A Thinking Toolkit for Software Engineering

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This Talk is dedicated to the memory of

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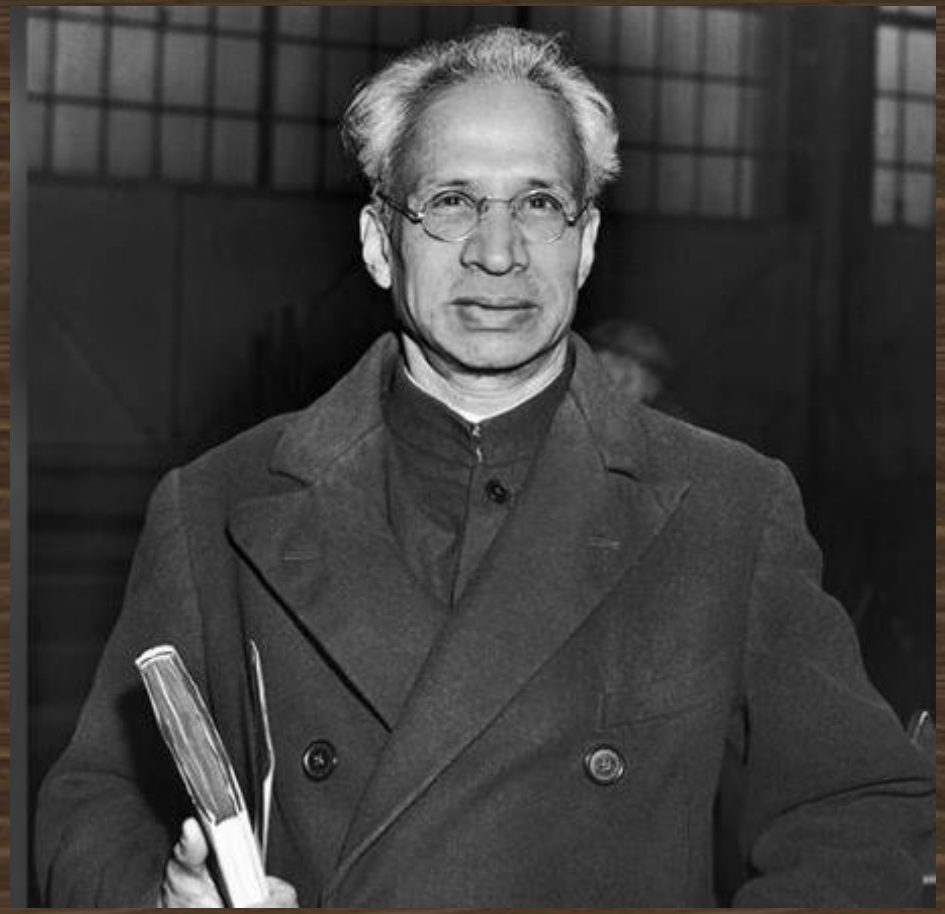

About the Presenter

- Co-Author of Books, “ .NET Design Patterns” and “C++ Reactive Programming” (writing) for Packt Publishing
- Has Written a university level accredited paper on “Ontology”
- Has created a course on “Philosophical Tools for Software Engineering” (Presented @ Rubyconf India – Preconference)
- Presented in more than 200 events
- “Father” of SLANG Compiler Infrastructure
  - Slang4.net,Slang4Jvm, Slang4CPP (LLVM),SlangJs,
  - Slang4Py, Slang4VB.net
- A budding expert on comparative philosophy (Indian/Western)
- A Critique of Digital Solutioning and Technology Fads
- Sr. Solutions Architect @ UST Global

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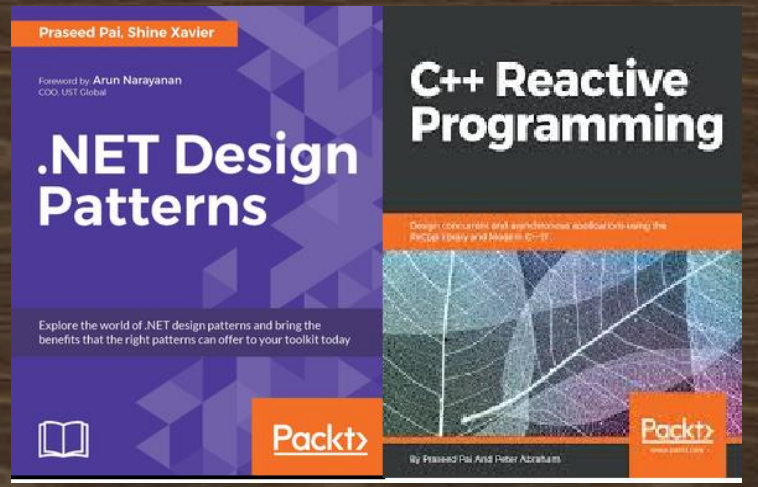

Who is an “Architect”?

Architect (n) – Any person who has “fooled” around in the Software Industry for a sizeable period of time (ever shrinking span) who is past his prime, as a Programmer Or Engineer, systematically moved up in the hierarchy to obey “Peter Principle”.

Hackathons – Is Programming a Combat sport?

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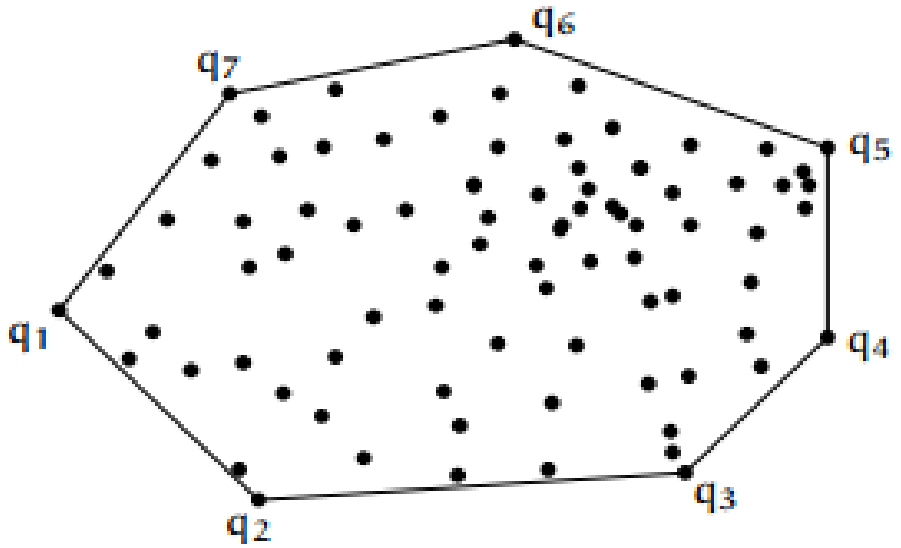
Genesis of this Session

(a) Input.



(b) Output.

What are we going to Cover?

