TOWARDS SUSTAINABLE FUTURE

BY TRANSITION TO THE NEXT LEVEL CIVILIZATION

how many moments left ?

COUNTDOWN'S ON

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Symposium "The Future of Life and the Future of Our Civilisation"
Frankfurt, 2-6 May 2005, http://archive.future25.org/Symposium05

Countdown agenda

1. Universal science of complexity

Unreduced solution to any *real* interaction problem

2. Life as unfolding interaction complexity

System evolution as step-wise complexity development

3. Transition to superior level of life *now*

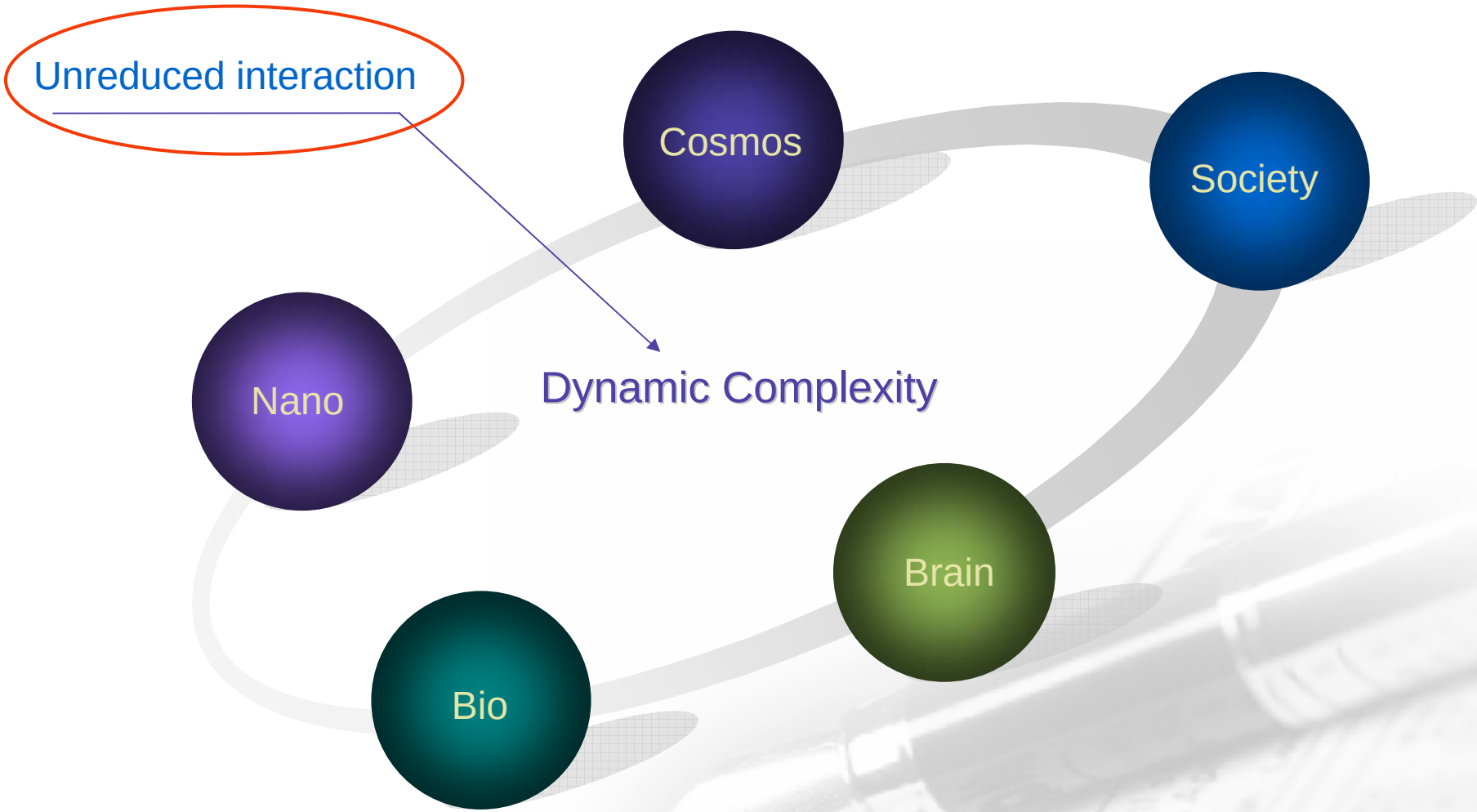
We *are* at the point of inevitable *complexity revolution*

4. Particular transition aspects

New knowledge, social structure, production, settlement

http://cogprints.org/4113/

Universal Science of Complexity



http://arxiv.org/find/quant-ph,gr-qc,physics/1/au:+Kirilyuk/0/1/0/all/0/1

Unreduced dynamic complexity

- Life/planet dynamics and evolution = unreduced interaction process
- Unreduced interaction analysis: permanent chaotic, fractally structured realisation change → universal dynamic complexity

  >> usual "science of complexity" (1 realisation, 0 complexity, no complexity definition)

- Classification of all dynamic regimes (more regular or chaotic) and transitions between them → what can ever happen/emerge
- Intrinsic chaos is inevitable in any real interaction (multivaluedness): unreduced dynamic complexity of life, brain, civilisation, etc.

