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## John Boyd's OODA Loop

Back in the 1950s, Boyd was known as the best fighter pilot in America and perhaps the world. He flew for the US Airforce and reached the rank of Colonel. His first nickname (of many) was "40-second Boyd" because while working as a flight instructor at Fighter Weapons School, he had a long-standing \$40 bet with all comers that he could put them on his "six" then outmaneuver them to reverse positions for a kill in under 40 seconds. Never once did he lose.

Grant Hammond, the author of the original book on Boyd, *The Mind of War*, describes the complex man like this:

To one senior Air Force four-star, Boyd was "a 24 karat pain in the ass." To a Marine four-star he was "the quintessential soldier-scholar." While one fellow student called him "the 'cussingest' man I ever met," another four-start called him "Christ-like." To those in the Pentagon whose ire he garnered, he was "that f @\*#ing Boyd."

He was known by various names including "the Mad-major," "The Ghetto colonel," and "Genghis John." To those who believed in him and his causes, he was more than a hero he was a virtual saint and they would have followed anywhere and taken on any foe, regardless of the odds.

How did one man inspire such radically different opinions? Boyd was both brilliant and a misfit who was his own worst enemy. He did not do things by the book or play by the rules. He did not care much for shined shoes, immaculate uniforms, or protocol niceties. On a visit to the Air Force Academy driving with his host, he noticed the superintendent in the car behind him on base. Boyd rolled down the window in the cold and snow and started pumping his middle finger in the air at the car behind, in front of several dozen cadets. His host, appalled by the action, tried to stop him, but Boyd said, "Aw hell, we were in pilot training together and this is just a fighter pilot greeting."

Boyd was both vilified and respected by those who knew him. To many, he was not very likable. He smoked smelly cigars, talked loudly, and got right in your face when he argued with you, spittle flying. He was pushy, arrogant, and profane in the extreme and would frequently end run his boss, or his boss's boss, up to, and including, the secretary of the Air Force and the secretary of defense. He had the courage to state his views—and defend them regardless of consequence. His supporters admired and respected his integrity and willingness to challenge and persevere. He was totally incorruptible, had little use for money, and refused to cash dozens of TDY

reimbursement checks for speaking engagements after he retired. He inspired intellectual respect and virtual awe, intense loyalty, and unbounded compassion for those who became “the acolytes” of Boyd’s small but intense following on his various crusades.

Boyd was able to get away with being a “24-karat pain in the ass” and avoid court-martial *only* because he was brilliant.

In the late 1950s, he taught himself enough calculus to work out the formulas for describing his unique view of the maneuver-counter maneuver aerial dogfight. He published his findings in a secret document titled *Aerial Attack Study*. The document was so revolutionary it ended up spreading throughout Western military culture, essentially becoming the bible for air combat.

In the 60s, on his own initiative, he taught himself advanced mathematics and physics and then stole millions of dollars worth of government computer time using dummy accounts so he could study the comparative flight performance envelopes at different speeds, altitudes, and G-forces for every American fighter and plot them against every Soviet fighter.

Boyd did this because he wanted to answer the question as to why the F-105’s 10 to 1 kill ratio versus MiGs in Korea collapsed to 1-1 in Vietnam when US pilots seemed to lose their air-superiority.

Once the Air Force brass found out about his expensive theft they pushed for a court-martial. Luckily Boyd had uncovered fundamental truths about aircraft build and aerial warfare which led to his creation of Energy-Maneuverability theory, EM theory for short, which went on to completely change aeronautical design and how fighter jets were tested and built — eventually culminating in the creation of the F15 Eagle and F16 Fighting Falcon, two of the most successful fighter jets in history.

So instead of a court-martial, the Air Force was forced to give him two commendation awards instead.

Following his retirement from the Air Force in the mid-70s, Boyd went into self-imposed exile to study and prepare for the next phase in his evolution.

A former friend and coworker of Boyd, Frank Spinney, shared the following about this period in Genghis John’s life, during a speech given at the U.S. Naval Institute.

