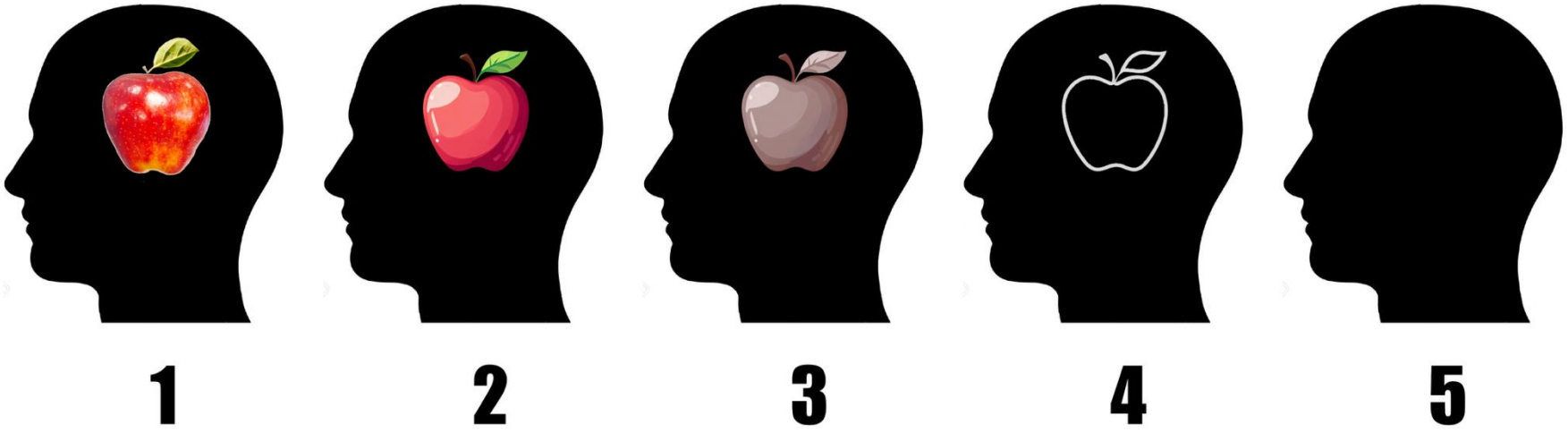

MENTAL
MODELS
Ceci n'est pas une pipe.

What is a Mental Model?

- A mental model is an internal representation of external reality

What is a Mental Model?

- A mental model is an internal representation of external reality
- It is a framework to help us understand systems, make decisions and solve problems