  FRACTAL ⇓ FRACTAL

  Exponentially high efficiency → "magic" properties of all "living" systems

- Universal evolution/dynamics law: universal symmetry of complexity, total complexity conservation by its internal form transformation

  dynamic information → dynamic entropy

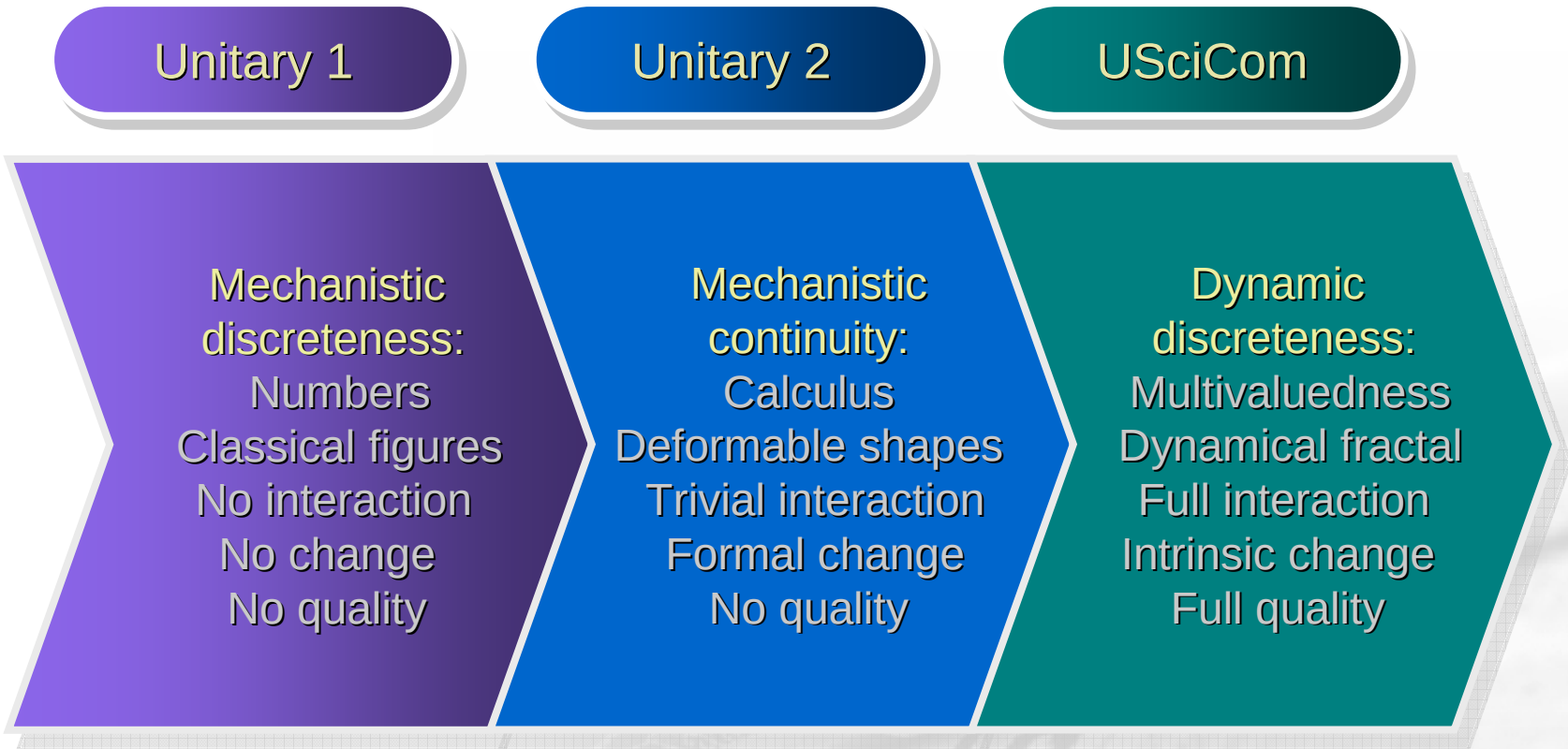
- Applications: http://arxiv.org/find/quant-ph,gr-qc,physics/1/au:+Kirilyuk/0/1/0/all/0/1

