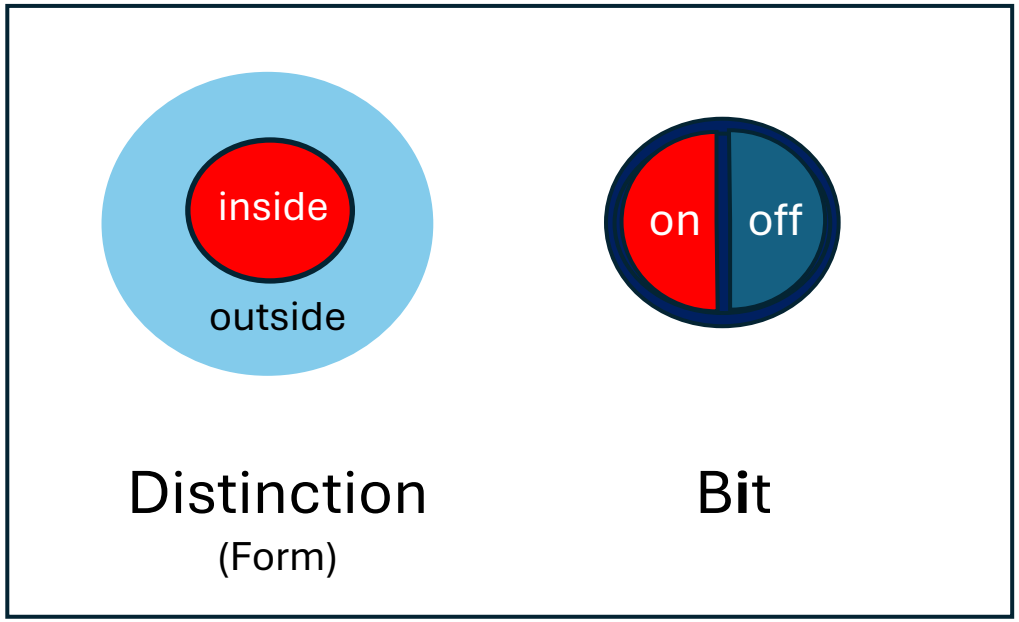
Two Basic Elements of Information



Common

Common Feature	**Distinction** **(Form)**	**Bit**
1 Action	Distinction	Choice
2 Possible Outcomes	Inside / Outside	On / Off

Differences ?

Bit

1948: C.E. Shannon calculates electric signal flow in telephone wires

- Shannon invents the 'Bit' as calculatory unit for information (signals)
- 1 bit → Selection of two ***equiprobable*** states
- Bits measure **information content** (**entropy**)

What is entropy?

Bits and Entropy

Entropy is a Relatively **New** Concept (19th Century)

1824: Carnot: Energy Flow in Steam Engines
1850+ Clausius, Kelvin: Second Law of Thermodynamics
1865: Clausius: Term "Entropy" (Inner Capacity of Moving)
1877: Boltzmann: Statistic Model of Entropy
1948: C.E. Shannon: **Information Entropy, Bit**
1948+ C.F. Weizsäcker et al.: Microlevel/ Macrolevel

