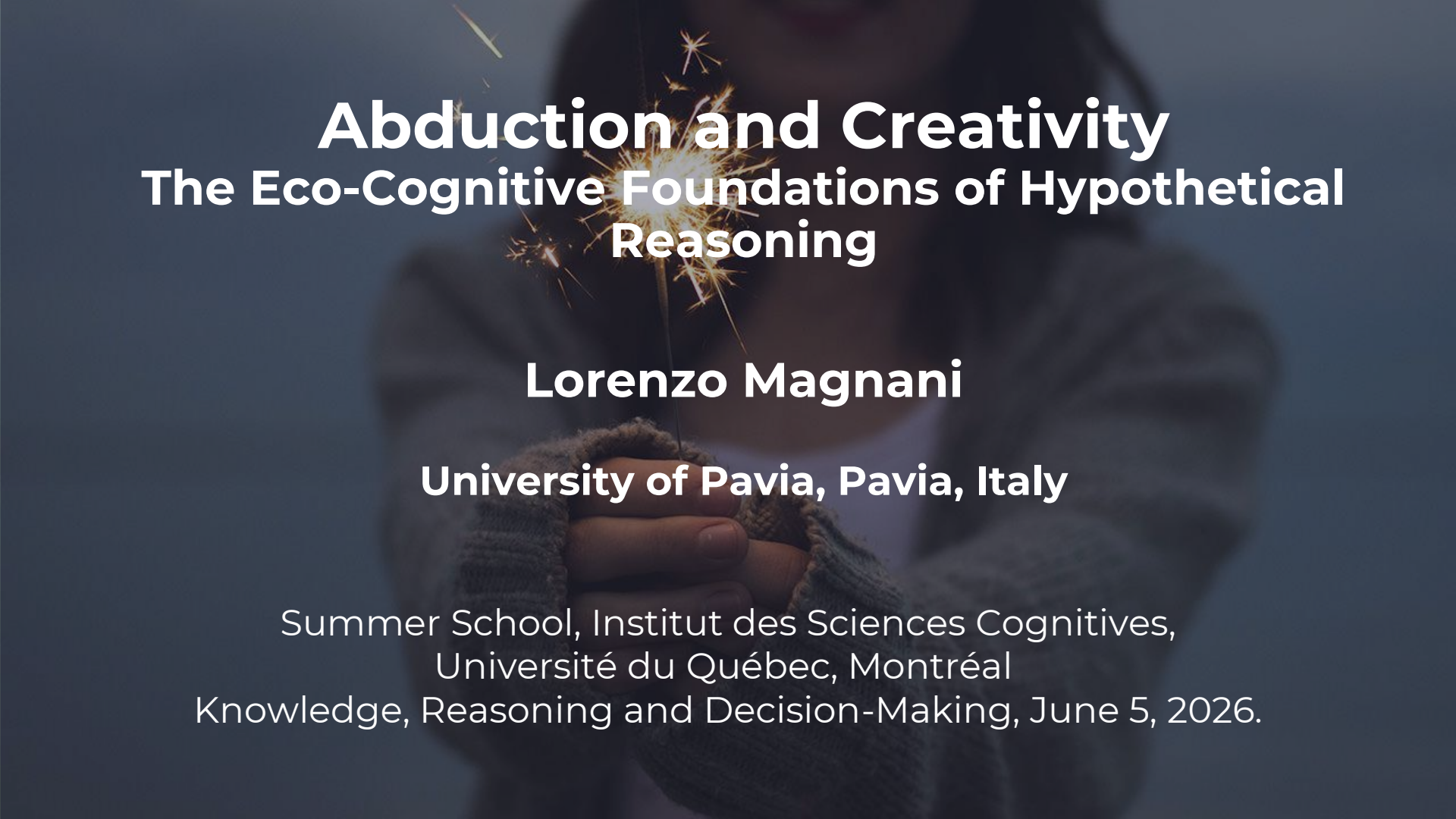

Abduction and Creativity
The Eco-Cognitive Foundations of Hypothetical Reasoning

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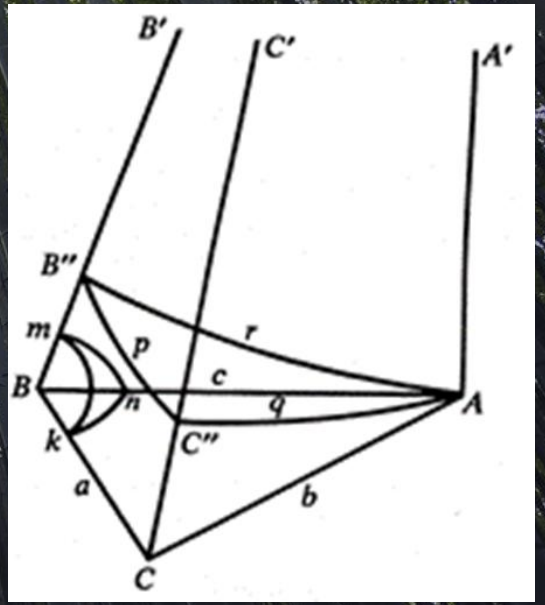
INFERENCE

Peirce stated that all thinking is in signs, and signs can be icons, indices, or symbols. Moreover, all **inference** is a form of sign activity, where the word sign includes “feeling, image, conception, and other representation” (*CP* 5.283), and, in Kantian words, all synthetic forms of cognition. That is, a considerable part of the thinking activity is **model-based**. Of course model-based reasoning acquires its peculiar creative relevance when embedded in abductive processes

ABDUCTION
REASONING TO HYPOTHESES

SENTENTIAL

MODEL-BASED

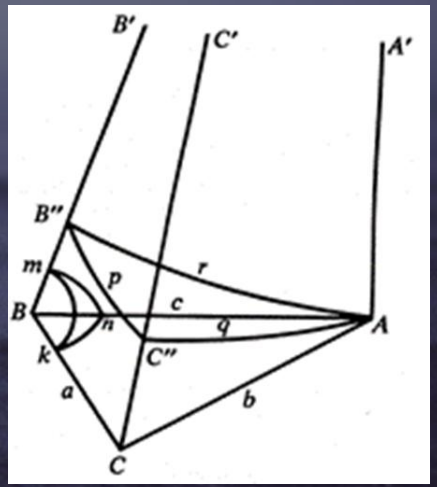


MODEL-BASED COG

Simulative reasoning
Analogy
Visual-iconic reasoning
Spatial thinking
Thought experiment
Perception, sense activitie
Undubitable)

MANIPULATIVE ABDUCTION

THINKING THROUGH DOING



CONTRUALS

DEDUCTION AS ECO-COGNITIVE IMMUNIZATION

A deduction (συλλογισμὸς) is a discourse (λόγος) in which, certain things having been supposed, something different from the things supposed results of necessity because these things are so. By "because these things are