- Principles around which this “Toolkit” is structured
  - A Unified Intellectual framework to structure our thoughts
  - Philosophical tools from Indian/Western Philosophy
  - Better English through Better Vernacular skills?
  - Mathematics as a cultural asset
  - Programming as an Intellectual activity
  - Software Engineering is a Social discipline (which transcends Geographic boundaries)
- Some Programming Facts
- Tidbits of Indian/Western Philosophy
- Reasoning about Machine Learning
- “Social Engineering” skills (including Cross Cultural Encounters)
- An Unusual introduction to Design Patterns
- Math is not hard, as people make it to be!

Test Your “General Knowledge”

- Identify these Personalities
- Which particular country designers of C++ and C# belong?
- Which company/divison pioneered GUI/Mouse/Networking?
- Father of “Open Source Movement”
- Give some examples of “Recursive Acronyms”
- “KISS” principle is based on which statistical principle?
- Matrix came first or Determinant Came first?
- Who coined the term “Robot” and who defined three laws of “Robotics”
- Who solved “Fermat’s Last Theorem”?
- Why trigonometric functions in Computer languages are defined in radians?
- Can anyone tell the difference in principle between “FOSS” vs “BSD”?
- Which Financial Product company which MS tried to acquire and failed in 90s?
- What is “Cargo Cult Programming”?
- Nationality of the person who created Bitcoin crypto currency?

Some Programming Facts (which everyone should know)

- Programming has got Limits!
- Why Byte Order matters in Programing? (an Anecdote)
- Know your Processer
- Know your VM and its internals
- Clock – “Drosophila Melanogaster” of Computer Graphics
- Some 3D Concepts with associated Math

Some Programming Facts (which everyone should know)

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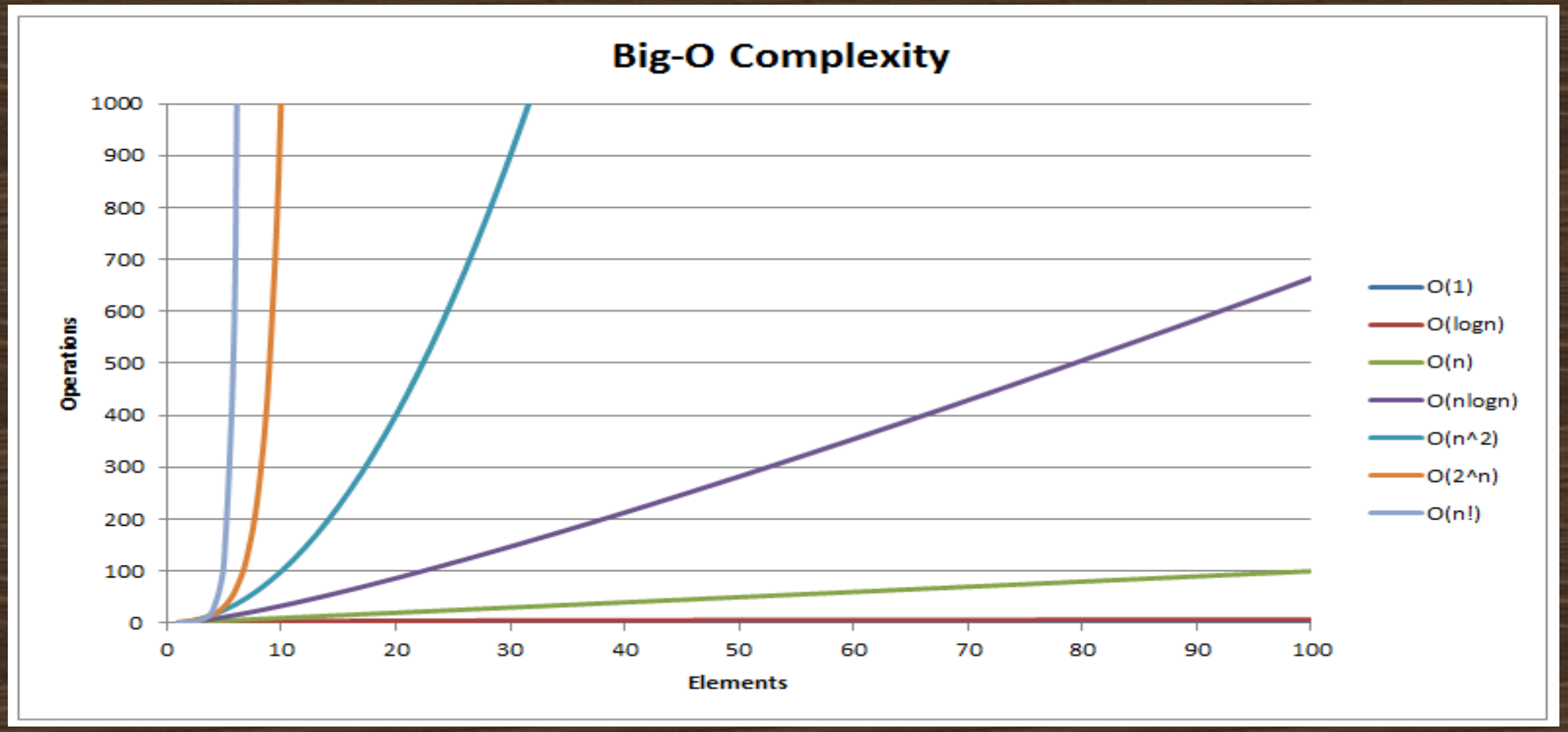
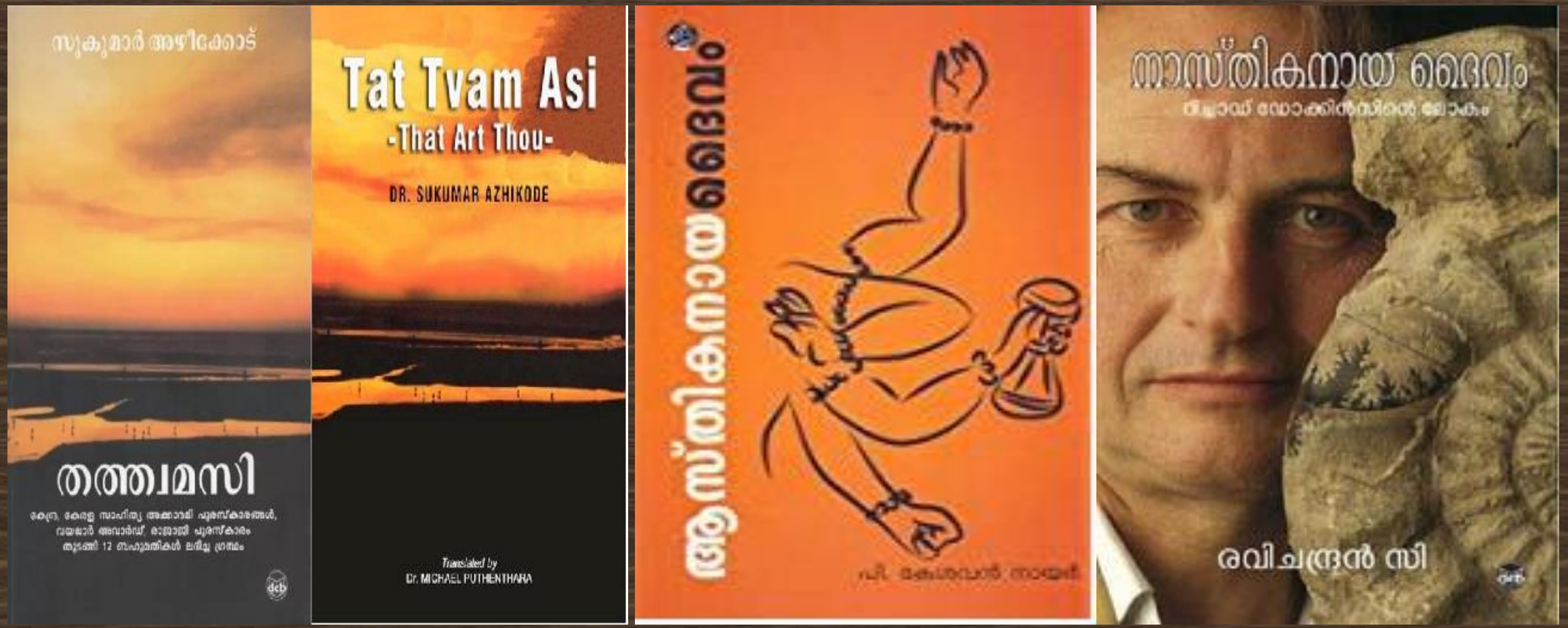
Algorithmic Complexity