Science Progress Diagram

NEW MATHEMATICS OF COMPLEXITY

Unitary science: only one from many real system realisations

Universal Science of Complexity (USciCom): all system realisations



http://arxiv.org/abs/physics/9806002

Unreduced Interaction Dynamics

Arbitrary many-body interaction process:

$$\left\{\sum_{k=0}^{N}\left[h_k\left(q_k\right)+\sum_{l>k}^{N}V_{kl}\left(q_k,q_l\right)\right]\right\}\Psi\left(Q\right)=E\Psi\left(Q\right),\quad Q=\left(q_1,q_2,\ldots,q_N\right)$$

or

$$\left\{h_0\left(\xi\right)+\sum_{k=1}^{N}\left[h_k\left(q_k\right)+V_{0k}\left(\xi,q_k\right)\right]+\sum_{l>k}^{N}V_{kl}\left(q_k,q_l\right)\right\}\Psi\left(\xi,Q\right)=E\Psi\left(\xi,Q\right),\quad \xi\equiv q_0$$

The unreduced (nonperturbative) general solution is always *probabilistic* (phenomenon of *dynamic multivaluedness* = *intrinsic chaoticity*):

$$\rho\left(\xi,Q\right)=\sum_{r=1}^{N_{\Re}}{}^{\oplus}\,\rho_r\left(\xi,Q\right)$$

Dynamically determined probability

$$\alpha_r=\frac{N_r}{N_{\Re}},\qquad \sum_r\alpha_r=1$$

Unreduced Interaction Dynamics

Arbitrary interaction process in terms of (free) component eigenvalues:

$$h_0(\xi)\psi_n(\xi) + \sum_{n'} V_{nn'}(\xi)\psi_{n'}(\xi) = \eta_n \psi_n(\xi)$$

where the total system state-function is obtained as

$$\Psi(\xi, Q) = \sum_{n \equiv (n_1, n_2, \ldots, n_N)} \psi_n(q_0)\varphi_{1n_1}(q_1)\varphi_{2n_2}(q_2)\ldots\varphi_{Nn_N}(q_N) \equiv \sum_n \psi_n(\xi)\Phi_n(Q)$$

Usual perturbative approximations:

$$\left[h_0(\xi) + V_{nn}(\xi) + \tilde{V}_n(\xi)\right]\psi_n(\xi) = \eta_n\psi_n(\xi), \quad V_0(\xi) < \tilde{V}_n(\xi) < \sum_{n'} V_{nn'}(\xi)$$

Unreduced general solution of the same problem:

$$\rho(\xi,Q) \equiv \left|\Psi(\xi,Q)\right|^2 = \sum_{r=1}^{N_{\Re}} \oplus \rho_r(\xi,Q), \qquad \rho_r(\xi,Q) = \left|\Psi_r(\xi,Q)\right|^2$$

$$\Psi_r(\xi,Q) = \sum_i c_i^r \left[\Phi_0(Q)\psi_{0i}^r(\xi) + \sum_{n,i'} \frac{\Phi_n(Q)\psi_{ni'}^0(\xi) \int_{\Omega_\xi} d\xi' \psi_{ni'}^{0*}(\xi') V_{n0}(\xi') \psi_{0i}^r(\xi')}{\eta_i^r - \eta_{ni'}^0 - \varepsilon_{n0}} \right]$$

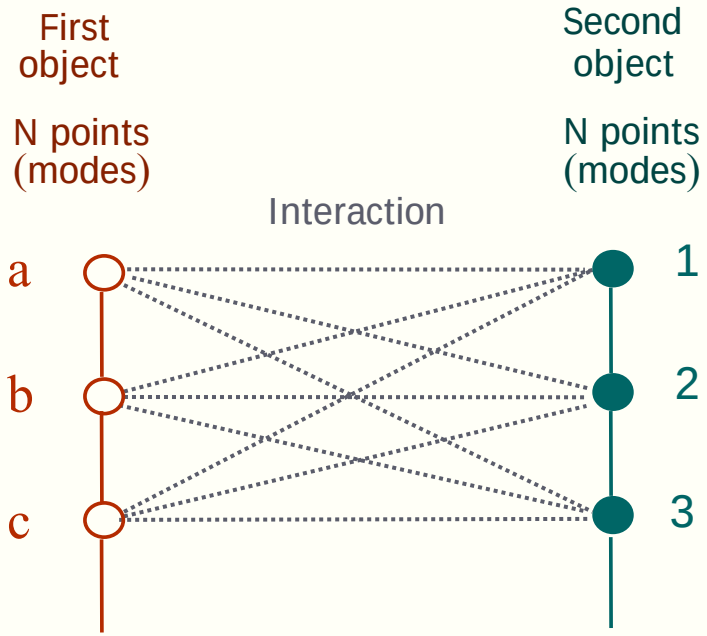
where $\{\psi_{0i}^r(\xi), \eta_i^r\}$ are eigen-solutions of the *effective* equation

$$h_0(\xi)\psi_0(\xi) + V_{\text{eff}}(\xi;\eta)\psi_0(\xi) = \eta\psi_0(\xi)$$

$$V_{\text{eff}}\left(\xi;\eta_i^r\right)\psi_{0i}^r(\xi) = V_{00}(\xi)\psi_{0i}^r(\xi) + \sum_{n,i'} \frac{V_{0n}(\xi)\psi_{ni'}^0(\xi) \int_{\Omega_\xi} d\xi' \psi_{ni'}^{0*}(\xi') V_{n0}(\xi') \psi_{0i}^r(\xi')}{\eta_i^r - \eta_{ni'}^0 - \varepsilon_{n0}}$$

