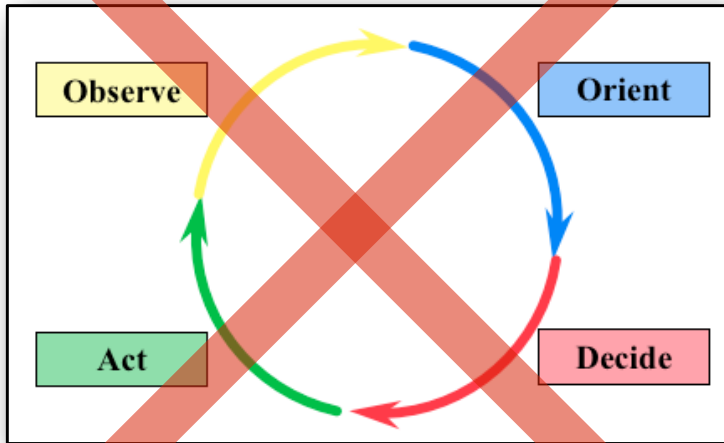
The Model is a very limited Pedagogical device, useful in understanding Boyd's idea of Orientation as opposed to being a tool for use in any kind of operational sense.

We believe the following charts are consistent with Boyd's ideas, but be advised

-- any errors are Spinney's alone.

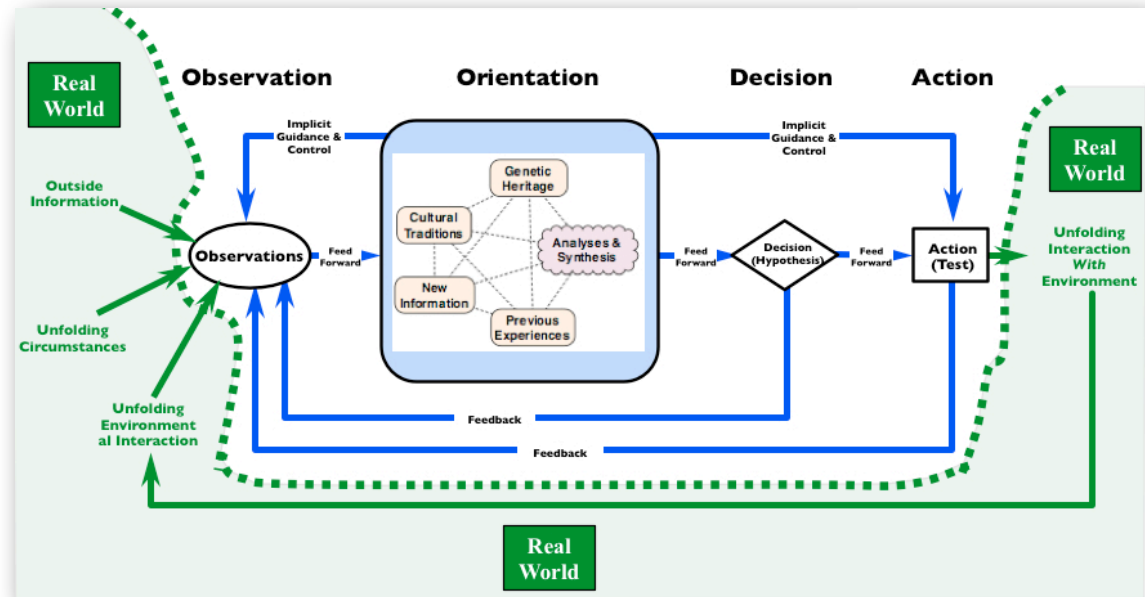
Impression #1 :
Boyd's OODA Loop is an **Organic Conception of how the **Mind** Operates**

Mechanical



Organic

Or



the OODA Loop should be thought of as a complex *interplay* of ...

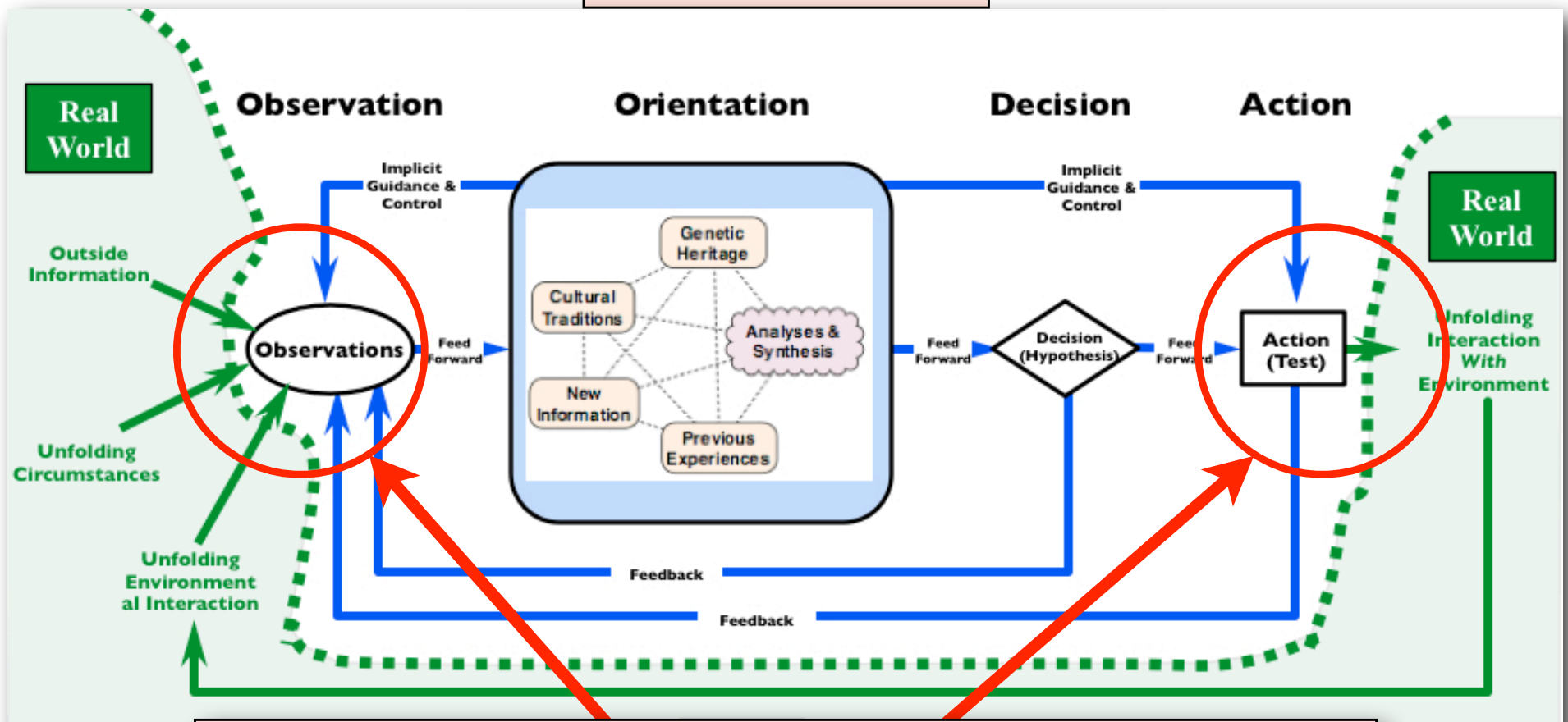
Homeostatic Control Loops in a Mental Struggle to

