

Cognitive skills in inter- and transdisciplinary projects: The role of education in environmental systems analysis

Karen Fortuin & Kris van Koppen

Td-conference, September 15-17, 2010



ENVIRONMENTAL
SCIENCES GROUP
WAGENINGEN UR

Environmental Problems are complex problems



Interdisciplinary approaches
Transdisciplinary approaches

Knowledge & skills of an environmental scientist

Knowledge of disciplines

Communication skills

Knowledge of interdisciplinarity

Cognitive skills



Research questions

- What are cognitive skills that enhance students' ability to cope with complex environmental problems?
- What can education in systems analysis contribute to enhance these cognitive skills?
 - What can systems approaches offer to enhance these skills?
 - How can a BSc course in environmental systems analysis train these skills?

Cognitive skill 1: Understanding the whole

- Ability to understand environmental issues in a holistic way, taking into account the interaction between social and biophysical dynamics



CSkill 2: Understanding & connecting disciplines

- Ability to identify, understand, critically appraise, and connect disciplinary and more integrative approaches

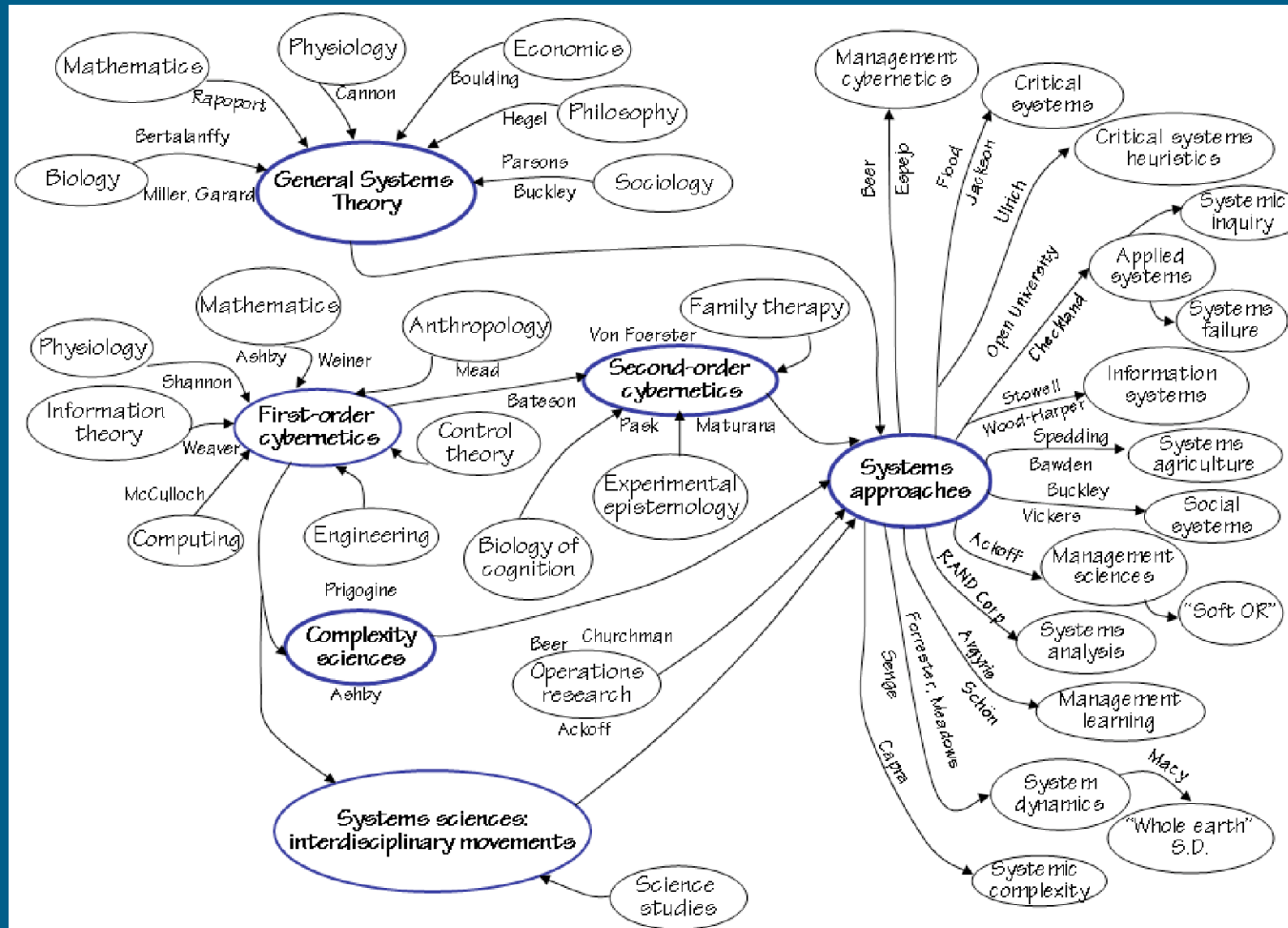


Cognitive skill 3: Meta-reflection

- Ability to look at the research practice from a meta-level and to reflect on the role of (interdisciplinary) research in solving societal problems and the interplay with stakeholders with competing interests

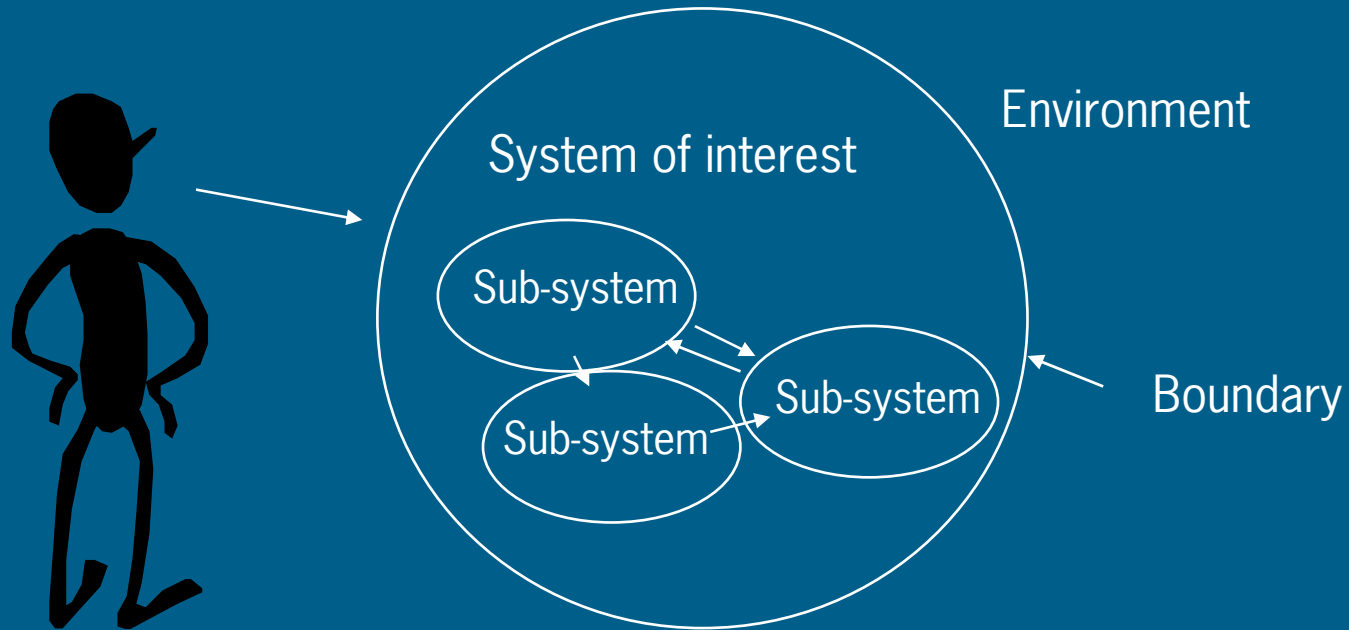


Rich history of systems approaches



(Ison, 2008)

Key elements of systems approaches



(based on Ison, 2008)

What can systems approaches offer?

Cognitive skill 1: Understanding the whole

- Systems approaches by definition are supportive in conceptualizing complex issues
 - offer conceptual tools
- Teaching systems approaches might increase *systemic* awareness

What can systems approaches offer?

