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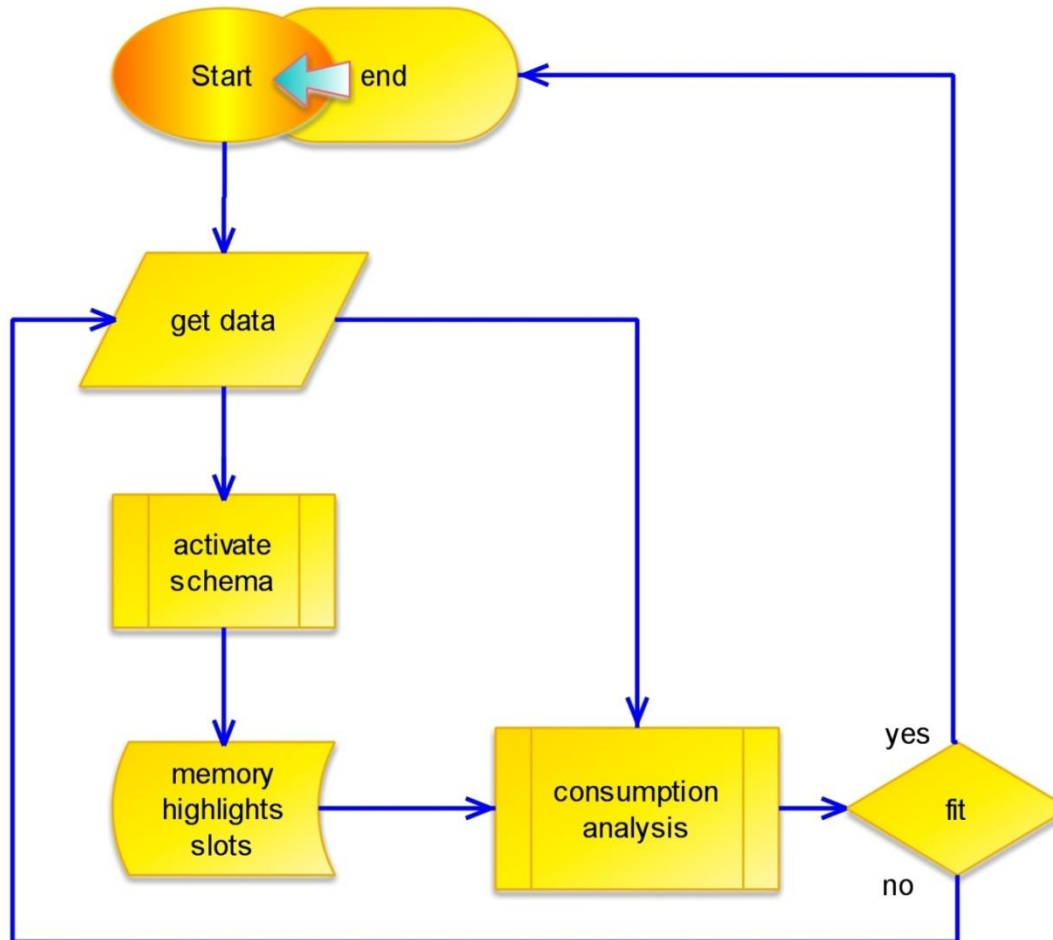
# **Anticipation as the central element for the working of individual minds and whole societies**

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## Overview of the talk:

- Ouroboros Model
  - sober Motivation & background
  - General layout
  - Consumption Analysis
  - Concept Formation
- Attention as focused **anticipation**
- Emotion as evaluated **anticipation**
- Problem Solving using the past to anticipate the **future**
- **Envisioning the future relies on schemata from the past**  
(old chunks in new arrangements & relations)
- *Example:* communication as dynamically shared and updated **anticipations**
- *Example:* Justice shows importance of wide-ranging **consistency**
- Shedding light on questions of a „Discipline of Anticipation“
- Future