All this was the stuff of legend in 1973 when I met Boyd, who was living modestly with Mary the Saint and their five children in a run-down apartment complex in Northern Virginia. He was well into his third mutation: the Ghetto Colonel. Like Immanuel Kant, he was an austere man of intense rectitude, whose life had become devoted to the study of

science, philosophy, and the humanities in a small room. Like Kant, Boyd was obsessed with understanding how the mind creates knowledge, or in modern parlance, how it creates theoretical models of the real world — how new observations make existing theories obsolete, and how the mind replaces old theories with new theories in a never-ending cycle of destruction and creation.

To this end, he devoured books on physics, mathematics, logic, information theory, evolutionary biology, genetics, cognitive psychology, cultural anthropology, sociology, political science, economics. Between 1973 and 1976, he poured his intellectual energy into producing a 16-page double-spaced, type-written paper describing his theory. Entitled “[Destruction and Creation](#),” this abstract treatise describes how a dialectical interplay of analysis and synthesis destroys and creates our mental images of the external world. It describes what pressures drive this mental process, and how internal phenomena naturally regulate it in a never-ending dialectic cycle, which takes on the outward manifestations of disorder turning into order, and order turning into disorder.

At the heart of Boyd’s theory of knowledge was a natural regulation mechanism that he discovered by unifying for the first time certain aspects of the Incompleteness Theorem of Mathematics and Logic discovered by Kurt Godel, an Austrian mathematician; physicist Werner Heisenberg’s Uncertainty Principle; and the Second Law of Thermodynamics. Typically, he did not even try to publish his paper, although he did vet it through many distinguished scientists and mathematicians — none of whom was able to poke any holes in it.

“Destruction and Creation” became the intellectual foundation of his monumental study of competition and conflict — although at the time, he had no idea where his philosophical musings might take him.

Looking back at those four years between 1973 and 1976, I now understand that they were a period of intellectual refueling for the next campaign in Boyd’s war against a bureaucratic establishment that had lost sight of its goal. For unlike Immanuel Kant, Boyd worked in the Pentagon, a moral sewer dedicated to using other people’s money to feed the predators in the Hobbsean jungle known as the military-industrial-congressional complex.

Viewed from this perspective, the Ghetto Colonel’s lifestyle was much more than an aesthetic philosopher’s quirk. It was a deliberate choice reflecting that bureaucratic warfare in the Hobbsean jungle had replaced the aerial dogfight as his first love.

Boyd loved a good skunk fight and he played for keeps — instinctively applying Napoleon’s dictum of preparing a circumspect defense before unleashing an audacious attack. He built up his defenses by eschewing careerism and materialism, which left the

generals and bureaucrats nothing to work on, no opportunity to gain leverage on him, no bait to tempt him into corruption. The Ghetto Colonel became an impenetrable fortress, a bastion of moral power in a way that Mohandas Gandhi would have easily understood. From the perspective of the bureaucracy's authoritarian mentality, however, the man was certifiably insane; even worse, he was completely out of control.

I once asked him why he lived this way. He got in my face, the ever-present cigarillo clenched between his teeth, its hot tip popping up and down a quarter of an inch from my nose, and amidst a gush of suffocating smoke, he explained: "The most important thing in life is to be free to do things. There are only two ways to insure that freedom — you can be rich or you can reduce your needs to zero. I will never be rich, so I have chosen to crank down my desires. The bureaucracy cannot take anything from me, because there is nothing to take."

This statement went to the core of a puritanical ethos. For the Ghetto Colonel, life revolved around a simple choice: To be or to do? He could be somebody, with all the shallow accoutrements of power and small achievements — high rank, a big office in the Pentagon's E-ring, and a big post-retirement job with a defense contractor — or he could do important things and make a real contribution to society. The Ghetto Colonel was more interested in doing things than in being somebody, so he cranked down his needs. His choice really was very simple and logical, if somewhat bizarre and indecipherable to the inhabitants of Sodom on the Potomac.

There's so many good bits in there that we could spill gallons of ink and burn through mountains of paper discussing them. But this is a report on markets, so I'll save the broader philosophical discussions for another day and get to the meat of what we're here for today.