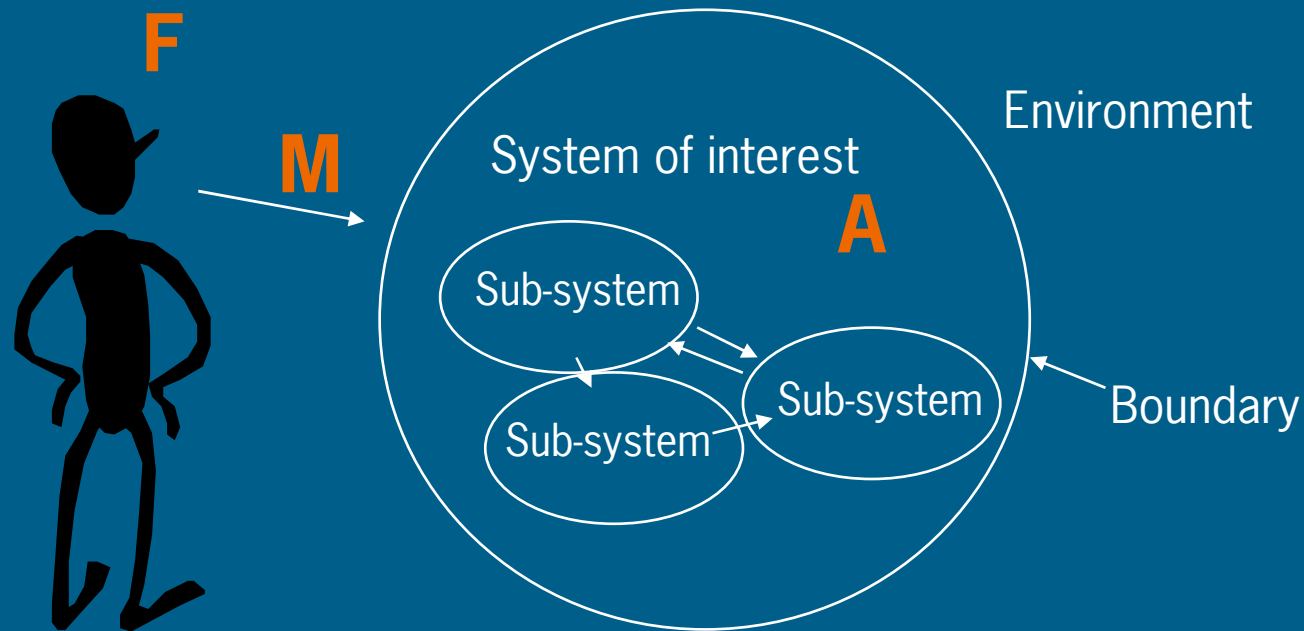
Cognitive skill 2: Understanding & connecting disciplines

- Insight in nature of (sub)systems
 - hard systems, soft systems, related to which disciplines
- Building bridges via modeling



What can systems approaches offer?