so", I mean "resulting through them," and by "resulting through them" I mean "needing no further term from outside (ἔξωθεν) in order for the necessity to come about" [Aristotle, 1989, A1 24, 20-25, p. 2].

1. In syllogistic theory local/environmental cognitive factors - external to the inferential process, regarding users/reasoners, are given up. Accordingly, a logic gets consequence right if it is right for sets of sentences taken without reference to **factors of speaker-use and other pragmatic considerations.**

2. Syllogism **is** considered as a context-free sequence of (on most accounts) three categorical propositions.

3. Aristotle himself expressly contends that the **necessity** of this kind of reasoning is related to the circumstance that "no further term from outside is needed", in sum syllogism is the fruit of a kind of **eco-cognitive immunization**.

SITUATEDNESS

TRUTH CREATIVITY

Abduction is related to local, pragmatic, user-sensitive factors associated to situatedness, that is to factors that are subject to the influence of strong eco-cognitive constraints and chances. Aristotle:

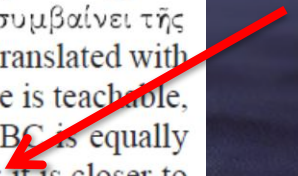
BEYOND SYLLOGISTIC DEDUCTION
SITUATEDNESS: TRUTH CREATIVITY

THE NEED OF "LEADING AWAY"

Eco-Cognitive Situatedness (Abduction)

