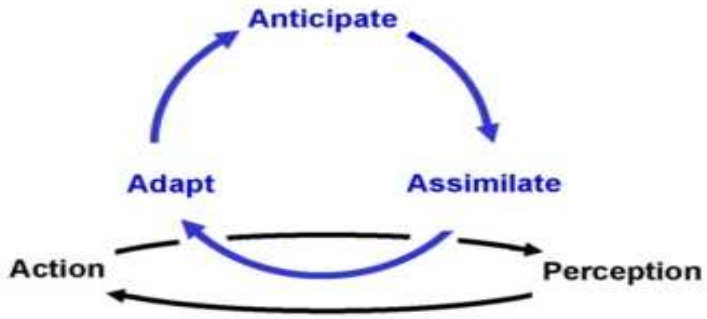
From meaningful information to representations, enaction and cognition

E-CAP 08 **Christophe Menant** **- Bordeaux, France –**

1) Cognition process. System submitted to constraints

a) Cognition, Cognitive Systems. Definitions:

*** Cognition as a cycle of anticipation, assimilation, and adaptation embedded in, contributing to, and benefiting from a continuous process of action and perception.** (D. Vernon 2006)



*** Cognition for animals, humans and robots.**

*** Cognitive process uses transfer of information**

b) Cognition and systems submitted to constraints.

*** No cognition per se.**

***"earliest living organisms ... subject to a constraint of viability"** (Stewart, J. 1996)

*** Cognition: system/agent that has constraints to satisfy in its environment.**

*** system – constraint – perception/action**

- Mouse – Survival - Seen cat as danger, actions

- Bicycle rider – Equilibrium - Pressure on palm of hand on handle bar, actions

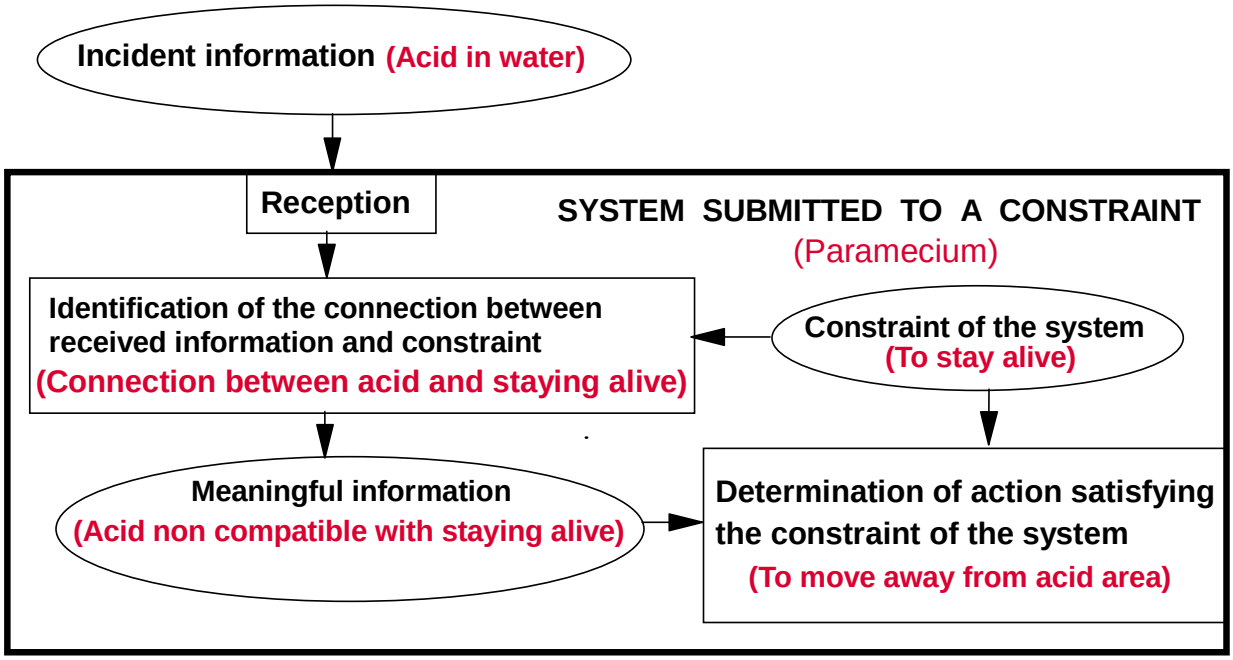
- Researcher - Need to understand/discover - Conference as new data, actions

- Car driver - In time arrival - Seen traffic jam as delay, actions

- Robot - Goal to reach - Identified light as direction, actions

2) Constraints. Meaning generation. Meaningful representation. Enaction

a) Constraints. Meaning generation (Menant 2003, 2005)



