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"Life, Local Constraints and Meaning Generation. An Evolutionary Approach to Cognition" (Jan 7th 2015)

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Proposed Abstract.

The relations between life and cogntion have been addressed through different perspectives [Stewart 1996, Boden 2001, Bourgine and Stewart 2004, van Duijn & all 2006, Di Paolo 2009]. We would like here to address that subject by relating life to cognition through a process of meaning generation. Life emerged on earth as a far from thermodynamic equilibrium performance that had to maintain herself. Life is charactertized by a 'stay alive' constraint that has to be satisfied (such constraint can be included in the constraint of being able to maintain far from equilibrium thermodynamic conditions [Bickhard 2011]). The local 'stay alive' constraint has to be satisfied in an environment containing elements potentially supportive or harmfull. A key activity for the living entity is to characterize these elements in terms of meaningfulness relatively to the 'stay alive' constraint. This process can be modeled with an existing tool where a system submitted to an internal constraint generates meaningful information characterizing elements of the environment: the Meaning Generator System (MGS) [Menant, 2003, 2014 a]. In a few words: when a system submitted to an internal constraint receives from the environment an information that has a connection with the constraint it generates a meaning usable for the implementation of an action satisfying the constraint.The generated meaning is the connection existing between the received information and the constraint. The MGS models this process and interfaces to the action implementation for constraint satisfaction The meaning is generated by and for the system. The MGS grounds meaning generation in constraint satisfaction and links the living entity to her environment in a relational process. A simple example is with a paramecium close to a drop of acid. The paramecium which is submitted to a 'stay alive' constraint will move away from the acid area. The received information 'presence of acid' generates the meaning 'acid not compatible with the 'stay alive' constraint' which triggers the moving away action (that example is close to Varela's bacteria swimming up a sugar gradient. What the MGS brings in addition is a modeling of the significance of the chemical gradient for the organism). The action implemented to satisfy the constraint modifies the environment and the received information, establishing an interactive process linking the living entity to her environment. During its evolution animal life has elaborated new constraints (like 'live group life') and new functions enriching meaning generation and action scenarios. As a result the build up of meaningful representations has improved the constraint satisfaction processes of animals, embedding them in their environments in relational and interactive terms [Menant, 2011].

Cognition can be defined by proposing that 'a system is cognitive if and only if sensory inputs serve to trigger actions in a specific way, so as to satisfy a viability constraint' [Bourgine, Stewart 2004]. Cognition can also be considered as exemplifying a 'vital criterion of responsiveness' [Boden, 2001]. Consequently the MGS can be positioned as an elementary and generic version of animal cognition. For animal life, meaning generation for internal constraint satisfaction links life and cognition in a relational and interactive process.

Cognition for human life is more complex as new performances have to be taken into account like self-consciousness and free-will. Meaning generation at human level is a challenging subject as human constraints are not clearly understood [Menant, 2011]. Many research activities are in process looking for some understanding of human mind [Philpapers]. One area of investigation is an evolutionary approach to self-consciousness using meaning generation where anxiety limitation comes up as a generic human constraint [Menant, 2014 b]. Assuming that we can have clear enough an understanding of some human constraints, we can look at the MGS for partly extending to humans the link between life and cognition that has been established for animals. So overall, we can consider that the MGS approach makes available an evolutionary link between life and cognition for animals, and partly for humans.

A characteristic of the proposed system approach to meaning generation is the possibility to use it for any type of agent, be it organic (with intrinsic constraints) or artificial (with derived constraints). Such characterization of agents through meaning generation can be used to discriminate artificial itelligence from human intelligence (see the MGS usage to support Searle's chinese room argument [Menant, 2013]).

On a more general basis, the proposed system approach can positions the MGS as a simple model for an internal source of normativity. It's usage as a simple building block allows a bottom-up modeling for normativity in the sensorimotor approach. The 'stay alive' constraint could also be taken as a starting point for an evolutionary grounding of sensorimotor norms 'in the biological normativity of the agent as a whole' [Di Paolo & all 2014].

The proposed presentation will develop the points summarized here above and position them relatively to the autopoietic and enactive approaches. Several possible continuations will also be highlighted.

Keywords: cognition, life, evolution, meaning generation, constraint, normativity, grounding, sensorimotor, agent, enaction, autopoiesis.

References:

* **Bickhard, M. (2011)** email with the author.
* **Boden, M. (2001)** 'life and cognition' in '*The Foundations of Cognitive Science', Joao Branquinho Ed. Oxford University Press, 2001.*
* **Bourgine, P. Stewart, J. (2004)** 'Autopoiesis and cognition' *Artificial life, Summer 2004, Vol. 10, No. 3, MIT Press Journals.*
http://www.mitpressjournals.org/doi/abs/10.1162/1064546041255557#.VJLBnCuG-UI
* **Di Paolo, E. A. (2009)** 'Extended life' *Topoi 28:9-21.*
https://ezequieldipaolo.files.wordpress.com/2011/10/dipaolo_extended_life_final.pdf
* **Di Paolo, E. A., Barandiaran, X. E., Beaton, M., Buhrmann, T. (2014). '**Learning to perceive in the sensorimotor approach: Piaget's theory of equilibration interpreted dynamically' *Frontiers in Human Neuroscience . 01/2014.* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4115614/
* **Menant C. (2003)** 'Information and Meaning', *Entropy 2003, 5, 193-204*
http://philpapers.org/rec/MENIAM-2
* **Menant C. (2011)** 'Computation on Information, Meaning and Representations. An Evolutionary Approach' in *'Information and Computation. Essays on Scientific and Philosophical Understanding of Foundations of Information and Computation'. Edited by: Gordana Dodig-Crnkovic and Mark Burgin.*
- Book chapter*:* http://philpapers.org/rec/MENCOI
- Book: http://www.worldscientific.com/worldscibooks/10.1142/7637
* **Menant C. (2013). '**Turing Test, Chinese Room Argument, Symbol Grounding Problem. Meanings in Artificial Agents'. *APA Newsletter Philosophy and Computers Fall 2013 ISSN 2155-9708*
http://philpapers.org/rec/MENTTC-2
* **Menant C. (2014 a) '**Introduction to a systemic theory of meaning' *(Short paper)*
http://philpapers.org/rec/MENITA-5
* **Menant C (2014 b) '**Consciousness of Oneself as Object and as Subject. Proposal for an Evolutionary Approach'. *TSC 2014 Poster*. http://philpapers.org/rec/MENCOO .
* **Philpapers (2015)** search on 'human mind' http://philpapers.org/s/human%20mind
* **Stewart, J. (1996).** 'Cognition = Life: Implications for higher-level cognition'. *Behavioral Processes 35.*
http://pagesperso.lina.univ-nantes.fr/~prie-y/archives/ENACTION-SCHOOLS/docs/documents2006/Berder-rev.doc
* **Van Duijn, M., Keijzer, F., Franken, D. (2006) '**Principles of Minimal Cognition: Casting Cognition as sensorimotor Coordination'. *Adaptive Behavior 2006; 14; 157* http://dl.acm.org/citation.cfm?id=1139896