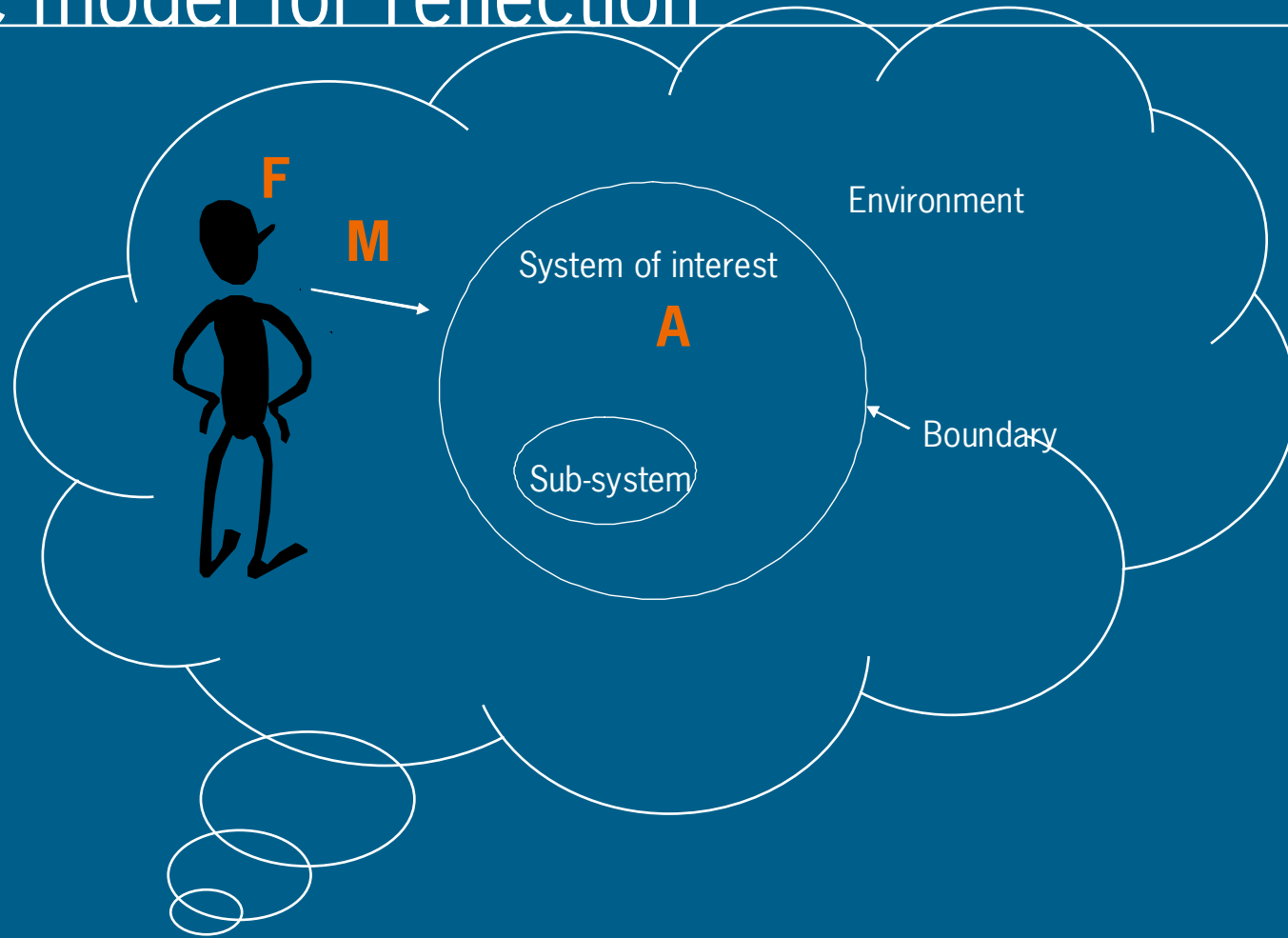
Cognitive skill 3: Meta-reflection



Heuristic model for reflection

(based on Ison, 2008)

Heuristic model for reflection



(based on Ison, 2008)



Case: Environmental Systems Analysis course

Characteristics of the course

- Complex problems
- Introduces a *systematic* approach to analyze complex problems (six-step approach)
- Lectures on tools and analytical techniques
- RAINS week (Integrative Environmental modeling)
- Group assignment (3-4 students)