But what does entropy mean?
→ *Order? - Disorder?*

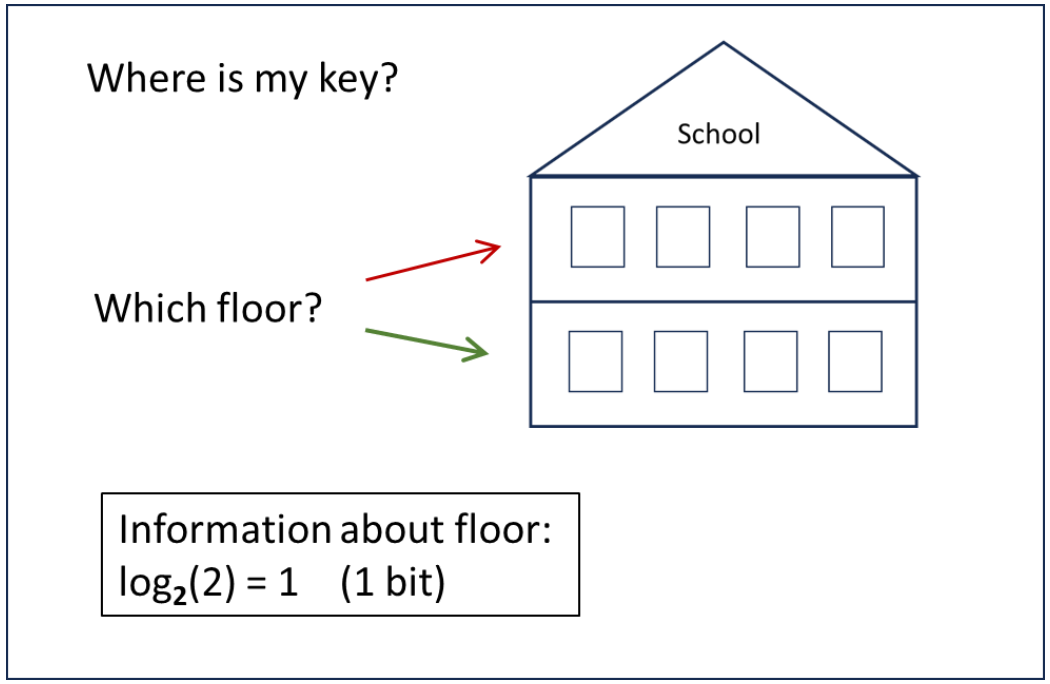
Entropy

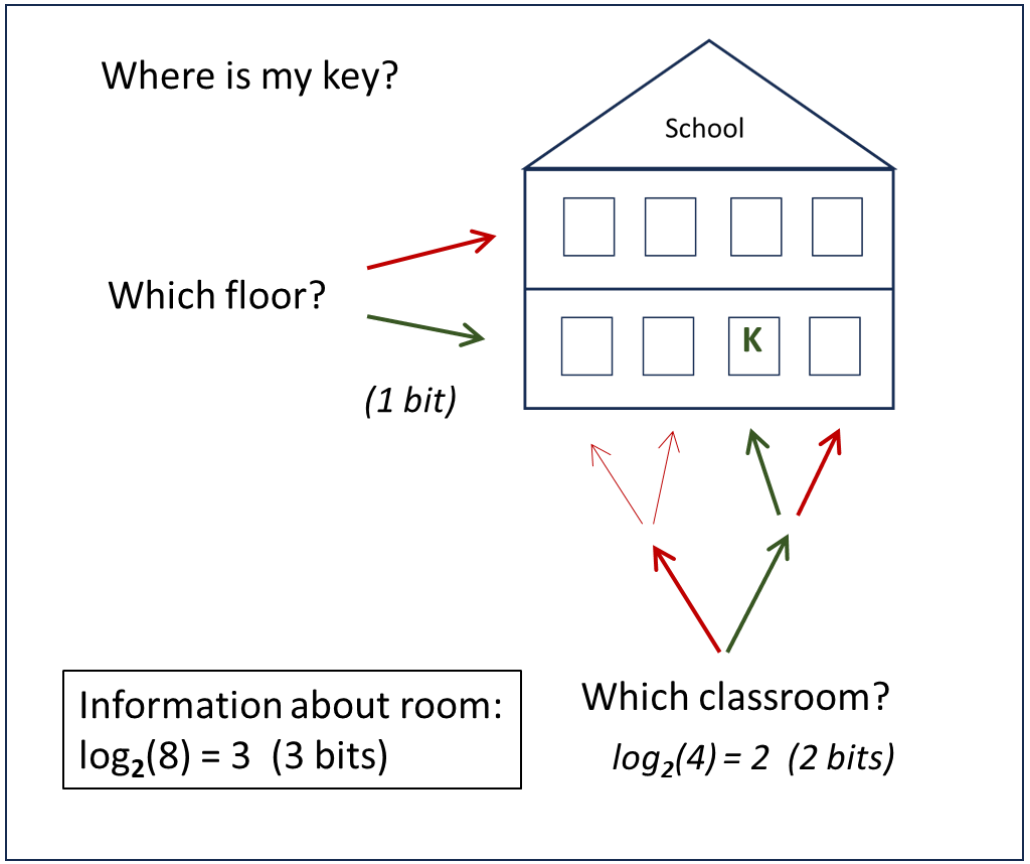
Energy and Entropy, subjects of the two General Laws of Physics:

- 1st Law of Thermodynamics: d**E**/dt **=** 0 → *Equation* → *Calculations (Schrödinger etc.)*
- 2nd Law of Thermodynamics: d**S**/dt **≥** 0 → *Unequation*

Entropy: Between Micro and Macro Level

Micro and Macro Level Define Entropy *(Example W.Salm)*:





Two Levels define Entropy

Entropy is the information known in micro,
but unknown in macro level

Information lies in the step from macro to micro level

- Coarse grained view: **macro** level
- Fine grained view: **micro** level

The two levels are relative and movable (dynamic)

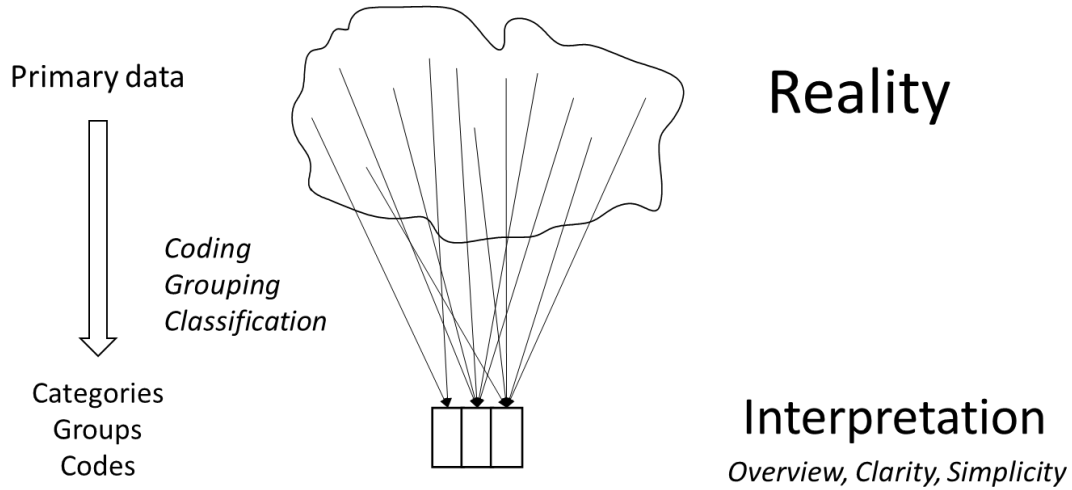
Entropy = 'Information *Tension*' = 'Information *Surprise*'
= from Intransparency to Transparency

How do we move between the levels?

Moving from Macro to Micro Level – and Back

Microlevel → full **details**
Macrolevel → relevant **overview**

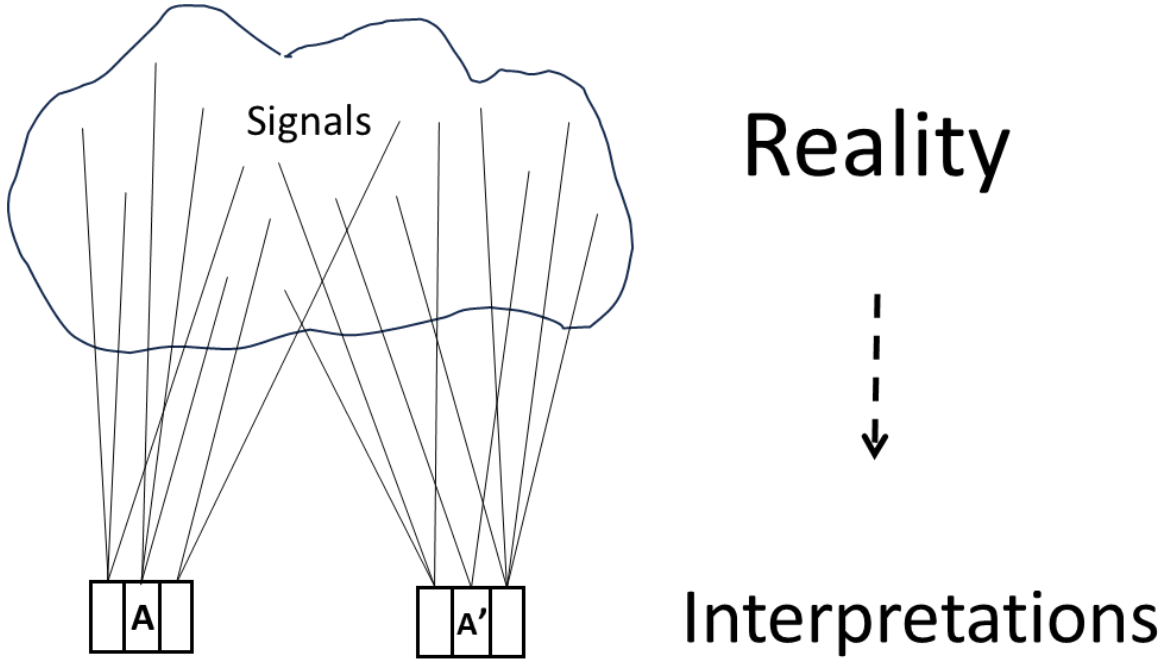
→ *Example* ***Classification:***



When we classify, we loose information about the details – intentionally!