*** Paramecium submitted to a "stay alive" constraint (Constraint of the system).**

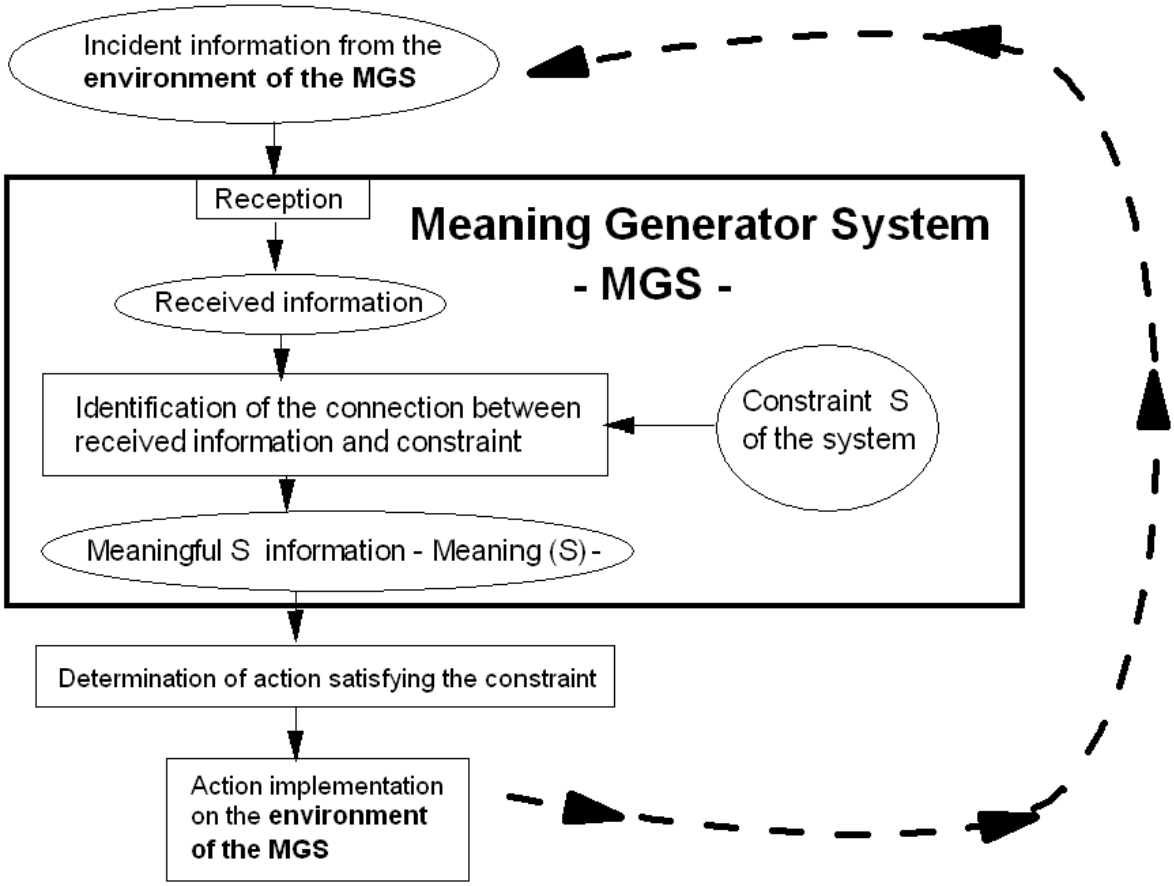
*** Acid non compatible with staying alive (Meaningful information).**

*** Paramecium moves away from acid area (Action to satisfy the constraint).**

*** Meaning by the system and for the system.**

**** A meaning is a meaningful information that is created by a system submitted to a constraint when it receives an external information that has a connection with the constraint.***
The meaning is formed of the connection existing between the received information and the constraint of the system.
The function of the meaning is to participate to the determination of an action that will be implemented in order to satisfy the constraint of the system.

b) Meaning Generator System (Menant 2003, 2005)



*** MGS Properties**

- Constructivist approach. Embedded in perception/action.

- Dynamically links a system to its environment for constraint satisfaction.

- Building block. Links with memory, simulation, scenarios, other MGSs, ...

- Can modify functions/identity/constraints of higher level systems.

- Gives meaning for the system to its environment. Groundings in/out.

- Constraint linked to the nature of system.

- Transmission and networkings of meanings. Evolutionary approach.

- Close to a simplified version of the Peircean triadic approach on sign.