Elementary length $\Delta x = \lambda = \Delta\eta_i^r$, time $\Delta t = \Delta x / v_0$, action $\Delta\mathcal{A} = V_{\text{eff}}\Delta t$

Unreduced Interaction: Dynamic Multivaluedness (Chaos)



(N × N) combinations
of mode entanglement
(a1,a2,a3,b1,b2,etc.)

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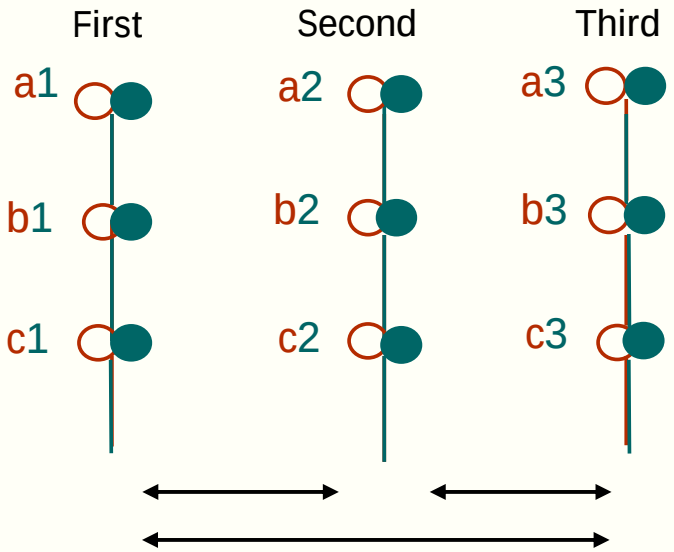
N-fold redundance

Dynamically redundant interaction result: incompatible system *realisations*



Permanent realisation change
in *causally (dynamically) random* order

Universal Regimes of Complex Dynamics

Two limiting regimes of complex dynamics:
multivalued self-organisation/SOC and *uniform (global) chaos*

Universal criterion of global (strong) chaos:

$$\kappa \equiv \frac{\Delta\eta_i}{\Delta\eta_n} = \frac{\omega_\xi}{\omega_Q} \simeq 1$$

or *resonance* of the main system motions

Criterion of quasi-regularity (self-organisation): $\kappa \ll 1$ (or $\kappa \gg 1$)

As network intensity grows one *cannot avoid resonance* ("jam"): $\kappa \sim 1$
and therefore *essential dynamic randomness becomes inevitable*

Highly complicated interaction networks cannot be close to regularity
Ordinary, unitary dynamic models and approaches are inapplicable

Let's transform the unitary approach *defect* ("insolubility")
into the unreduced, complex-dynamic operation *advantage* :
superior power and qualities

Large Interaction Network Properties

Huge efficiency growth of dynamically chaotic (*multivalued*) interaction:

Chaotic network efficiency is determined by the number of *all combinations of links*

$$N! \simeq \sqrt{2\pi N}(N/e)^N \sim N^N \propto C \text{ (unreduced dynamic complexity)}$$

where the number of links N is very large itself

Unitary (regular) dynamic efficiency grows only as N^β $(\beta \sim 1)$.

The huge advantage in efficiency expresses *intrinsic creativity/adaptability* of the unreduced complex dynamics obtained at the expense of its *chaoticity*

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LIFE, INTELLIGENCE, CONSCIOUSNESS, SUSTAINABILITY, ETC.

Particular aspects and applications

(1) Knowledge-based structure of advanced (intelligent) civilisation dynamics

(2) Holistic dynamics of intelligent communication network ("superbrain")
Complex-dynamic meaning of *true* intelligence/consciousness (physics/0409140)

(3) Intelligent network participants *automatically* become more intelligent
Ability to solve unreduced, complex-dynamic problems → *revolution of complexity*

(4) Universal symmetry/development of complexity: unified guiding principle
Transformation of *dynamic information* ("interaction potential") into *dynamic entropy*