Aristotle, Prior Analytics -> Naturalization of Logic

XXV. It is leading away (ἀπαγωγή) when it is clear (δῆλον) that the first term belongs to the middle and unclear (ἄδηλον) that the middle belongs to the third, though nevertheless equally convincing (πιστόν) as the conclusion, or more so; or, next, if the middles between the last term and the middle are few (ὀλίγα) (for in all these ways it happens that we are closer to scientific understanding (πάντως γάρ ἐγγύτερον εἶναι συμβαίνει τῆς ἐπιστήμης)). For example, let A be teachable, B stand for science [otherwise translated with "knowledge"], and C justice [otherwise translated with "virtue"]. That science is teachable, then, is obvious, but it is unclear whether virtue is a science. If, therefore, BC is equally convincing (πιστόν) as AC, or more so, it is a leading away (ἀπαγωγή) (for it is closer to scientific understanding (ἐγγύτερον γάρ του ἐπίστασθαι) because of taking something in addition, as we previously did not have scientific understanding (ἐπιστήμη) of AC). Or next, it is leading away (ἀπαγωγή) if the middle terms between B and C are few (ὀλίγα) (for in this way also it is closer to scientific understanding (εἰδέναι)). For instance, if D should be "to be squared," E stands for rectilinear figure, F stands for circle. If there should only be one middle term of E and F, to wit, for a rectilinear figure together with lunes to become equal to a circle, then it would be close to knowing (ἐγγύς ἂν εἴη τοῦ εἰδέναι). But when BC is not more convincing (πιστότερον) than AC and the middles are not few



because of taking something in addition

Eco-Cognitive Model of Abduction

Reasoning is something performed by cognitive systems. At a certain level of abstraction and as a first approximation, a cognitive system is a triple (*A, T, R*), in which *A* is an *agent*, *T* is a *cognitive target* of the agent, and *R* relates to the *cognitive resources* on which the agent can count in the course of trying to meet the target-information, time and computational capacity, to name the three most important. My agents are also *embodied distributed cognitive systems*: Cognition is embodied and the interactions between brains, bodies, and external environment are its central aspects. Cognition is occurring taking advantage of a constant exchange of information in a complex distributed system that crosses the boundary between humans, artifacts, and the surrounding environment, where also instinctual and unconscious abilities play an important role. This interplay is especially manifest and clear in various aspects of abductive cognition.

OPTIMIZATION OF ECO- COGNITIVE OPENNESS, SITUATEDNESS, CREATIVITY, AND CHANCE-CURATION

Thanks to my eco-cognitive model (EC-Model) of abduction I emphasized the crucial role played in abductive creative cognition by "optimization of eco-cognitive situatedness", which depicts a ne chance-curation: indeed, cogniti situatedness favor crea