**active !**



## Basic Loop Structure of the Ouroboros Model

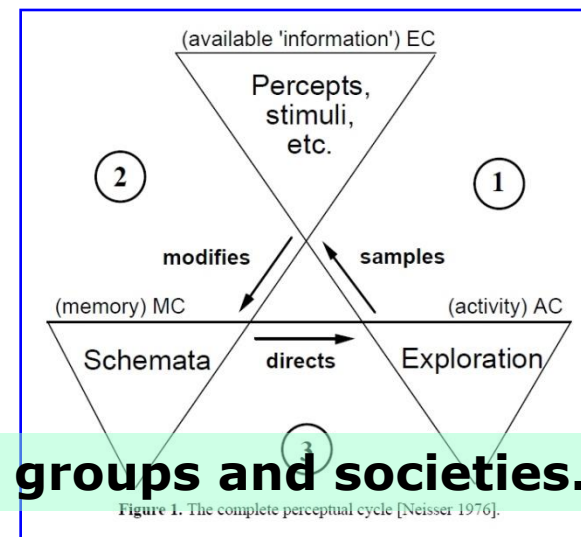
Thomsen, K. The Ouroboros Model in the light of venerable criteria.  
Neurocomputing 74, 121-128, 2010.

# The Ourobors Model, Main Features, I

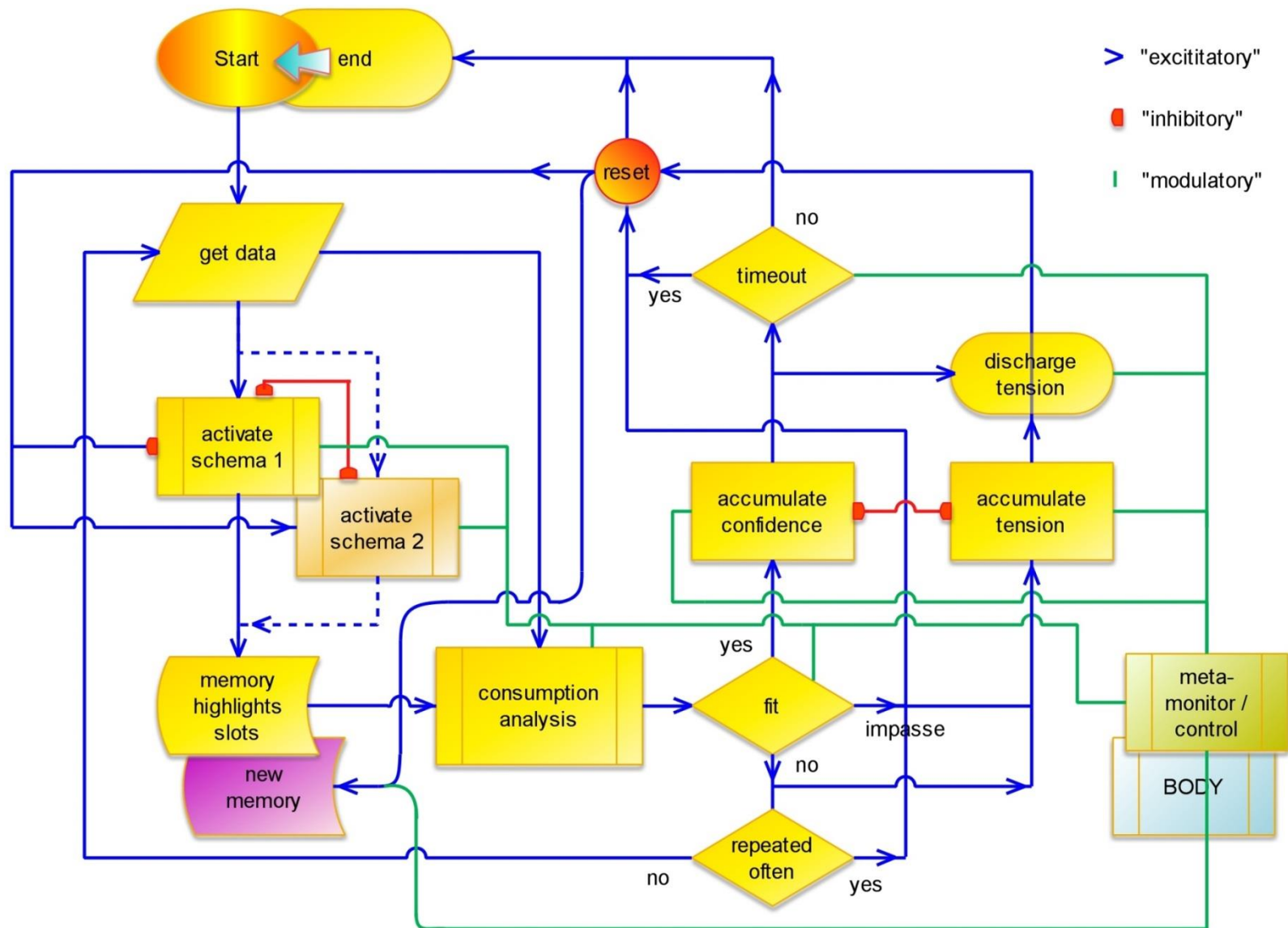
The Ouroboros Model proposes a dynamic and self-organizing cognitive architecture with the backbone of one fundamental recursive algorithm in the form of an extended action / perception cycle :

....anticipation,

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



Not restricted to a single brain but applicable to groups and societies..