Boyd's decade long study into the nature of reality and how we interact and compete within it culminated in a 370 slide presentation titled [A Discourse on Winning and Losing](#). The briefing covers a lot but at **its core is an operating framework for how to survive and thrive in our complex reality.**

The operating framework is what I'm sharing with you today. And underlying this framework is what Boyd referred to as his scientific trinity of Gödel, Heisenberg, and the Second Law of Thermodynamics.

**Gödel** proved that it's impossible to embrace mathematics within a single system of logic so that any consistent system remains incomplete. In Boyd's words this means that "Gödel's proof indirectly shows that in order to determine the consistency of any new system we must construct or uncover another system beyond it. Over and over this cycle must be repeated to determine the consistency of more and more elaborate systems."

Meaning, there is always something beyond our contrived systems. No explanation is fully self-contained.

**Heisenberg's Uncertainty Principle** states that it's impossible to know both the position and velocity of subatomic particles with accuracy. We can know either but not both at the same time. Boyd took this to mean that uncertainty lies at the foundation of our physical universe and therefore should be embraced by our attempts to understand and interact with it.

And the **Second Law of Thermodynamics** states that all closed systems increase in entropy over time (ie, chaos spreads). Boyd explained it like this, "entropy is a concept that represents the potential for doing work, the capacity for taking action or the degree of confusion and disorder associated with any physical or informational activity. High entropy implies a low potential for doing work, a low capacity for taking action or a high degree of confusion and disorder. Low entropy implies just the opposite."

This is an oblique way of saying that in order to decrease entropy one must maintain an open system (open to new information, experiences, patterns etc...).

Hammond wrote in *The Mind of War* that Boyd's thinking is:

...based on the synthesis of those three insights. It is cosmic in its sweep and fundamental in its insight. It is an elegant yet simple proof of how we learn and why one must be able to destroy before one can create. Boyd proved to himself that logic, mathematics, and physics all proffered explanations of the same basic notion. Taken together these three notions support the idea that any inward-oriented and continued effort to improve the match-up of a concept with observed reality will only increase the degree of mismatch. Boyd saw Godel, Heisenberg, and the Second Law as keys to how to think, how to compete successfully, and how to adapt and survive.

Boyd's belief was that to compete in an uncertain reality — and all reality is tinged with varying degrees of randomness — one had to constantly perform destructive deduction and creative induction with the mental models we use to interpret and interact with reality.

This means that we need to routinely dissect and analyze our beliefs, aims, and strategies (destructive deduction) where we can take note of, and discard faulty assumptions and biases. And then follow up with creative induction where we take our disparate analyzed data and models and then synthesize and combine it into something new, something novel, something that's in better alignment with reality.

We need to build a snowmobile.

This was Boyd's favorite metaphor for what we're talking about. A snowmobile is a mismatch of various components from unrelated devices. It has the rubber treads of a tank, skis from a ski slope, the outboard motor of a boat, and the handlebars of a bicycle.

The individual parts of these unconnected objects (models) come together to create an entirely new creation, one that is better suited for its environment than any of the objects from which its parts are derived.

Scientist and author of one of my favorite books *Consilience: The Unity of Knowledge*, E.O. Wilson put it like this:

*We are drowning in information, while starving for wisdom. The world henceforth will be run by synthesizers, people able to put together the right information at the right time, think critically about it, and make important choices wisely.*

Turning back to Boyd's friend, Spinney:

Each of us bases our decisions and actions on observations of the the outside world that are filtered through mental models that orient us to the opportunities and threats posed by these observations. As Konrad Lorenz and others have shown, these mental models, which the philosopher of science Thomas Kuhn called paradigms, shape and are shaped by the evolving relationship between the individual organism and its external environment.

