Note

- **All images are only for visual effects there are no relation between actual product and our research**

Artificial Intelligence and Robotics

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Profetional
Experts automation

Presentation Overview

- **Definition of robotics**
- **Robotics' relevance to AI**
- **Current developments in the field**
- **Current implementations**
- **Roadblocks to robotics research**
- **Future of robotics**

Definition of Robotics

- ## A robot is…

  - "An active artificial agent whose environment is the physical world"

    --Russell and Norvig

  - "A programmable, multifunction manipulator designed to move material, parts, tools or specific devices through variable programmed motions for the performance of a variety of tasks"

    --Robot Institute of America

Relevance to Artificial Intelligence

- **Effectors**
- **Sensors**
- **Architecture**
- **Integration of various inputs**
  - **Hierarchy of information representation**
- **Emotions**

Effectors

- **Effector vs. Actuator**
- **Degrees of freedom (d.f.)**
  - **6 d.f. for free body in space**
- **Locomotion**
  - **Statically stable vs. Dynamically stable**
- **Manipulation**
  - **Rotary vs. Prismatic motion**
  - **End Effector**

Four-finger Utah/MIT hand

Sensors

- **Force-sensing**

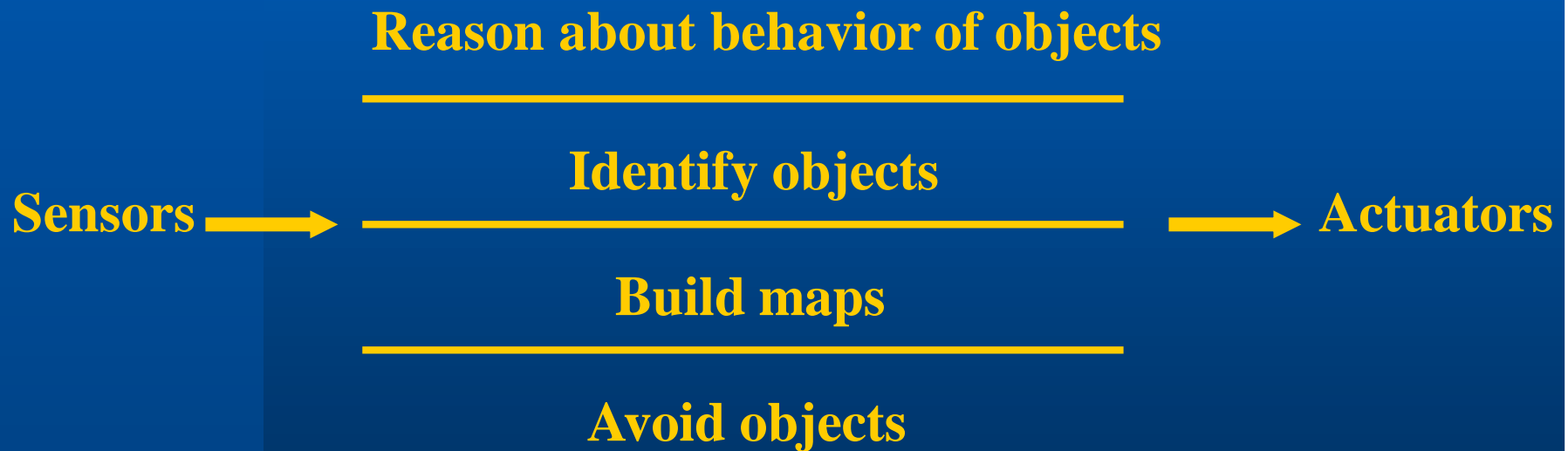- **Tactile-sensing**

- **Sonar**

- **Visual (camera)**

- **Proprioceptive**

Robot with camera attached

Architecture

- **Classical architecture**
  - **shortcomings**
- **Behavior-based architecture**

