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Eusocial Complexity and Methodological Individualism

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- **Contextualize *complex methodological individualism* (CMI) in social sciences into a broader and more general scientific context including physical, biological and ethological sciences.**

Levels of reality

- In many domains: a *micro*-level and a *macro*-level.
- Micro-level : individual entities, elementary individual rules of behavior, short range local interactions.
- Macro-level : global structures describable with concepts whose content has nothing to do with micro entities.

- **Understand conceptually, causally, and mathematically, the relations between the two.**
- **No *semantic reductionism* applicable.**
- ***Antinomy***
  - **thesis of independence between levels**
  - **antithesis of the non-independence between levels.**

- **Example 1**: ***thermodynamics*.**
- **Macroscopic concepts : temperature T, pression P, volume V with no atomic or molecular content.**
- ***Critical* phenomena, *phase transitions* (water boils at the critical value of 100° under a pression of 1 bar).**

- **Micro-level interpretation of thermodynamical variables in terms of local behavior (vibrations) and local interactions (impacts, collisions) between molecules.**
- **Boltzmann (1871): reinterpretation of thermodynamics in terms of statistical physics.**

- **Example 2. Geometry of sand dunes and sandpiles.**
- **Micro elementary entities are grains of sand locally interacting by rolling.**
- **The macro geometric shape *emerges* from a fractal entanglement of myriads of micro *avalanches* of different scales.**

- ***Complex spontaneous order.***
- **The slope of the dune or pile is a *critical* value.**
- **The complex multiscale system of sand grains has the property of *stabilizing* on its critical state, while criticality seems to be the opposite of stability.**

- **Phenomenon of "self-organized criticality".**
- **Discovered in 1987 by**
  - **Per Bak,**
  - **Kurt Wiesenfeld,**
  - **Chao Tang (now Professor of biophysics at Beijing University).**

- **Relation of *emergence* between the two levels.**
- **The conceptual independence of the macro level must be *mathematically justified*.**
- ***Computational synthesis*.**
- **Viktor Vanberg on Hayek.**

From Physics to Politics

(P. Dumouchel & J-P.Dupuy, 1981)

- **Example 1.**
- **Neuro (micro)→Psycho (macro): Neural functional architectures.**
- **See my *Elements of Neurogeometry*: neuro-mathematical models of Phenomenology of perception and of laws of Gestalt theory.**
- **Revolutionary new techniques of *in vivo* optical imaging.**

- **Emergence is *proved* looking at huge systems of non-linear differential equations expressing how neurons fire and emit spikes.**
- **Neural networks go back to 1940-1950: J. von Neumann, N. Wiener, W. McCulloch, W. Pitts.**