Classification is Interpretation

- Intepretation is Simplification (Going to the Macrolevel)
- Different interpretations are possible:



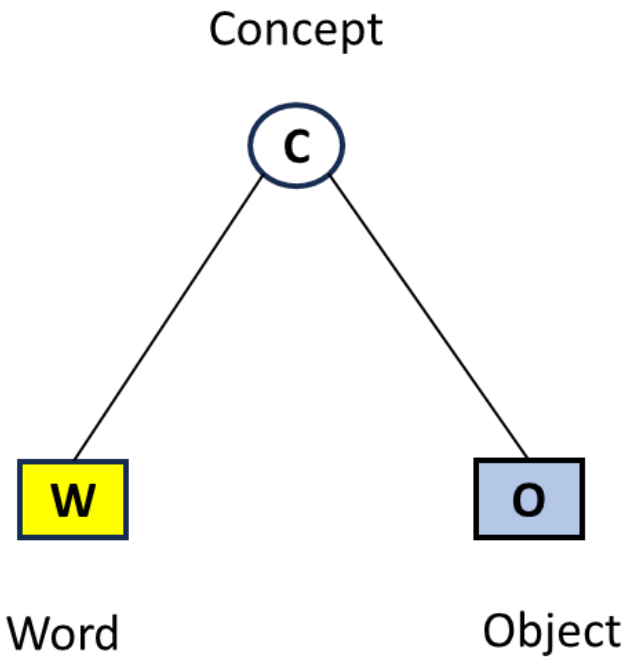
How do we share our interpretations?

Language

Semiotic Triangle

- Aristotle / C.S. Peirce / J. Piaget / J.F. Sowa
- Ogden/Richards, 1923: "The meaning of meaning“:

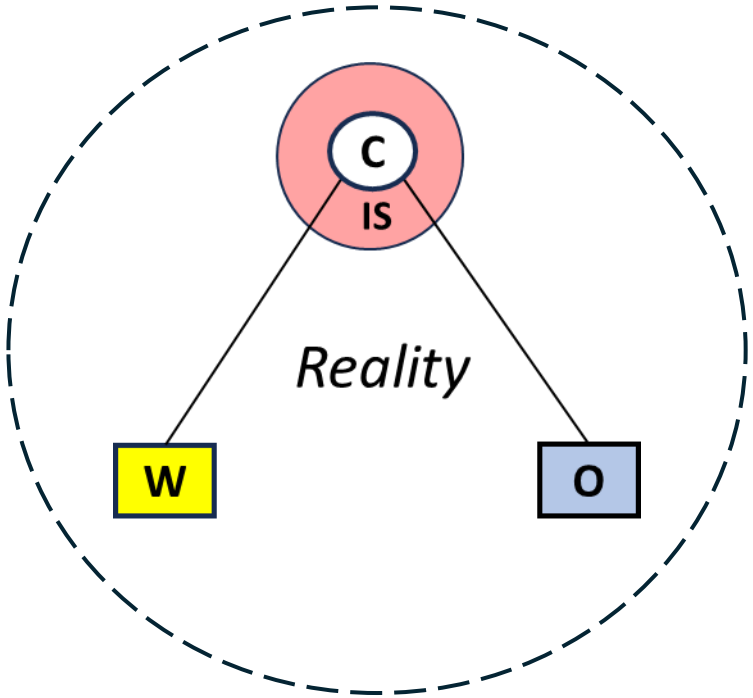
No direct relation from **words** (W) to **objects** (O)
Internal **concepts** (C) relate words and concepts



Interpreter, Reality and Constructivism

- Who links words and objects to concepts?
- Who draws a distinction?