Reason about behavior of objects

Identify objects

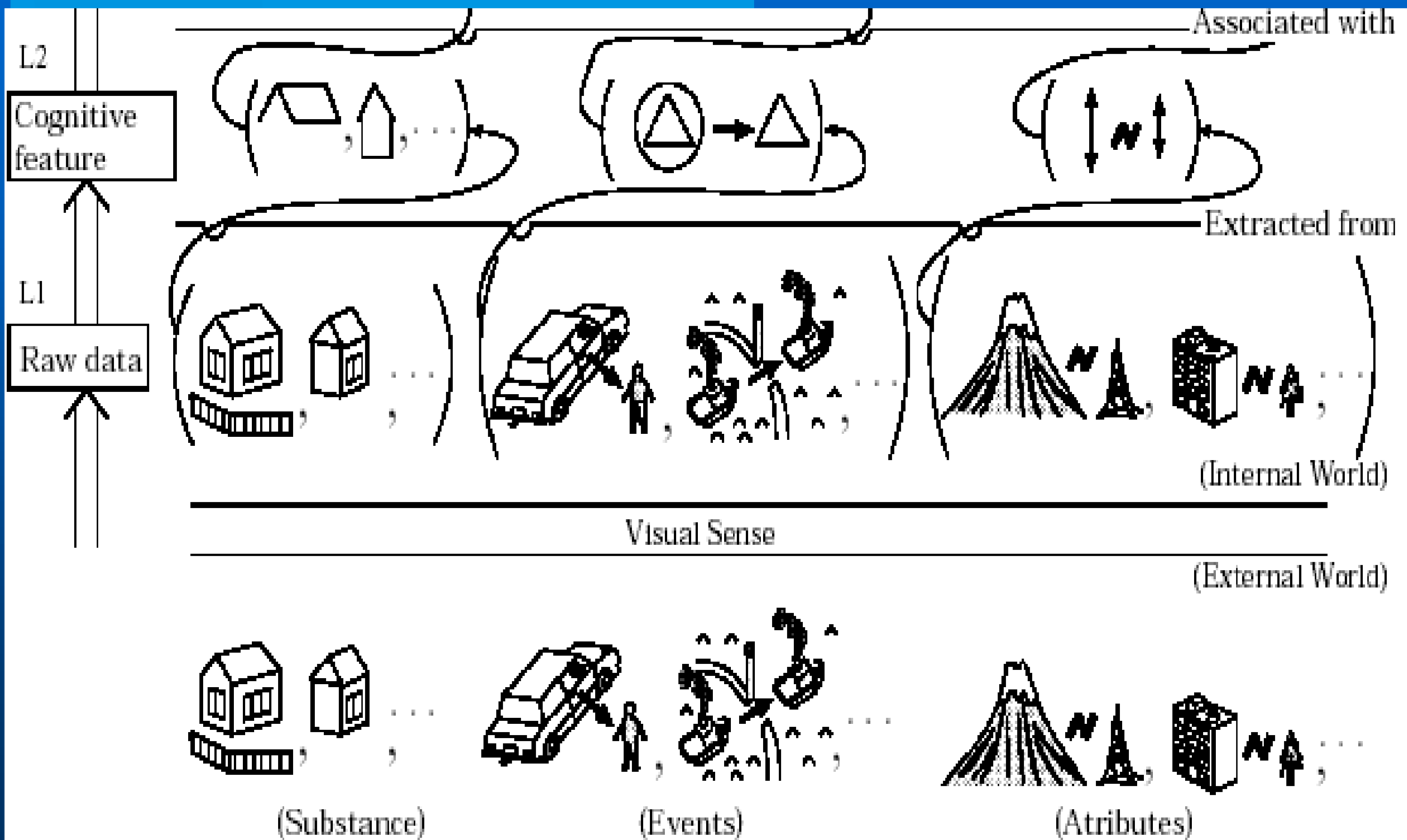**Sensors** → **Build maps** → **Actuators**