Evolve a Matchup of

Living Organisms* to Their **Environments**

(* The Idea can be Applied to Individuals - Groups - Cultures)

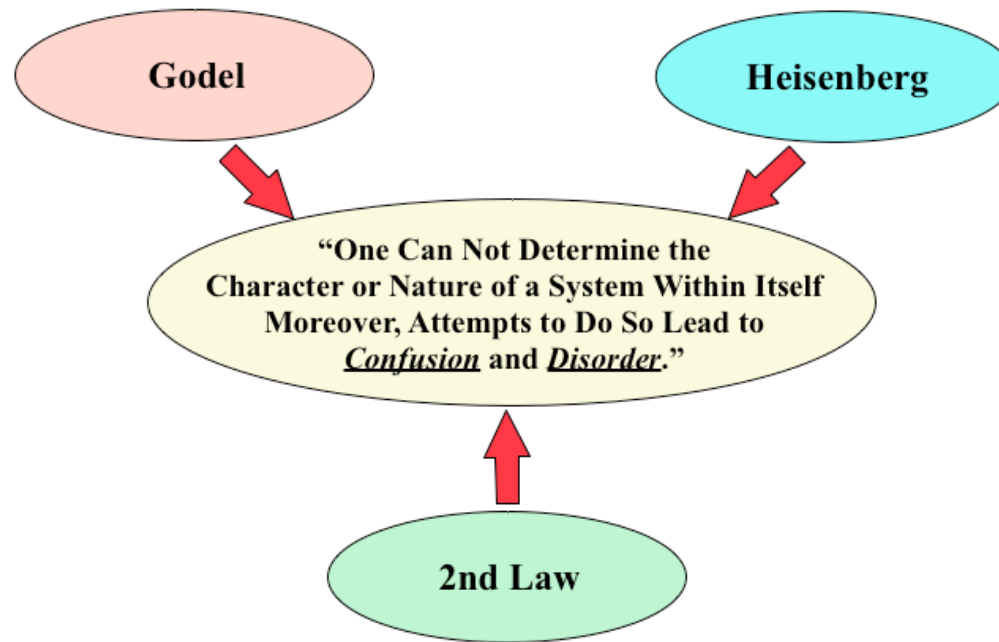
Impression #2:



Observations & Actions
are the **ONLY** points where the **OODA Loop** comes into contact with
External Reality.

All of the other operations of the loop are *Internal*
with all the **Hazards** that **Inward Focus** implies.
(Which brings us back to **Boyd's Snowmobile**)

Recall Boyd's Snowmobile

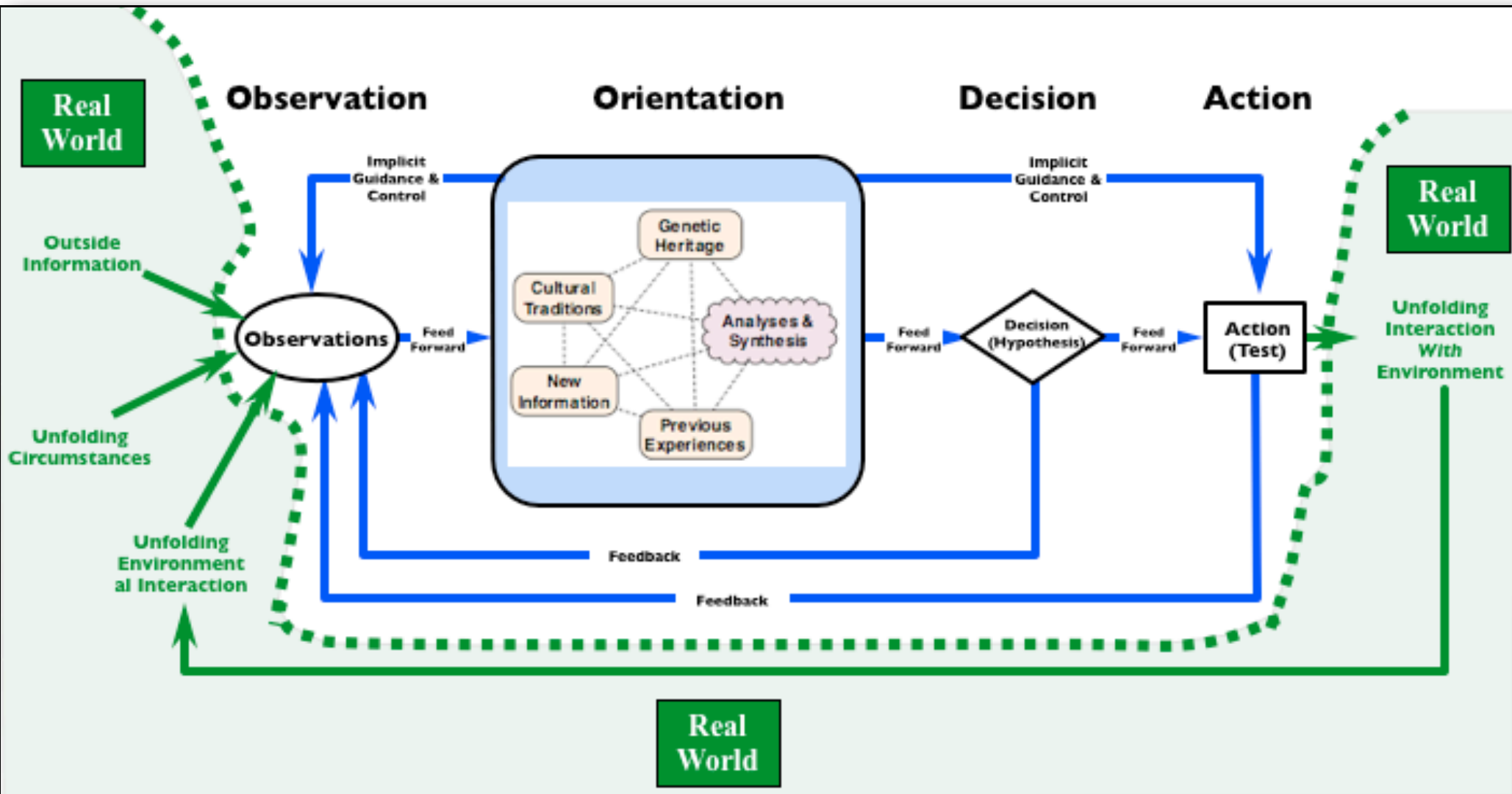


Implication For Strategy in Competition & Conflict:

