First Ecosystem Complexity Workshop

Bled Sept. 24-26 2004

Workshop Organization

- Pre-conference activities
  - email exchanges
  - formulation of questions
- People invited according to their expertise
- 23 Ecologists from different fields (engineering, biology, physics, mathematics), countries, backgrounds
- 2 “tables”
  - Complexity
  - Evolution and Networks

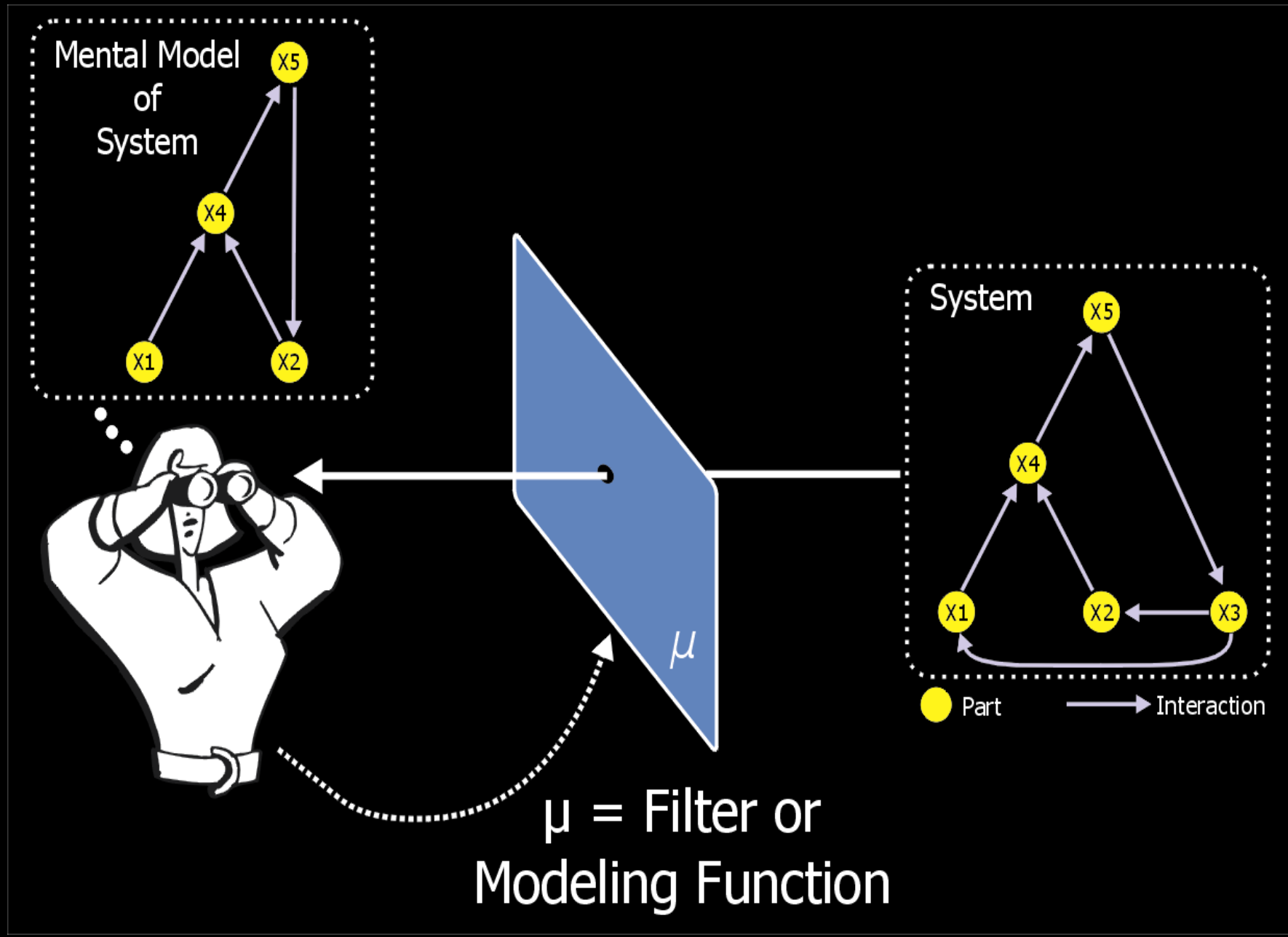
What's Complexity?

