Advances in Cognition and Adaptivity for Intelligent Systems

Cognitive/Adaptive Panel

Tuesday 1745 to 1930

The Panel

- Olivier Chator,France
- Knud Thomsen, Switzerland
- Marta Franova, France
- Terry Bossomaier, Australia

Scaling – energy

- Watson versus human contestants
- More efficient strategies
- Low precision computation

Scaling – algorithms

- Search versus patterns
- Specific applications vs general intelligence
  - computer creativity?
  - Koch and Tononi consciousness
- Do we want general intelligence machines

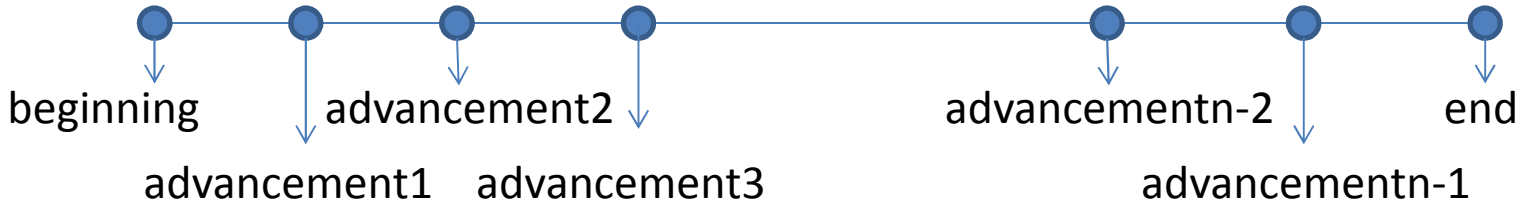
Entanglement between the Cartesian and Newtonian Approaches to Creativity