In conflict, each participant, from the individual soldier, trying to survive to the commander trying to shape strategy, must make decisions based on his orientation to reality — his appreciation of the external circumstances which he must act on. Boyd argued that one's orientation to the external world changes and evolves, because it is formed by a continuous interaction between his observations of unfolding external circumstances and his interior orientation processes that make sense of these circumstances. These interior process take two forms activity: analysis (understanding the observations in the context of pre-existing patterns of knowledge) and synthesis (creating new patterns of knowledge when existing patterns do not permit the understanding needed to cope with novel circumstances).

The synthetic side of the dialectic is crucially important to one orientation because it is the process by which the individual (or group) evolves a new worldview, if and when one is needed to cope with novel circumstances. But as Kuhn and others have shown, the synthetic process can be extremely painful, because its nature is to build a new paradigm by destroying the existing one.

A big part of our job as speculators is to inch by inch try and pull back the curtain on a constantly changing complex reality. We do this by ripping apart our beliefs and rebuilding new ones, creating Munger's latticework of mental models, from which we can pull from when the environment calls for it.

Some of the models we've shared for example are:

- [Capital Cycle Theory](#)
- [Bubble Rotation](#)
- [Kuhn Cycle](#)
- [Debt Cycle](#)
- [Play the Player](#)
- [Liquidity](#)
- [Core-Periphery](#)
- [Reality Narrative Lag](#)
- [Boom/Bust](#)
- [Possibilities > Probabilities](#)
- [Transactions Approach](#)
- [BoP Constrained](#)
- [Gerschenkron Growth Model](#)

What Boyd gives us, which is so incredibly valuable, is a strategic framework from which to effectively use these models and operate from.

The framework is called the O-O-D-A Loop which is an abbreviation for **O**bserve, **O**rient, **D**ecide, **A**ct.

The OODA Loop is the ultimate compression of Boyd's philosophy. Hammond writes that for Boyd, "the OODA Loop is a composite of how we think and learn, the source of who we are, and the potential we possess. It is a profoundly simple explanation of the nearly infinite variety that is possible. It is a shorthand for life itself, a model for how we think, and the means by which we both compete and collaborate."

Boyd describes the centrality of the OODA Loop as this:

Without our genetic heritage, cultural traditions, and previous experiences, we do not possess an implicit repertoire of psycho-physical skills shaped by environments and changes that we have previously experienced.

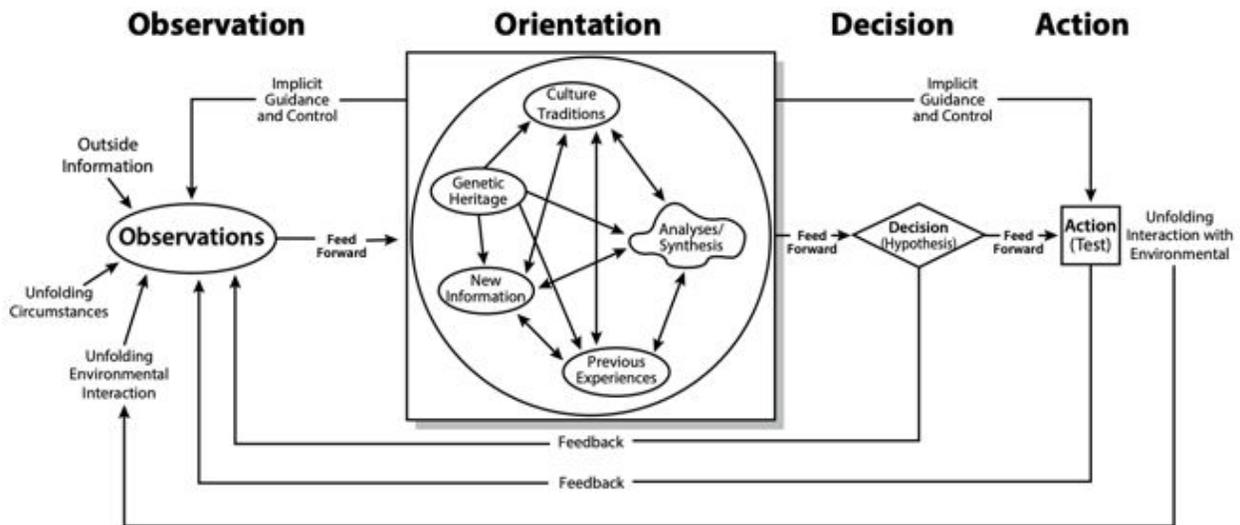
Without analysis and synthesis across a variety of domains or across a variety of competing independent channels of information, we cannot evolve a new repertoire to deal with unfamiliar phenomena or unforeseen change. Without a many-sided implicit

cross referencing process of projection, empathy, correlation, and rejection (across many different domains or channels of information), we cannot even do analysis and synthesis.