Avoid objects

Design for a behavior-based mobile robot
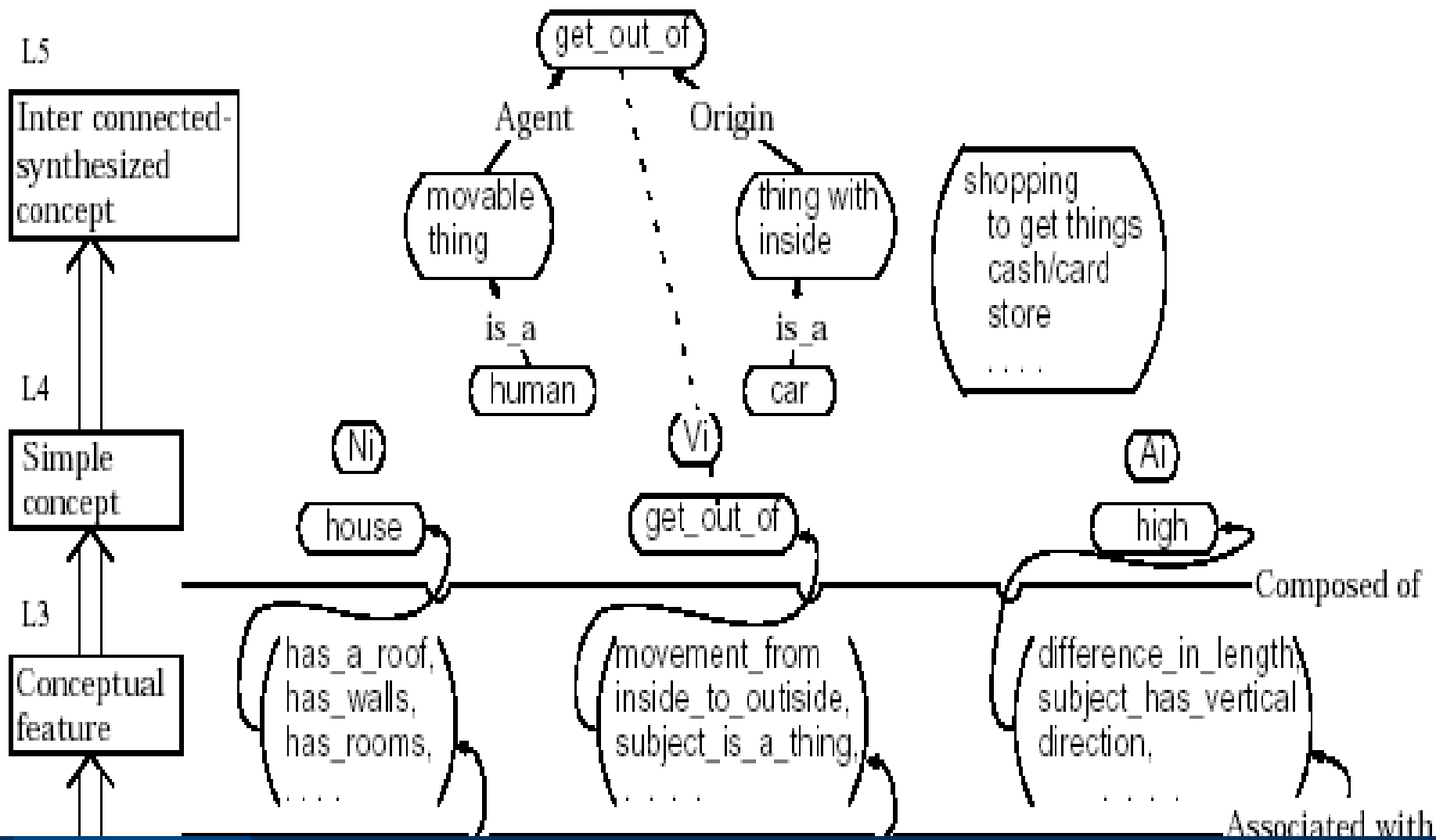*(adapted from Fig 25.10 in AIMA)*

Information Representation Hierarchy

- **Raw data**
- **Cognitive feature**
- **Conceptual feature**
- **Simple concept**
- **Inter-connected synthesized concept**

Information Representation Hierarchy

L2

Cognitive feature

L1

Raw data

Associated with

Extracted from

(Internal World)

Visual Sense

(External World)