If the Interior Operations of an Adversary's OODA loop can be induced to **Hijack Observations & Actions**, his OODA Loop would become **Isolated** from the **Environment** and would be induced to ***Collapse into Confusion & Disorder***

The next few slides will explore Boyd's insight.

What Can We Say About the Internal Workings of an OODA Loop?



Any Ideas?

Hints:

1. There are Two Types of Loops.
2. One of the “Control” Loops is Very Different from All the Others

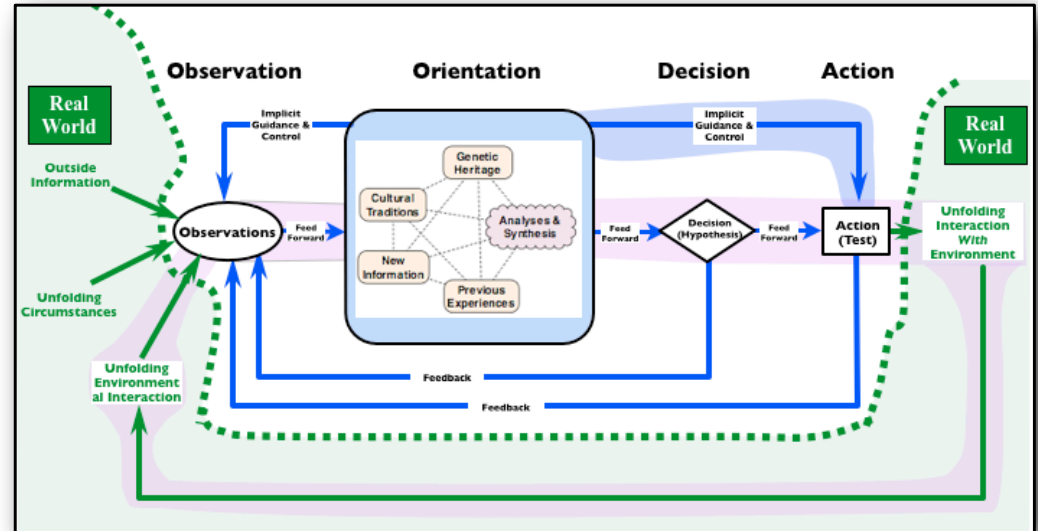
Recall the Goal:

Increase one's capacity for independent action in a competitive environment of Limited Skills & Resources

Two Types of Loops

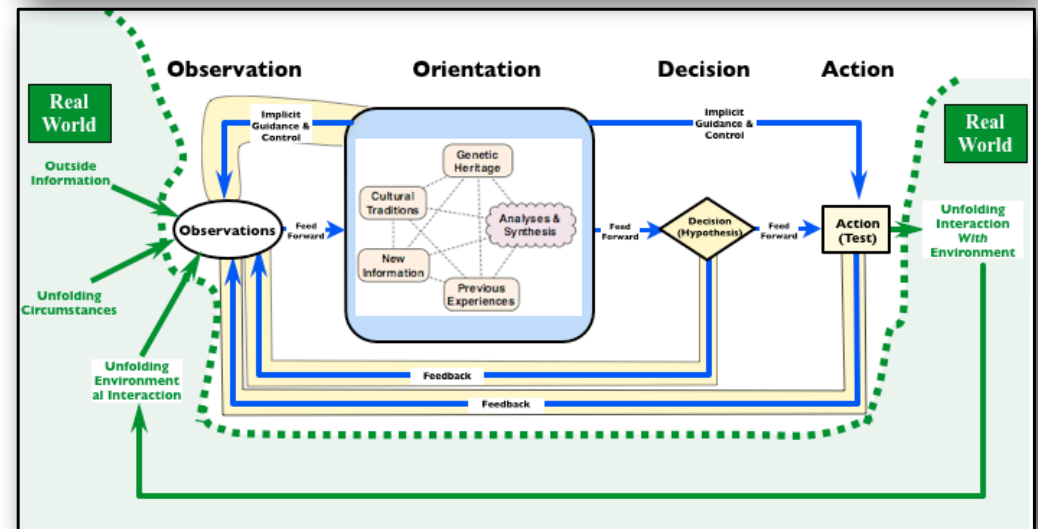
Feed Forward Loops

Can be thought of as the energy flow powering the Goal Seeking behaviour of the OODA forward thru Time.



Feed Back Loops

Can be thought of as Regulating the Goal Seeking Behaviour of the OODA loop forward thru Time.



Which one of these loops is very different from all the others?