Evolution as complexity development

- System evolution as a result of the symmetry of complexity:

  qualitative, irreversible, dynamically discrete (quantized) change (event): transformation of dynamic information, I, into dynamic entropy, S, while the sum, total complexity, $C = I + S$, remains unchanged:

  $$\Delta C = 0,\ \Delta S = -\Delta I = -\Delta \mathcal{A} > 0,$$

  where the extended, nonlinear action $\mathcal{A} = I$ is a unified measure of complexity-information, $|\Delta \mathcal{A}| \sim |V_{\text{eff}}|\Delta t$

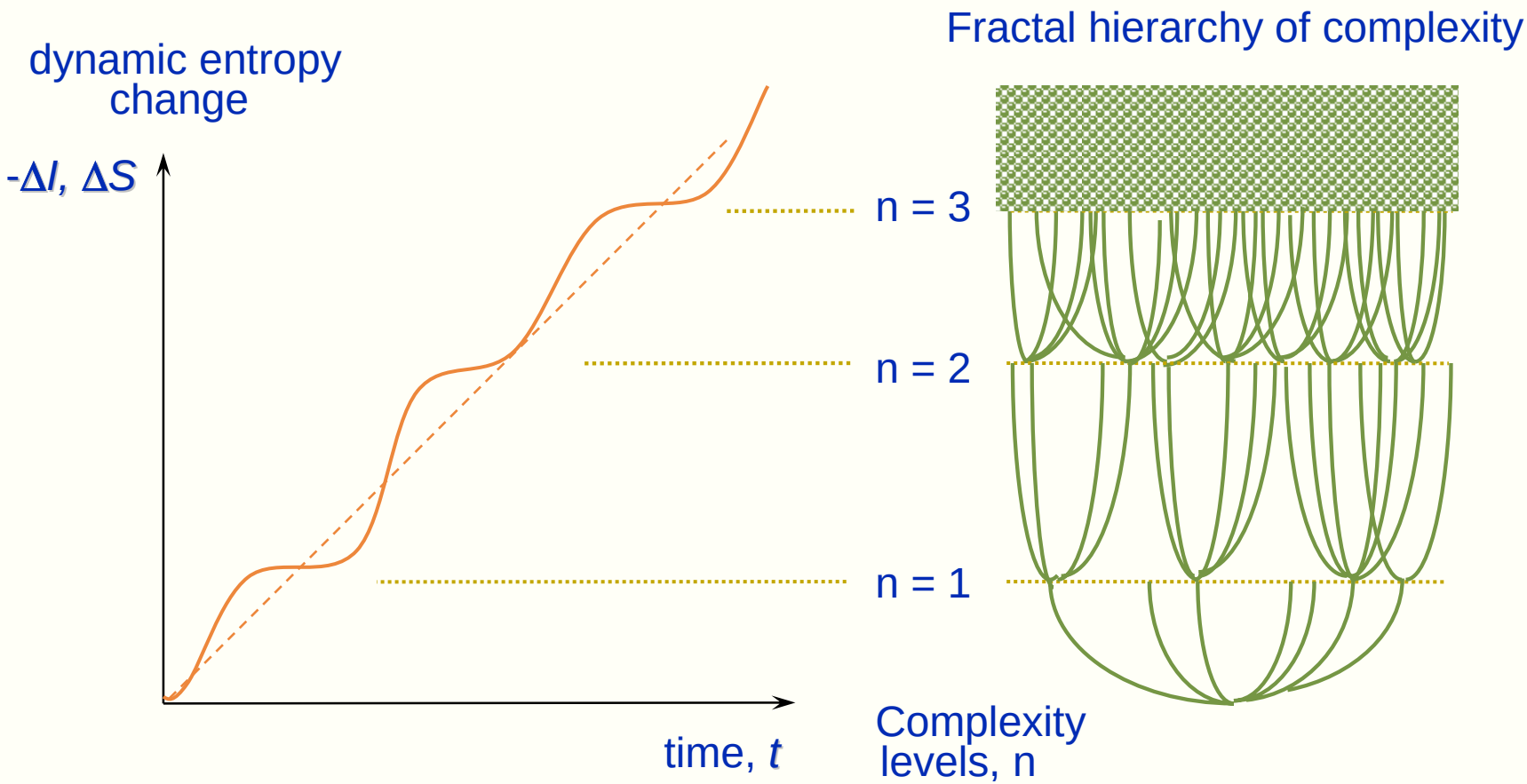
- Generalised Hamilton-Jacobi and Schrödinger equations:

$$\frac{\Delta \mathcal{A}}{\Delta t}\Big|_{x=\text{const}} + H\left(x, \frac{\Delta \mathcal{A}}{\Delta x}\Big|_{t=\text{const}}, t\right) = 0, \quad \hat{H}\left(x, \frac{\Delta}{\Delta x}\Big|_{t=\text{const}}\right)\Psi(x) = E\Psi(x)$$

- The universal meaning and dynamics of any system evolution, progress, and existence: complexity development as a result of the symmetry of complexity → sense of history, life, etc.