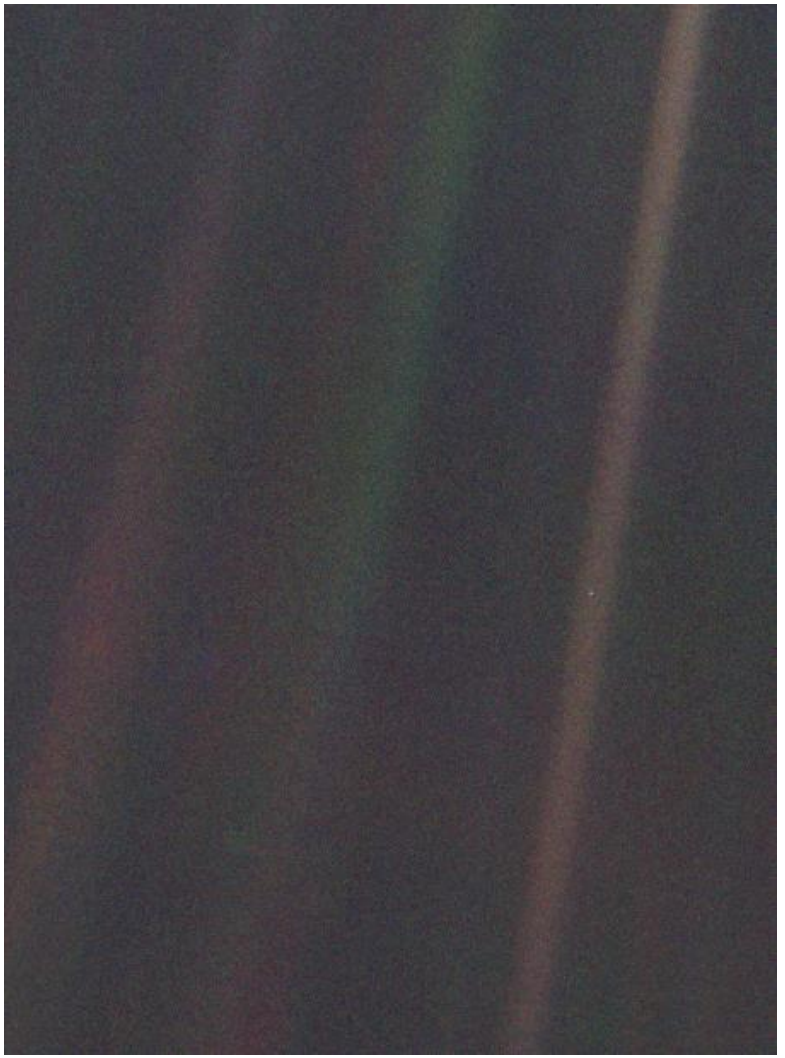


All models are wrong
– George Box

https://www-sop.inria.fr/members/Ian.Jermyn/philosophy/writings/Boxonmaths.pdf

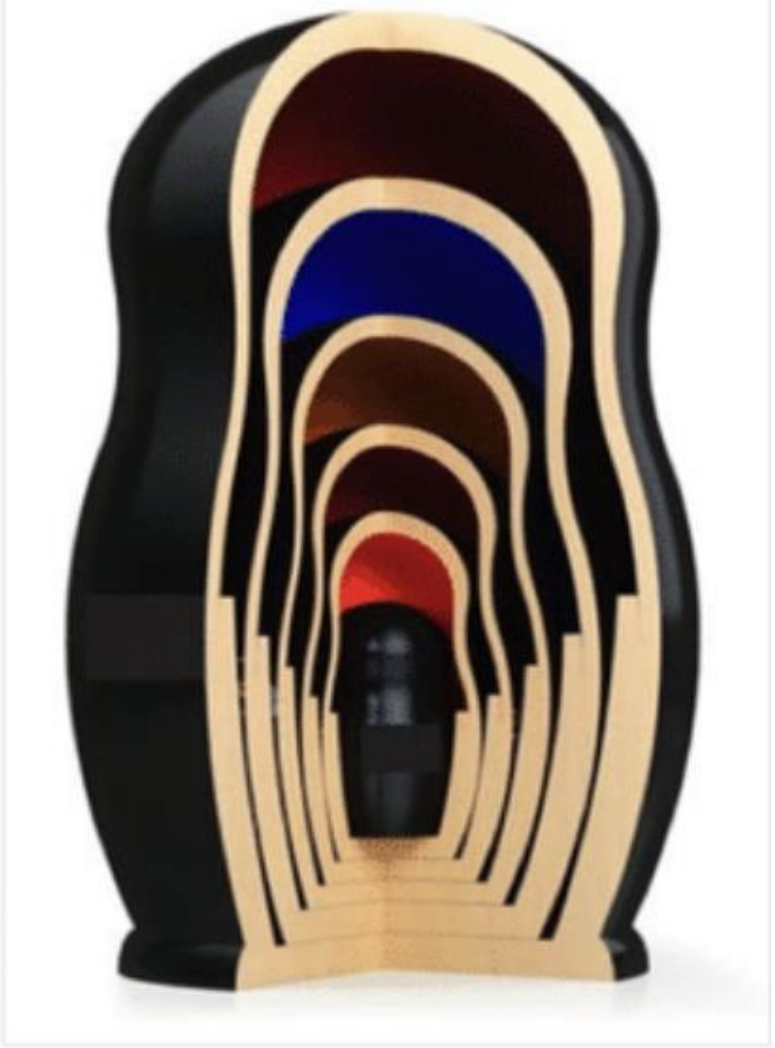
Mental model: maps

- Maps are a representation of a territory
  - Maps are a useful model of territory
  - A 1:1 map is useless