Impression: #3

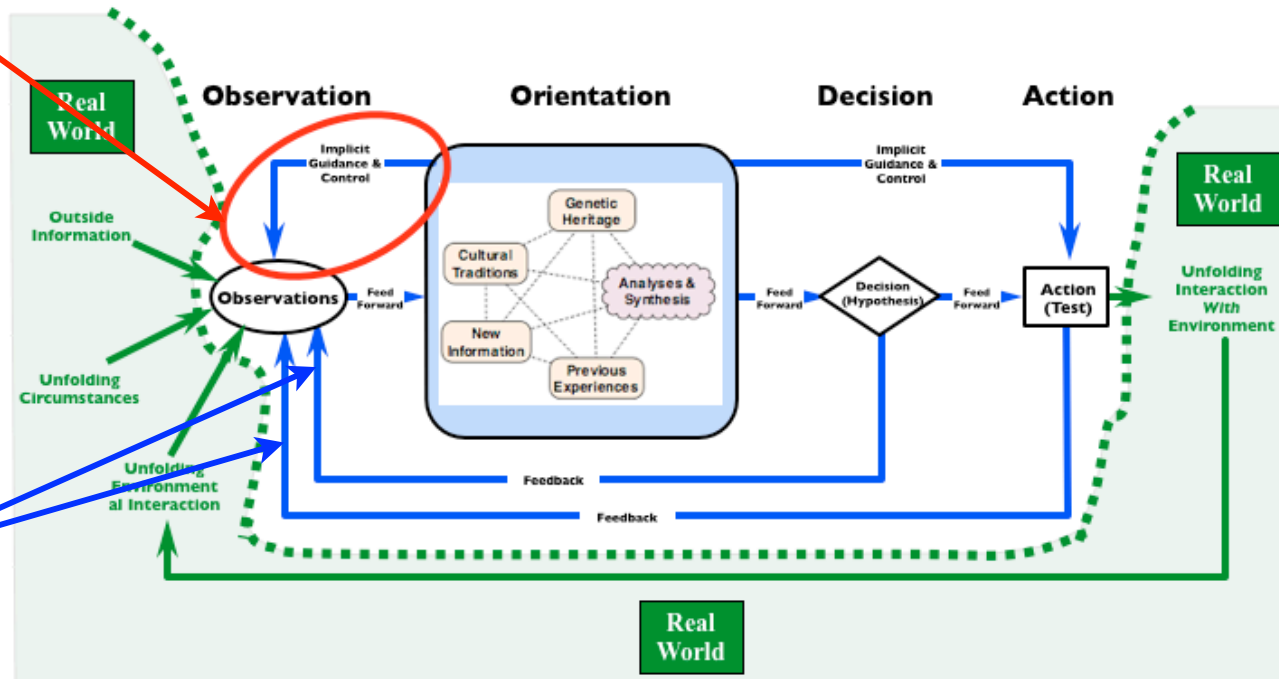
Positive Feedback

*Disconnected from Environment
Can Drive Loop Away from Goal!*

Danger: Amplifies!!!
(like placing a speaker next to a microphone)

Negative Feedback

Dampens
makes corrections like a thermostat, to
drive loop Toward Goal



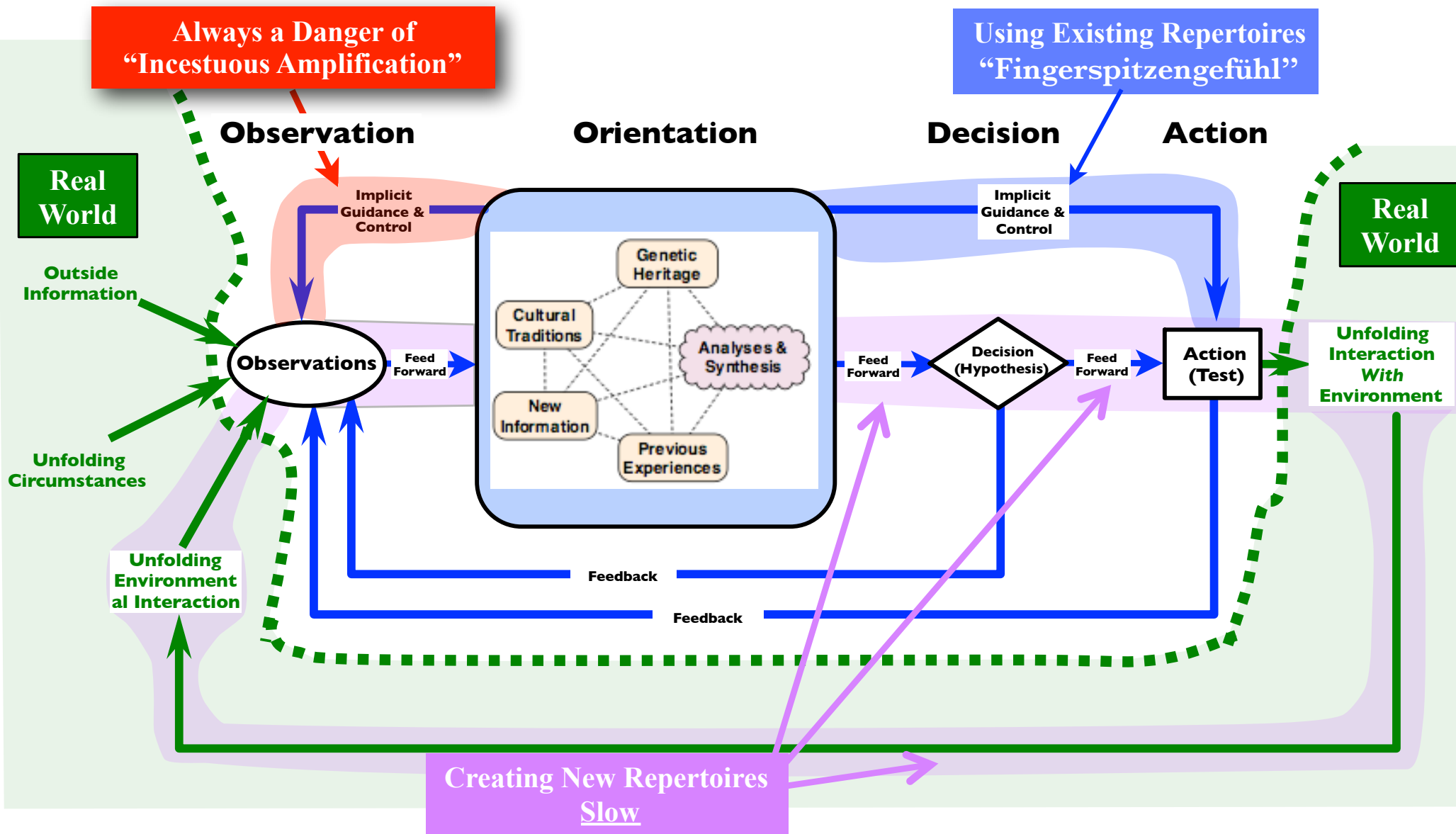
Positive Feedback can Seduce the loop into ‘Seeing What it ‘Wants’ to See’ as Opposed to What ‘Is’
ORIENTATION can *Distort* Observations to *Disconnect* the Organism from its *Environment*
... thus isolating the loop ...
Making All OODA Loops **Prone to Collapsing** into *Confusion & Disorder*

VULNERABILITY:

All OODA Loops embody the *Potential for “Incestuous Amplification”*

Implicit - Quick & Easy - Natural
(Internal - Orientation Shapes Observation)

Implicit => Quick & Easy - Natural - Almost Instinctive
(Internal: Orientation Shapes Action)