- Many aspects to the definition

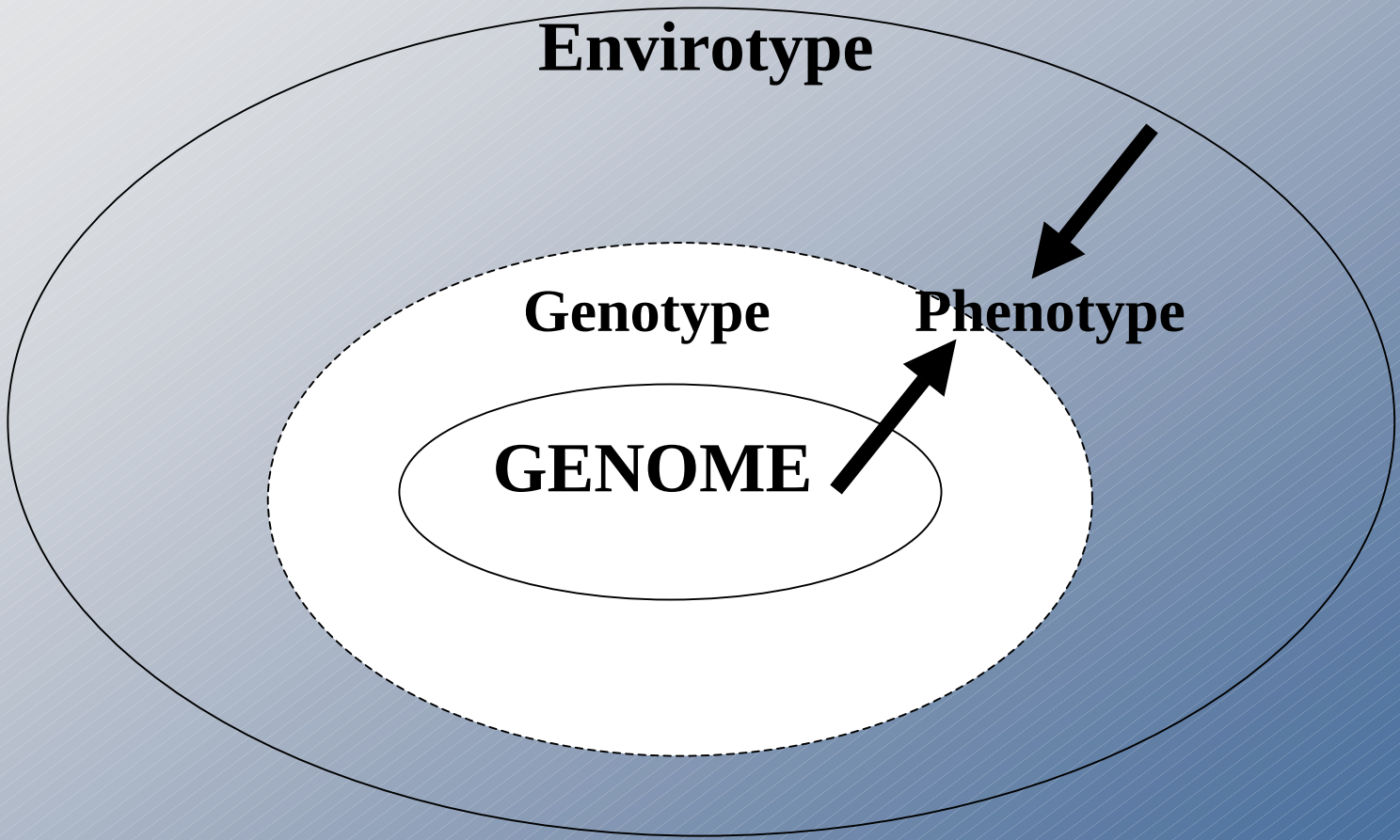
- Is complexity "in the eye of the observer"?
  - Intrensic Complexity
  - Extrensic Complexity

Flavors of Complexity

- structural complexity (number and size of existing gradients)
- functional complexity (flows and interrelations, number of links/loops within the system)
- complexity in composition (number of compartments, species diversity)
- spatial and temporal complexity (number of limiting factors per life cycle, GIS indexes on patchiness of the environment)
- complex behaviour


