AS-74.4192 Elementary Cybernetics
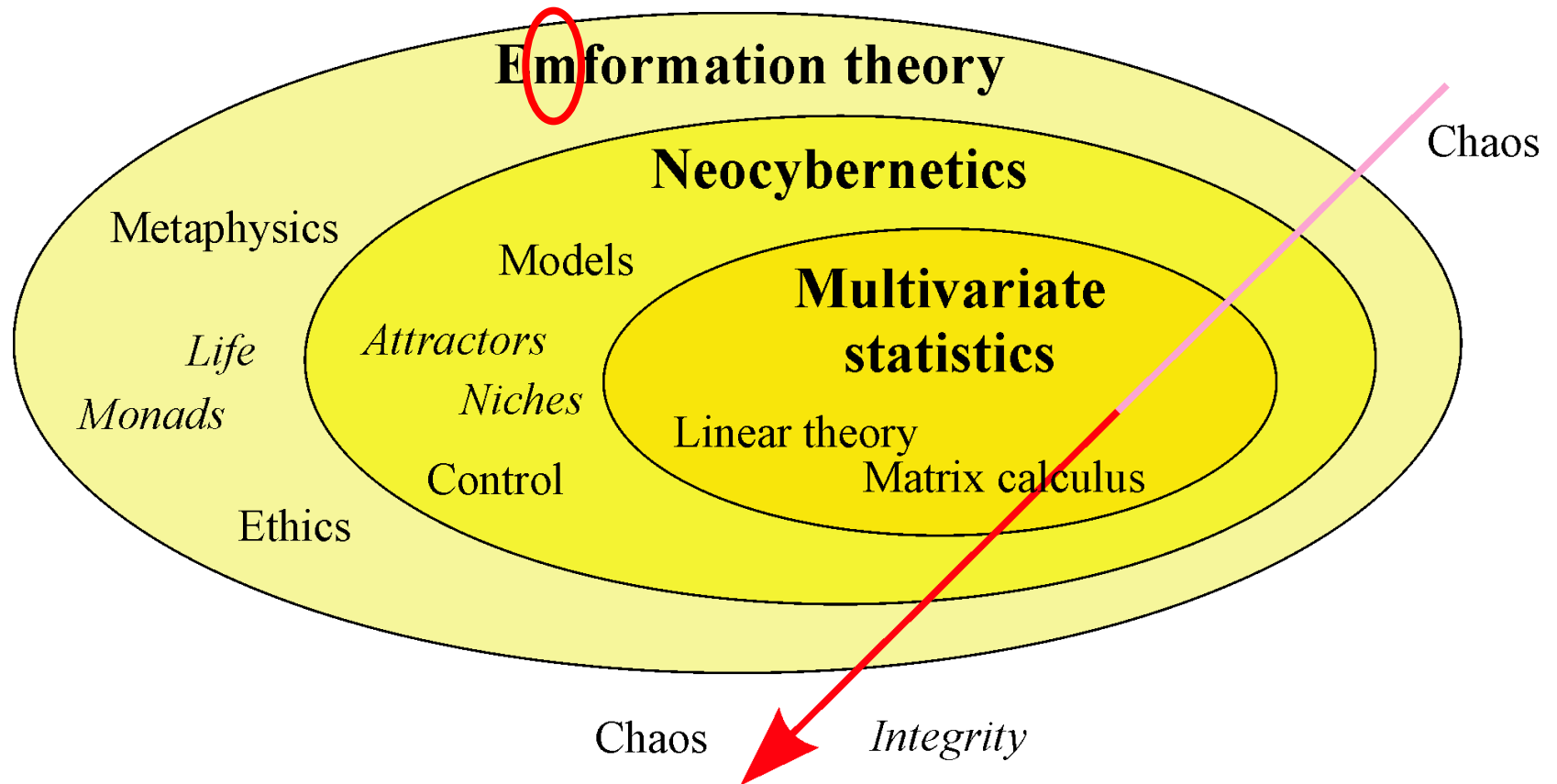
Bonus Lecture "ω+2":