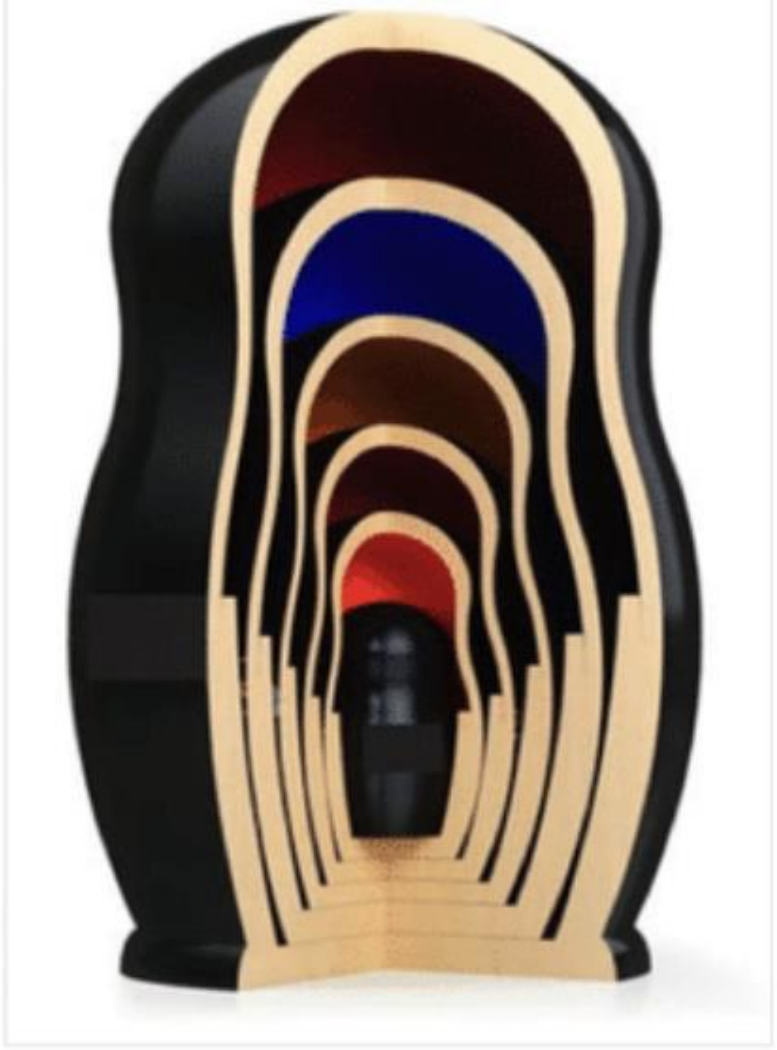
Mental model: OSI

- The OSI model separates communication into layers



Mental model: OSI

- The OSI model separates communication into layers
- Layers are separated by well defined boundaries



Mental model: Networks

- Networks are systems to get information from point A to point B

Mental model: Networks

- Networks are systems to get information from point A to point B
- The simplest network is a direct connection

Mental model: Networks

- Networks are systems to get information from point A to point B
- The simplest network is a direct connection
- If there are more potential end points
  - we can add connections between all points
    - full mesh with $O(n^2)$ connections

Mental model: Networks

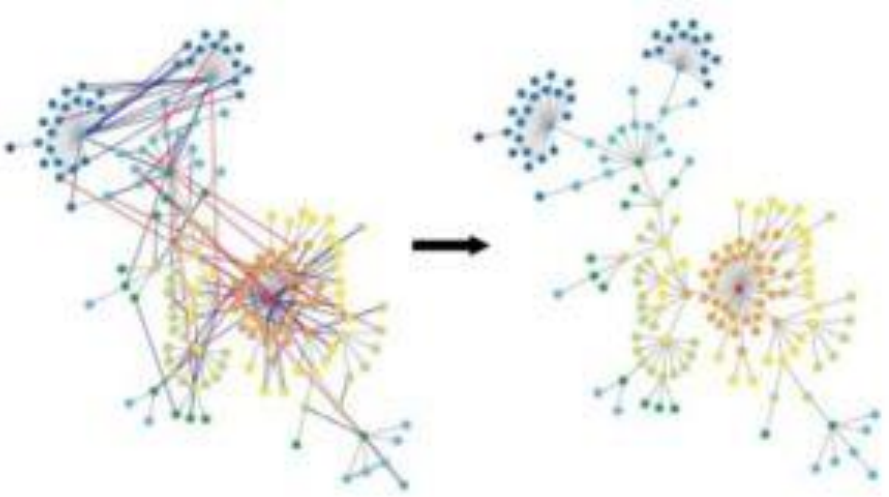
- Networks are systems to get information from point A to point B
- The simplest network is a direct connection
- If there are more potential end points
  - we can add connections between all points
    - full mesh with $O(n^2)$ connections
  - We add another node purely for mediating connections
    - star network/hub-and-spoke with O(n) connections

Mental model: Networks

- Networks are systems to get information from point A to point B
- The simplest network is a direct connection
- If there are more potential end points
  - we can add connections between all points
    - full mesh with $O(n^2)$ connections
  - We add another node purely for mediating connections
    - star network/hub-and-spoke with O(n) connections
  - Or a mix

Mental model: Fractals

- Fractals are patterns which repeat themselves at larger and smaller scales
  - Beaches
  - Networks
  - Clouds
  - Trees
  - Roads



Mental model: Shortest path

- Packets on the network have to travel by the shortest and/or cheapest route possible
  - Make routes more specific
  - Prepend routes
  - Route maps
  - BGP communities

Other mental models for TE

- Centralised Path Computation
  - One place to calculate the routing table instead of each router doing it individually
  - Segment Routing/MPLS

Other mental models for TE

- Centralised Path Computation
  - One place to calculate the routing table instead of each router doing it individually
  - Segment Routing/MPLS
- Bulkheads
  - Limit damage when links fail
  - Engineering for maintaining capacity

Other mental models for TE

- Centralised Path Computation
  - One place to calculate the routing table instead of each router doing it individually
  - Segment Routing/MPLS
- Bulkheads
  - Limit damage when links fail
  - Engineering for maintaining capacity
- Traffic segmentation
  - Split by type of traffic (Label Switched Path)

Mental model: First principles thinking

- Drill down from evidence to determine axioms in your system

Mental model: First principles thinking

- Drill down from evidence to determine axioms in your system
- Challenge those axioms
  - What if something was different/false/true?
  - What if some assumption was wrong?