A Unified Intellectual Framework

- The Subject Matter
  - Every discipline has got a central concern
  - Every discipline has got a realm
  - Key Entities and their relationships (Ontology)
  - Processes (Ontology)
  - Knowledge Source & Ascertainment of Truth (Epistemology)
  - Context/Purpose/Agents (Epistemology/Axiology)
  - Pragmatics (Axiology)
  - Applications (Axiology)
- Philosophical Positions which Practitioners take
- Folklore & Urban myths
- Adjacent Disciplines

Better English through Better Vernacular



Better English through Better Vernacular (Contd..)

- For us Indians, English is always a foreign language!
- We might be able to converse well in English, communicate well in English is a different matter.
- Understanding (?) and Interpreting a new Concept in Vernacular language will take you a long way towards “internalized” Cognition (and vice versa)
- A Rich amount of English Words along with Vernacular meaning is really effective
- Engage in sophisticated discourse in Vernacular language as well
- Understand Vernacular Metaphors and its English Equivalent (vice versa)
- Your Thinking skill will improve remarkably (I can testify for myself!)

English – Hindi/Malayalam

Induction - ?

Deduction – ?

Abduction - ?

System – ?

Hierarchy – ?

Network – ?

Conclusion - ?

English – Hindi/Malayalam

Induction - aagamanam/ aagaman

Deduction – nigamanam/nigaman

Abduction - abyoohanam

System – Vyooham/Vyooh

Hierarchy – Adhikaradhishtita Shreni

Network – Jala Vidya

Conclusion - Nirnaya

Some Uses of Philosophy

- A source to broaden our Intellectual horizon
- Every man has a Philosophy. Studying it, makes us to align our beliefs with some kind of standard. Helps communicate ideas better
- A Grammar for Thought (If we are looking for one)
- A great Emotional Shock Absorber
- Character Transformation through deliberate study of Philosophy
- Ability to articulate complicated and deep topics succinctly
- Study of Philosophy will make you a universal citizen.
- Ability to Study vast amount of topics
- “Unusual effectiveness” of Philosophy in Professional Life