Progress by complexity steps

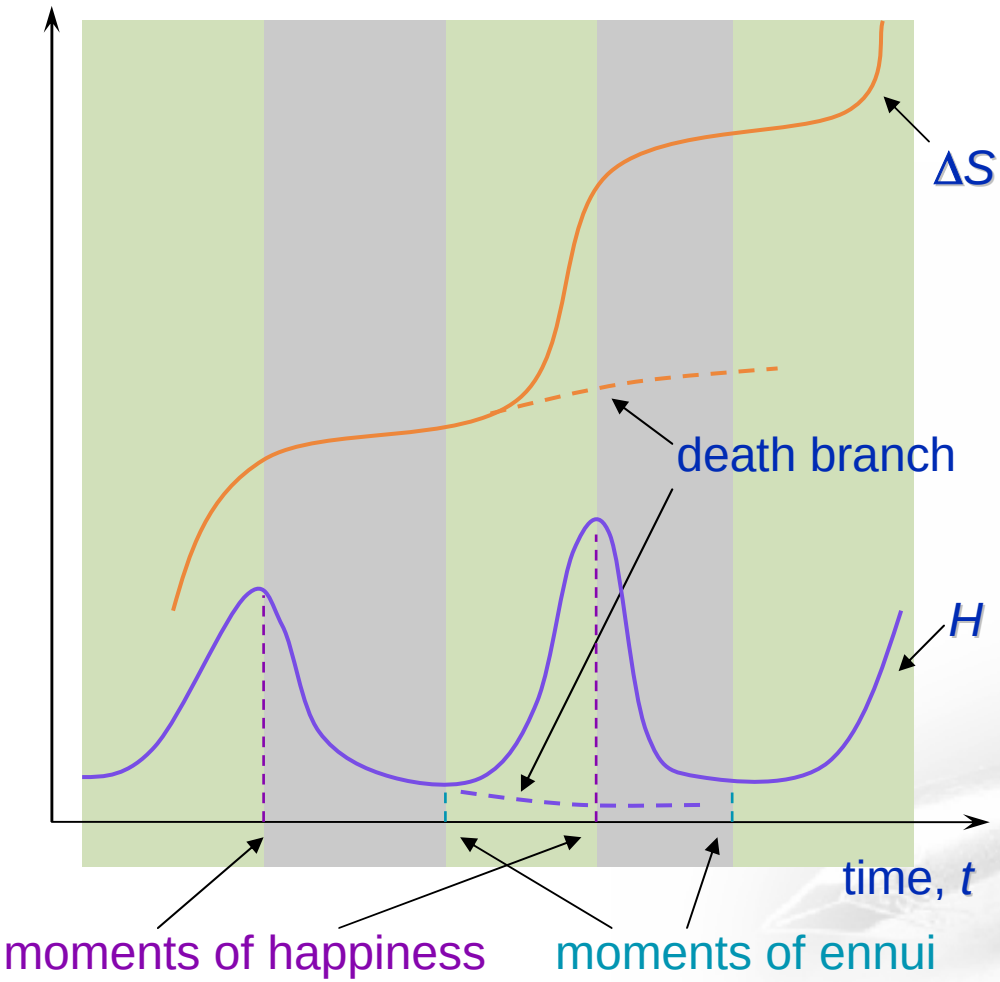
DYNAMICALLY DISCRETE COMPLEXITY DEVELOPMENT



Any structure creation is a *growth* of complexity-entropy

“progress” vs “decline”

dynamic entropy change, ΔS,
Hamiltonian (energy), $\Delta S/\Delta t = H$, E



For *both* “progress” and “decline”:

$H = \partial S/\partial t > 0$

Progressive development (creation):

$W = \partial H/\partial t = \partial^2 S/\partial t^2 > 0$

Decline (decay, degradation):

$W = \partial H/\partial t = \partial^2 S/\partial t^2 < 0$

Max progress results (“happiness”):

$\partial H/\partial t = \partial^2 S/\partial t^2 = 0, \ \partial^2 H/\partial t^2 < 0$

Max decay results (“ennui”):

$\partial H/\partial t = \partial^2 S/\partial t^2 = 0, \ \partial^2 H/\partial t^2 > 0$

Transition *max* (“moment of truth”):

$\partial^2 H/\partial t^2 = 0, \ \partial^3 H/\partial t^3 < 0$

Decline crisis (“moment of sin”):