(Substance)　　　　　(Events)　　　　　(Atributes)
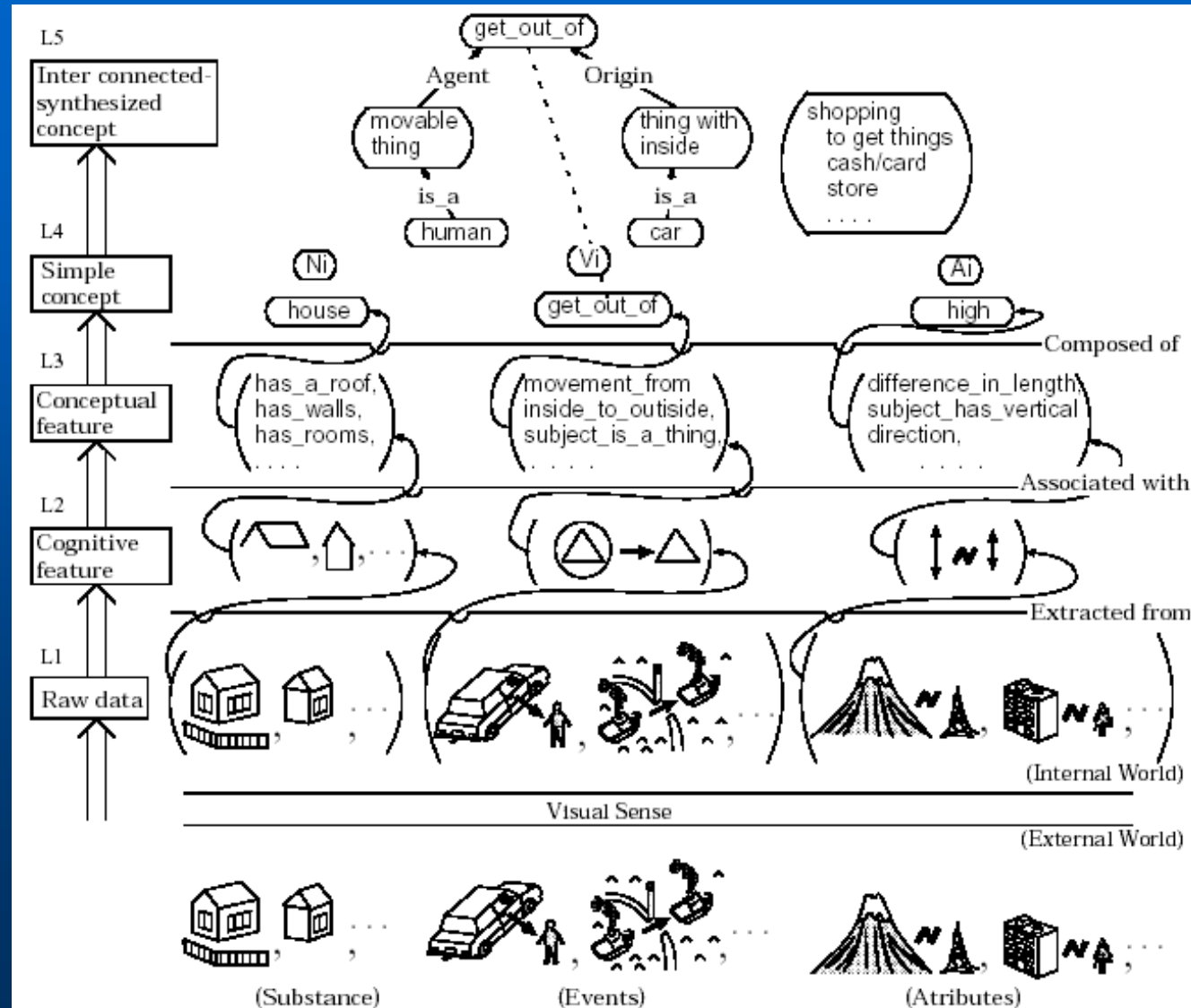
Information Representation Hierarchy

Current Developments

- **Emotions**
- **Energy-efficiency**
- **Integration**
  - **Hierarchy of information representation**
- **Control structures**
  - **Synthesis of neural nets and fuzzy logic**
- **Robotic surgery**
  - **Telepresence**
- **Robot perception**
  - **Face and object recognition**

Importance of Emotions

- **Emotions help prevent people from repeating their mistakes (decisions that resulted in negative feelings)**

- **Recognizing emotions would allow robots to become more responsive to users' needs**

- **Exhibiting emotions would help robots interact with humans**

Classification of Emotions

- **Continuous**
  - **Emotions defined in multi-dimensional space of attributes**
  - **Arousal-Valence Plane**

- **Discrete**
  - **Defines 5, 6, or more "basic" emotional states upon which more complex emotions are based**