Explicit => Difficult - Can Feel Unnatural & Unnerving
(Internal Regulated by External - May Require Destructive Deduction, if New Synthesis is Needed)

Examples

ORIENTATION Can *Highjack* Observations

Napoleon's Ulm Campaign 1805

- See Appendix A

Grant's Vicksburg Campaign 1862-3

- See Appendix B

France 1940

- Maginot Line Mentality
- Schlieffen Mentality

France 1944

- Patton Deception
- Bletchley Park

Vietnam 1965-72

- Body count
- Interdiction bombing

Propaganda

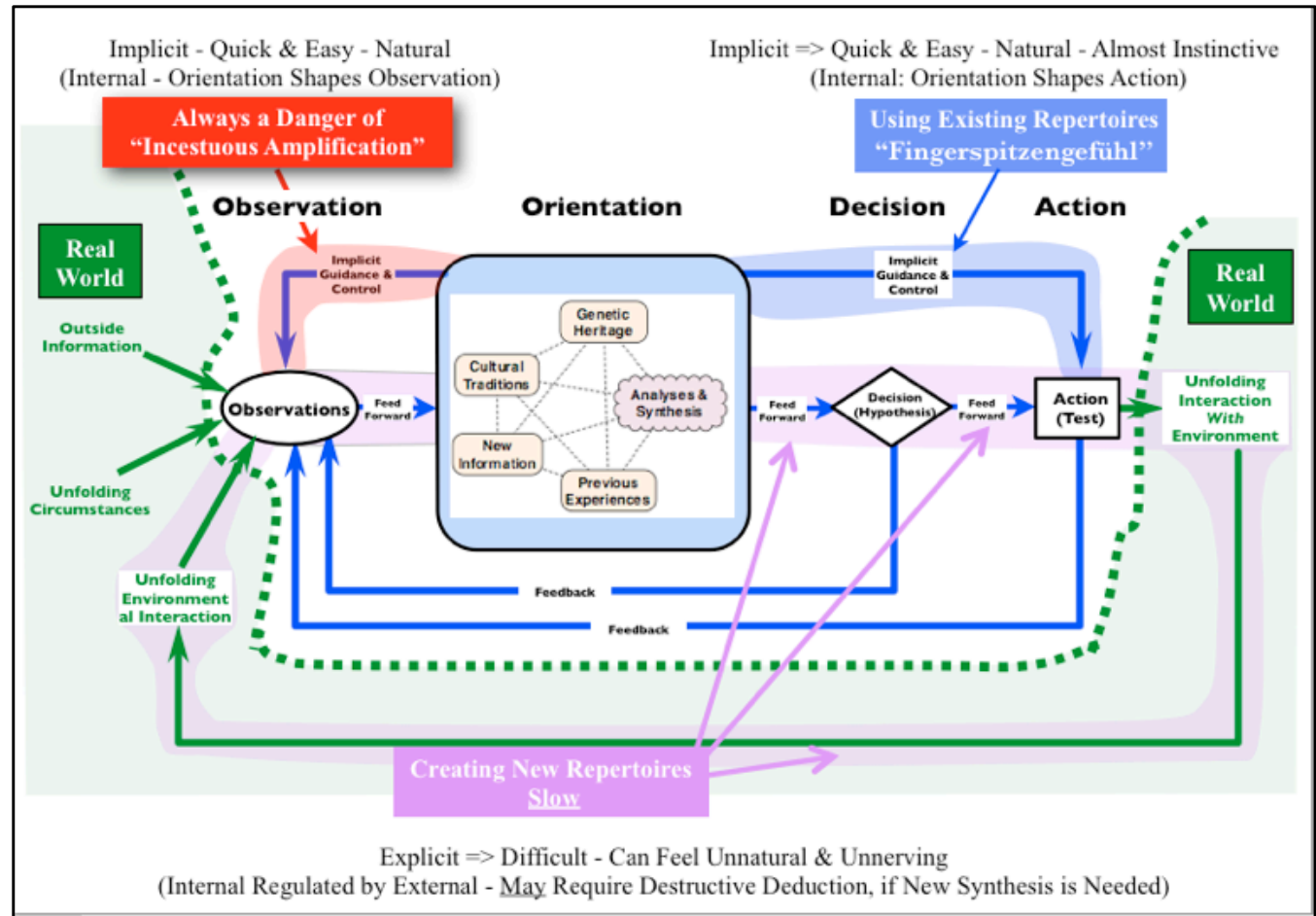
- Nazi Demonization of Jews

Iraq 2003

- Saddam's wpons of mass destruction

Michaelson-Morely Revisited

- Counter example



Point:

The OODA Loop can be a tool for exploration in case study method & doctrinal research

The OODA “Loop”

Is an Analytic/Synthetic Interaction by Which
Our Mental Orientation *Connects* With the External World
In an Evolving, Open-Ended, Far-From-Equilibrium Process
Governed by Control Loops Embodying *Positive* as well as *Negative* Feedback

The entire "loop" (not just orientation) is an ongoing many-sided implicit cross-referencing process of projection, empathy, correlation, and rejection.

**The OODA Loop is an Unpredictable
Evolutionary Phenomenon**

...that is always...

Prone to Chaos

... On the Other Hand ...

... When things go out of whack ...

We can see something **new** and **strange**; and that is when we **learn** something

Boyd's "Revelation" or Bottom Line

Brings Us Back to the Centrality of his 1976 Paper to an Understanding of his Theory of Conflict

(Note: written after the completion of his Entire Discourse — Summarized on Slide #4)

Revelation

A **loser** is someone — individual or group — who cannot build snowmobiles when facing uncertainty and unpredictable change;

Whereas,

A **winner** is someone — individual or group — who can build snowmobiles, and employ them in an appropriate fashion, when facing uncertainty and unpredictable change.

Appendix A: Napoleon's Maneuver to Ulm 1805

NAPOLEON'S OPENING OFFENSIVE IN THE WAR OF THE THIRD COALITION

Background

- Third Coalition--an alliance of England, Austria, Russia, and Sweden--was formed in 1805 for the purpose of restoring Europe to the territorial balance of the pre-revolutionary era.
- Third Coalition used the French seizure of Savoy as a casus belli in August 1805.

