The Ouroboros Model

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Algorithmic Structure and some Effects

Assuming that memories are organized in some type of schema structures, any activation of one component of an entry will trigger some expectation of other features linked in this schema (Thomsen 2008). The main constituent of the Ouroboros Model then is a self-referential recursive process consisting of alternating phases of data acquisition and evaluation; an iterative monitor process termed 'consumption analysis' is checking how well expectations triggered a one point in time fit with successive activations. The following principal activity cycle is identified:

- *anticipation*
- *action / perception*
- *evaluation*

These sub-processes are joined into a full circle, and the snake bites its end, the Ouroboros devours its tail.

Consumption analysis highlights discrepancies between anticipations based on prior experience and the current situation; it can be understood as a specific algorithm for pattern matching, which not only delivers simple feedback on identity but also some meta-information concerning the overall performance, the relevance and quality of results, and also suitable starting points for the next actions.

Attention

Discrepancies signal that something unexpected is being encountered and that, against the background of available experience, some modification of the current behavior might be necessary. At the simplest level, occurring features and stored frames can be seen as effectively triggering attention to an open slot in a schema structure.

Emotion

Monitoring the quality of congruence with prior experience provides a very useful feedback signal for any actor. In our body we feel how things go and also what we should do in general terms; emotions are triggered by certain events and in turn bias (mostly) appropriate action schemata.

Problem Solving

Under many conditions a Bayesian approach can be verified as the optimum way of considering all applicable evidence in order to arrive at a decision. Always it is most important to combine prior probabilities with current data. The interplay between partially activated schemata and newly observed features does just that. Effort is effectively concentrated to constraint satisfaction and to closing gaps in a model.

Cognitive Growth and Teaching

With the positive signal that everything fits nicely, the associated positive emotions mark a good basis concerning the expected future usefulness of the schema in question. Whenever pre-existing structures cannot satisfactorily accommodate new data this will be accompanied by the opposite signal from the consumption analysis monitor. Learning thus is directed to issues where it is useful and most needed. New information can best be learned if it lies just at the border of already established structures. Natural and artificial minds can best be taught with pre-existing knowledge and novel input appropriately matched.

Sleeping and Dreaming

All known agents who exhibit some substantial measure of intelligence and consciousness spend a sizeable fraction of their life in seemingly strange states of sleep. Any attempt at a comprehensive account of mental functions should therefore include a profound explanation of this fact.

Given the stringent time constraints in the real world concerned with survival, consumption analysis inevitably produces "leftovers", i.e. not-allocated features and not-confirmed concepts, which accumulate with time. The Ouroboros Model explains sleep as a specific and multifaceted housekeeping function for maintaining appropriate signal / noise conditions in a brain by actively erasing data garbage.

References

Thomsen, K. 2008. *The Ouroboros Model.* Cogprints 6081, http://cogprints.org/6081/