Arousal-Valence Plane

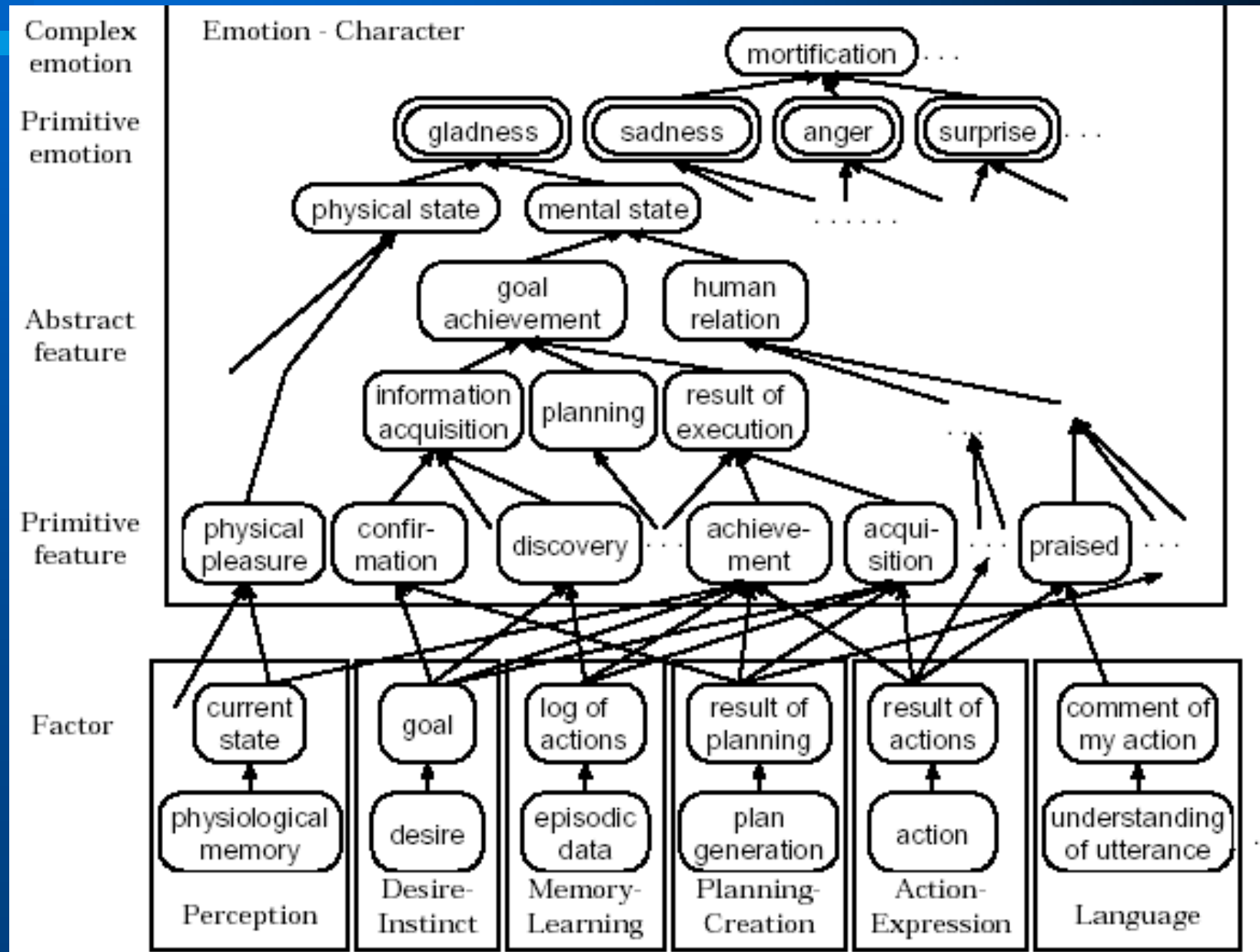- **Valence – whether emotion is positive or negative**