Situation Facing Napoleon in August 1805

- Formation of Third Coalition forced Napoleon to shift his strategic focus from England to the Continent--the Austro-Russian threat in East forced him to abandon plans for invading England.
- Bulk of French forces (210,000) were concentrated on the Channel coast near Boulogne, only other major troop concentration (50,000) was in North Italy.
- Napoleon's appreciation identified two serious threats: (1) The Austrians--reinforced by the Russians--could concentrate in the Bavarian Danube basin, penetrate the Black Forest, and invade Alsace. (2) The Austrians could invade Northern Italy and possibly Southern France. Napoleon viewed the threat to Alsace as being the most severe because a link-up of the Austrian and Russian armies could seriously outnumber his forces.

Napoleon's General Plan

- Idea: Seize the initiative with a massive preemptive attack aimed at defeating the Third Coalition in detail.
- Action: - First, defeat Austrians in Danube Theater before the Russians can reinforce them.
- Next, turn on remaining Austrians and Russian reinforcements north of the Alps.
- Use forces in Italy to tie-down Austrian forces in North Italy.

Ulm Maneuver: The Epitome of Napoleon's Operational Art

Means Factors Favoring Napoleon

Austrians assumed that Napoleon would focus his main effort in North Italy as he had in 1796 and 1800.

Third Coalition forces had defective, confusing chain of command.

Austrian planners did not account for the 10 day difference in the Russian and Austrian calendars. Consequently, Austrian forces prematurely moved into Bavaria out of supporting range of Russian reinforcements.

Napoleon's Preparations to Safeguard Freedom of Action

Interfered with enemy intelligence by sealing French borders, controlling the press, delaying his departure from channel coast while secretly moving 210,000 troops to the middle Rhine, and by entrusting corps commanders with minimum information on the overall plan.

Divided army into seven corps:

- Each corps contained elements of all arms, including a division of light cavalry to serve as recce/screening troops.
- Congestion was avoided by assigning each corps an independent line of march with its own foraging areas.
- Security was maintained by keeping corps within mutual supporting distance and by varying their size (from 14000 to 41000)--even if enemy knew of a corps' position, he would be unsure of its strength.

Drastically reduced the size of the Army's support tail--carried only 8 days of bread and biscuits.

Maneuver Action

Deep penetrating recce cavalry monitored the Austrian advance into Bavaria and searched for Russian reinforcements.

When the Austrian's reached Ulm and the Russians had not arrived within supporting range, Napoleon:

1. Launched a feint attack out of the Black Forest to draw the Austrians further to the west.
2. Launched the initially dispersed main force in a rapid convergent flank march from the middle Rhine, passing north and east of the Austrians, to a rendezvous on the Danube east of Ulm. This movement was masked by the hills of the Black Forest, the eastward line of the Jura Mountains (along the north shore of the upper Danube), and a dense cavalry screen.
3. Crossed the Danube, set up a base of operations at Augsburg, set-up defensive positions to block Russian reinforcements, and marched south and west to seal-off all of the Austrians lines of retreat.

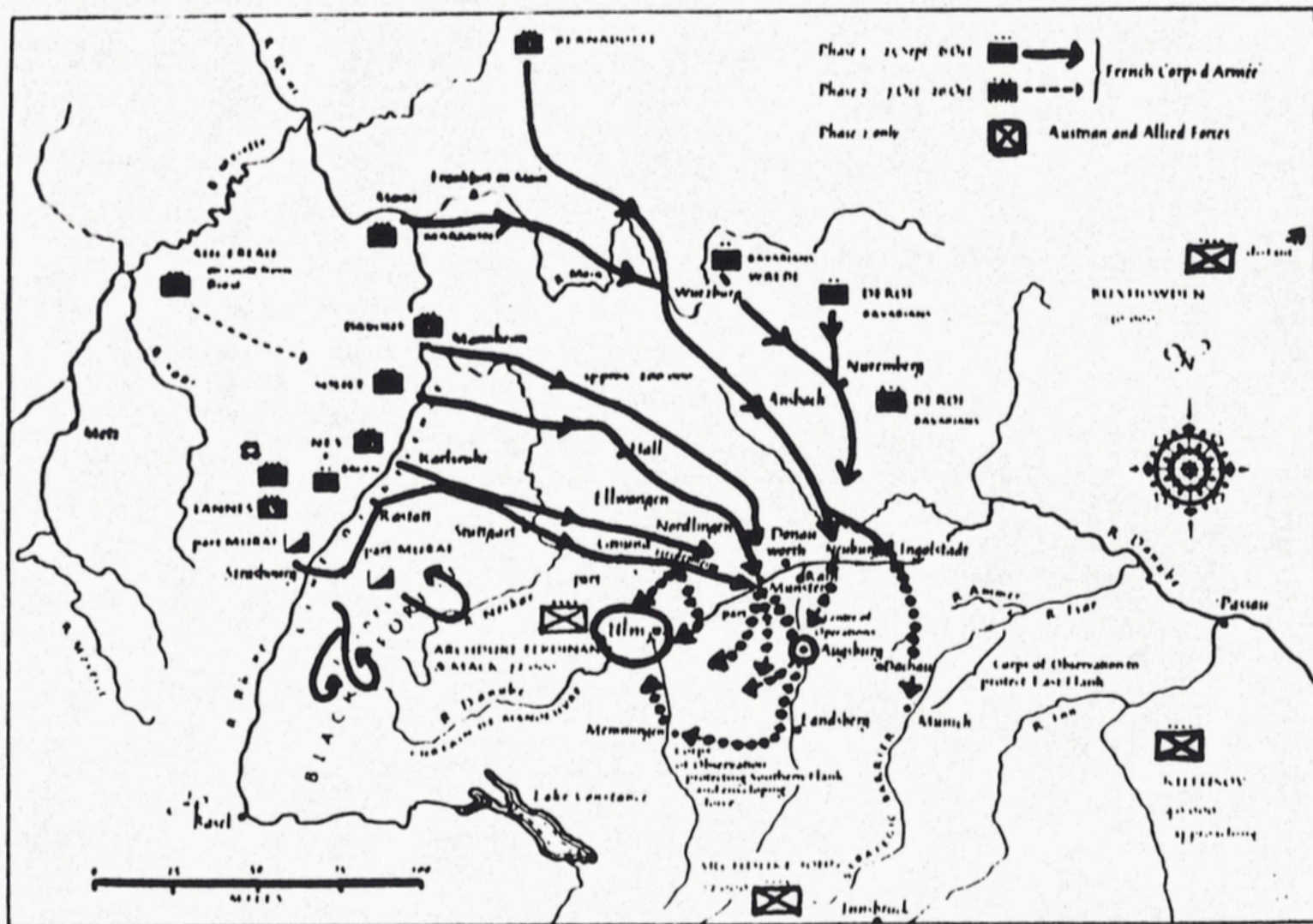
End

- In a massive single envelopment Napoleon moved 210,000 troops 200 miles in 13 days and placed the bulk of his army in the Austrian rear astride all line of retreat.
- Diversion of Austrian attention (caused by the feint) coupled with a rapid strategic infiltration (i.e., widely dispersed, well-screened forces moving rapidly into the Austrian rear) at first confused, then paralyzed the Austrian command. For example:
 - The nominal commander (Archduke Ferdinand) and the assigned commander (General Mack) could not agree on a counter-maneuver; as a result, they merely ordered that the Austrian forces concentrate in the vicinity of Ulm.
 - At one point General Mack, grasping at straws, believed rumors that the British invaded France and concluded that Napoleon was in full retreat for the Rhine River.
 - As the situation worsened, personal relations between Mack and Ferdinand broke down.
 - Austrians surrendered en masse without fighting a decisive battle.