Loop augmented with mechanisms for flexible schema selection and the recording of likely useful new memories including self monitoring by keeping track of the current performance

# The Ouroboros Model, Main Features, II

- All concepts are stored in (non-strict hierarchy of) **SCHEMATA**, i.e., frames.. with features linked together
- Activation of any one feature biases associated ones, i.e. provokes expectations
- A monitoring loop "**CONSUMPTION ANALYSIS**" checks the fulfillment of these expectations
- Expectations can be violated, met, exceeded; feedback = **EMOTIONS**
- Feedback directs Flow of Activity

Representations are being built up

### 3 Regimes, i.e. Outcomes of the Consumption Analysis:

- **Everything fits ( $\Rightarrow$  *new/strengthened entry*)**
- **A good portion of all (relevant) activity can be satisfactorily “consumed”**
- **Nothing fits ( $\Rightarrow$  *new memory entry*)**

„attentive“

„attentive“

In addition are associations and categorizations gradually distilled from the statistics of co-occurrences (e.g. abstract concepts, similar to evolution, e.g. of apriori, novel categories can develop as “buds”),

„pre-attentive“

all of this similar for diverse levels of abstraction,  
and crossing levels like in person centered approach

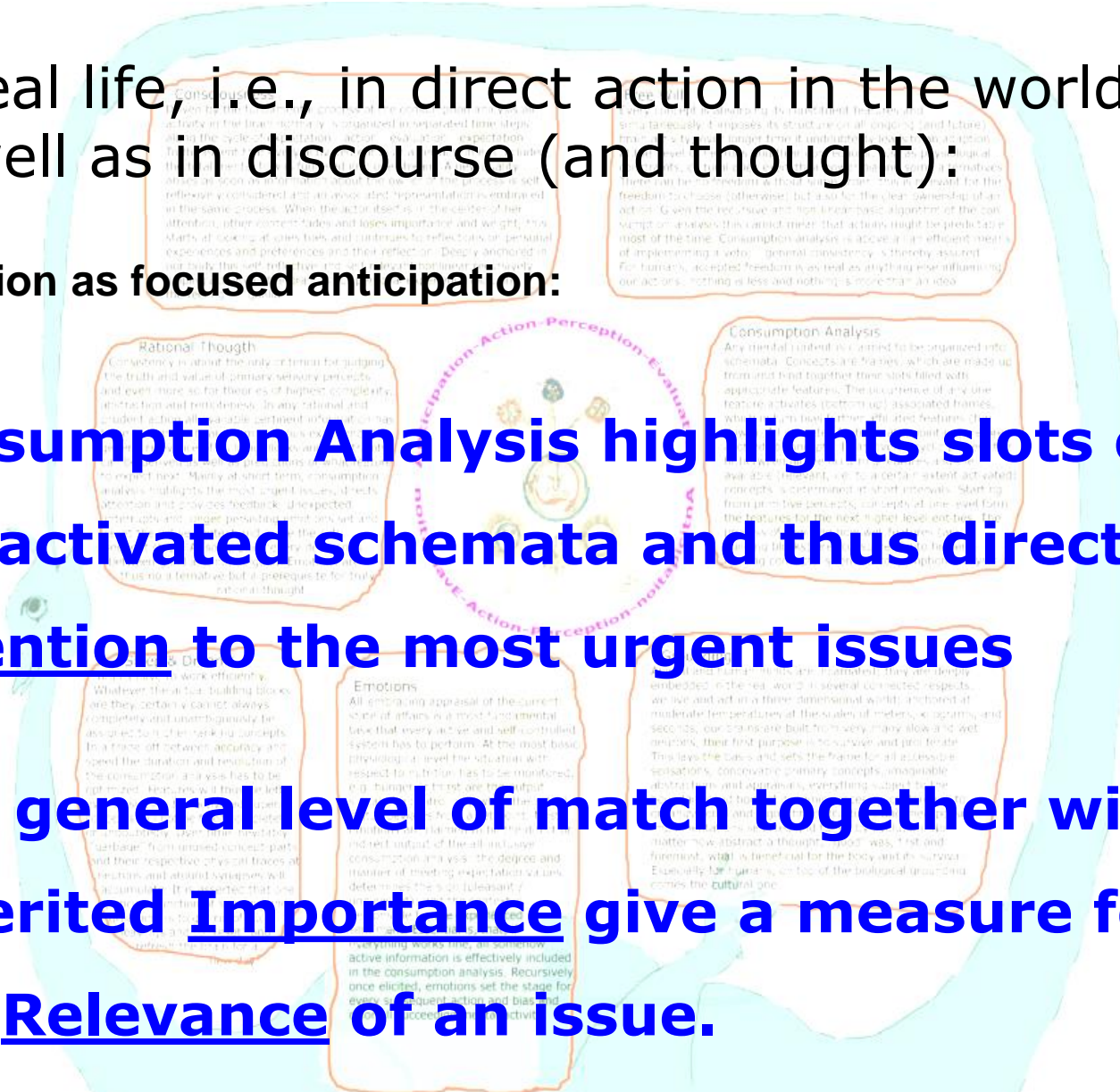


In real life, i.e., in direct action in the world, as well as in discourse (and thought):

Attention as focused anticipation:

**Consumption Analysis highlights slots of the activated schemata and thus directs Attention to the most urgent issues**

**The general level of match together with inherited Importance give a measure for the Relevance of an issue.**





Consciousness

derived from evaluation

To the extent that every activated entity of a certain kind in the total field of law is furnished info. one stream. When arises as soon as information about the owner of the pre-reflective is considered and an answer that representation in the same process. When the actor itself is in the center of attention, other entities fades and loses importance and

ling in anyt

looping and in the brain, social personal experience in the feeling of "qualia"

[illegible][illegible]

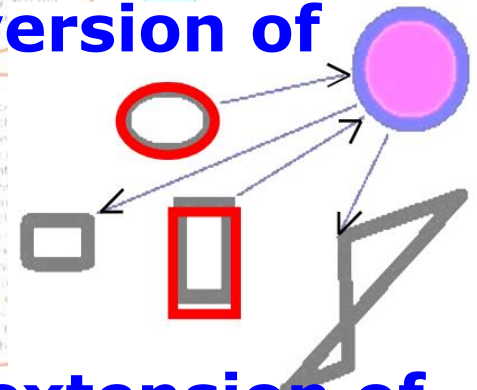
the goodness of  
the coin, a necessary  
behavior!

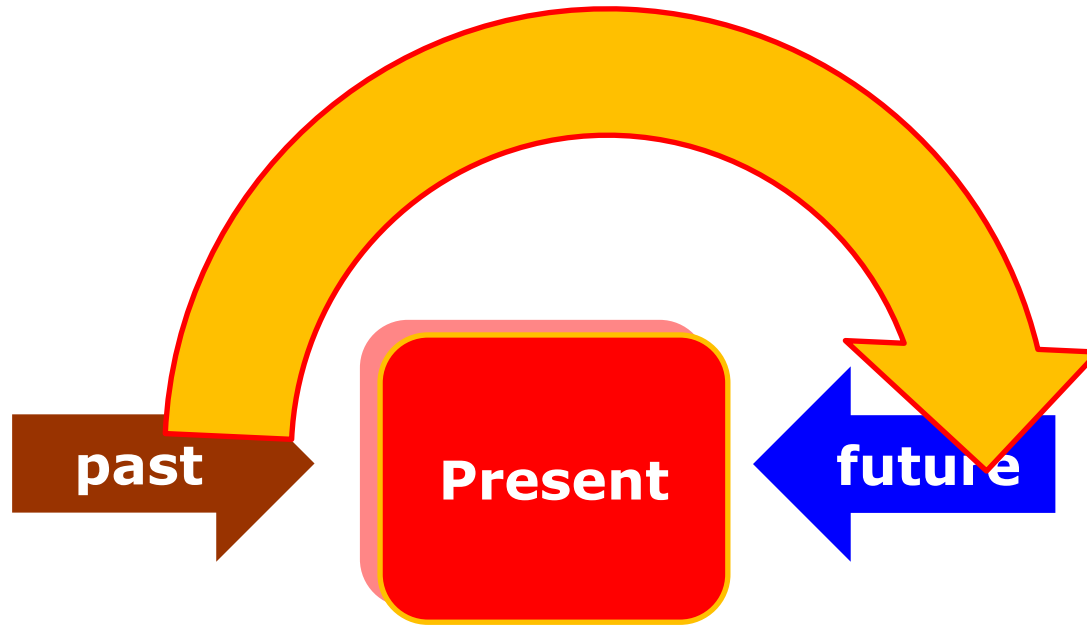
## Problem Solving:

**The Algorithm underlying the Ouroboros Model can be seen as a specific version of pattern matching and constraint satisfaction.**

**It can also be understood as an extension of production systems, any feature can serve as a starting point for activating a schema.**

**Combining this way prior Knowledge with new data yields Bayesian Performance.**



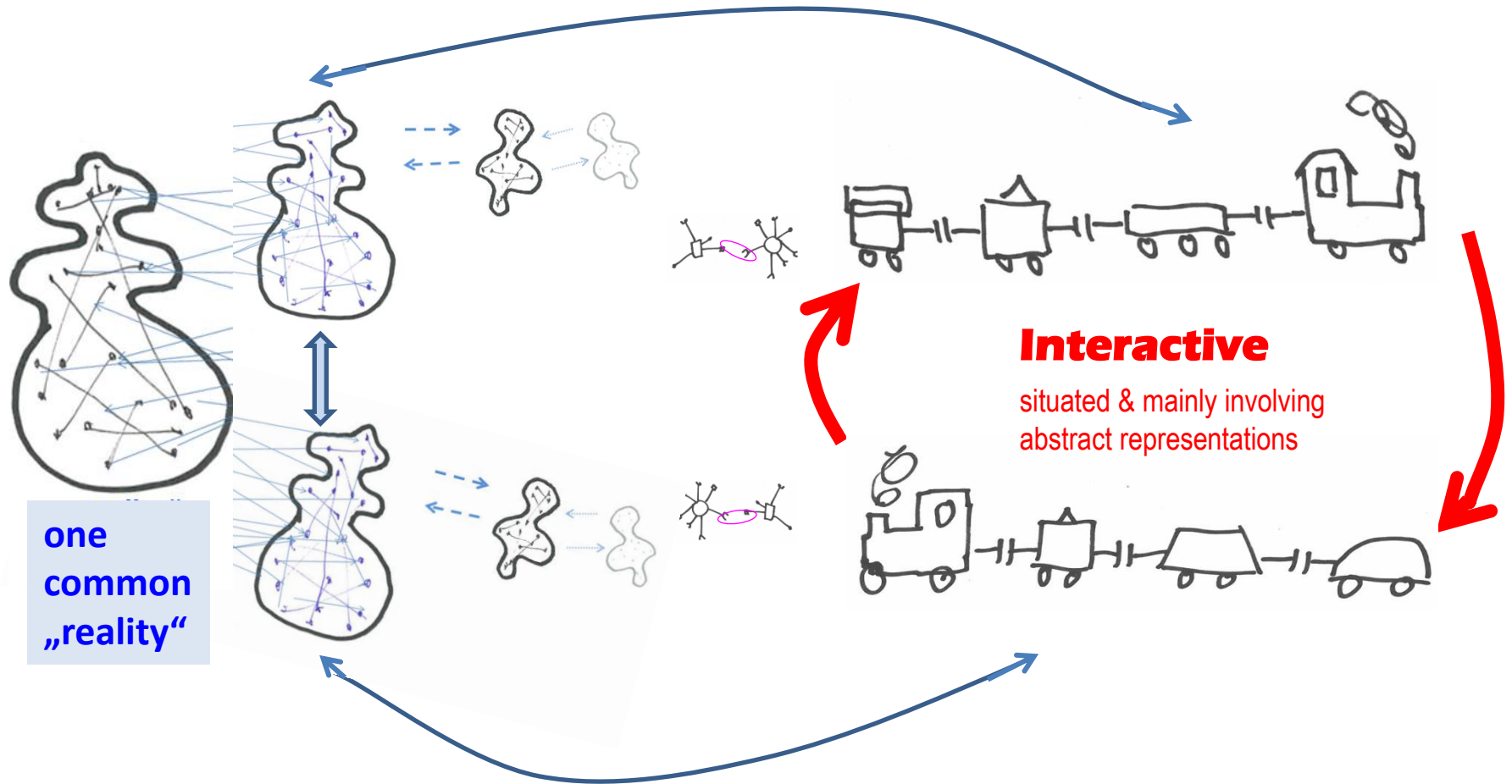


„use the past  
to understand  
the present“

„use the future  
to understand  
the present“

**use the past to anticipate the future  
and the whole picture to act in the present**