Answer: the observer or interpreter = IS



← *IS = Interpretive System*

IS and the Laws of Form

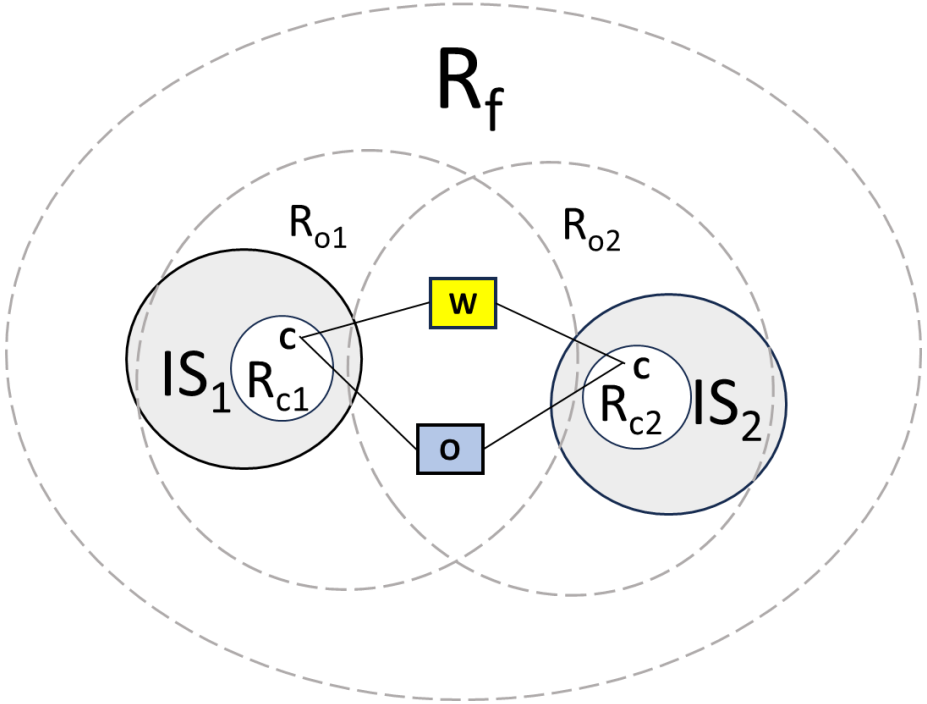
Who *'draws the distinction' ?*

- Interpreter (IS) is a **part** of the full unlimited reality (R_f)
- Interpreter (IS) reconstructs (R_c) the full reality R_f (no copy, no 1:1)

- Full reality R_f is limitless
- Reconstructed R_c reality is visible only to interpreter
- We live in our reconstructed R_c ← *Constructivists, not Solipists*

Communication Between Two IS

- Both IS observe a limited space (R_o) of full reality (R_f)
- Their individual observed R_o's overlap
- They try to clear and enlarge their common R_o
- They adjust the meanings (C) of words (W) and situations (O) in a dynamic process
- This process establishes the resonance between IS_1 and IS_2
- A resonance between IS_1 and IS_2 is, at the same time, a precondition for their communication.



Rf: full, unlimited reality
IS: interpreter
R_o: observed reality
R_c: internal reality reconstruction
C: internal concepts
W: uttered, written words
O: objects in real situations

Common for Distinction and Bit

Common Feature	**Distinction** **(Form)**	**Bit**
1 Action	Distinction	Choice
2 Possible Outcomes	Inside / Outside	On / Off

One basic information step

- 1 → 2
- Macro → Micro Level
- Action (Dynamic) → Result (Static)

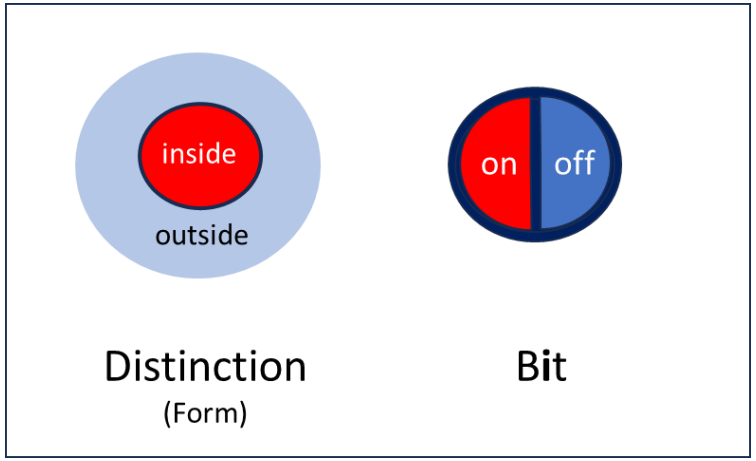
Differences

- **Border**:
  - Distinction: **open** (unmarked state)
  - Bit: **closed**

- **Information content** (Entropy):
  - Distinction: S > 1 Bit,
  - Bit: S = 1 Bit