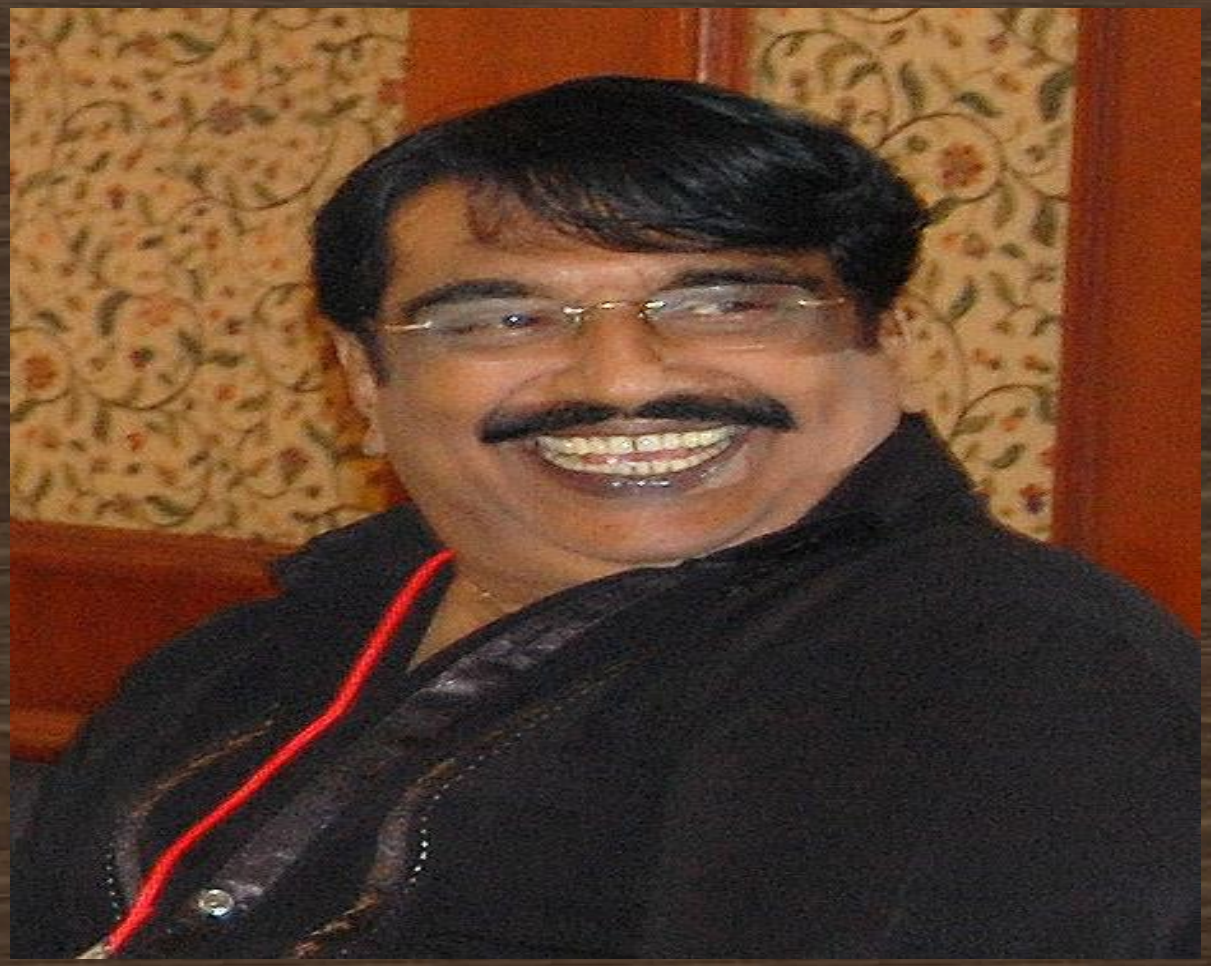
Some Key ideas of Western Philosophy

- Epochs
  - Greek, Medieval, Renaissance (Modern), Post-Modern
- Branches
  - Metaphysics, Epistemology, Ethics, Aesthetics, Politics, Logic
- Fundamental Questions
  - Who am I?, What Can I Know?, What Should I do?
- Primary Methodology
  - Analytical, Reductionist
- Humanistic Traditions
  - Existentalism,, Phenomenology ,Nihilism , Dialectical Materialism (Marxian)
- Philosophy of Science Methods
  - Induction, Deduction ,Abduction,Falsificationism

Some Key ideas of Indian Philosophy

- Vedas and Upanishads
  - Rig, Yajur, Sama, Atharva
  - Various Upanishads
- Main Schools
  - Heterodox (Veda not as a Testimony) , Orthodox (Veda as Testimony)
- Three Hetrodox Schools
  - Carvaka , Jaina , Budhist Traditions
- Six Orthodox Schools (Darshana)
  - {Nyaya, Vaisesika} , {Samkhya, Yoga}, {Mimamsa, Vedanta}
- Philosophical Methods
  - Holism and Intuitionistic,Experiential in nature
- Method of Philosophical Arguments (a form of Dialectic)
  - Purva Paksha (apriori) , Khantana (Refutations), Uttara Paksha (Conclusion)

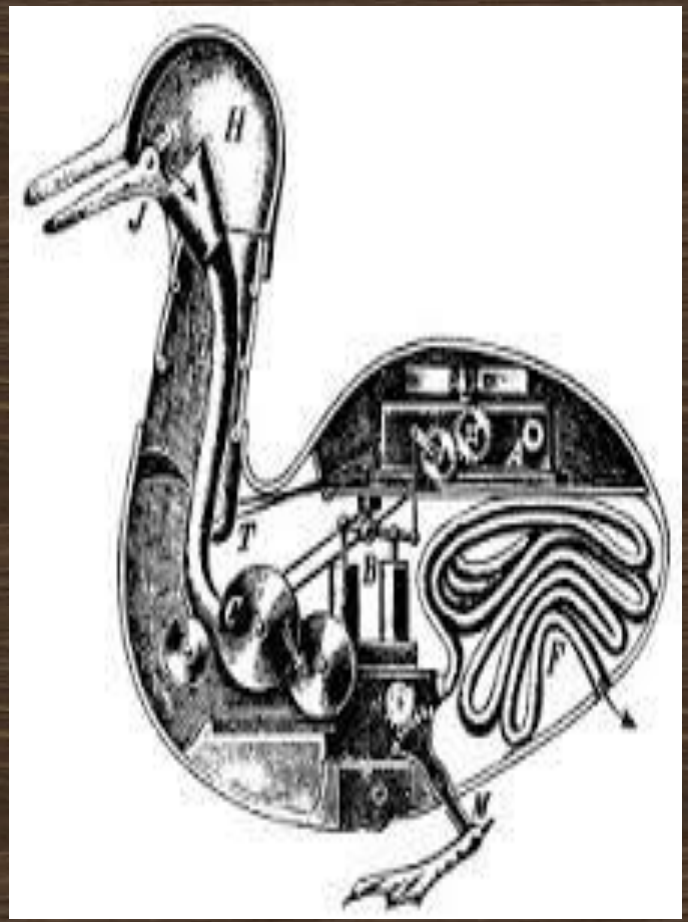
Western Philosophy vs Indian Philosophy – Car or a Boat?



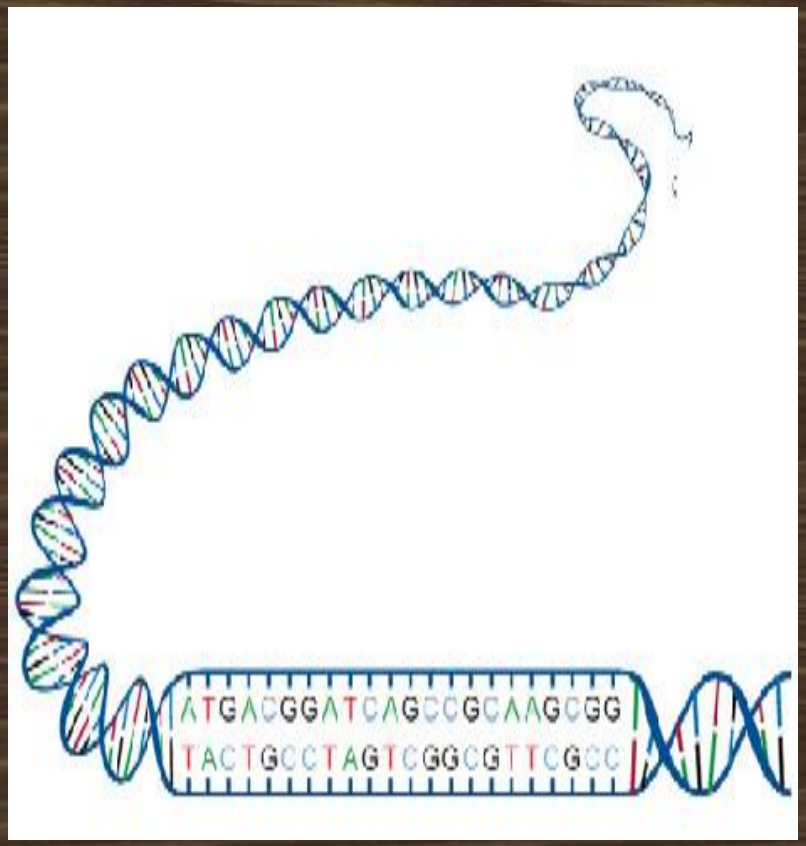
In India, it is like this, I do not know how it is in Punjab?
- Punjabi House