$\partial^2 H/\partial t^2 = 0, \ \partial^3 H/\partial t^3 > 0$

Replete Industry: Critical Instability

UNITARY SYSTEM: DEATH BY SUCCESS

industrial revolution

"gravitational" attraction to the material basis

STABLE

UNSTABLE

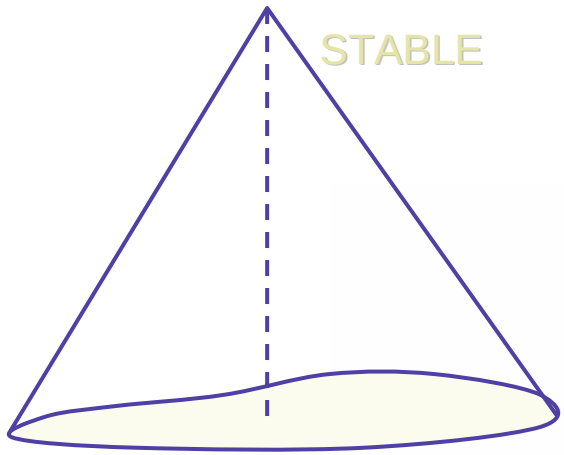
spinning top dynamics

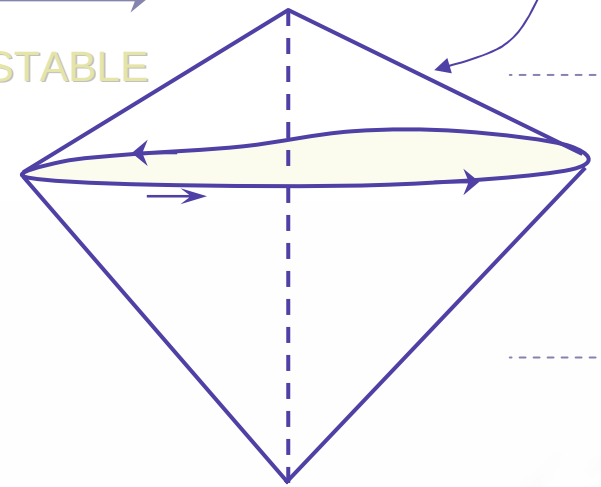
social position

elite

middle class

labour

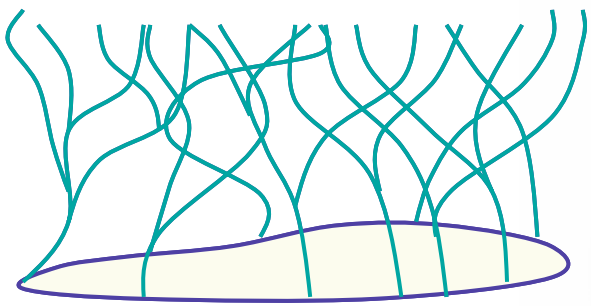




pre-industrial unitary society

post-industrial unitary society

sustainability transition



unlimited complexity growth

AFTER SUSTAINABILITY TRANSITION
GROWTH CAN ONLY INCREASE STABILITY:
"LIVING ARBORESCENCE" DYNAMICS

Sustainability Transition

CREATIVE APOCALYPSE NOW

GREAT SUSTAINABILITY TRANSITION BEGINS TODAY

- The “End” of History, Science, Art, Religion, etc.: exhaustion
- Maximum “ennui” point is just behind us: beginning “agitation”
- Transition maximum is still (qualitatively) far ahead of us

OPPOSITION TO TRANSITION CHANGES: LOSSES

- Discreteness: Transition *is* a result of *all* system interactions
- One cannot overcome the (dynamic) entropy growth
- Unsuccessful transition is replaced by a *death branch*

UNDERSTANDING OF TRANSITION DETAILS: GAINS

- Universal science of complexity → *rigorous*, reliable futurology

http://arxiv.org/abs/physics/9806002

New kind of knowledge

SCIENCE REVOLUTION: UNREDUCED COMPLEXITY

BLIND (EMPIRICALLY BASED), BUT OMNIPOTENT R&D: REAL DANGER

- ✓ Today's empirical technology modifies the *whole depth* of complexity: high energies, genomics, biochemistry, ecosystem, society, psyche

  Without equally complete knowledge *only destruction* can result

CAUSALLY COMPLETE UNDERSTANDING OF REALITY: NO "MODELS"

- ✓ Scholar science is an ultimately rough, *dynamically single-valued* "model" of the *dynamically multivalued reality*: *anti*-completeness, including single-valued imitations of empirically defined "complexity"

  Transition to the unreduced, complex dynamics is *vitally* important: One cannot fool Nature (contrary to funding bodies and taxpayers)

ONLY UNREDUCED KNOWLEDGE FOR SUSTAINABILITY TRANSITION

- ✓ Universal science of complexity for the *"knowledge-based society"*

  Only unreduced science can guide the transition to sustainable life

http://arxiv.org/abs/physics/9806002

Complexity-increasing production

GROWTH WITHOUT DESTRUCTION

FROM DESTRUCTION TO CREATION BY COMPLEXITY BOOST

→ From declining to progressive phase: transition to superior complexity
→ Complexity-driven technologies: "bio-inspired" complexity growth