- **Action**:
  - Distinction: Distinction (to context)
  - Bit: Choice (of predefined two)

- **MacKay**:
  - Distinction: Descriptive information content
  - Bit: Selective information content



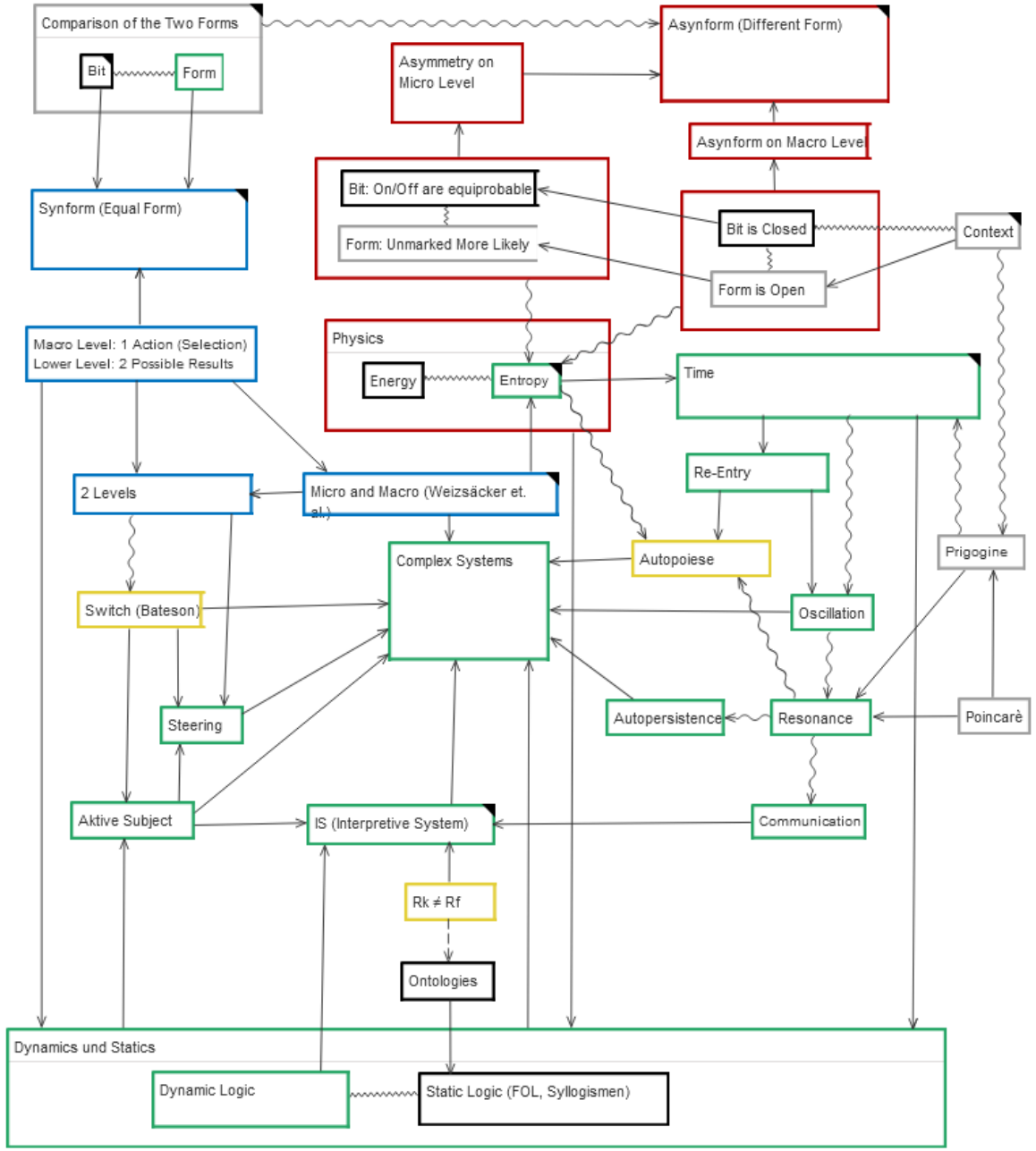
Examples Closed Systems

- Classifications
- Set of natural numbers
- Syllogisms of Aristotle
- FOL
- Experiments in laboratories
- Standards

Examples Open Systems

- Biotops
- Societies
- Human knowledge
- Languages
- Brains
- Art
- Life
- Q-Bits
- Logodynamics

Context Diagram



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