Making Representations: From Sensation to Perception

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Original cartoon by George Aldridge

Overview

- Understanding Cognition
- Experience
- Cognitive Capabilities
- Sensation
- Perception
- Representations
- Prediction and Anticipation
- Robots
- Intelligence
- Innovation

Understanding Cognition

Analytical

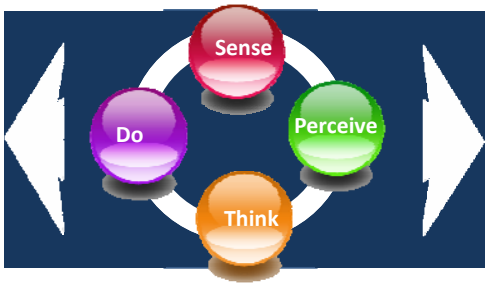
Explanation Models
Prediction Models
Experiments on People, Animals

Constructive

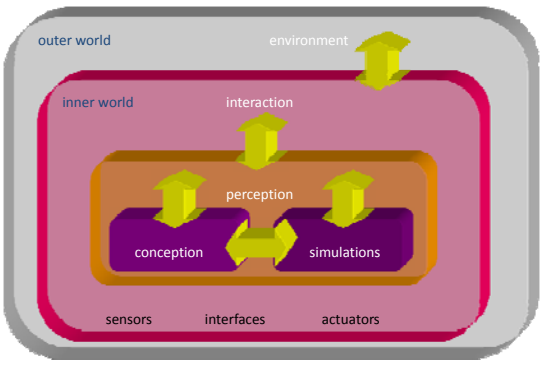
Explanation Models
Prediction Models
Building Artefacts; Computer Software; Robots

Enactive Experience

Experience Cycle

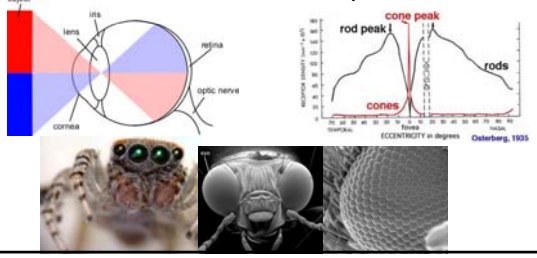


Cognitive Capabilities

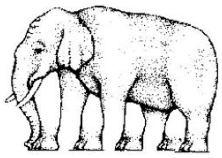


Sensation

- Cones and Rods are the biological analogies of **pixels**. Each pixel is a digital image is equal but this is not true for the human eye.



Perception

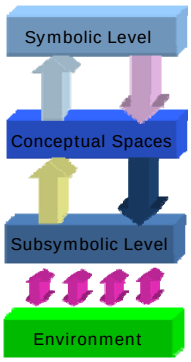


Recognition

Dealing with Novelty

Conceptual Spaces

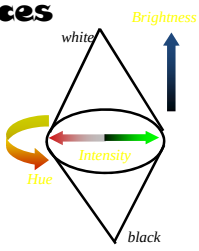
- Provide a geometrical representation of concepts.
- Predict and explain psychological phenomena.
- Provide an architectural component for artificial agents that supports concept formation.



Peter Gärdenfors

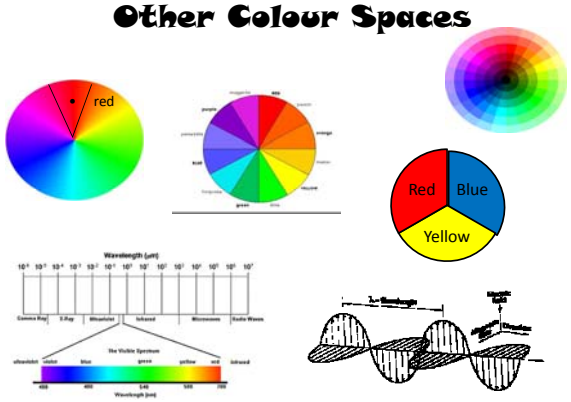
Conceptual Spaces

- Quality Dimensions
  - -similarity judgments
  - -{q_1, q_2, q_3, …}
  - - q_i takes values from Domains Q_i
- – Some dimensions have a distance measure, some are simple orders.
- – Conceptual Spaces
  - $\mathbf{C} = \mathbf{Q}_1 \times \mathbf{Q}_2 \times \mathbf{Q}_3 \times \ldots \times \mathbf{Q}_n$
- – Objects are points/regions
- – Concepts (and categories) are regions