Result

In 26 days, without fighting a major battle, Napoleon decisively defeated the Austrians on the Danube front. This freed up his forces for the invasion of Austria, the occupation of Vienna, and the defeat of the Russo-Austrian forces at Austerlitz during the next six weeks.

ULM CAMPAIGN, 1805



The Maneuver of Ulm, September 25 to October 21, 1805

Key Points

To successfully play this strategic game, Napoleon needed a better Orientation to the rapidly unfolding situation, superior strategic mobility, and a less vulnerable logistics tail than his adversary.

Napoleon's victory at Ulm suggests a rapidly changing strategic maneuver can have decisive moral and mental effects *before* the battle begins. At Ulm, these effects appear to flow out of the interplay of his adversary's mental state of DISORIENTATION with the need to adapt to a rapidly changing, *menacing* situation.

On the Other Hand

We have not described the inner workings of the Austrian OODA loops to analyze how their OODA loops came unglued at the moral and mental levels of conflict.

Appendix B:

Vicksburg Campaign (April 1862 - July 1863)

Strategic Conception - Conquest of the Mississippi River would:

- Cut Confederacy in two and interfere with east-west flow of supplies (particularly food stuffs) and reinforcements.
- Provide Union with secure North-South LOC to support future operations.
- Increase Union's political solidarity by re-opening vital trade route to sea for merchants of Northwest.

Preliminary Actions

- April 1862: Adm. Farragut opened southern Mississippi to Baton Rouge.
- June 1862: Conquest of Memphis opened Mississippi south to Yazoo River (just north of Vicksburg).

Situation Nov 1862

- Conquest of Vicksburg would open Mississippi and sever east from west because:
 1. Vicksburg was last significant river fortress in Confederate hands.
 2. Vicksburg was railway crossing for only open east-west railroad.

Grant's Opening Moves

December 1862 - January 1863

Plan

- ◆ Sherman would move down the Mississippi by water from Memphis to the Yazoo River and conduct an amphibious assault just north of Vicksburg
- ◆ Grant, co-operating with Sherman, would draw off some defenders by advancing on Vicksburg from the Northeast

Action

- ◆ Grant (using a single RR line as an LOC) was forced to retreat when Confederate cavalry destroyed his forward supply depot (Van Dorn) and also cut his rail communications further north (Forrest).
- ◆ Sherman (assuming Grant was advancing as planned) attacked, got bogged down in the swamps, and was repulsed by reinforced defenders on the high ground north of Vicksburg.

Grant's Opening Moves December 1862 - January 1863



<http://hd.housedivided.dickinson.edu/node/39220>

LESSONS LEARNED

1. Excessive dependence on long vulnerable rail LOC curtailed Grant's capacity to cope with changing condition's--i.e., his freedom of action. Consequently he could not retain initiative when LOC was cut by small, lightly armed, highly mobile raiding forces.
2. During subsequent retreat, Grant's army was forced to sustain itself by living off the country-side, thereby learning that it was possible to move a large force a considerable distance through hostile territory without an extensive support tail.
3. Swamps north of Vicksburg were a formidable defensive obstacle that should be avoided if possible.

GRANT'S FIRST NAPOLEONIC MANEUVER

Means

End

Preparations to Safeguard Freedom of Action

- Set up secure support base close to Vicksburg.
- Ambiguous activities (e.g., construction of canals) to keep own troops busy (i.e., preserve morale) and create appearance of preparations for another attack from North.
- Launch naval/land attack from New Orleans north towards Port Hudson to divert attention.
- Launch 600 mile cavalry raid deep in adversary rear (i.e., from Tenn. to Baton Rouge) to divert attention, disperse reserves, and sow confusion by interfering with telegraph and rail communications.

