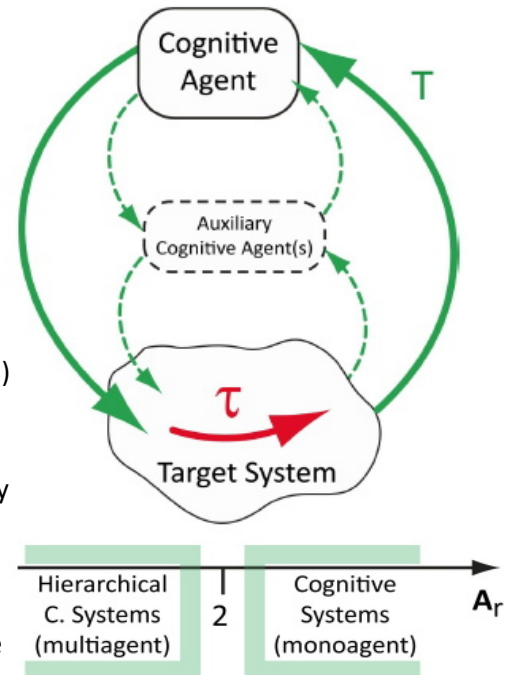




Cognition – The Art of Control - and related concepts (agility, hierarchy, autonomy, coordination)

- Control is a dynamic process that attempts to drive changes towards specific goals. Two classes of cognitive strategies may basically be defined. In the real, living beings as well as sophisticated machines typically make use of such strategies.
- The first class of strategies relates to cases where actions are “one-way”, where goals can be successfully reached without any consideration of real, intermediary effects of these strategies. When feasible in practice, this approach is favored.
- The second class addresses more difficult cases, when unforeseen errors and disturbances occur, requiring adaptive (in the broad sense) control actions. Here dynamic considerations dictate the selection of one subclass of strategies, among three possible choices:
 - Full power; “on-off”, or “bang-bang” control. The perception of any deviation of the path to the goal, leads to full blown corrective action.
 - Adaptive; “feedback” control. The current state of the matter is continuously monitored, including the effect of previous corrective actions, and this appropriately modulates corrective actions.



This is the core of classic control theories and somewhat extends the capabilities of a single controller (or agent) when the previous subclass fails.

- Hierarchical; “cascade” control. Unfortunately, it is often the case that the agent cannot ensure a satisfactory control on his own, even with most sophisticated adaptive strategies. A collective approach must then be envisioned. A certain autonomy can be granted to an auxiliary, more specialized system; or reciprocally, in agreement with an auxiliary, more general system to overview the context and circumstances of the task, a certain coordination can be ensured.
- In all cases, control implies cognition, and a certain tropism to a future goal, i.e. more or less implicitly time, and the imaginary.. The imaginary has no limit, yet it is important to know that for control, for changing the real, the laws of physics cannot be escaped.
- Thus for a concrete case, it is not an arbitrary decision (e.g. of a purely political, moral, or wishful nature) but the laws of the real that dictate which subclasses are applicable in practice, and which not. And fortunately, experience and scientific evidence provide a simple criterion, time-related, to guide the selection of these precious control strategies.
- The key criterion is the relative agility of the controller (the agent in control) versus the system to be controlled. The agility is here the speed to react, the inverse of the time to react. For a simple, full power approach to have a chance to succeed, a fast agility is necessary on the control side (relative agility higher than twenty). In the opposite case, for a comparatively slow control system (relative agility smaller than two), a hierarchical approach is required, implying notably some autonomy of the subsystems, for managing their necessary, fast actions.

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