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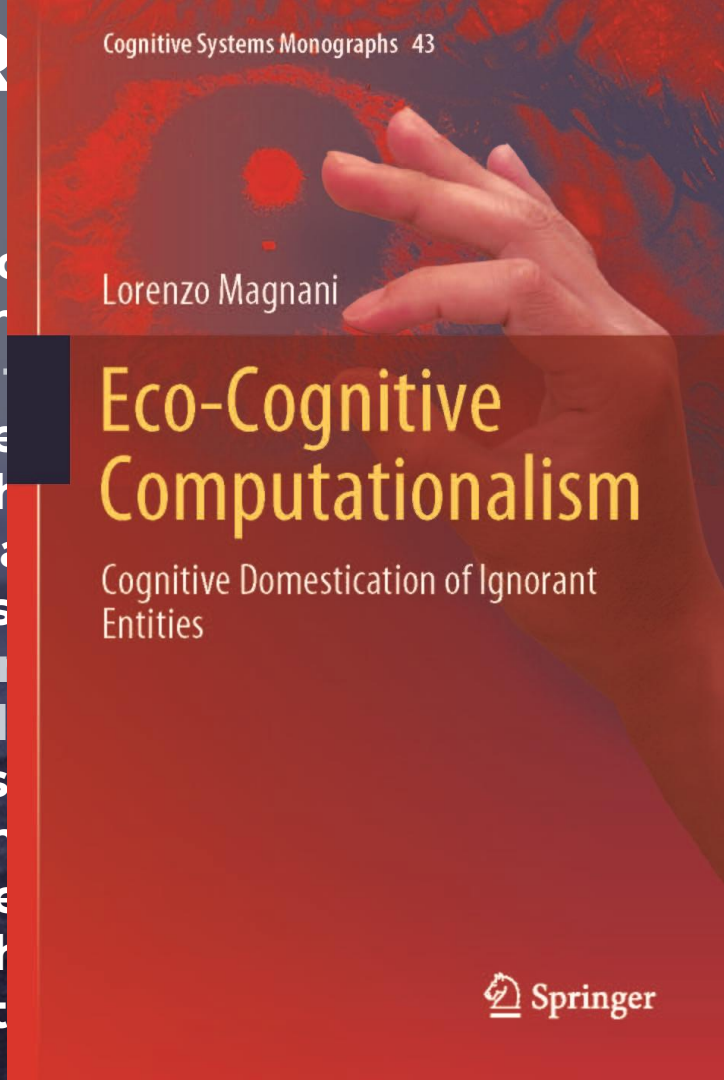
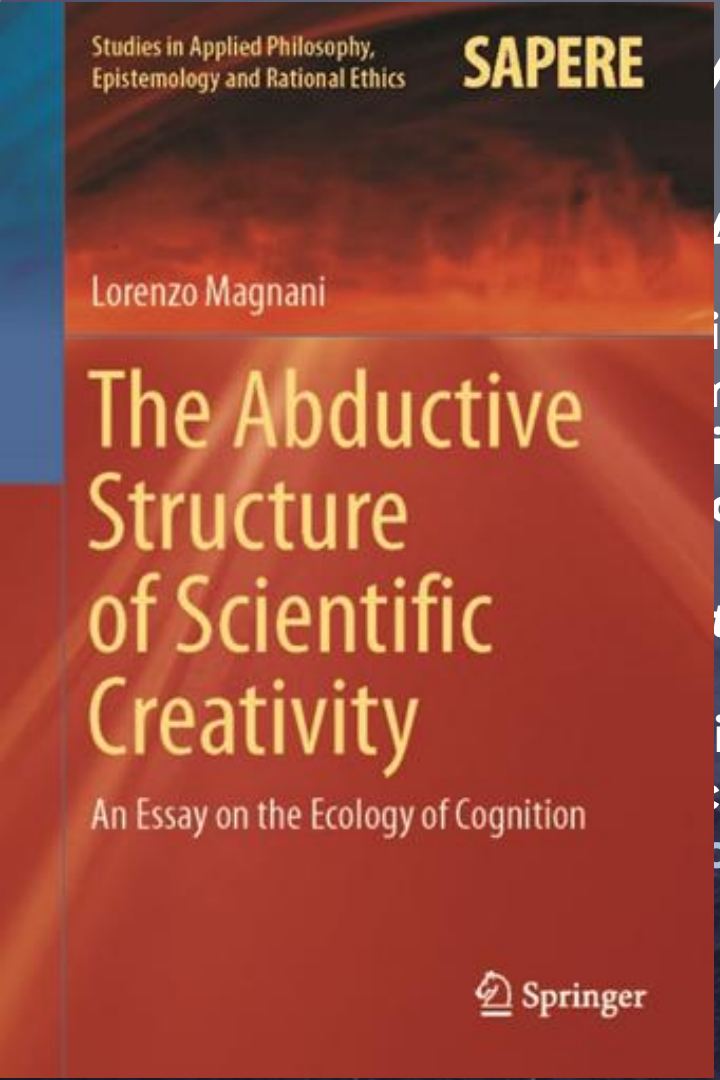
DISSIPATIVE BR
AND ECO-COGNITIVE

**The eco-cognitive "openness" is physically r
character of human brain as an open syster
with the environment (an "open" or "dissipa
is the continuous attempt to reach the e
environment in which it is embedded, and th
be switched off without producing severe da
means that we cannot even think of the s
physical essence which is its openness (ever
point of view an isolated brain is considered
"closed", it does not exist as a brain). Cons
contrary to the computational case, orderin
the outside thanks to what I have calle
domestication of ignorant entities" (cf. th
Cognitive Computationalism), but it is t
"internal" dynamical process of**