## Example, Communication:



**All discourse takes place in nested loops and relies on some shared rules, it cannot work without a minimum of common reference (and grounding), *one has to respect a minimum of convention to tell anything however new***



## Example, Justice:

**The Ouroboros Model sees justice as an abstraction from repeated occasions where human actions effecting other humans give the good feeling of a well-balanced exchange, relations and (social) structures**

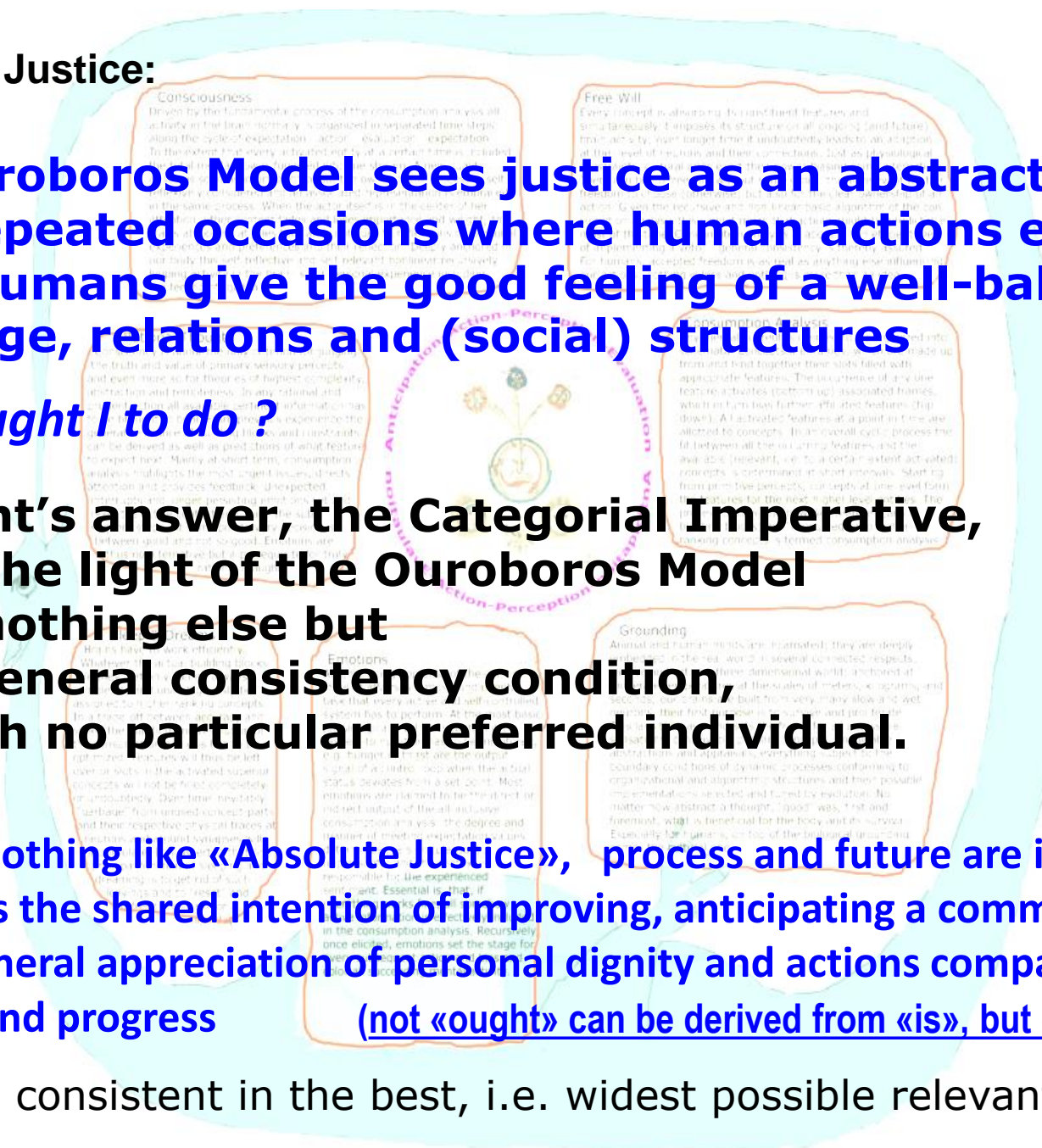
***What ought I to do?***

**Kant's answer, the Categorical Imperative, in the light of the Ouroboros Model is nothing else but a general consistency condition, with no particular preferred individual.**