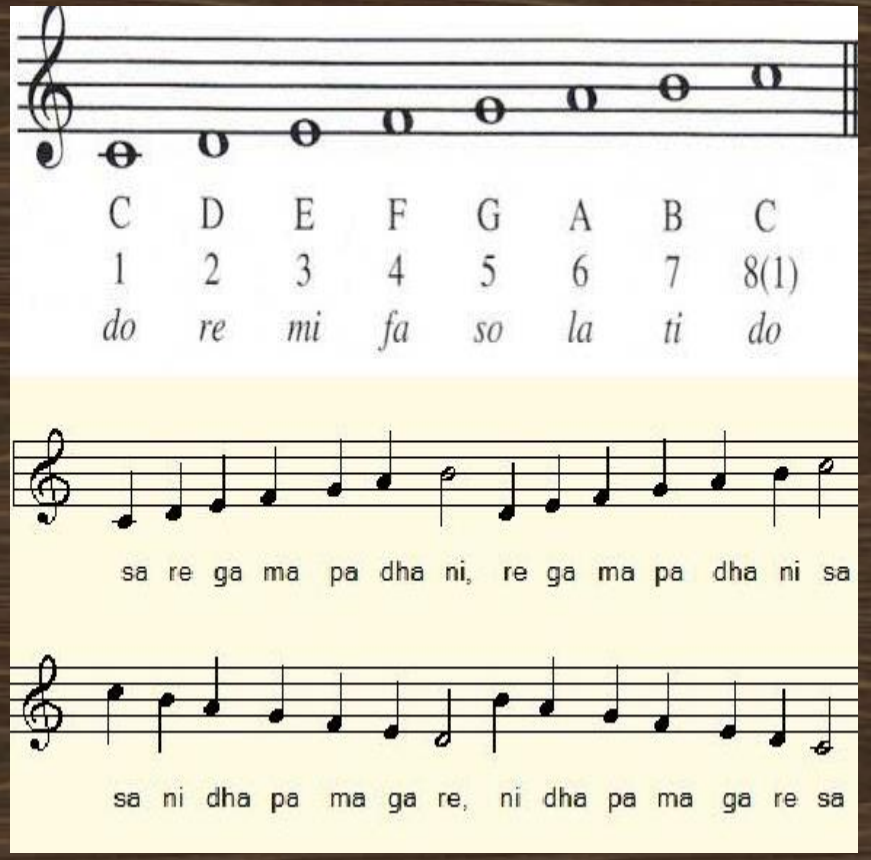
TOOL #1 (Understand the Gist of the world and also see the Big Picture)

REDUCTIONISM and HOLISM



Reductionism in Life & Music





What has Regular Expression,SQL Query and Functional Composition has in common?

CLOSURE

Closure in RE

Re(NULL) => NULL

Re(“”) => “”

Re([a-z]) => [a-z]

Re.Re => Re

(Re | Re) => Re

Re* => Re

The above stuff defines Re (Recursive definition)

What about R+?

Re+ = Re.Re*

Closure in SQL

Data is stored in a data structure called Relation
Relations can be combined using Rel Ops

CartesianProduct(Rel1,Rel2..Reln) => Rel
Restrict(Rel,Predicate) => Rel
Project(Rel,fieldlist) => Rel
Rename(Rel)=> Rel
SetOperators(Rel1..Reln) => Rel
Group(Rel,Pred) => Rel
And so on….

Closure in FP

A = F(G(H(x)))

Functional Composition works because of Closure of Operations

Other instances of Reductionism

- Dance Forms
- Photo Plotters
- LISP interpreter
- Digital Gates and Computer Construction
- Programming Languages (SEQuence,Branching,Iteration,Recursion)
- Gesture based UX (A set of primitive Gestures)
- The List Goes on

Limits of Reductionism

- Assumes Sum of Parts is Equivalent to the whole
- Cannot Model Emergent Behavior due to the Inter-dependence of parts
- Limits of Machine Learning – A case study

Holism

- Whole is more than sum of parts
- Models Emergent Behavior
- Successful in Evolutionary Biology, Social Sciences and Systems Modelling
- Software Requirement Analysis
- Design of UX
    - Mental Model of the Users
    - Considering the User Value System (Culture)

Perils of “Polyglot Programming”

TOOL #2 (Organize your thought with greater Discretion)

- Materialism vs Idealism (Metaphysics)
- Empiricism vs Rationalism (Epistemology)
- Induction, deduction and abduction (Method of Science and Thinking in General)

TOOL #3 (Understand the Contextual truth)

Dialectics , Logic & Reductio Ad Absurdum

Dialectics vs Logic

Laws of Logic

- Law of Identity (A = A or A <> something else)
- Principle of Non Contradiction (A and not A => false)
- Law of Excluded Middle (Things should be True or False, not in between)

Laws of Dialectics

- Process of Change
  - Reality is modelled as a process of change. What is true can become false in the future
- Principle of Contradiction
  - Since change is constant , Contradiction being the dynamic underlying change is also constant
- Principle of Relationship
  - Parts are Meaningful only in the relationship to the whole (context)

Reductio Ad Absurdum

- Also known as Proof by Contradiction
- Useful when a constructive proof is time consuming and economically not viable
- Rather than trying to prove something as correct, we assume what we are trying to prove is correct and find contradictions, if it were true
- Successfully used in Mathematics,Arguments and in Courts

TOOL #4 (Think Comprehensively!)

Analysis/Synthesis vs Systems Thinking

Analytical vs Systems Thinking

- The Art, Craft and Science of Analysis
- Analysis/Synthesis Model of Problem Solving
- A Top Decomposition of the Problem into Parts to a granular level , until we have reached a state where we cannot decompose parts further or it has become fine-grained to be amenable for studying it.
- A Bottom up process of Synthesis
- In Western Philosophy and Science, Rene Descartes is regarded as the father of modern Analysis
- Reductionism vs Holism – Analytic Thinking vs System Thinking
- Assumption of Independence of Variables and Interdependence of Variables
- Additive factors (Linear) vs Non Linear Factors
- Systems are Simulated as it cannot be mathematically modelled correctly, if not non-linear

Tool #5 (Bust Your Mental Blocks)

Be an Iconoclast

Intellectual caste system

- Harvard/Sloan/Stanford Management Graduates
  MIT/Stanford/Brown/Ivy league Graduates
  IIM
  IIT
  NITs
  Govt run state colleges (CET,GEC etc)
  Private Elite institutes
  Donation Colleges
  Polytechnics
  Automatic Graduates
  ITIs