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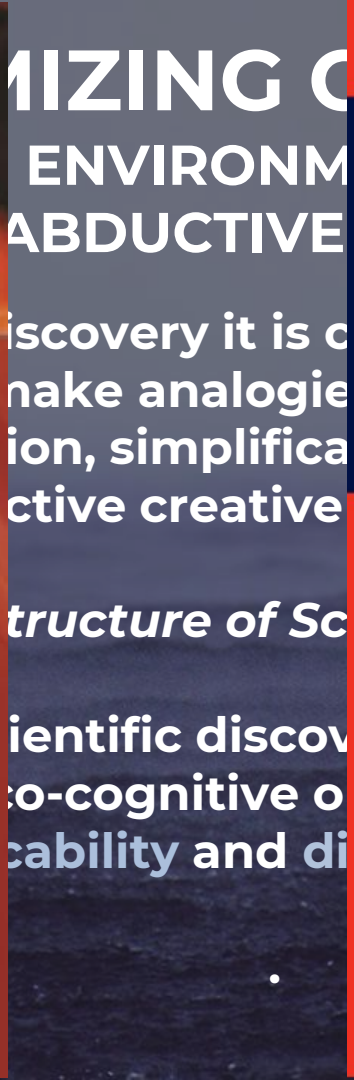
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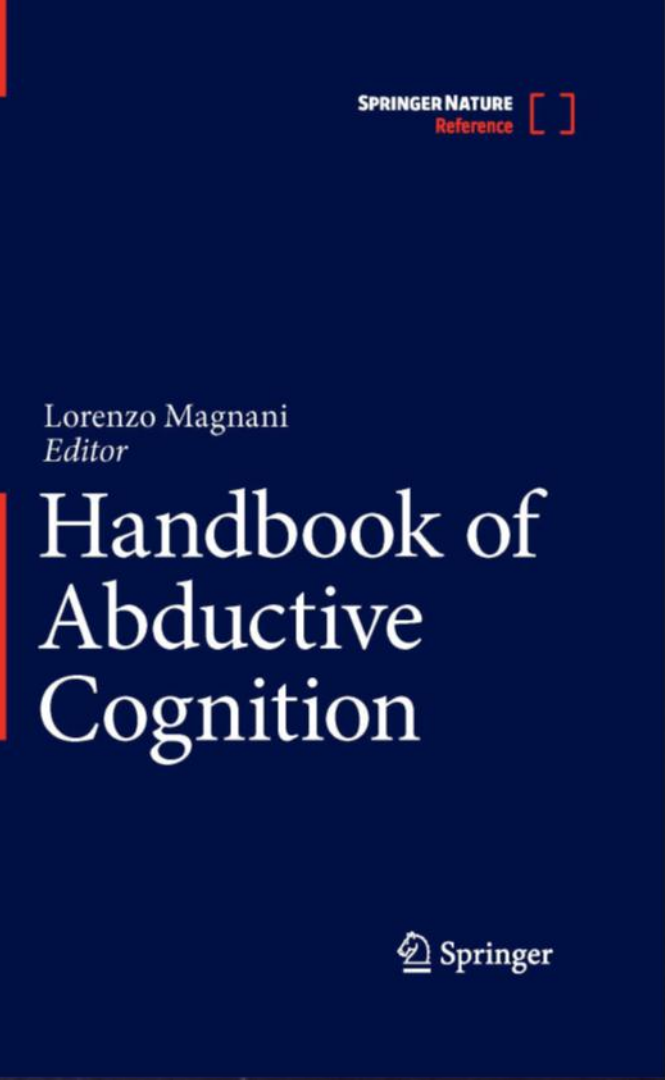
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IRRELEVANCE AND IMPLAUSIBILITY EXCULPATED

Relevance and plausibility in abductive reasoning have to be relativized and so the epistemologically embarrassing concepts of irrelevance and implausibility exculpated: in an eco-cognitive perspective they are not always offensive to reason

When Feyerabend in the famous *Against Method* emphasizes the role of what he calls "counterinduction", he is just presenting to us the complete unreasonable and unwarranted character of scientific discovery: the guessed hypothesis could be devoid of relevance to the problem in the framework of the upholders of the rival theory but also, even if not necessarily, in the perspective of the agent herself that – paradoxically – guessed the new "strange" hypothesis. Of course the relevance requirement is related to the current state of knowledge of both agonists. However, the new hypothesis can result "relevant" later on, for example when recognized as a genuine new discovery. To summarize, candidates to be solutions which seem weird – irrelevant – soon can become relevant if they are recognized as solutions. To make an example, the strange Cartesian hypothesis of a *plenum vortices* made of particles, destroyed by the Newtonian concept of action at distance, later on appeared more rational and fully compatible with the Einstenian framework.