Marta Franova

CNRS & LRI UMR8623 du CNRS, France

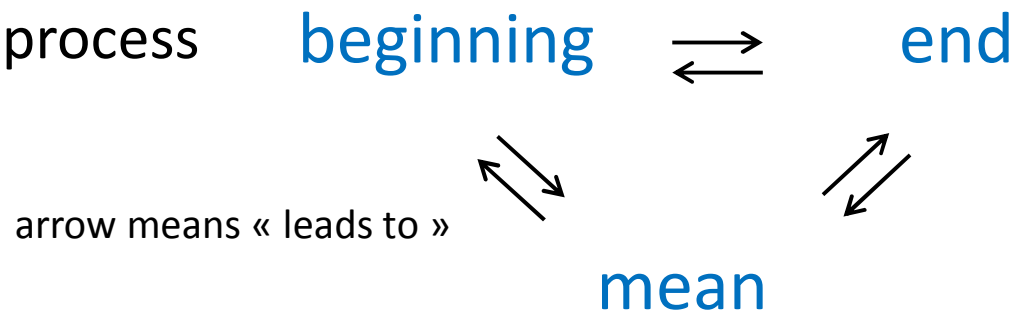
Newtonian Creativity

linear step-by-step process

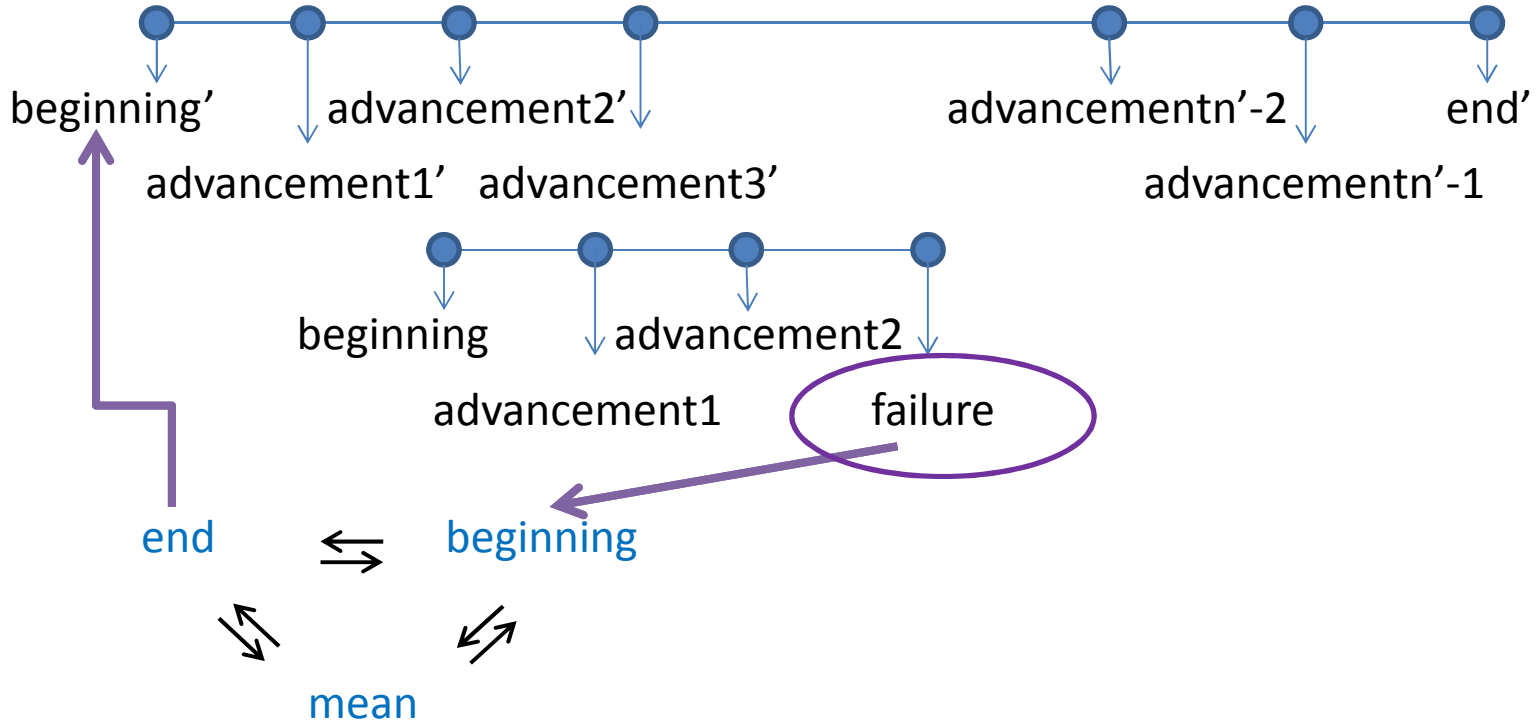


Cartesian Creativity

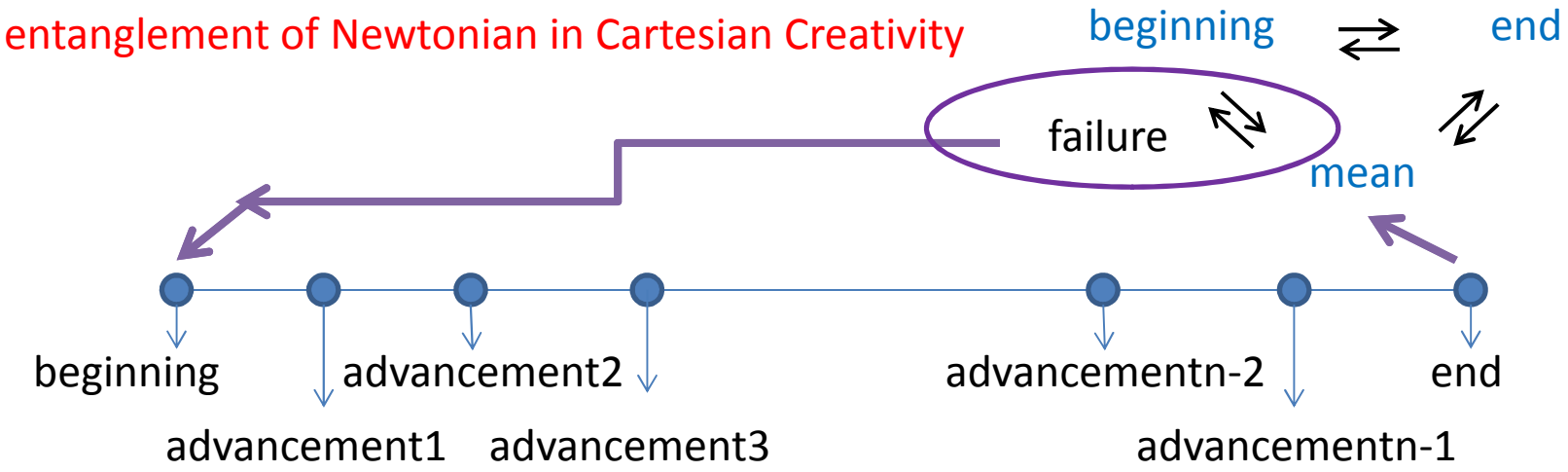
cyclic (recursive) process



entanglement of Cartesian in Newtonian Creativity



entanglement of Newtonian in Cartesian Creativity



Adaptive & Cognitive

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2: IMS Lab, UMR 5218, ENSC/IPB, University of Bordeaux, France

Cognitive and adaptive needs

Territorial authorities need adaptive tools

- To facilitate everyday life (administrative acts)
- To increase perception of institutions efficiency
- To stimulate the inhabitants and enterprises interests
- To improve local coresponsability and capabilities on SD targets

Studies and projects at Conseil Général de la Gironde

- Open Data projects (semantic and anticipation of needs)
- “On line” administrative acts for everyone
- Concrete projects like SD skill sharing systems

How to merge cognitive and adaptive technologies ?