*** Meaning generation is part of cognition.**

c) Representation as set of meaningful information

*** "Representations do not exist independent of individuals for whom they are "meaningful"."** (Scheutz, M. 1999)

*** Representation as a set of meanings relative to the represented item:**
(ex: representation of a cat for a mouse)

- **Real time sensory meaning of item.**
  (seen cat is a danger)

- **Available action scenarios relative to item, with real time update.**
  (stand still, run away. Options updatable by cat movements)

- **Memorized past experiences of item.**
  (new cat or known fast/dumb cat. Cat's habits, past experiences)

- **Anticipated evolutions of item**
  (simulation of direction options)

- **Covers what is represented and the content of the representation.**

d) Meaning Generation, Enactive approach and Representations

*** Meaning generation is part of enaction**

*** "five key "pillars" to the enactive approach: A dynamical systems perspective and emergence, embodiment, biological autonomy, "sense-making" (the creation of meaning), and experience"** (McGann, M. 2006)

*** "sense-making, which we identified as one of the central concepts of the enactive approach"** (Di Paolo and all, 2007)

*** " Weber & Varela (2002) mention valence to refer to initial forms of meaning-generation in the autopoietic system: "Stimuli from outside enter the sphere or relevance of such a unit only by their existential meaning for the keeping of the process of self-establishment."** (Colombetti, G. 2008).

*** "in an enactive perspective, meaning is inseparable from the whole of context-dependent, life motivated, embodied activity, without being at all a hazy concept beyond the reach of scientific understanding."** (Di Paolo and all, 2007)

*** Representations, as made of meaningful information, are to be part of enaction**

3) Examples of meaningful information/representations

SYSTEM	CONSTRAINT	RECEIVED INFORMATION	MEANINGFUL INFORMATION	ACTION
MOUSE	Stay alive (no predators)	Seen cat	Cat presence incompatible with staying alive	Escape via mouse hole (reflex)
FROG	Stay alive (food)	Seen moving black shape	Availability of food	Catch and eat fly (reflex)
HUMAN on a bike	Safety needs	Pressure on hand while riding a bike	State of equilibrium	Move body to keep equilibrium on bike (reflex & anticipating)
HUMAN researcher	Desire to know	Content of books, journals, forums, Presentations,...	New information. Agreement/disagrement New ideas	Contact author, Propose new study (anticipating, thinking)
ROBOT	Reach plug	Blinking light signal	Plug direction indication	Move toward light (automatism)

4) Conclusion and continuations

a) Summary of points addressed:

- Cognition is related to systems having constraints to satisfy in an environment.
- Meaning as generated by a system for constraint satisfaction. Part of cognition.
- Meaning Generator System: building block linking system to its environment.
- Representation: integrated set of meanings relative to the represented item. (Senses, memory, scenarios, anticipation, ...).
- Meaningful information/representations to be part of Enaction.

b) Continuation:

- Enaction and first person experience.
- Enaction and agency, self, identity, autonomy.
- Position of phenomenology in cognitive sciences.
- Evolution from matter to unicellular life (constraints).
- Nature and content of human specific constraints.
- Meaning generation at embodiment/enactive levels.

References

*** Colombetti, G.** 2008 *« Enaction, sense-making and emotion »* (To appear in Stewart, J., Gapenne, O. & Di Paolo, E. (eds). *Enaction: Towards a New Paradigm for Cognitive Science*. Cambridge MA: MIT Press. 2008. Forthcoming.) . Enaction, Sense-Making and Emotion
*** Di Paolo, E., Rohde, M., and De Jaegher, H.** 2007. *"Horizons for the Enactive Mind: Values, Social Interaction, and Play"* To appear in *Enaction: Towards a New Paradigm for Cognitive Science*, J. Stewart, O. Gapenne, and E. A. Di Paolo (Eds), Cambridge, MA: MIT Press, forthcoming.
*** McGann, M.** *"What is "Enactive" Cognition?"* euCognition *http://www.eucognition.org/wiki/index.php?title=Cognition_Briefings*
*** Menant, C.** 2003 " Information and Meaning". Entropy 2003, 5, 193-204. http://cogprints.org/3694/
*** Menant, C**. 2005 *" Information and Meaning in Life, Humans and Robots":* * Foundations of Information Sciences (Paris, July 2005). http://cogprints.org/4531/
*** Scheutz**, M. (1999). "The Ontological Status of Representations". In A. Riegler, M. Peschl \& A. von Stein (eds.) *Understanding Representation in the Cognitive Sciences*. Plenum Academic / Kluwer Publishers: Holland, 33--38.
*** Stewart, J.** (1996). *"Cognition = Life: Implications for higher-level cognition"*. Behavioural Processes 35: 311-326.
*** Vernon, D.** *"What is cognition ? One view of cognitive systems"* euCognition Wiki (http://www.eucognition.org/wiki/index.php?title=What_is_Cognition%3F_One_View_of_Cognitive_Systems)