Mental Model of System
X5
X4
X1
X2
μ
System
X5
X4
X1
X2
X3
Part
Interaction
μ = Filter or Modeling Function

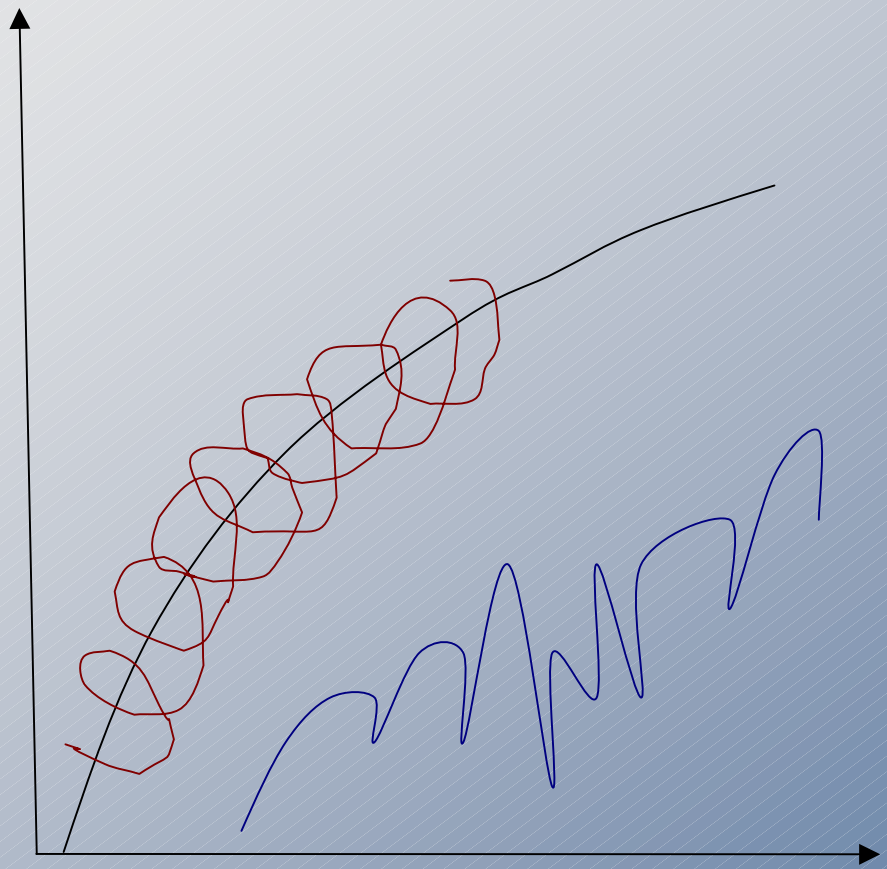
Dialogue between genotype & “envirotype”



Why are ecosystem complex? Genesis & Evolution

- Speciation is the origin of ecosystem complexity
- Species niche construction induces further speciation and diversification
- This process generates constraints (new problems to be solved)
- Constraints become the driving force of evolution
- Genotype + Constraints → phenotype.

Ecosystem “Evolution”



Ecosystem are driven to final states rather than pulled to an attractor.

Ecosystem have no goal.

Complexity tends to incrase during constructive phase of Holling’s adaptative cycle

There are creative destruction phases in order to proceed to evolution

Complexity-Stability Debate Revisited

What's the relationship between complexity and stability?