Learning Hindrances For the Individuals

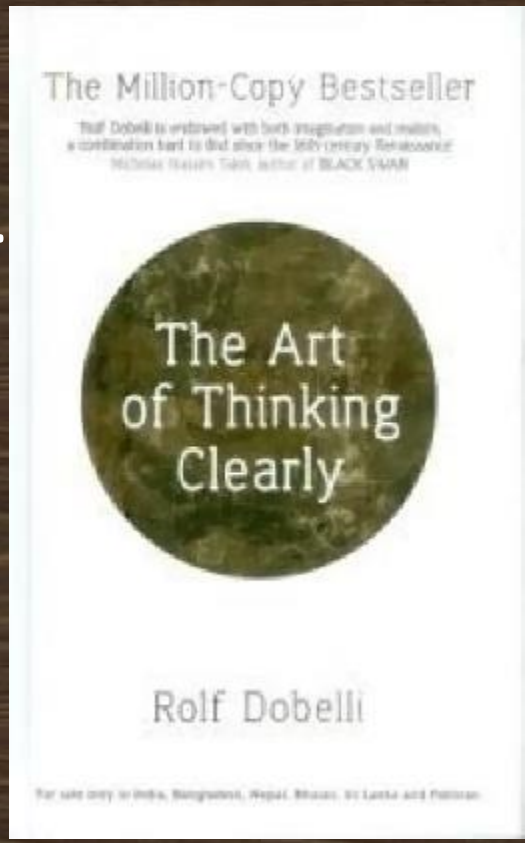
- Bottom up Learning
- Individual Learning Blocks

Bottom up Learning

- Learn Fundamentals, go to the lowest level of abstraction, iteratively learn more and more advanced topics to reach “Knowledge Bliss”
- Excellent for learning things, when you do not have people around who knows what you are learning
- A method apt suited for creating future “Scientists”, where as most of the people are “Craftsmen” (Artists and Engineers)
- Satisfies the need for “Cognitive Closure” and a Self satisficing exercise
- Was good during the pre-internet era and schools and colleges emphasize it

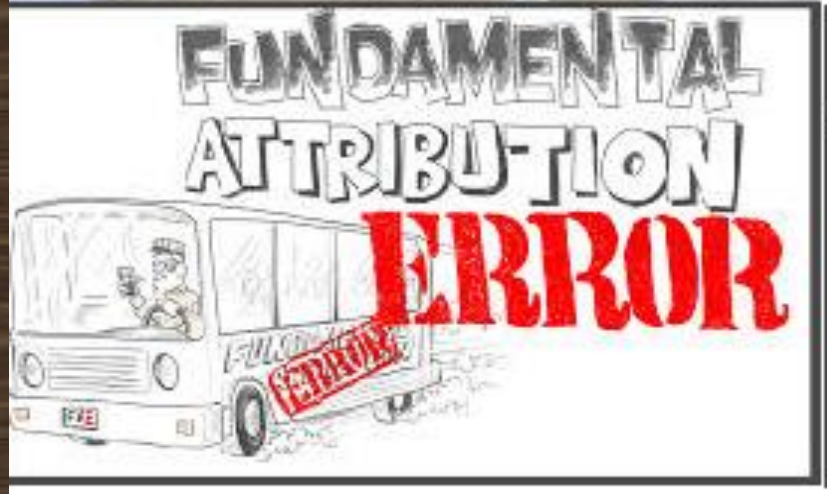
Individual Learning Blocks

- Mental Blocks are there for everyone!
- Framing, Fundamental Attribution Errors, Loss Aversion etc.
- Religious and Cultural Bias
- Aversion to certain things because of past experiences
- Lack of a “Stupidity Ring”
- Lack of Peer Pressure