Book on

Ɛnformation Theory

Historical perspective

- How things have Ɛvolved since the original course
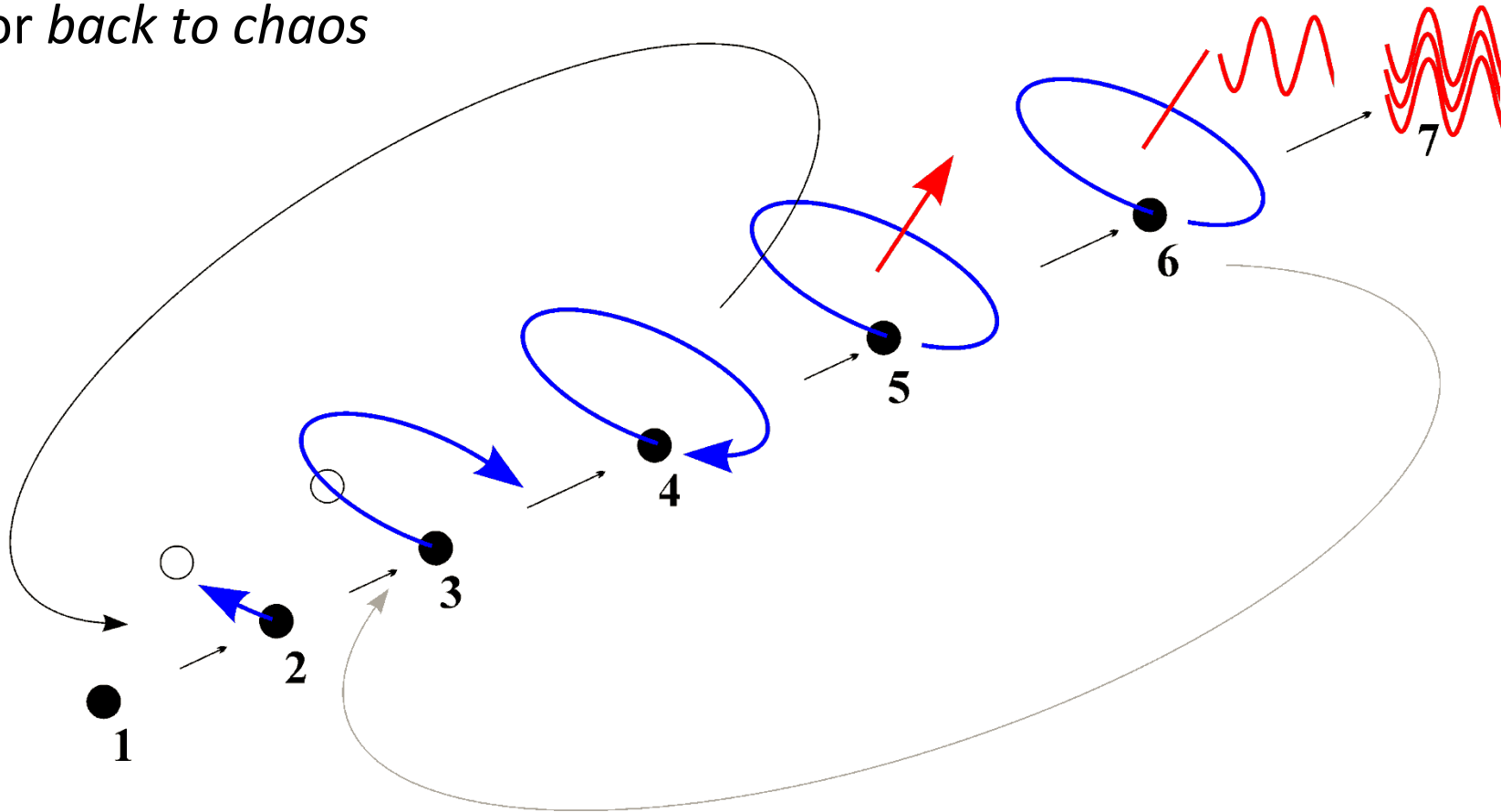
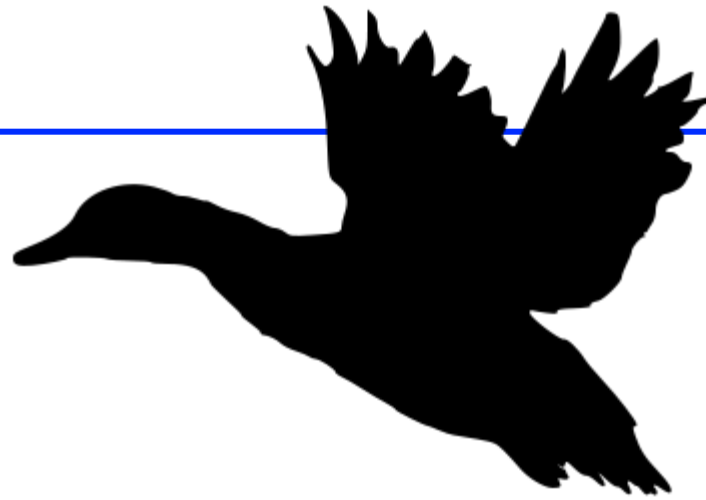# Ultimate Challenge: *Subjective Worlds*

