Syllogism
Classical form of Deduction
and
Information Security

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Merriam-Webster dictionary defines "Syllogism" as a classical form of **deduction**, specifically an argument consisting of a **major** and a **minor** premise and a conclusion.
Syllogism is a type of argument mostly used in the legal world . This article is an effort to blend syllogism with information security as we see it today.

EXAMPLE OF SYLLOGISM

John Danaher, on his blogpost "Understanding Legal Argument (1): The Five Types of Argument" provides an easy-to-understand definition and example of syllogism.
"Philosophers and logicians would say that the basic form of legal argument is a syllogism: a simple **three-step argument** involving a major premise **(a general principle or rule),** a minor premise **(a claim about a particular case or scenario)** and then a conclusion **(an application of the general rule to the particular case)."**

1) If roses are red, then violets are blue. **(Major Premise)**
(2) Roses are red. **(Minor Premise)**
(3) Therefore, violets are blue. **(Conclusion)**

SYLLOGISM AND ITS CO-RELATION TO INFORMATION SECURITY

As in every other industry, information security professionals are subjected to the rigorous drill of decision making . More than ever, these decisions have wide ranging ramifications towards the constituency they serve , both internal and external. The fast and rapidly evolving threat landscape provides no solace; on the contrary it imposes a burden on the information security decision. The burden to take decisions, fast and quick least the adversary gains an upper hand.
It is a well-accepted norm to base decisions on a major premise or as a general rule or principle. Herein lies the problem and the reason for this article. Decisions need to be based on due care, subject to the scrutiny of due diligence, the two key pillars of informed decision. To this end , it is imperative that the decision maker is made aware of the threat landscape, both present and past. The outcome of an informed decision is not based on major premises expected to provide a deterministic outcome, but one based on sound reasoning grounded on the concepts discussed here. An informed decision is steppingstone towards a journey with reduced surprises answering the four W's (what, where when and why) and the H (How)

To understand Syllogism from an information security perspective, we first need to understand four important terms. The underlying concepts of these four terms provide the necessary and relevant co-relation for this article.

1) What is a "Black Swan" event
2) What is Deterministic Predictability
3) Isaac Newton laws published in 1687
4) What is "CHAOS" , also popularly known as the "Butterfly effect "

BLACK SWAN

Nassim Nicholas Taleb in his book " The Black Swan, the impact of the highly improbable" describes Black Swan as an event with the following three attributes.

1. First, it is an **outlier**, as it lies outside the realm of regular expectations, because nothing in the past can convincingly point to its possibility.
2. Second, it carries an **extreme impact** (unlike the bird).
3. Third, in spite of its **outlier status**, human nature makes us concoct explanations for its occurrence **after the fact**, making it explainable and predictable.

DETERMINISTIC PREDICABILITY

Marquis De Laplace explains in his book how French mathematician Pierre-Simon Laplace asserted in his 1814 volume **"A Philosophical Essay on Probabilities"** on deterministic predictability.
" If we knew everything about the universe in its current state, then "**nothing** would be **uncertain** and the future, as the past, would be present to [our] eyes."

ISAAC NEWTONS LAWS PUBLISHED in 1687

"Philosophiae Naturalis Principia Mathematica" (Mathematical Principles of Natural Philosophy), established the three laws of motion and the law of universal gravity.
Isaac Newton laws published in 1687 suggested a tidily predictable mechanical system—the "**clockwork universe**.".
Encyclopedia.com explains the concept as follows - "Clockwork universe refers to the concept of the universe as a system that behaves in a manner as patterned and dependable as a mechanical clock. Like a clock, the universe could be thought of as something both designed and constructed—something both conceptualized by a divine artificer and made by a divine craftsman. Like a clock, the universe, once set in motion by its creator, could be visualized as

something able to operate without corrections or interference from outside. The regular motions exhibited by the sun, moon, stars, and planets provided the basis for elaborate medieval clocks that could mimic the patterned motion of these celestial objects."
https://www.encyclopedia.com/education/encyclopedias-almanacs-transcripts-and-maps/clockwork-universe

CHAOS

Listed below are statements from Gleick James's book -**Chaos making a new science.**

1. WHERE CHAOS BEGINS, classical science stops.
2. The modern study of chaos began with the creeping realization in the 1960s that quite simple mathematical equations could model systems every bit as violent as a waterfall.
3. Tiny differences in **input** could quickly become overwhelming differences in **output**—a phenomenon given the name **"sensitive dependence on initial conditions."**
4. When the explorers of chaos began to think back on the genealogy of their new science, they found many intellectual trails from the past. But one stood out clearly. For the young physicists and mathematicians leading the revolution, a starting point was the **Butterfly Effect.**

BUTTERFLY EFFECT

1. Peter Dizikes, in MIT Technology Review dated Feb 22, 2011 (https://www.technologyreview.com/2011/02/22/196987/when-the-butterfly-effect-took-flight/) states that 50 years ago, Edward Lorenz, a mild-mannered meteorology professor at MIT, while working on his computer entered some numbers into a computer program simulating weather patterns. The unexpected result led Lorenz to a powerful insight about the way nature works **"small changes can have large consequences.**
2. The idea came to be known as the **"butterfly effect"** after Lorenz suggested that the flap of a butterfly's wings might ultimately cause a tornado.
3. The butterfly effect, also known as **"sensitive dependence on initial conditions,"** has a profound corollary: ***forecasting the future can be nearly impossible.***
4. In Lorenz's particular system of equations, **small errors proved catastrophic.**

"BUTTERFLY EFFECT" ON SCIENCE AND THE WORLD .