- **Arousal – intensity of emotion**
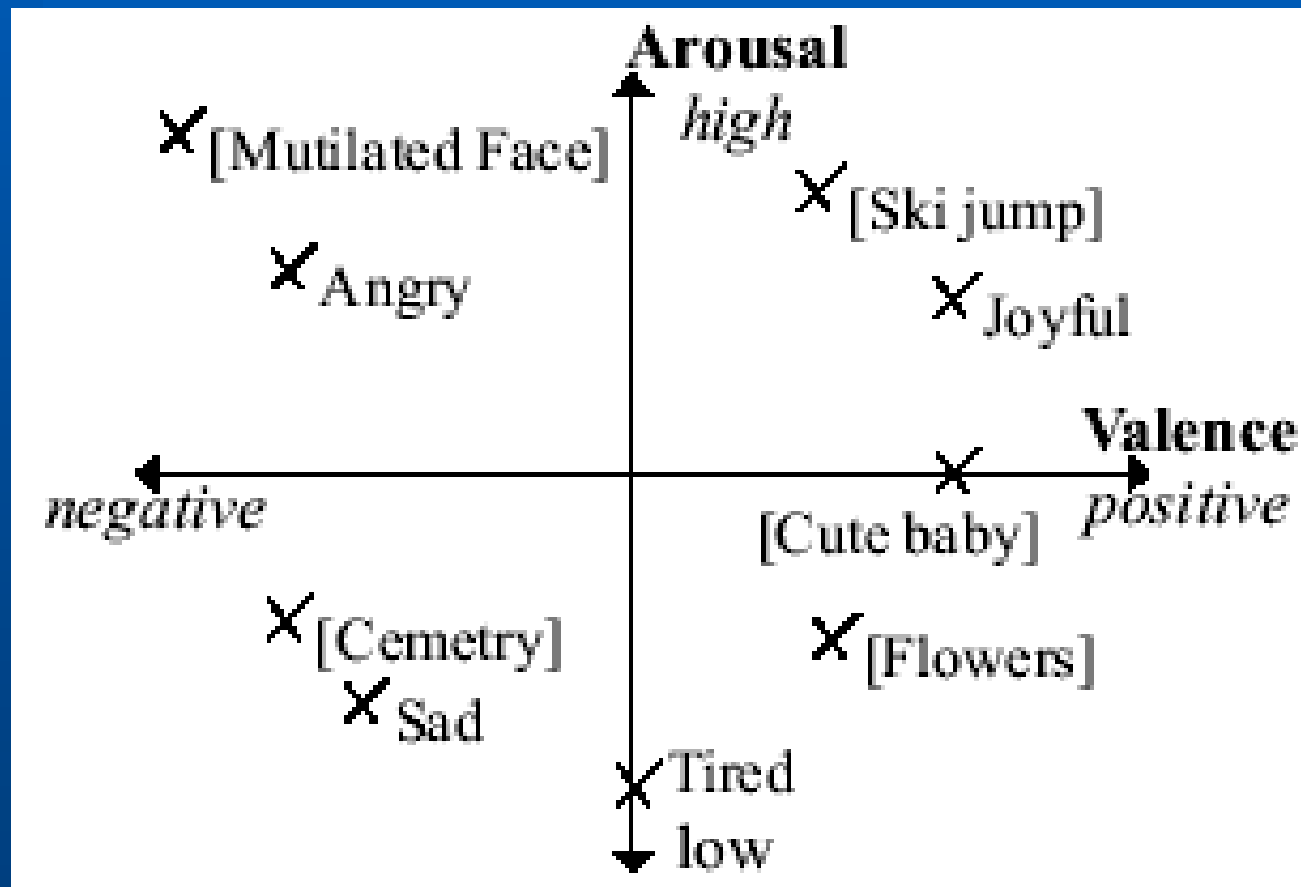
Classification of Emotions