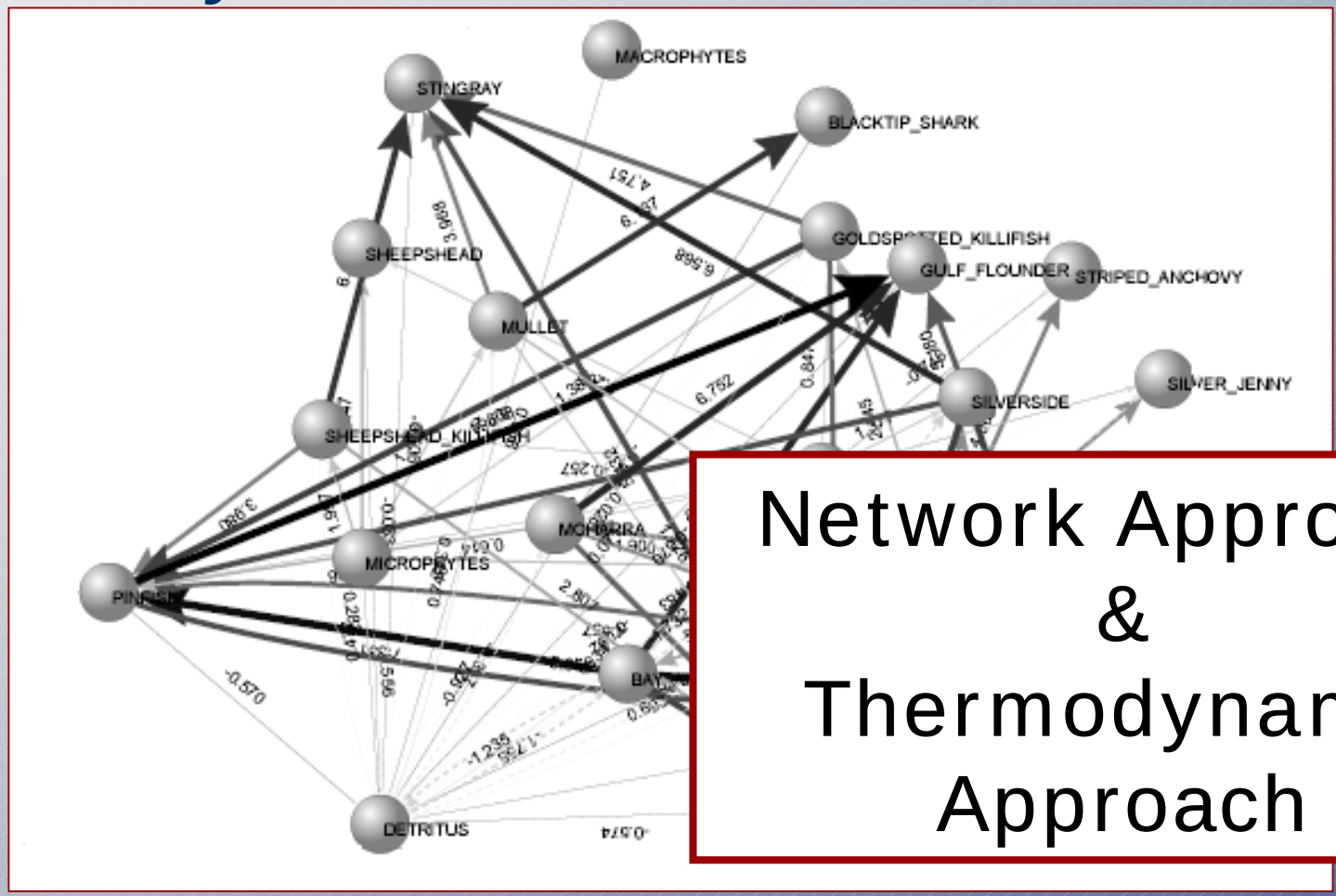
Is complexity driven by varying inputs and disturbances?

Are complex systems more resilent or persistant?

Is complexity just another name for diversity?

How we can relate complexity and adaptability?

How to study complexity of ecosystems?



Network Approach
&
Thermodynamic Approach

What to measure?

N. of compartments, links/loops, length of cycles

Structural dynamic ability

Species diversity

Number of limiting elements

Flow/Biomass ratios

Trophic level decomposition

Holistic system Indicators

Emergy
Exergy
Ascendency
network indicators

Are these approaches ready for the challenge of complexity?

- We need more integration/comparison between different theories
- Extend these approaches to include time (dynamic aspects)
- User friendly software
- Case studies/collaborative texts
- Interaction with other disciplines dealing with complexity (engineering, physics, economics, social sciences)
- Interdisciplinary teams

Next Steps

- Reduce learning curve for new graduate students (textbooks, software, reviews, case studies)
- Applications & communication with management (articles on applied ecology/management journals, seminars, workshops)
- Regular meetings/workshops
- Building a consortiums
- Common website