Without OODA Loops, we can neither sense, hence observe, thereby collect a variety of information for the above process, nor decide as well as implement actions in accord with these processes. Or, put another way, without OODA Loops embracing all the above and without the Ability to get inside other OODA Loops (or other environments), we will find it impossible to comprehend, shape, adapt to, and in turn be shaped by an unfolding, evolving reality that is uncertain, ever-changing, and unpredictable.

The entirety of the OODA Loop process looks like this:

Boyd's OODA Loop



Notice the continuous feedback loops at each step of the process. Every stage of the OODA Loop informs the other and so on. The process is more organic than it is mechanical. Never is it static but rather it's constantly fluid; always updating, reorienting, evolving.

Now how does all of this apply to markets?

For one, prediction is not only futile but completely misses the point of the game. Prediction only works in linear environments whereas markets are a natural system, and thus are dynamic, non-linear.

Just like in war you don't set a strategy, execute, and pray to Mars that you chose wisely. No!

You **Observe** what's going on, and then **Orient** off what you see as key information, then make your **Decision** using existing mental models for interpreting reality and finally **Act**... You then repeat and repeat over and over... constantly observing and reorienting to not only new information but new interpretations of that information — ruthlessly trashing your bad assumptions — and then hopefully evolving your models of reality, deciding what to do next, and following through ad infinitum...

If you study the trading greats you find that they did the OODA Loop process instinctively.

Take the Palindrome, George Soros, for example, who's said:

*My approach works not by making valid predictions, but by allowing me to correct false ones.*

*The reflexive nature of human relations is so obvious that the question I would like to ask is, why has reflexivity not been properly recognized? Why, for instance, did economic theory deliberately ignore it? [And the answer is because] it cannot be reconciled with the goals of analytical science, which is to provide determinate predictions and explanations. **Reflexivity throws a monkey-wrench into the works by introducing an element of uncertainty.***

*As an investor, I find statistical probability of limited value; what matters is what happens in a particular case. The same applies with even greater force to historic events. **I cannot make reliable predictions about them; all I can do is formulate scenarios.** I can then compare the actual course of events with the hypothetical ones. Such hypotheses have no scientific validity, but they have considerable practical utility. They provide a basis for real-life decisions.*

Or Bruce Kovner:

***One of the jobs of a good trader is to imagine alternative scenarios.** I try to form many different mental pictures of what the world should be like and wait for one of them to be confirmed. You keep trying them on one at a time. Inevitably, most of these pictures will turn out to be wrong — that is, only a few elements of the picture may prove correct. But then, all of a sudden, you will find that in one picture, nine out of ten elements click. That scenario then becomes your image of the world reality.*

These guys can build snowmobiles!

*What is strategy? A mental tapestry of changing intentions for harmonizing and focusing our efforts as a basis for realizing some aim or purpose in an unfolding and often*

*unforeseen world of many bewildering events and many contending interests...*

*To discern what is going on we must interact in a variety of ways with our environment. We must be able to examine the world from a number of different perspectives so that we can generate mental images or impressions that correspond to that world.*

*We can't just look at our own personal experiences or use the same mental recipes over and over again; we've got to look at other disciplines and activities and relate or connect them to what we know from our experiences and the strategic world we live in. By an instinctive see-saw of analysis and synthesis across a variety of domains, or across competing/independent channels of information, in order to spontaneously generate new mental images or impressions that match up with an unfolding world of uncertainty and change. ~John Boyd*