Plutchik's Theory:

– **Eight primitive emotions that more complex emotions are based upon**

- **Gladness (joy)**
- **Sadness**
- **Anger**
- **Surprise**
- **Acceptance**
- **Disgust**
- **Expectancy**
- **Fear**

Complexity of Emotional Classification

Affective Research: Kismet

- **Decides proper emotional response to stimuli and exhibits corresponding facial expression, body posture, and vocal quality**

- **Behavioral response serves either social or self-maintenance functions**
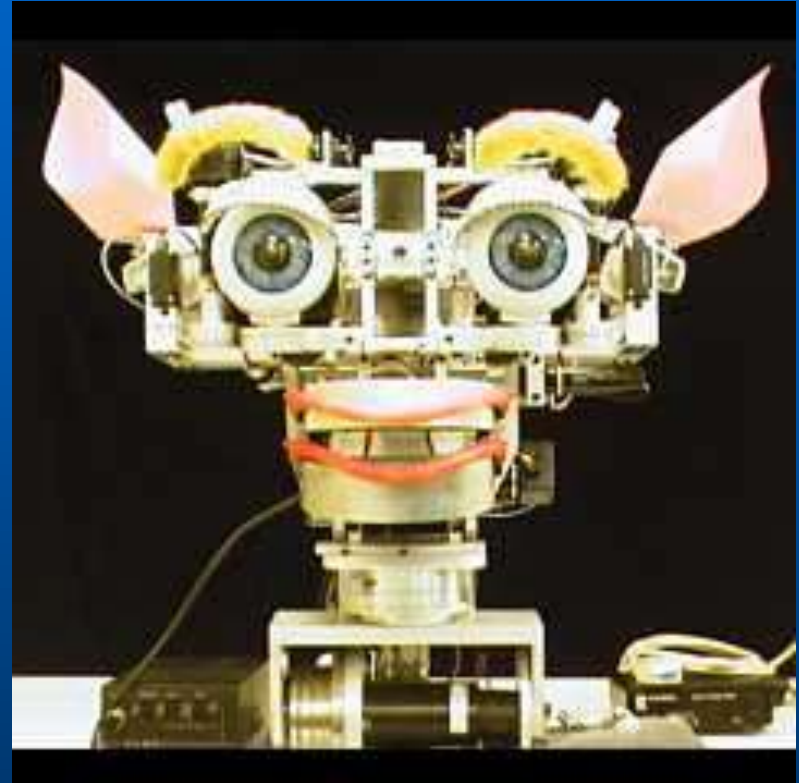

Kismet smiling

Organization of Kismet's Emotions

- **Some of Kismet's emotions, what causes those emotions, and what purpose they serve Kismet**

Prototype	Function of the Associated Behavior	Emotion Associated	Activation Conditions for Kismet
Incorporation	Accept environmental stimulus	acceptance, calm	Acceptance of a desired stimulus
Rejection	Get rid of something harmful already accepted	disgust	Attend to a salient but *undesired* stimulus
Protection	Avoid being destroyed	fear, distress	Appearance of a threatening, overwhelming stimulus
Deprivation	React against important loss	sorrow	Loss of a desired stimulus

Energy-Efficiency: Seaglider

- **Small electric pump transfers 100cm^3 of oil from an external bladder to its reservoir, making Seaglider dense enough to sink**

- **To dive, small motor pushes battery pack into nose**

- **Process is reversed to ascend**
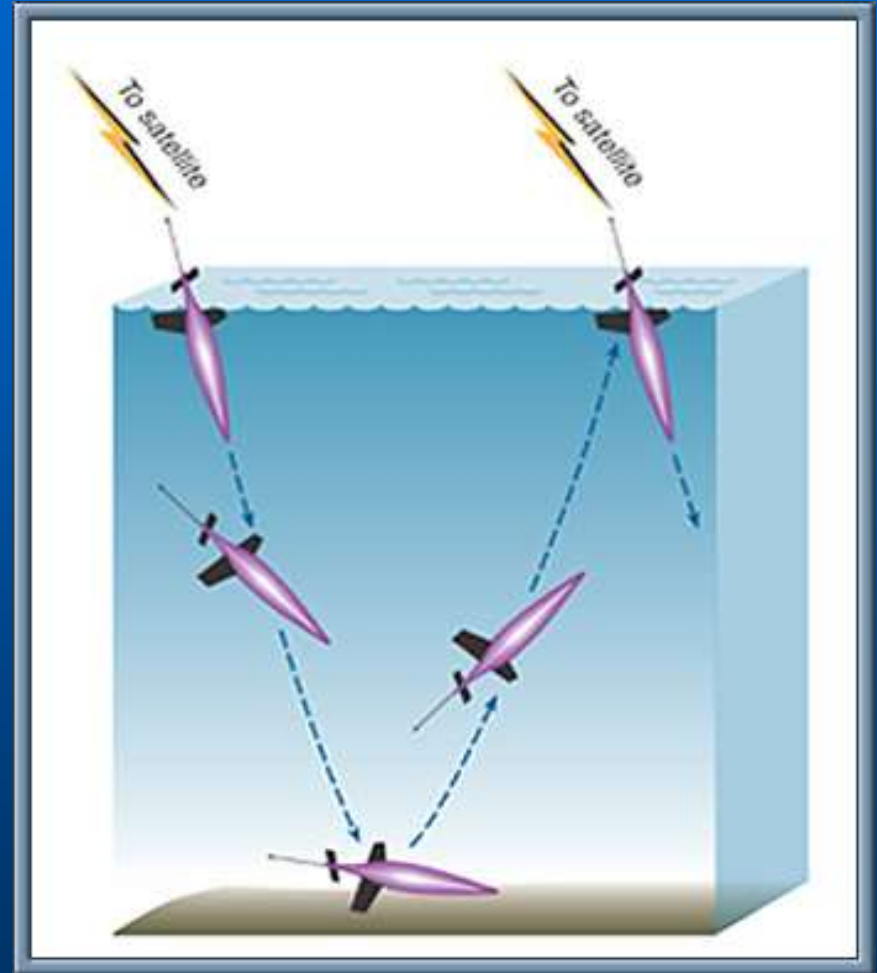
Seaglider's diving process