LOCKED ABDUCTIVE STRATEGIES UNDERMINE THE MAXIMIZATION OF ECO-COGNITIVE OPENNESS

LOCKING STRATEGIES AFFECTS CREATIVITY

I contend that to reach rich selective or creative good abductive results efficient strategies have to be exploited, but it is als
environment characterized by what I have calle
cognitive situatedness, in which eco-cognitive ope
favor good creative and selective abduction reason
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ion a
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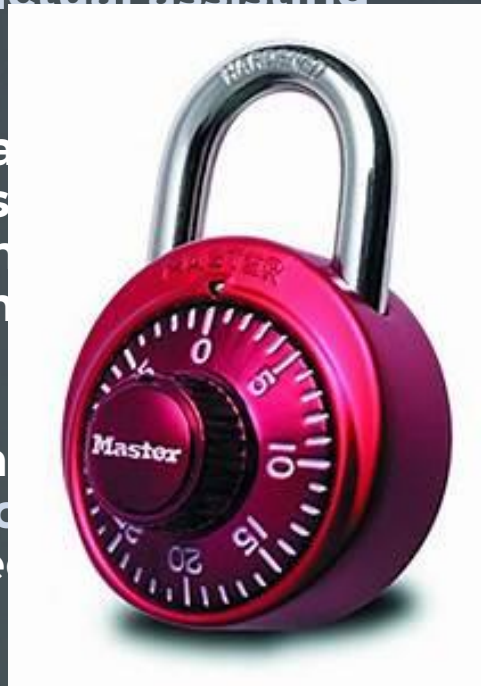
or ot
:.) to

LOCKED STRATEGIES IN DEEP LEARNING

During the game Go (and so in AphaGo/AlphaZero, the famous deep learning program) in between the two players surroundings are basically formed by board, stones, and possible artifactual assisting accessories.

The strategies which are activated are multiple, but a
because the components of each scenario are always
the number of present stones and their configuration
finite and unchanging framework (no new rules, no n
new boards, etc.)

These strategies lack the part which could refer to th
resorting to sources of information different from the c
the rigid given scenario, present in strategies relate
“creative” cognitive activities.



BIG DATA: HUGE BUT LOCKED

Researchers that study the epistemological, cognitive, legal, and ethical problems of big data in general and of the relationship between big data and machine learning (and deep learning) have stressed the need for a de-contextualization of facts from their context of origin to the aim of improving the quality of their eventual computational manipulation. Just to make an example, in the case of biological data “One of the main tasks of database curators is to decontextualize the data that are included in their resources, so that they can travel outside of their original production context and become available for integration with other datasets (thus forming a big data collection) [. . .] Despite constant advances, it is still impossible to automate the de-contextualization of most types of biologicaldata” [Leonelli, 2014, p. 4].

GOOD ECO-COGNITIVE OPENNESS

HUMANS AS COGNITIVE CREATIVE WARRIORS

Higher forms of human creative abductive intelligence are characterized by good "eco-cognitive openness and situatedness" . This refers to the fundamental nature of the human brain as an "open" or dissipative system, continuously coupled and attempting to achieve equilibrium with its environment. This constant interaction and openness to new, unconstrained information and experiences is the physical basis for human creativity and "unlocked" cognitive strategies. It allows for a rich, adaptive, and situated understanding of the world, going beyond pre-defined rules or data. Human cognitive agents have at their disposal a high level of eco-cognitive openness because they can: 1) integrate multimodal inputs, 2) integrate cultural knowledge, social interactions, and sensory information (visual, auditory, and tactile) to generate abductive hypotheses.

LLMs LOCKED STRATEGIES

Limited environmental interaction:

1. Limited environmental interaction cor
information (such as text corpora and
environ
inputs. A LLM, for example, does not acti
human might; rather, it creates text based
A
a result, its “mental processes” - so to sp
“locked” to a static

2. Limited manipulative cognition and ab
engage with or alter its surroundings, in
physical instruments to develop ideas (su
using the iterative input from outside m
produced alg

Even if it can generate a wide range of outputs, its “creativity” is shaped by the data it was trained on and the prompts it receives, which limits its ability to engage with the outside world in real-time or adapt to entirely new domains without retraining. Of course, the lack of “agency” is patent because GenAI automates content creation but lacks the intentionality or environmental interaction that characterizes human cognition. Its outputs are often evaluated for realism, coherence, or diversity rather than true novelty or contextual understanding.

3. Weak abductive reasoning: GenAI gene
image or a coherent story) in a manner similar to low-level human creative abduction.
Without “retraining” or fine-tuning, it cannot naturally integrate new environmental

CHANCE:
Y IN AN ECO-
SPECTIVE

the “moral” problem of
lity
human creativity
d focuses on how to enhance

pice (creative abduction),
mology, and cognitive science.
nd “social” virtues
re extremely important:
ty promotes human creativity,
kinds of knowledge
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Thanks

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