- R&D anticipation (phd theses involvement)
- “intelligence” into institutional IT systems

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Benefits & Constraints

Benefits for institutional organizations

- Focusing on particular cases treatments
- Reduce delays for exchanges with everyone
- Problems anticipation

Constraints for institutional organizations

- Think “cognitive & adaptive” (DSI, all services)
- Work with new methods
- Include R&D activities (phd students) ? Why not…

Evolution seems to be mandatory

- Because of technologies (BYOD, internal process impacts)
- Because of inhabitants habits

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Questions / Answers

Thanks for your attention

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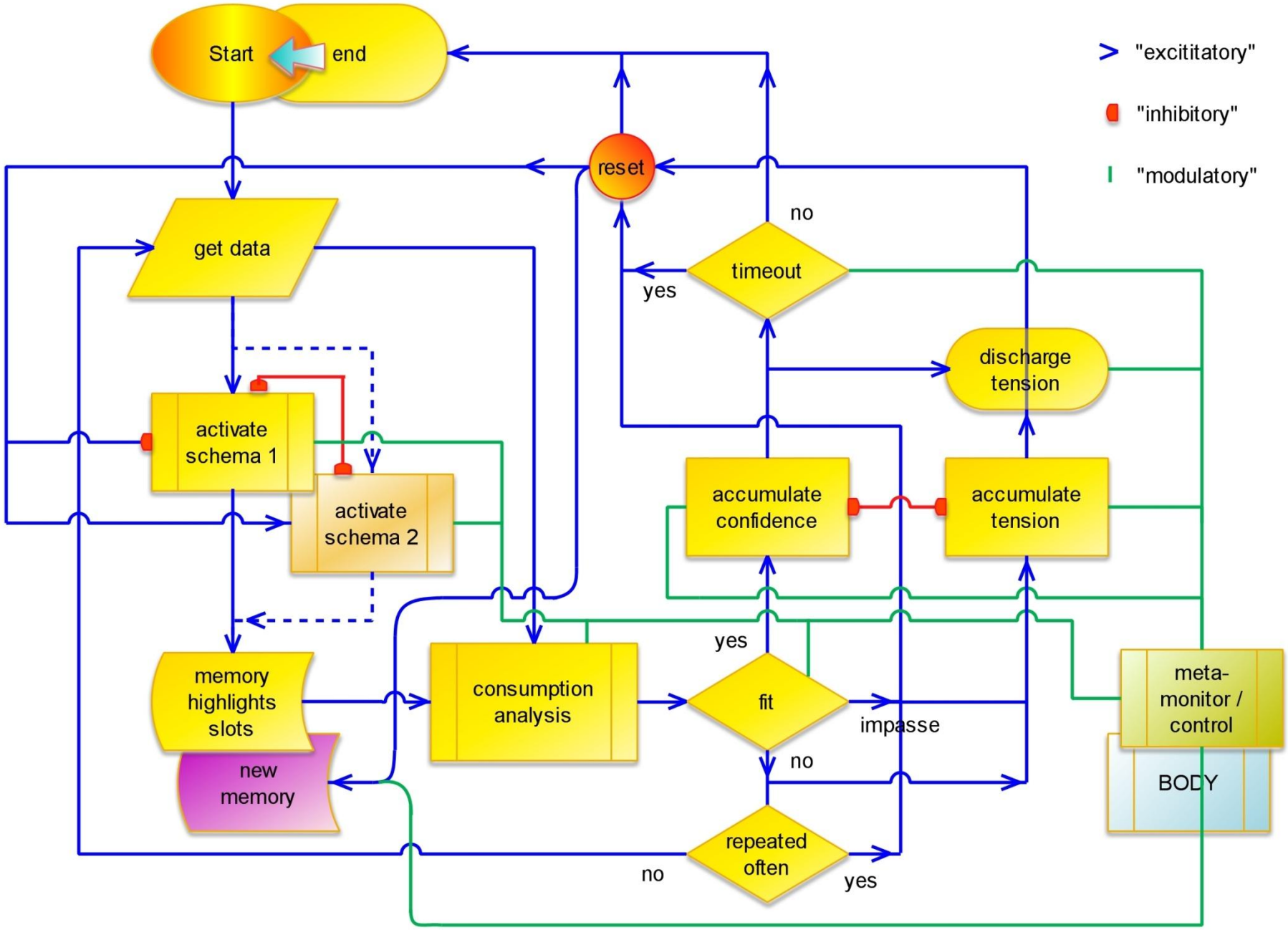
....anticipation,

- action / perception,
- evaluation,
- anticipation,...