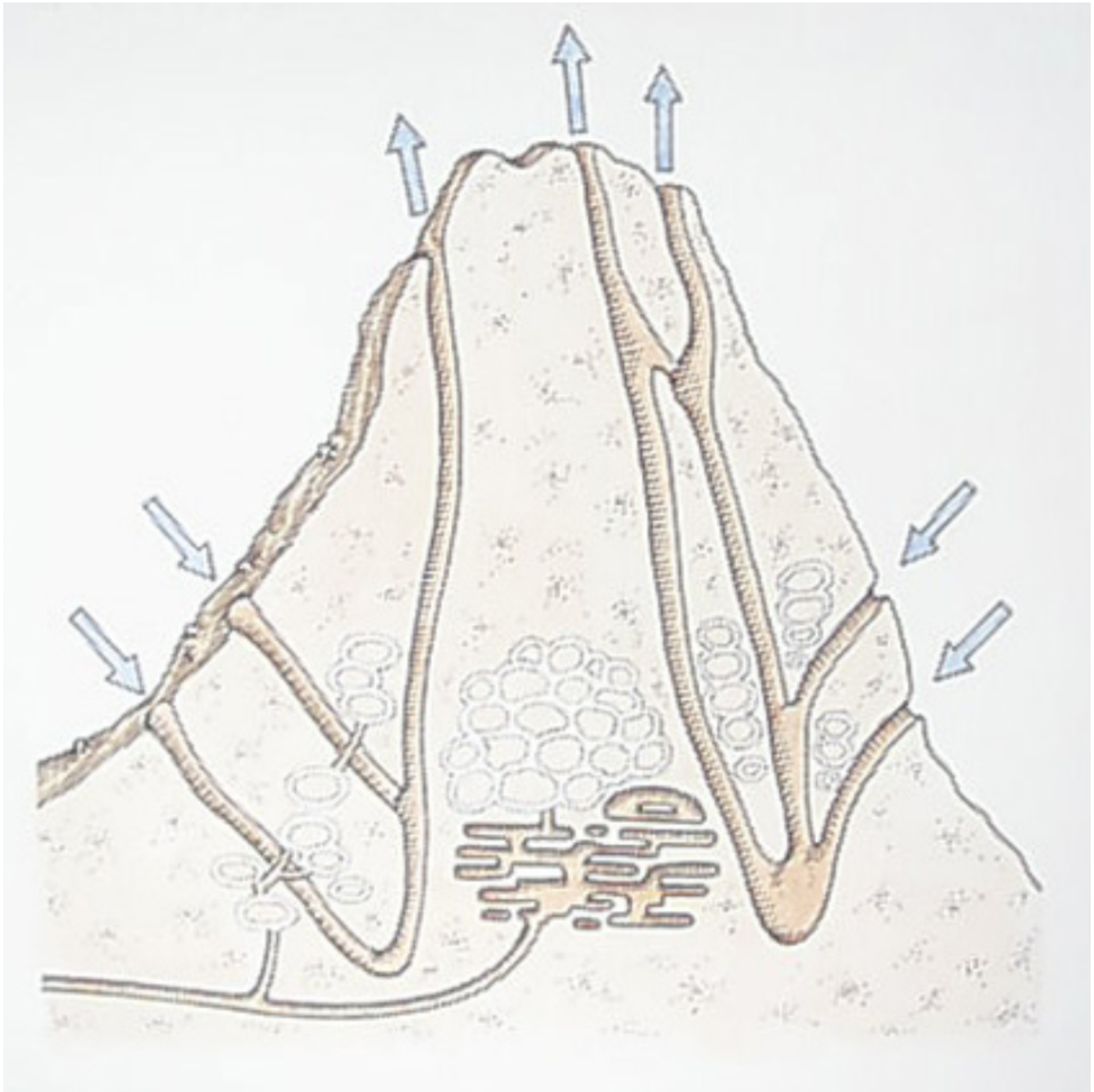
- **Great precursor: Hayek in *The Sensory Order*.**
- **Acknowledged by G.Edelman (Nobel 1972), J.Fuster.**
- **See B. Caldwell, B. Smith, and F. Di Iorio.**
- ***The Sensory Order After 25 Years* is very akin to the contemporary concept of functional architecture.**

- **Example 2. Ethology.**
- **Multi-agent collective, distributed, and decentralized intelligence as a new paradigm for solving problems that individual agents are unable to solve.**
- **"Swarm intelligence", "distributed artificial intelligence", "ant colony optimization algorithms", etc.**

- **The collective intelligence is *incommensurable* with the individual intelligences.**
- **It *emerges* from their *global cooperation.***

- **Social insects: bee hives, wasp and ant nests, termite mounds.**
- **Social insects are considered since Aristotle as "political animals" (zoôn politikon) because *they cooperate to produce public goods*.**

- **Global architectures - "architectures without architects":**
  - **honeycombs with hexagonal tesselations,**
  - **immense mounds (extended up to ten kms at human scale) with pillars, external walls, galleries, cellars, channels, ridges, spiral conducts for ventilation and cooling, valves, brood chambers, etc.**



- ***Stigmergy*** **(1959), Pierre-Paul Grassé.**
- **Key concept of theories of swarm intelligence.**
- **A spontaneous emergence of coherent activity builds gradually, without any centralized planning and control, seemingly intelligent structures.**

- **Mathematical models are highly non trivial.**
- **(In contrast with the physical examples) strong *top-down* "imerging" causality upon the micro individuals.**

- **Eusociality** (1966, S. Batra): the highest level of organization of animal sociality.

- **Cognitive VS Eusocial complexification**

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  - ***"vertical" cognitive complexification*** **of the individual intelligences;**
  - ***"horizontal" eusocial complexification*** **leading to a "swarm intelligence" with two levels micro-macro.**

Mandeville's *Fable*

- ***The Fable of the Bees*** **of Bernard Mandeville (1670-1733) which, according to Hayek, "asked the right question".**
- **His apologue "*The Grumbling Hive: or, Knaves Turn'd Honest*" (1705), later called "*The Fable of the Bees; or, Private Vices, Publick Benefits*" (1714, 1723, 1729) had a major impact.**

- **A hive functions properly only when each individual bee, each with its very limited representational ressources,**
  - **does what it has to do in the framework of division of labor and**
  - **follows strict rules without bothering about collective advantages or disadvantages.**

- ***Interactions*** **of bees according to efficient selected *rules*, and not altruist virtues, produce collective wealth, benefits and public goods.**