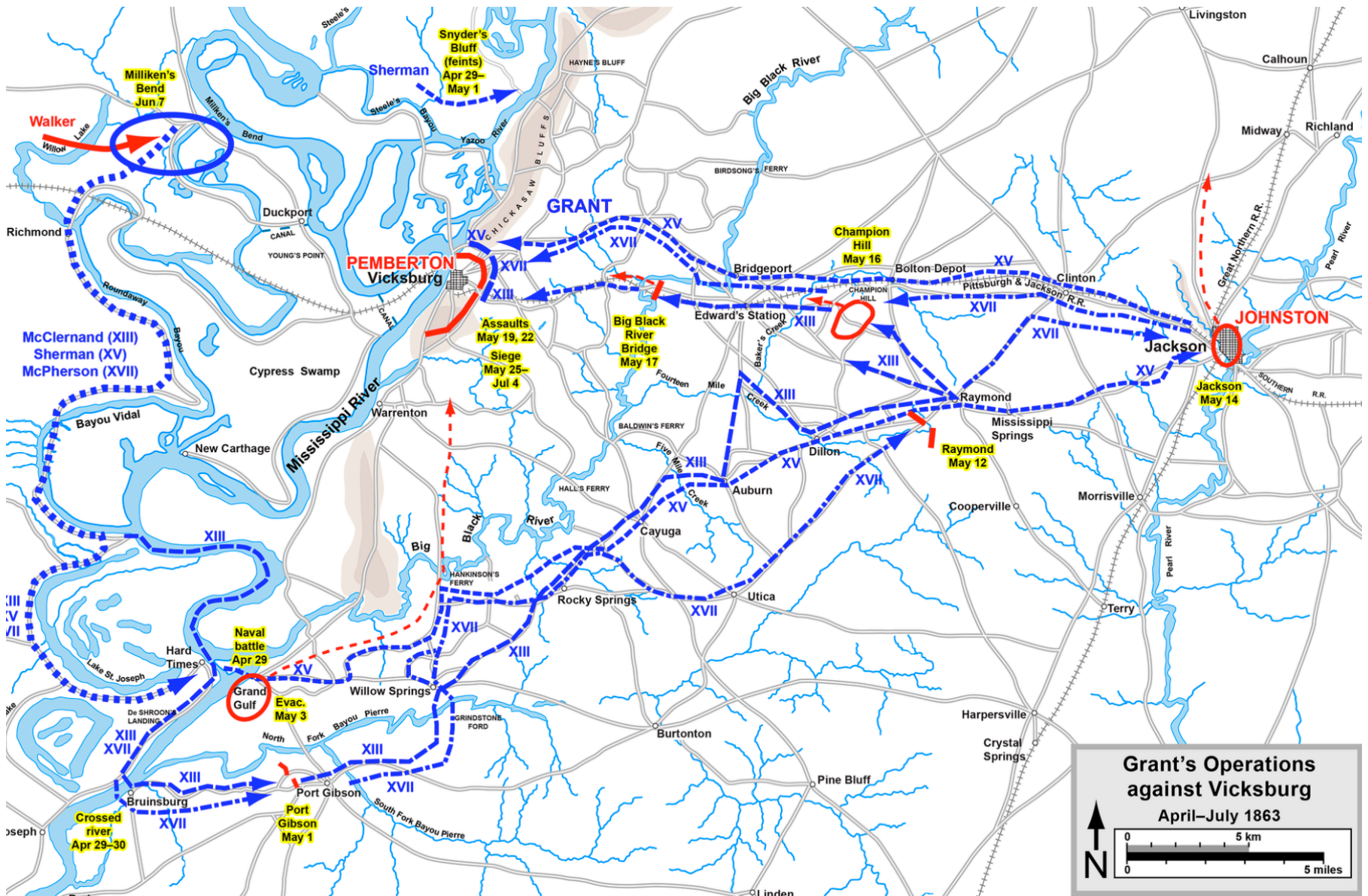
Maneuver Action

- Using river as screen, rapidly move bulk of forces 35 miles south of Vicksburg.
- Use Naval forces at night to move supplies via river south past Vicksburg.
- Launch feint attack in north, cross river in south and set up forward supply base as springboard for deep flank maneuver.
- Carrying only five days rations, cut loose from supply trains and live off land as means to rapidly move between Confederate forces and to occupy communications deep in Confederate rear.
- Pursue retreating forces and focus attack on isolated forces defending Vicksburg by rapid march towards own secure base operations.

- Ambiguous/Deceptive preparations, disruption of communications, and rapid movements in unexpected directions disoriented Confederate leader--as evidenced by his failure to adapt in a directed way to the unfolding situation. For example, he:
 - Dispersed his reserves.
 - Responded to feint in North.
 - Tried to attack Grant's non-existent support tail.
 - Panicked and retreated into Vicksburg rather than maneuvering to rejoin friendly forces (as directed by his superior).
- Once besieged within Vicksburg, Confederate forces "stiffened their backbones" (i.e., restored their moral and mental balance) and gallantly withstood assault, bombardment, and starvation for 47 days.

RESULT

Grant moved 200 miles in 19 days, fought five victorious battles against isolated detachments of a numerically superior enemy, and besieged/captured Vicksburg.



Walker
Milliken's Bend
Jun 7

Snyder's Bluff
(feints)
Apr 29–
May 1

Champion
Hill
May 16

Jackson
May 14

Naval
battle
Apr 29

Grand
Gulf
Evac.
May 3

McClerland (XIII)
Sherman (XV)
McPherson (XVII)

Assaults
May 19, 22
Siege
May 25–
Jul 4

Big Black
River
Bridge
May 17

Raymond
May 12

Crossed
river
Apr 29–30

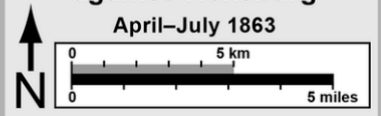
Port
Gibson
May 1

GRANT

JOHNSTON

PEMBERTON
Vicksburg

Grant's Operations
against Vicksburg
April–July 1863



Observation

During the Vicksburg maneuver, Grant's adversary broke-down and panicked; yet during the subsequent siege, the same adversary restored his moral and mental balance in the face of a hopeless situation.

Raises Question

Why did Grant's adversary respond to the physical effects of his isolation in two profoundly different ways?

Comments on the Effects of Isolation

Vicksburg Manuever

- Relatively short time span--i.e., 19 days.
- Numerically inferior forces separated and isolated adversary detachments with a welter of rapidly changing--hence unpredictable--threats deep in adversary's rear communications zone.
- Disorientation and panic among Confederates suggest mental and moral disintegration.

Vicksburg Siege

- Relatively long time span--i.e., 47 days.
- Numerically superior forces isolated adversary with a set-piece--hence predictable--encirclement and eventually strangled the adversary.
- Innovative adaptations (e.g., making mortars out of hollow tree trunks) and gallant defense by Confederates suggest mental effectiveness and moral strength.

Key Contrasts

- During the maneuver; the moral, mental, and physical effects reinforced each other, however, during the siege, the physical effects were not reinforced by the mental and moral effects.
- Grants unpredictable maneuver activities disoriented his adversary, made it difficult to adjust to circumstances, and thereby broke down his adversary's moral and mental resistance. Grant's predictable siege activities--being anticipated and taking place over a longer time period--did not disorient his adversary and made it easier to adjust to circumstances and hence maintain or increase his mental and moral resistance.

Comments on the Effects of Isolation
(Cont.)

Implications

- The physical effects of interdicting and isolating an adversary are not automatically reinforced by the mental and moral effects:
- The examples of Ulm and the Vicksburg maneuver suggest--but do not prove--the idea that strong reinforcing effects flow out the ability to place one's adversary in a mental state of disorientation--which is evidenced by his inability to adapt in a directed way to a fast changing unpredictable threat.
- The examples of the Confederate blockade and the Vicksburg siege suggest that reinforcing effects can be weak to non-existent when one's adversary is faced with a steady predictable threat.

HISTORICAL NOTE

- During the planning phase, Sherman argued that the proposed maneuver would overexpose Grant's army and run the risk of a disastrous defeat.

- After the successful completion of the maneuver, Sherman exclaimed (on May 19):

"Until this moment I never thought your expedition a success. I never could see the end clearly until now. But this is a campaign; this is a success, if we never take the town!"

- Point: Sherman learned from Grant to increase mobility by living off the country-side.