Creative, not restrictive ecology concept → real sustainability

UNIVERSAL CRITERION OF PROGRESS: $\partial H/\partial t = \partial^2 S/\partial t^2 >> W_{death}$

→ Self-accelerated complexity development: *sustainability by creation*
→ Against "sustainability" by restriction: entropy growth is invincible

Unreduced science of complexity: unique basis for new production

HUMAN ASPECTS OF NEW PRODUCTION: CREATIVE PERSONALITY

→ From massive and reductive to *individual* and *creative* technology
→ From centralised and rigid to *distributed* and *evolving* structure

Complexity-driven production involves essential *personal progress*

http://hal.ccsd.cnrs.fr/ccsd-00004214

Non-unitary social structure

ORDER WITHOUT GOVERNMENT: POWER OF IDEAS

FROM UNITARY TO HARMONICAL SYSTEM: THE LAST BASTILLE

- Versions of Unitary System: totalitarian, democratic, meritocratic
- Harmonical System: *emerging* social order (cf. "market economy")

Sustainability Transition: from Unitary to Harmonical *complexity*

HARMONICAL SYSTEM: UNREDUCED INTERACTION COMPLEXITY

- Autonomous evolution of interacting (small) "management" units ≠ "NGO" or "free-market" structures *within* the Unitary System
- *Superior democracy*: real, inevitable extension of unitary "freedom"

Harmonical System is the *unique* way of *any* further progress

THE PRICE TO PAY FOR HAPPINESS: DISTRIBUTED REVOLUTION

- High-order "phase transition": growing "seeds of freedom" network

Complexity-based origin of Harmonical Future → new science bliss

NEW SCIENCE STRUCTURE → http://arxiv.org/abs/physics/0403084

New kind of settlement

MAN-MADE NATURE

BIO-INSPIRED AND BIO-DOMINATED, DISTRIBUTED INFRASTRUCTURE

- → Unitary infrastructure: centralised (urban), rigid, reductive, decadent
- → Harmonical infrastructure: man-made "forest", omnipresent, evolving

Creation, not "protection" of "natural" (= *complex*) environment

SETTLEMENTS SUBMERGED INTO CREATED "NATURAL" COMPLEXITY

- → Harmonical interaction with nature → *growth* of natural complexity
- → Complex-dynamic environment influence on man: complexity boost

The unreduced nature complexity should become again *our home*

NATURAL COMPLEXITY EVOLUTION: SUPERNATURE, NOOSPHERE

- → From "biosphere" to *Supernature*: *greater* than "natural" complexity
- → *Noosphere*: entangled intelligence and Supernature development

Harmonical evolution: *nondestructive*, *unlimited* growth & diversity

http://hal.ccsd.cnrs.fr/ccsd-00004214

SUSTAINABILITY COMPONENTS

UNREDUCED COMPLEXITY APPLICATIONS

- Unified, causally complete fundamental physics (quantum mechanics, relativity, particles, fields, forces, cosmology): no “mysteries”, transparent, realistic knowledge and world view, the unique way to unlimited clean energy
- Real, complex-dynamic nanodevices (quantum & classical), huge efficiency
- Causally complete, reliable genomics (unreduced interaction dynamics)
- Complex-dynamic biology: causal evolution theory, integral medicine
- Creative ecology/development: realistic, unreduced sustainability concept
- Emerging genuine intelligence and consciousness (natural and artificial)
- Complex-dynamic, intelligent communication networks and software systems

UNREDUCED SUSTAINABILITY CASES

- “Poor” countries rise by local, permanent, constructive, massive interaction: creating a new, quality life for oneself, not extended misery for others
- Practical responsibility of scientists for creation of “knowledge-based society” and “understanding-based (complete) knowledge”: no deficient “models”
- Constructive use of diversity instead of destructive mechanistic unification

http://arxiv.org/find/quant-ph,gr-qc,physics/1/au:+Kirilyuk/0/1/0/all/0/1

Cosmic Life, Future, and Complexity: Concluding Remarks

→ Intrinsic unification of *causally specified* meaning and purpose of life, future, progress, nature, cosmos, and our destiny:
universal symmetry and development of complexity
→ *practical guiding principle* for civilisation development

→ Life *realisations* are *multiple* and *different*: unique life is improbable
You'll meet new intelligence when you become more intelligent:
complexity correspondence principle
→ unified intelligence: find an alien within yourself

→ Life exams are fair: you progress or disappear
Complexity challenge is about one's mind-set:
apocalyptic time needs individual Revelation
→ real Future comes as a higher consciousness level

→ Every future is uncertain at the transition point
one should understand now all futures
→ Universal Science of Complexity is *the true futurology*

http://arxiv.org/abs/physics/9806002

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