- **Social value of selfish behavior in complex societies of Aristotelian "political animals".**

- **Conflict between the new born economical liberalism and the traditional christian ethics.**
- **Already in Blaise Pascal and Pierre Nicole (1625-1695, a Jansenist of Port-Royal).**
- **Society should be based upon "enlighted" self-love rather than upon charity.**

- **Mandeville inspired Adam Smith : an "invisible hand" ensures the "Wealth of Nations".**
- **This first formulation of self-organized spontaneous order operates as a "*ruse of reason*".**

- **Pierre Nicole : to make selfish interests cooperate in an *unintended* way to the benefit of public welfare is "the secret plan of God", "the hidden order of God".**

- **"There is no need of virtuous individuals to get a virtuous society".**

- **Selfish individuals are able, without knowing it and willing it, to do "an admirable thing".**

- **The more they aim at their own interests, the more they become interdependent, and the more they compose "a superior reality *able to transcend each bet*."**

- **Hayek on Mandeville**. ***Lecture on a master mind: Dr Bernard Mandeville*** **(1966).**

- **The *moral* evaluation of Mandeville is irrelevant.**

- **The "harmony" of interests is neither natural (phusis and cosmos) nor artificial (nomos and taxis):it is an emerging *unintended* spontaneous order.**

Eusociality in humans

- ***Homo Sapiens*** **is a primate situated on the "vertical" axis of cognitive evolution.**
- **But the cultural evolution (great civilizations) introduced an *"horizontal" eusocial-like complexity.***
- **This was alien to the evolutive line of *Homo Sapiens*. Whence the "asocial sociality" (Kant).**

- **"Eusocial-like" in a *cultural* (not biological) sense.**
- **E. Wilson : *The Social Conquest of Earth: humans are eusocial apes* (2012)**
- **Debate with: Gintis, Hamilton, Dawkins (author of *The Selfish Gene*, 1976).**
- ***Mismatch* of the eusocial cultural evolution with the primate brain.**

- **Our biological inheritance is not adapted to *global* social coordination.**
- **Modern open societies require eusocial impersonal, "objective", and external rules.**
- **But what type of rules?**

- **Hobbes' solution (1588-1679) in the *Leviathan* : coercitive centralized power constraining individuals to cooperate.**

Spontaneous order and CMI

- **Hayek : alternative conception of *spontaneous order*.**
- **Pluralism and individual freedom are not sources of disorder, anarchy and social struggle but, on the contrary, lead to higher forms of organization.**

- **For CMI, global macro rules have to secure the *institutions* enabling the emergence of an open and evolutive spontaneous order.**
- **But, the possibility of emergence *must* be *proved* using mathematical modelling and computational synthesis.**

- **Problem : *the rationality of selfish agents seems to be incompatible with global coordination*.**
- **<u>But</u>, positive results on the emergence of cooperation in evolutionary game theory.**
- **R.Axelrod, K.Sigmund, M.Nowak, R.May (see my "Formal models of the 'invisible hand'. From Hayek to evolutionary game theory").**

J.Ober and Greek poleis

- Thucydides' *History of the Peloponnesian War.* Chapter III, the discourse of Corinthians at Sparta.
- Liberalism has been invented by Athenians.
- Josiah Ober (Stanford) : "*The Rise and Fall of Classical Greece*" (2015).

- **Ancient Greece "efflorescence", its "miracle", its exceptional wealth, its creation of public goods by a *rational* collective cooperation.**
- **The Greek system of poleis (1035 city-states) : an acentered network of competitive-cooperative units → a political "horizontal" solution to the *enigma of large scale global cooperation*.**

- "Good rules" : Solon, Clisthene, Pericles.
- They elicited in the new middle classes an avalanche of unique competences and specializations, concurrential exchanges, technological innovations, investments and risk taking.

- **Ober refers to works of institutional economy :**
  - **Douglas North (Washington Univ., Nobel),**
  - **Daron Aemoglu (MIT),**
  - **James Robinson (Harvard)),**
  - **game models of cooperative choice (Axelrod).**

- **Ober does not use the term "eusociality", but the analogy with social insects as political animals in Aristotle's sense is the core of his investigation.**
- **He refers to the work of Deborah Gordon (Stanford) on ants.**
- **Gordon focuses on the very sophisticated exchanges of *information* between individuals.**

- **Even if he does not refer explicitely to Hayek, Ober describes in some sense the ecosystem of Greek poleis as a sort of first catallaxy in human history.**
- **This ancient catallaxy is founded on an eusocial complexity.**