Paintings by
Vladimir Fomin

Contents: Seven Chapters

- Story from *chaos* to *consciousness* ...

  ... or *back to chaos*

The Miraculous Transformation

Chapter 1: Principles of Existence

- **Starting from complete chaos**
  - Normal distributions
  - Statistical moments $\mathrm{E}\{z\}$, $\mathrm{E}\{z^2\}$
- **Natural semantics inherited from below**
  - Enformation $\mathcal{E}\{z^2\}$ or *energetic (in)formation*
  - Energy interpretation – ability to *make difference that makes difference*
- **Evolution, optimality, and linearity**
  - "Nothing makes sense without reference to evolution"
- **Towards enformation maximization**
  - Distinction between activities x and resources u
  - Expression for maximum acquired enformation
- **New thinking tools needed**
  - Mathematics necessary for "natural" concepts

Holding the Waves

Chapter 2: Emerging Models

- Manipulation of enformation formula $\bar{x} = Q \, \mathcal{E}\{\overline{x}\overline{u}^{\mathrm{T}}\} \, \bar{u}$

  - Principal subspace analysis

  - "Ecological lockers" emerge

  - Pattern matching against features

  - Observer effect: "equalization" of the experienced environment

- Stability through negative feedback

  - Separate time ranges of signals

  - Dynamics solving asymptotic expressions

- Emergent "static friction"

  - Dissipation (energy loss) to keep system running

  - Staying "alive" only for strong enough coupling

- Example: analysis of visual patterns

  - "Strokes" in handwritten digits

The Birth of Sampo

Chapter 3: Starting the Mills

- ## Analysis of feedback
  - Estimation through regularized regression takes place

- ## Systems as controllers
  - Optimal modeling + optimal estimation = "optimal control"
  - Efficient exhaustion of enformation

- ## Enhanced controls
  - Less dissipation – evolutionary advantage
  - Room for new trophic layers

- ## Entropy as general explanation
  - Consistent increase of entropy in all systems
  - Neocybernetic systems as Maxwell's demons