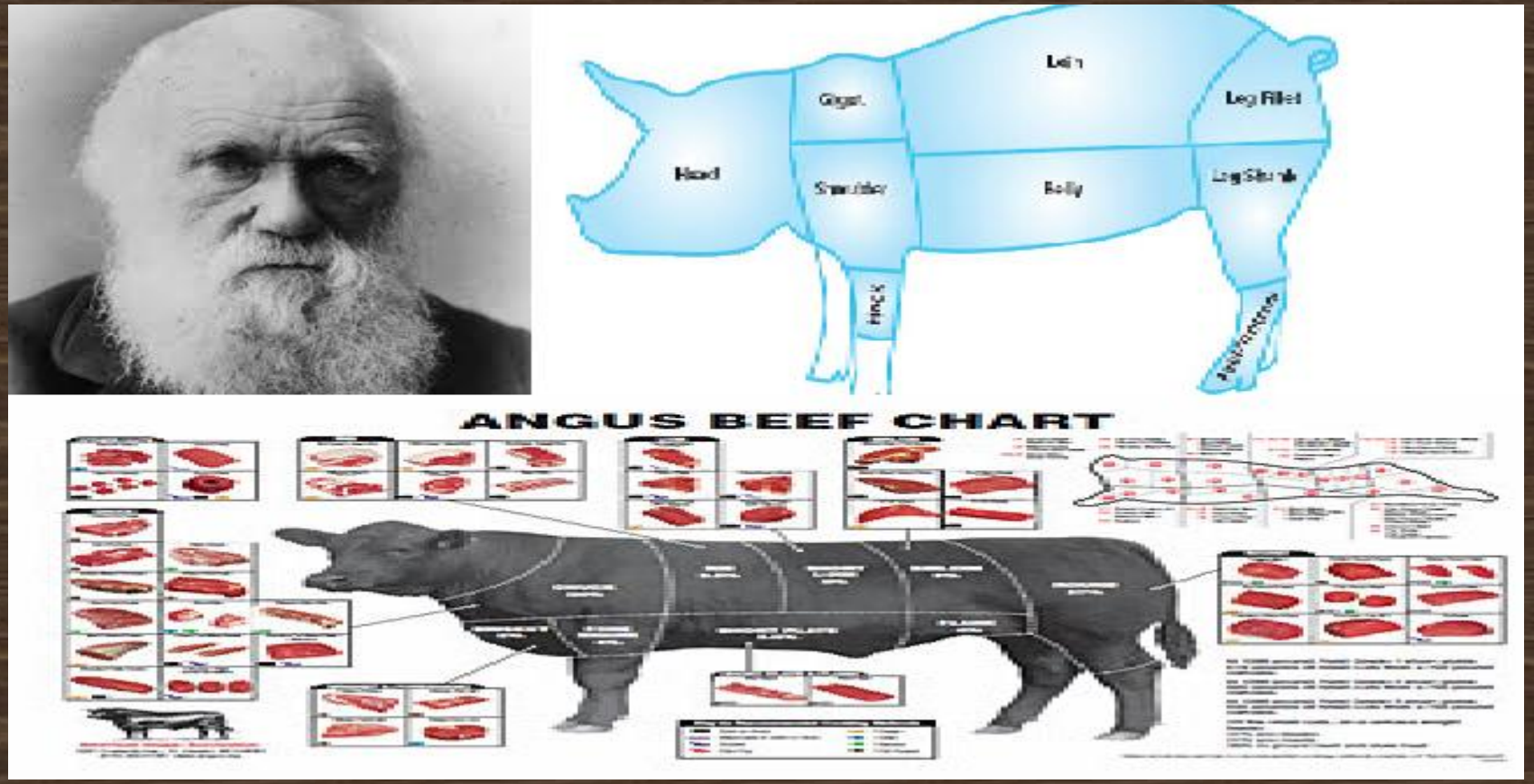


Mental Blocks

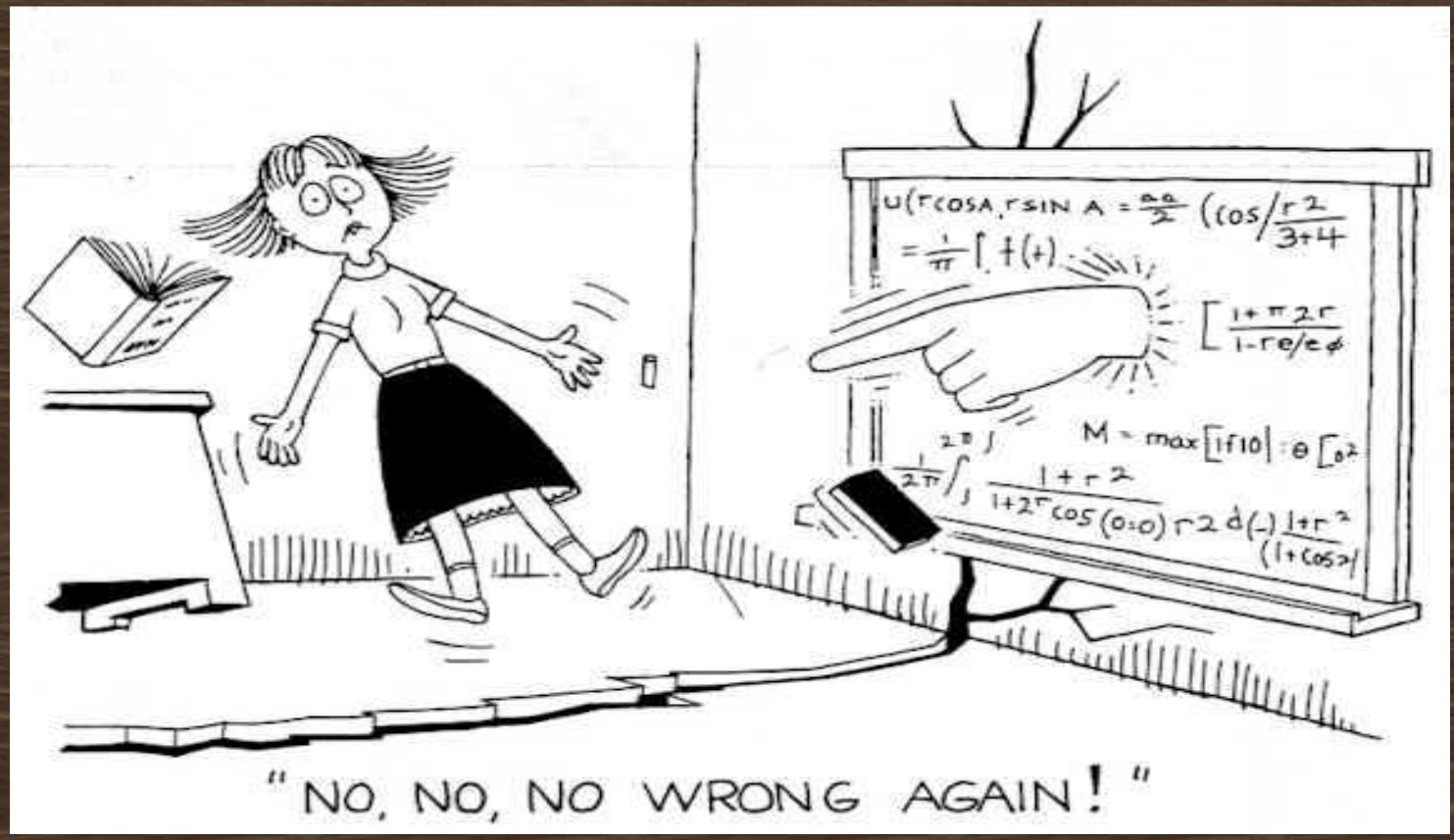
Biases and Fallacies



Religious and Cultural Bias



Haunted! - MathoPhobia



Stupidity Ring

http://praseedp.blogspot.in/2014/09/you-know-about-stupidity-ring.html

Peer Pressure

How to Overcome Individual Learning Blocks

- “Top Down” Learning
- Learn By Doing approach
- Identify and try to bust the blocks

How Can an Individual stretch beyond his limit?

- Join forces with like minded people to form teams
- Collaborate with Others to improve the odds for success

TOOL #6 (Keep Things Simple to make it easy!)

Occam's Razor

Occam’s Razor

- Also called “Law of Parsimony”
- Do not Add Entities Unnecessarily
- The Idiom behind “Keep it Simple Stupid”
- Minimizes Error from Inductive Reasoning

Tool #7 (More Languages you know, the Better)

SAPIR WHORF HYPOTHESIS

SAPIR WHORF HYPOTHESIS

- Also called “Linguistic Determinism”
- Formulated by Ed Sapir & Benjamin Whorf
- It is not yet a theory (in strict scientific sense)
- Statistically significant confirmation is there
- Seems to work in the case of Programming languages
- Learn Each language which is based on Turing Machine,Lambda Calculus and Predicate Logic

Be a Polyglot!

Patterns of Snobbery and Tactics to deal with them

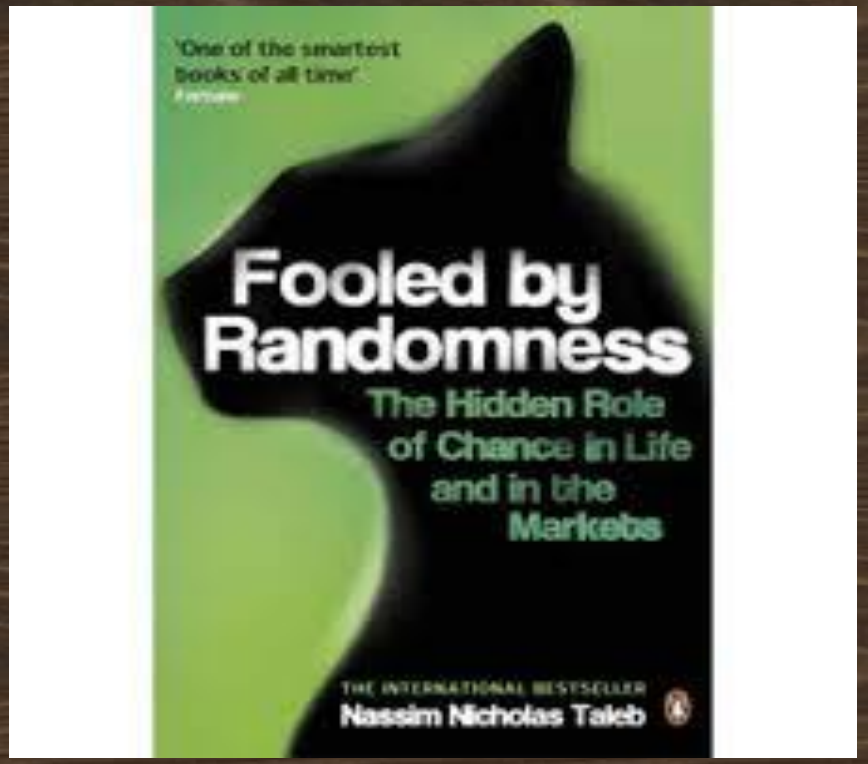
An Interlude

Das Kapital

- “The Whole world is in the clutches of the capital, where Individuals do not have much say”

Only problem out there in the world!