The Ouroboros Model can be seen as continuation and extension of successful approach used by evolution, - with an added component of directionality focusing attention and memory to where the need arises


Start
end
"excititatory"
"inhibitory"
"modulatory"
reset
get data
timeout
no
yes
discharge tension
activate schema 1
activate schema 2
accumulate confidence
accumulate tension
yes
memory highlights slots
new memory
consumption analysis
fit
impasse
no
meta-monitor / control
BODY
repeated often
no
yes

Consciousness

Driven by the fundamental process of the consumption analysis all activity in the brain normally is organized in separated time steps along the cycle of expectation - action - evaluation - expectation... To the extent that every activated entity at a certain time is included, the total mental flow is funneled into one stream. A new quality arises as soon as information about the owner of the process is self-reflexively considered and an associated representation is embraced in the same process. When the actor itself is in the center of her attention, other content fades and loses importance and weight; this starts at looking at ones toes and continues to reflections on personal experiences and preferences and their reflection. Deeply anchored in our body this self-reflective and self-relevant nonlinear recursively looping activity in the brain is our personal experience including the feeling of "qualia".

Free Will

Every concept is absorbing its constituent features and simultaneously it imposes its structure on all ongoing (and future) brain activity; over longer time it undoubtedly leads to an adaption at the level of neurons and their connections. Just as physiological constraints, cultural ones exert their power biasing some alternatives. There can be no freedom without some order: this is relevant for the freedom to choose (otherwise) but also for the clear ownership of an action. Given the recursive and non-linear basic algorithm of the consumption analysis this cannot mean that actions might be predictable most of the time. Consumption analysis is above all an efficient means of implementing a veto; - general consistency is thereby assured. For humans, accepted freedom is as real as anything else influencing our actions; nothing is less and nothing is more than an idea.

Rational Thougth

Consistency is about the only criterion for judging the truth and value of primary sensory percepts and even more so for theories of highest complexity, abstraction and remoteness. In any rational and prudent action all available pertinent information has to be brought to bear. From previous experience the general relevance of building blocks and constraints can be derived as well as predictions of what feature to expect next. Mainly at short term, consumption analysis highlights the most urgent issues, directs attention and provides feedback. Unexpected interrupts and longer persisting emotions set and reset the active context and guide the subsequent steps. At some point every decision is between good and not so good. Emotions are thus no alternative but a prerequisite for truly rational thought.

Anticipation-Action-Perception-Evaluation-Anticipation-Action-Perception-Evaluation

Consumption Analysis

Any mental content is claimed to be organized into schemata. Concepts are frames, which are made up from and bind together their slots filled with appropriate features. The occurrence of any one feature activates (bottom up) associated frames, which in turn bias further affiliated features (top down). All activated features at a point in time are allotted to concepts. In an overall cyclic process the fit between all the occurring features and the available (relevant, i.e. to a certain extent activated) concepts is determined at short intervals. Starting from primitive percepts, concepts at one level form the features for the next higher level entities. The process of checking how well features (any building blocks) are "consumed" into higher-ranking concepts is termed consumption analysis.

Sleep & Dreams

Brains have to work efficiently. Whatever the actual building blocks are they certainly cannot always completely and unambiguously be assigned to higher-ranking concepts. In a trade-off between accuracy and speed the duration and resolution of the consumption analysis has to be optimized. Features will thus be left over or slots in the activated superior concepts will not be filled completely or undoubtedly. Over time inevitably "garbage" from unused concept-parts and their respective physical traces at neurons and around synapses will accumulate. It is asserted that one principal function of sleeping and dreaming is to get rid of such leavings and to "reset" and refresh the brain for a new day.

Emotions

All-embracing appraisal of the current state of affairs is a most fundamental task that every active and self-controlled system has to perform. At the most basic physiological level the situation with respect to nutrition has to be monitored, e.g. hunger or thirst are the output signal of a control loop when the actual status deviates from a set-point. Most emotions are claimed to be the direct or indirect output of the all-inclusive consumption analysis: the degree and manner of meeting expectation values determines the sign (pleasant / unpleasant); and the context is responsible for the experienced sentiment. Essential is, that, if everything works fine, all somehow active information is effectively included in the consumption analysis. Recursively once elicited, emotions set the stage for every subsequent action and bias and color all succeeding mental activity.

Grounding

Animal and human minds are incarnated; they are deeply embedded in the real world in several connected respects: we live and act in a three-dimensional world; anchored at moderate temperatures at the scales of meters, kilograms, and seconds; our brains are built from very many slow and wet neurons, their first purpose is to survive and proliferate. This lays the basis and sets the frame for all accessible sensations, conceivable primary concepts, imaginable abstractions and appraisals, everything subject to the boundary conditions of dynamic processes conforming to organizational and algorithmic structures and their possible implementations selected and tuned by evolution. No matter how abstract a thought, "good" was, first and foremost, what is beneficial for the body and its survival. Especially for humans, on top of the biological grounding comes the cultural one.