1. Lorenz's work also challenged the classical understanding of nature. The laws that Isaac Newton published in 1687 had suggested a tidily predictable mechanical system—the **"clockwork universe."** (https://www.technologyreview.com/2011/02/22/196987/when-the-butterfly-effect-took-flight/)
2. James Gleick, in his book "Chaos, Making a new science" states "The most passionate advocates of the new science go so far as to say that twentieth-century science will be remembered for just three things: "**RELATIVITY , QUANTUM MECHANICS and CHAOS".**
    a. "Relativity eliminated the Newtonian illusion of absolute space and time.
    b. Quantum theory eliminated the Newtonian dream of a controllable measurement process; and
    c. Chaos eliminates the Laplacian fantasy of "deterministic predictability."
3. Of the three, the revolution in chaos applies to the universe we see and touch, to objects at human scale.

KEY LEARNING FOR INFORMATION SECURITY PROFESSIONALS.

1. Governance and management functions define business objectives in pursuit of opportunities or needs. If decisions are based on "major premises" expecting a "deterministic" outcome, Black swan events and butterfly effects can present significant obstacles in achieving objectives.
2. Risk is invariably a matter of future events, there is always some amount of uncertainty. We need to be prepared for Black Swan events. Risk Appetite , risk tolerance and risk capacity play major roles.
3. Continuous monitoring of the external and internal context for "CHAOS" helps in being better prepared for ripple effects. Risk Exposure has a profound effect on sustainability of business.
4. Implementing controls based on any "major premise" cannot always provide a "deterministic" outcome . Attack surface is in a constant state of flux with defense-in-depth, depth-of-defense, and layered defense capturing our imagination. Risk posture and security posture need continuous monitoring.
5. Inherent expectations of Confidentiality, Integrity, Availability values (Major premise) from systems and solutions are insufficient in today's fast-changing tech world. Additional principles (Parkerian Hexad) that address the human element - Possession, Utility ,Authenticity, in addition to Non-Repudiation, Authorized Use and Privacy need due consideration.

6. The percentage of human (the weakest link) contribution to all security incidents is in excess of 80% . Predictability of the "human mind" is not feasible. A minor error can lead to catastrophic events. Continuous awareness is key, coupled with continuous monitoring for "outliers."
7. The process of hiring / promoting employees can have a butterfly effect "One rotten apple can spoil the whole basket". Vice versa it can also turn out to be a Black Swan event, an outlier with nothing in the past that can convincingly point to its possible outcome.
8. Product/service purchases or new SLA's ,based on "sensitive dependence of initial conditions," can cause a butterfly effect; good or bad.
9. Threat Intelligence, AI, ML, autonomous systems use enormous amount of historical data to make "decisions". Data Science, of which AI and ML are subsets have nothing in the past that can convincingly point to the possibility of " Black Swan" events. Our reliance on security systems that employ these technologies to mitigate risks is flawed . Human elements and human brains are indispensable.
10. Red , Blue, and Purple teams should train and practice to defend and attack systems based on futuristic " Black Swan" events , which are popularly referred as "Zero day." Basking in the glory of " everything is patched, up-to-date and cannot be breached" is akin to lowering our guard. Efficiency and effectiveness of controls need to be treated with "suspect" and not based on" major premise."
11. Contingency management practice of which Incident response and Disaster recovery are part of, need innovative and revolutionary ways to figure " butterfly effect" or "black swan" events. Being ready for all eventuality, however remote or unlikely can provide enhanced levels of assurance to stakeholders.
12. Information security is not "deterministic, nor should an organization base it on any "major premise" expecting a specific " conclusion" or "outcome".

CONCLUSION

Black swan events are a "Reality" and so is the "Butterfly effect. "The universe needs one "Edward Lorenz" to change theories accepted for centuries and usher in a revolutionary change in the way things are seen and perceived.
The interconnected internet and application powered world economy, that we live in, introduces us to a new unknown adversary – the attack surface. Upstream and down-stream risks are no longer outside the realm of any organization. Viewing incidents and events in isolation with a myopic eye is detrimental , both for the "victim organization" and its support structure- suppliers, vendors, clients etc. (butterfly effect).

The world of Information security is undergoing a paradigm shift- from a compliance and controls-based mindset to a " risks" based mindset. Black swan events in the form of "zero-day attacks" have a "butterfly effect." Basing our decisions on established "major premises" and expecting desired outputs or outcomes is a recipe for disaster.

A deterministic outcome with overarching reliance on technology and absence of "common sense" is similar to a brain death. Predictability of the human mind calls for a " Zero trust approach:". Trust no one, continuously verify.

Sherlock Holmes states in one of his famous quotes "When you have eliminated the impossible, whatever remains, however improbable, must be the truth." We need not be swayed by this statement as " we might not have considered the truth in the first place."

"Nothing Lasts for Ever", the title of a popular Sydney Sheldon's novel can be the guiding principle for organizations who wish to be antifragile- benefit from stress and variation. Change is constant, be realistic ,embrace it.; least it has an extreme impact.

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