“My uncle is a Pilot, What about yours?”



Some Taxonomy

- Intellectual Snobbery
- Accomplishment Snobbery
- Entrepreneurship Snobbery

Accomplishment Snobbery

- “Proud Dad” Attack
- “Flying Mom” Attack
- Yield and Counter Attack
- Domain Attack

Proud Dad

Flying Mom

Yield and Counter Attack

Domain Attack

- Attack based on the Semantics of Activities!

Entrepreneurship

- “Back paper” Entrepreneurship
- “Career Crisis” Entrepreneurship
- “Social Pressure” Entrepreneurship
- “IDEA” – Identity driven Entrepreneurial architecture

Intellectual Snobbery

- Direct Attack – Tackling them making things explicit
- Relevance attack – “A five ton person things that he is better than a three ton person for a two ton Job”
- Semantic attack - “How Intelligent you are?” vs “How are you intelligent?”
- Crowd Sourced attack – Override the weightage by “Crowd sourced” Knowledge

Why do people Snob?

- First Rank Holder Syndrome – They are trained that way
- Low ROI – due to information revolution, elite school learning does not pay
- Proxy Gratification – Accomplishment of wards, relatives, friends as an alibi to override someone
- Expectations mismatch – Stateful life of a Successful person and his temperament does not match
- Emotional Ventilation – Frustration with peer group non-acceptance

Constructive Solutions

How I tackled Snobs and Snubs?

- Created a digital identity by writing a generic Blog
- Public speaking on mostly Technical matters (forayed into others)
- Published an Open Source Compiler (more to be published soon)
- Wrote Two Books
- Created awareness about this phenomena around and how to tackle them (This presentation is a testimony!)

Do no go by “Tall” Stories!

Tool #8 (Pitch Your Idea better)

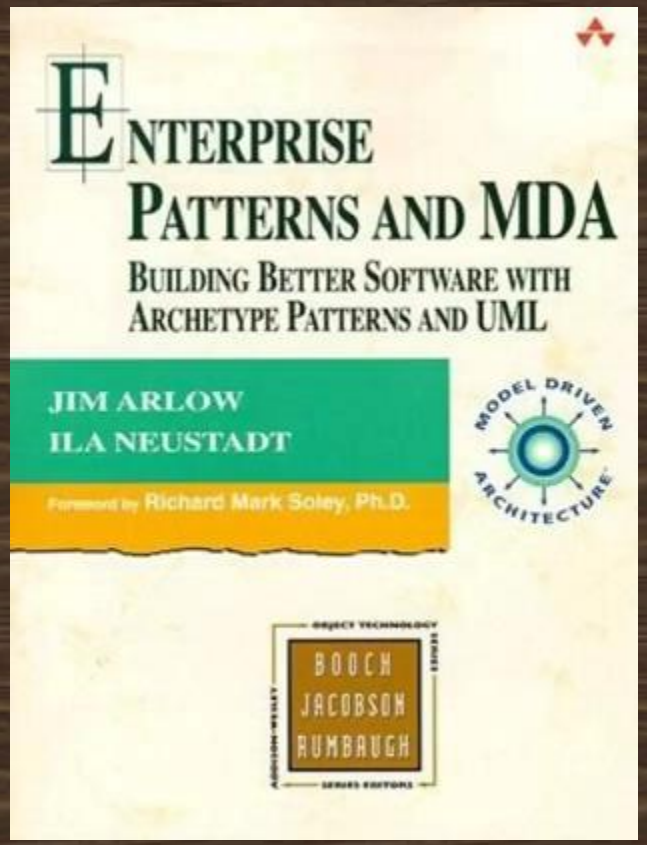
LOGOS,ETHOS,PATHOS and MYTHOS

LOGOS,ETHOS,PATHOS and MYTHOS

- Aristotle's Rhetoric strategies
- “MYTHOS” from Dev Dutt Patnaik

Tool #9 (Archetypes as a structuring mechanism for SE)

- CARL GUSTAV JUNG's notion of Archetypes
- Business Archetypes by Arlow/Neustadt
- "Enterprise Patterns and the MDA" book by Arlow/Neustadt



Tool #10 => Reality is always distorted

- Sankara’s Maya
- Plato’s cave

Applied “Philosophy” (Bit satirical)

Entrepreneurship – Is it for you?

- A “Psycho-Philosophical” analysis

SME vs Integrator Temperament

- Loners
- Adjustment Problems
- Synchronous
- Socially Active Only for making a living
- Individualistic
- Emphasizes IQ

- Extroverts
- Go Getters
- Handle Asynchrony better
- They Live in the Society
- Social
- EQ

Seven Classes of Entrepreneurship

- Back paper Entrepreneurship
- Career Crisis entrepreneurship
- Social Pressure Entrepreneurship
- "Can Afford Failure" Entrepreneurship
- "B-School" Entrepreneurship
- “Idea Driven” Entrepreneurship
- Accidental entrepreneurship (Self Employment getting scaled)

Aftermath of a Failure (for SME)

- Most SMEs will be like a village girl who lost her "Virginity“
- Some will be drifting into Corporate Jobs
- Most often, they barge on to next integrator

Aftermath of a Failure (for Integrator)

- Most Integrators think like a urban girl who had a one night stand!
- Most often they move to the next entrepreneurship venture
- Even if, they go corporate, they will succeed in Operational roles and go high in the career ladder.

SMEs in the Corporates

- SMEs grow very fast, initially
- After five years, SMEs need to make a choice
  - Go People vs Stay Tech
- If they succeed in People role, they drift to Integrator spectrum
- If they fail or stay stagnant, grow nihilistic and poke at Integrators
- if they fail or stay stagnant, and are +ve, they will indulge in Music, arts, Philosophy, Painting

JavaScript – Why it became the way it is ?

- Brendon Eich and his manager's dialogue
- Simplified Type rules using Dynamic typing
- As a consequence, class (type) based programming does not make sense
- Actor model might result in Event "Cacophony"
- Was forced to choose Prototype based OOP
- Reduction of class to a Dictionary
- How can one reduce a function to a value to keep in a dictionary?
- Induce FP constructs into the langauge

Move to the annexure on SE/Patterns

BlockChain – Is it warranted?

If a Problem warrants,Blockchain Solution

- It should be distribted
- It should be decentralized
- It should be Transaction based
- It should be Open
- Network should have enough “entropy”

Q&A

- If any!