- ## Change of viewpoint
  - Systems mastering their environments

The Carrier of the Word
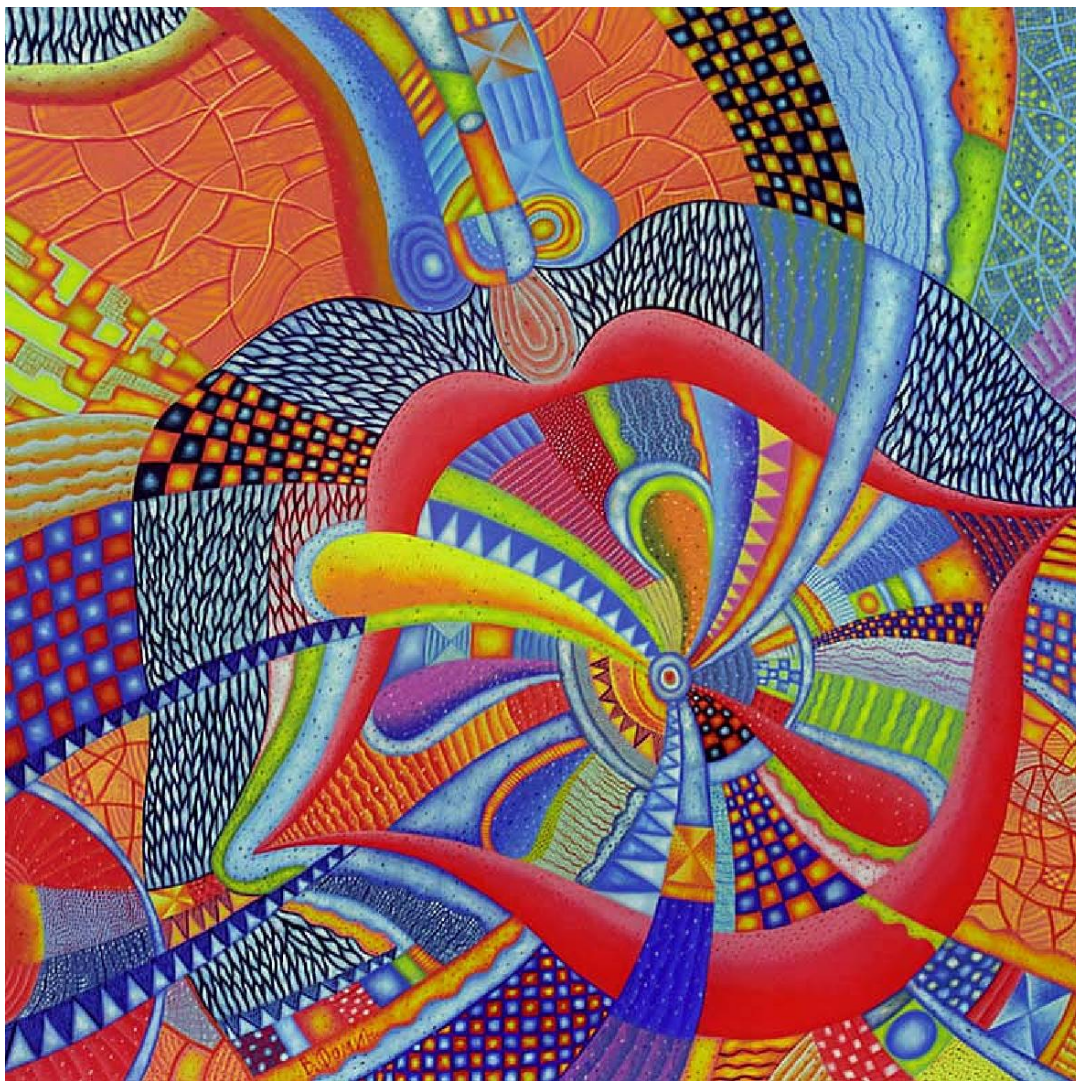
Chapter 4: Elements of Life

- Life: challenges
  - Escapes rigid analyses
  - Descriptive definitions miss the *essence* and *function*
- Monads
  - Fractal "atoms" in all living
  - Indivisible entities – but can vanish
  - *Enformation pumps*
- "Mental life"
  - *Interobjectivity* is possible?!
- Codes of life
  - Needed to restart the monad system in a controlled fashion
- "Artificial life"
  - Engineering work closes scientific loops

The Crying Vainamoinen

Chapter 5: Towards Freedoms

- **From outside view to inside view**
  - From population to individuals
  - Importance of "innovation", or "births"
  - Experimentation as internal noise
  - Fractality of evolution

- **Constraints vs. freedoms**
  - Rules vs. strategies

- **Evolution mechanisms**
  - Quantitative developments on the system level
  - Qualitative developments on lower levels

- **Collapses and cycles**
  - Regeneration after "cancers"
  - Spectra as *systemic fingerprints* for still higher levels

The Great Song of Vainamoinen

Chapter 6: Fields Forever

- **Deeper into details**
  - Understanding mechanisms and dynamics
  - Ultimate optimization – systems learn to become lossless
- **Frequency domain**
  - Laplace transforms – extension to complex-valued signals
- **Fields**
  - Freedom of time and place
  - Standing waves – *harmonies of spheres*?
- **Examples: orbitals + consciousness**
  - "Collapses of wave functions"
- **Towards a "new science"?**
  - Copernican revolution continued
  - Dualities reformulated

Bear, Apple of the Forest

Chapter 7: Closing Final Loops

- Experimental enformation-theoretic application
  - Ultimate challenge: subjective worlds
- Operating system for the mind
  - Has to stabilize the ultimate feedbacks
  - Boils down to *semiosis*
- Adjusted semiosis
  - Weighting of observations = values
  - Scope of emergence = models to be constructed over the time axis
- Morphic fields
  - Must be emulated within the mind
  - Towards "super-subjective worlds"
- Emergent deities
  - "Thinking fields" start organizing cybernetically?

Narratives and subjective worlds

- What is the *birth* of the World? – The beginning of *Kalevala* reveals that

Mieleni minun tekevi

Aivoni ajattelevi

...

My mind constructs

My brain thinks

...