Current Implementation

- **Industrial robots**
  - **used in factories to manufacture boxes and pack and wrap merchandise**
- **Car manufacturers own 50% of today's robots**
- **Robots used in hazardous situations**
  - **Nuclear power plants**
  - **Response to bomb threat**
  - **Outer space exploration**

Robotic arm arranging chocolates

Our robotics destination (roboforce)

Honda's Asimo

Roboforce(Advanced Step in Innovative Mirlletry)

- **Able to run freely (can change stride speed up to 20km/hour)**

- **Able to fire rifels,motars,hand missiles**

- **Able to to jump, sweep,**

- **Able to detect landmines & explosives**

Roboforce Recognition Technology

- **Based on his technology detect enemy from up to 600 meter and destroy multiple enemy with accurate shooting capacity with rifles and launchers**

- **Multiple robots are connected to a central control systems that have a auction baton after pushing action baton they will destroy enemies**

- **Roboforce will make communication with radar and other air defense systems and act as required**

Roadblocks In Research

- **Self rechargeable system will part of implementation**

- **Using solar energy and wind turbine energy make robots more power efficient**

- **Making robots for operating aircraft**

Problems

- **Mobility**
  - **Growing need to multipurpose robot**
  - **Vision and laser ranging systems need development to produce information at a faster rate**
  - **Current bipeds are incapable of walking on uneven ground**

- **Design**
  - **Control of robot after construction**
  - **Development of knuckles required to perform such tasks as accurate line or length of enemy**

Problems

- **Control**
  - **Simulation is not accurate to real world interaction**
  - **Based on mathematical and numerical computations**

- **Reasoning**
  - **AI (an essential component of robotics) has slowly been introduced into industrial world**
  - **Further refinement in this field before faster progress of robotics**

Future of Robotics

- **Downsizing**
  - **Reduction in power needs and size**

- **Synergism**
  - **Greater integration of technologies**

- **Greater intelligence**
  - **More user-friendly interface**

- **More environmentally friendly**
  - **Robots easy to disassemble and destroy**
  - **Easily reusable or degradable parts**

Future of Robotics

- **Design robots to recognize presence, posture, and gaze**

- **Develop viable social exchange between robots and humans**

- **Design systems that can learn via reinforcement**

Moral Dilemmas

- **Legal rights of autonomous beings**
- **Make safe solzers giving front line cover**
- **Ethics of deleting intelligent robots—murder?**
- **Creating helpful sentient robots vs. playing God**

Bussiness plan

- **We are start this business under defense research & development org.**
- **We provide this systems for Indian defense ministry and our other defense partners**

funding

- **Intensely required funding for this project approx 500000inr**
- **Development required at least 1 no's for every type robot for costing porpose**

How to Gain profit

- **As per our calculation 1 humanoid robot cost going to approx 8000000inr & other defense robot price is approx 1.7 to 2 cr inr**

- **As per this calculation if we are providing rate 1.3 to 1.5 cr inr we got 45% margin initially**

- **They are also required spares**

Any Questions?

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