Principles of
General Intelligence
Intelligence ~ Universe
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(Based on slides presented at a Cafe Scientifique Talk in 2009)

Boris Kazachenko 2003	An ability to produce expectations of future inputs through recognition & interactive projection of past inputs patterns (…) recorded patterns should form a hierarchy of compression/search range & syntatic complexity, with each level divided into fixed-range search units
Juergen Schmidhuber, 2003	Self-organizing hierarchical predictor ...
Jeff Hawkins, 2004	Hierarchical Temporal Memory – discovers causes in sensory inputs and predicts future inputs
Todor Arnaudov 2002-2004	Hierarchical predictor of future sensory inputs. Hierarchy of universal simulators of virtual universes.

- Predictability is a basic property of Universe!

- Intelligence is impossible in unpredictable environment!

quark
  proton, neutron, electron?
    atom
      molecule
        macromolecule
          DNA
            cell organelle
            cell
              tissue
                organ
                  system of organs
                  organism
                      (........)

Causality/Control

Private, tank crew, pilot

Specific physical actions of war

- To Shoot
- Throw bombs

- To attack or to take cover?
- Is there a bullet in the barrel? Should I reload?
- Where exactly to take cover?
- Where exactly is the clip? How exactly the clip is put on the gun?
- To aim?
  - Recognize the enemy .
  - If many – choose a target.
  - Predict target's trajectory.
- Should I listen to my superior?

private

corporal

sergeant

lieutenant

captain

major

general

marshal

Marshal

- Give commands on a map (abstract)
- Commands an army (abstract)
- Gives abstract commands/orders

„Surround the enemy's army and force them to surrender!“

Hierarchy of ever more-abstract "actions"

The higher levels make cascade calls of ever more specific actions, until they reach to <u>physical actions on the lowest possible level of causality/control.</u>

Higher levels receive information about the state of the lower ones and take it into consideration for their decisions (otherwise higher level commands could be impossible to execute in the reality).

Hierarchical causality/control with feedback

- Distribution of complexity
- Flexibility
- Makes government of complex systems possible

...The Neocortex of Human Brain...

- – Hierarchical functional organization
  - Neocortical columns and their universality
- – Hierarchical Temporal Memory

Prediction and Hierarchy

Constructing a system from the bottom-up, from the more specific to the more abstract.

Prediction (and causation) of ever bigger and more complex phenomenons.

All abstract concepts are derived from the lowest possible level of sensory inputs.

Virtual (Imaginary) Universes

Hierarchical virtual universes

Simulators of virtual universes

Mind (General Intelligence) –

Hierarchical self-organizing universal recognizer and predictor (simulator) of virtual universes

See Also:

**Jeff Hawkins
Boris Kazachenko
Juergen Schmidhuber
Marcus Hutter
Ben Goertzel
Singularity Institute**