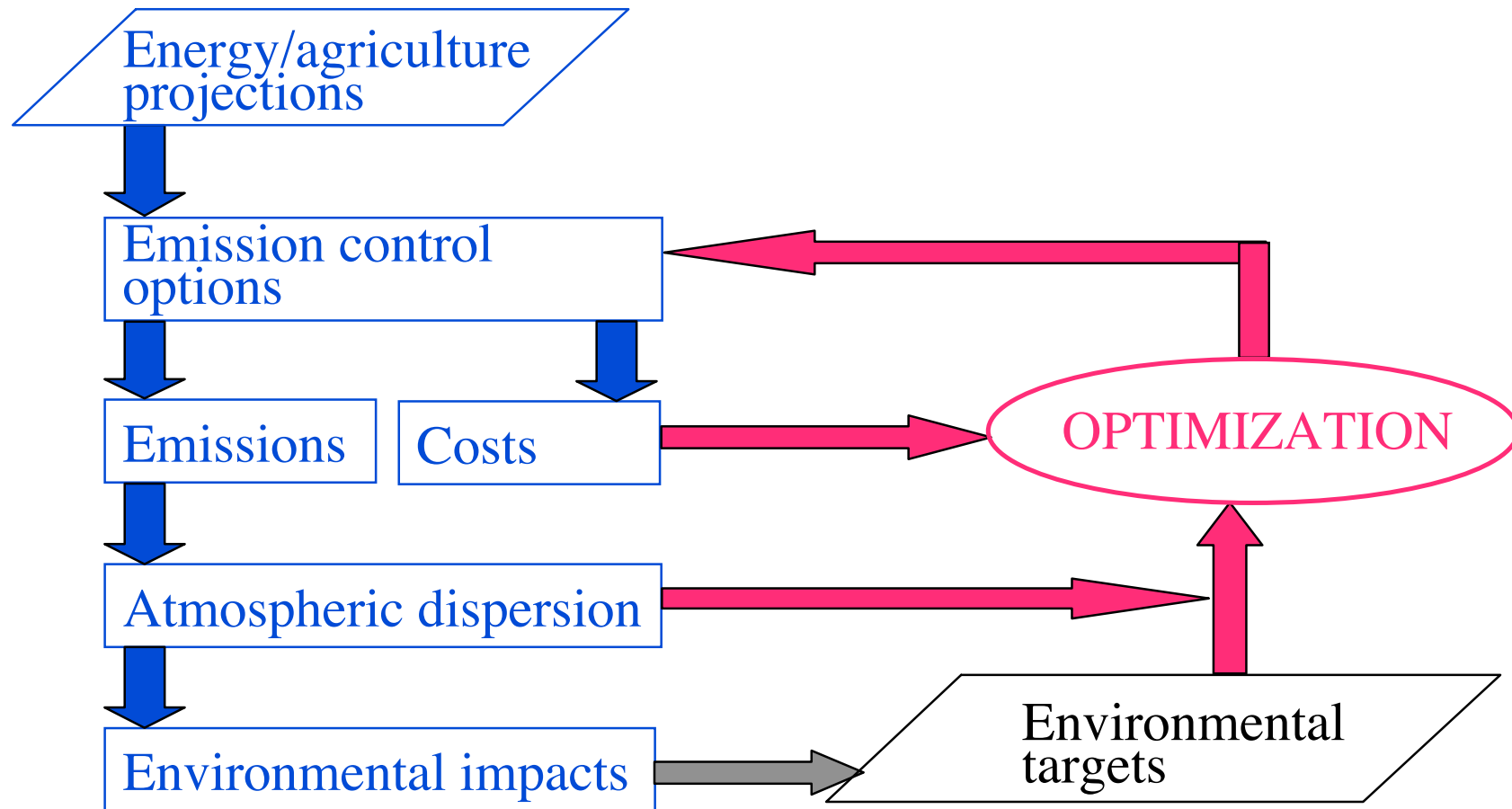
How are 'systems elements' implemented?

- General lectures
- 'RAINS week'
- Group assignment



The model: RAINS

developed by IIASA

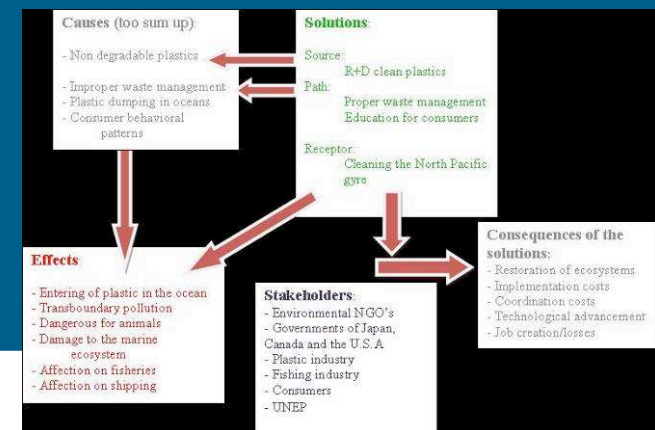


'RAINS week'

- Lecture on air pollution
- Lecture on RAINS model
- Role play on international negotiations
- Hands-on RAINS training
- Lecture on use of RAINS in negotiations
- Plenary reflection on strong/weak points of model

Group work

- Complex problem
- Learning through interaction
- Make a conceptual model
- Analyze the problem and apply tools (scenario analysis; MCA; indicators)
- Individual reflection



First findings

Process

- Learning by doing is important
 - helps to grasp the complexity of systematic approaches
- Diversity of students is valuable
 - helps to realize that there are various perspectives



First findings

'Outcome'

- Students realize the tension between detailed knowledge and general overview
- *Systemic* awareness increased, but very difficult to move beyond the level of *systematic* approach
- Reflection on 'meta-level' is not easy and requires long term attention



Recommendations

- Make explicit use of integrative models, but challenge students to look further
- Use 'learning by doing' and 'learning through interaction' strategies
- Make use of a diverse group of students
- Make explicit use of a heuristic model to help student to reflect on a meta-level

Discussion

- Teaching students an integrative way of thinking can and should start at BSc level
- What might accelerate BSc students' ability to reflect on a meta-level?

Thank you for your reflection!

karen.fortuin@wur.nl



ENVIRONMENTAL
SCIENCES GROUP
WAGENINGEN UR