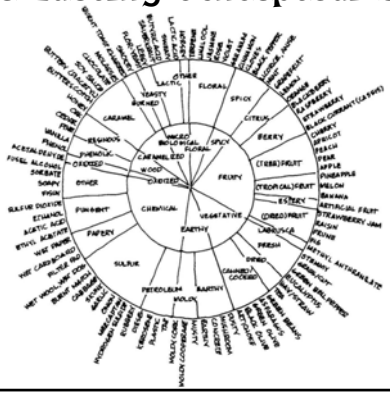


Human Colour Space

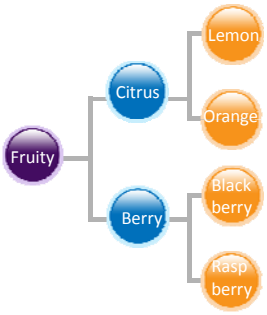
Other Colour Spaces



Wine Tasting Conceptual Space

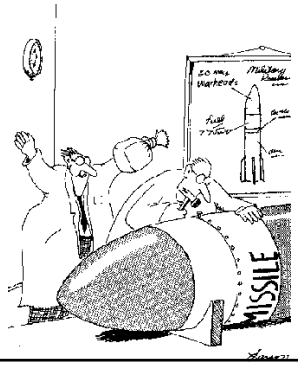


Wine Hierarchical Conceptual Space



Try Defining ordinary objects

Prediction and Anticipation

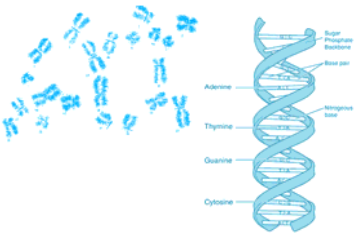


Making Sense

Representation = Grounded Information

Intelligence = Ability to Make Representations

Information v Representation



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GGCATAAGTTAATAACACTTTT
CCCCAAAATGGTGCTTTGGAT
TTGAAAAGGTCTGATGGGGA
GAAGGAGAACGTATCATCCTA
GCCCTCTCTTAATAAACCTAGA
AAAACGGGTAGTAAACTGTG
GATAGTCAGGAAAACACCCA
GCAAGGGACACAGCGTCAGG
AAATGAATCTTCCCCCCAACCC

George Luger

Best Representations

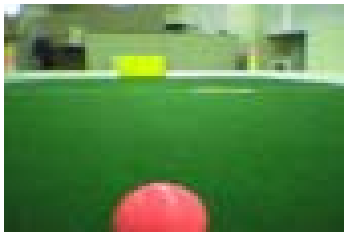
How to represent: "Pen #7 is red."

- *red(pen7)*
  - It's easy to ask "What's red?"
  - Can't ask "what is the color of *pen*7?"
- *color(pen7, red)*
  - It's easy to ask "What's red?"
  - It's easy to ask "What is the color of *pen*7?"
  - Can't ask "What property of *pen*7 has value *red*?"
- *proposition(pen7, color, red)*
  - It's easy to ask all these questions.

David Poole

Robot Soccer

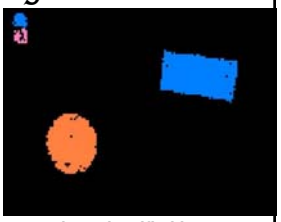
Robot Vision



The robots receive 25/30 images per second from their camera.

Image Analysis

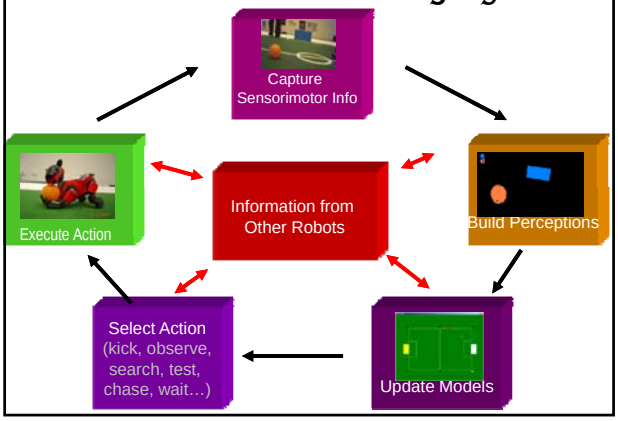
Raw image from Robot Camera



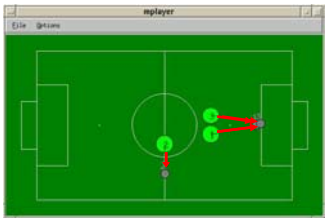
Colour classified image

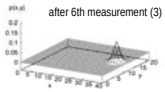
UTS Unleashed! Robot Soccer Team

Sense-Think-Act Processing Cycle



Social Information Sharing





Bernhard Nebel

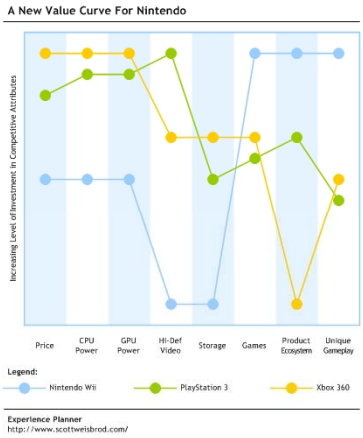
Innovation?

Blue Ocean Strategies

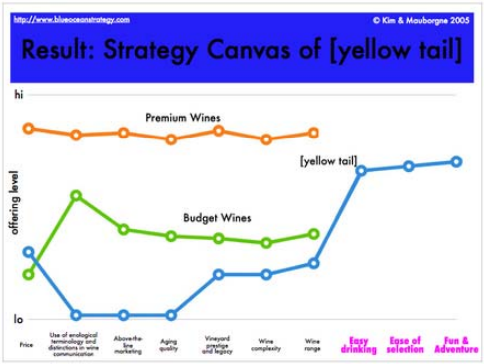
Business Strategy

Red Ocean Strategy	Blue Ocean Strategy
Compete in existing market space	Create uncontested market space
Beat the competition	Make the competition irrelevant
Exploit existing demand	Create and capture new demand
Make the value/cost trade-off	Break the value/cost trade-off
Align the whole system of activities with the strategic choice of differentiation or low cost	Align the whole system of activities in pursuit of differentiation and low cost

Kim and Maugorne



Reconceptualisation



Conclusions

- Perception is an experience!
- Conceptualisation is important in the study and experience of materials.
- Conceptualisation capabilities influence imagination and creativity.
- Changing conception can influence perception
- Innovation requires change. New materials and technologies, new perceptions, new conceptualisations and new experiences.
- What can I conceive of doing with the new material?
- What experiences can I anticipate?