**There is nothing like «Absolute Justice», process and future are important, decisive is the shared intention of improving, anticipating a common world with a general appreciation of personal dignity and actions compatible with survival and progress**

**(not «ought» can be derived from «is», but «ought not»)**

**Try to be consistent in the best, i.e. widest possible relevant frame...**



## Key questions: **Proposals from the Ouroboros Model**

- ✓ **What is anticipation?** Are anticipations imposed by the mind, ~~or~~ are they aspects of reality, ~~or~~ does anticipation involve a relation with both? **All of this**
- ✓ Are there different kinds of anticipation? **not really, only contents different**
- ✓ Which are the connections between the Discipline of Anticipation and Futures Studies? **All is built on / with material from the past**
- ✓ What are the qualitative and quantitative aspects of anticipations? Can anticipation be described mathematically? **Yes, to be worked out**
- ✓ Are there hierarchies of anticipations? **Yes, heritage from schemata, and / or hierarchy of values**
- ✓ What visual phenomena are associated with anticipation? magnification, scaling, zooming, expansion, contraction **All of these plus, e.g., priming**
- ✓ How do anticipations relate to emergence and the budding science of qualities?
- ✓ What are the social applications of anticipation?
- ✓ Can we relate anticipation to the science of sustainability and resilience?

**Work in progress, (positive) perspective is decisive !**



The potential mental processing power of an agent is ground-laid in **knowledge**, i.e. the number, complexity and elaboration of the concepts at her disposition

**Schemata**, their constituents and numbers of slots, the level of detail, the depth of hierarchies, degree of connection and interdependence of the building blocks, and the width, i.e., the extent of main schemata and their total coverage from the grounding level to the most abstract summits, determine what can be thought of efficiently

**quasi-global Adequacy, Coherence & Consistency** are crucial

**Sheer performance at a single point of time arises as a result of the optimum interplay between these structured data and the effective execution of all the described processing steps, in particular, self-referential consumption analysis (..anticipation..)**

**..there are constraints from implementational details**

**In the Ouroboros Model inherent meta-cognition effectively allocates resources (no exotic metaphysics needed). The Ouroboros Model is self-referentially consistent & autocatalytic, i.e., the proposed structures and effects are resulting from and also resulting in these very same concepts and consequences when implementing the proposed processes.**

**In particular, there is no problem with circularity:**

**The principal recursive algorithm progresses and evolves in time. When the snake bites its tail, the teeth and the tip of the tail belong to two distinctly different points in time. Starting with any basic set of expectations, discrepancies arising with actual input data can be determined and used for choosing and steering the following actions, including the establishment of revised structures & expectations / anticipations.**

**Widely separated questions can be tackled with just one approach; this is taken as one of the main arguments for the specific structures and processes of the Ouroboros Model.**



**Thank you for your attention !**

**and feel cordially invited to collaborations**

### 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 Thought

Consistency is about the only criterion for judging the truth and value of primary sensory percepts and therefore so is the need for the complexity of perception and reasoning. An individual has to be brought to bear from previous experience the general relevance 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.



### Consumption Analysis

Any mental content is claimed to be organized into schemata. Concepts are frames, which are made up from and bind together the slots filled with appropriate information. The structure of the feature space is organized into a hierarchy of levels, which in turn are filled with 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 brain is doing, as long as they certain functions are completely and unambiguously 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. Fear will leave 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.

### Emotion

All-embracing appraisal of the current state of affairs is not a mental 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. Humans or beasts have the output signal of a certain flow when a facial status deviates from the norm. More subtle emotions are connected to the 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 a world in several dimensions: space, time, and a multi-dimensional world and reduced to a single dimension 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 analyses, everything subject to the biological conditions of the mind. From the sensory input, organization and prioritization, and the resulting action, the first and most fundamental evaluation is: how good is the 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.