Mental model: First principles thinking

- Drill down from evidence to determine axioms in your system
- Challenge those axioms
  - What if something was different/false/true?
  - What if some assumption was wrong?
- Determine new set of axioms and build up a new model from there.

Mental model: Occam's razor

- The simplest explanation is the best starting point for an investigation

Mental model: Occam's razor

- The simplest explanation is the best starting point for an investigation

- Explanations exist; they have existed for all time; there is always a well-known solution to every human problem—neat, plausible, and wrong
  – H. L . Mencken

Mental model: Cynefin

- The Cynefin framework was created by Dave Snowden to help decision makers make sense of systems

https://en.wikipedia.org/wiki/Cynefin_framework

Mental model: Cynefin

- The Cynefin framework was created by Dave Snowden to help decision makers make sense of systems
- Five contexts:
  - Clear
  - Complicated
  - Complex
  - Chaotic
  - Confusion

https://en.wikipedia.org/wiki/Cynefin_framework

Mental model: Systems thinking

- A system is a group of interacting parts coherently organised to achieve something, with emergent properties which differ from the properties of the components.

Mental model: Systems thinking

- A system is a group of interacting parts coherently organised to achieve something, with emergent properties which differ from the properties of the components.
- Emergent properties mean any change can have effects elsewhere

Mental model: Systems thinking

- A system is a group of interacting parts coherently organised to achieve something, with emergent properties which differ from the properties of the components.
- Emergent properties mean any change can have effects elsewhere
- Everything is a system

Mental model: events and queues

- Every interaction between system components generates an event.

Mental model: events and queues

- Every interaction between system components generates an event.
- Generation of events faster than they can be processed means queues are created. These may be visible or invisible queues.

Mental model: events and queues

- Every interaction between system components generates an event.
- Generation of events faster than they can be processed means queues are created. These may be visible or invisible queues.
- Items in queues are *inventory*

Mental model: Theory of constraints

- Every system has exactly one constraint which limits the output of that system (a *bottleneck*).

Mental model: Theory of constraints

- Every system has exactly one constraint which limits the output of that system (a *bottleneck*).
- This is the only place where you can optimise for success.

Mental model: Theory of constraints

- Every system has exactly one constraint which limits the output of that system (a *bottleneck*).
- This is the only place where you can optimise for success.
- Trying to optimise elsewhere results in building up of inventory or wasted work.

Mental model: Leverage

- Levers are a simple, yet powerful tool to increase output for much smaller inputs

Mental model: Leverage

- Levers are a simple, yet powerful tool to increase output for much smaller inputs
- Leverage allows for outsized results if applied correctly
  - Pareto principle – 20% of the effort will get you 80% of the results

Mental model: Feedback loops

- Feedback loops are where the output of the system influences future input.

Mental model: Feedback loops

- Feedback loops are where the output of the system influences future input.
- Feedback loops are crucial to learning
  - Feedback loops may be positive or negative.
    - Negative feedback loops lead to stable systems
    - Positive feedback loops lead to growth (or decline)

Mental model: Feedback loops

- Feedback loops are where the output of the system influences future input.
- Feedback loops are crucial to learning
  - Feedback loops may be positive or negative.
    - Negative feedback loops lead to stable systems
    - Positive feedback loops lead to growth (or decline)
- Inventory in queues causes delays in feedback, which can make bad situations worse

- Mental models are the starting point for decision making
  - Models are units of mental compression to reduce complexity into simpler chunks
- Having more mental models leads to more options for decision making
  - This usually results in better decisions

Minutae

- Contact information: <devdas.b@gmail.com>
- Linkedin: https://nl.linkedin.com/in/devdas
- Books:
  - https://www.goodreads.com/book/show/44245196-the-great-mental-models
  - https://www.goodreads.com/book/show/3828902-thinking-in-systems
  - https://www.goodreads.com/book/show/6667514-the-checklist-manifesto
  - https://www.goodreads.com/book/show/35957157-thinking-in-bets
  - https://www.goodreads.com/book/show/66354.Flow
  - https://www.goodreads.com/book/show/113934.The_Goal
  - https://www.goodreads.com/book/show/6278270-the-principles-of-product-development-flow
  - https://www.goodreads.com/book/show/11721966-good-strategy-bad-strategy
  - https://www.goodreads.com/book/show/44135420-team-topologies
  - https://www.goodreads.com/book/show/20186.Seeing_Like_a_State