

# 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

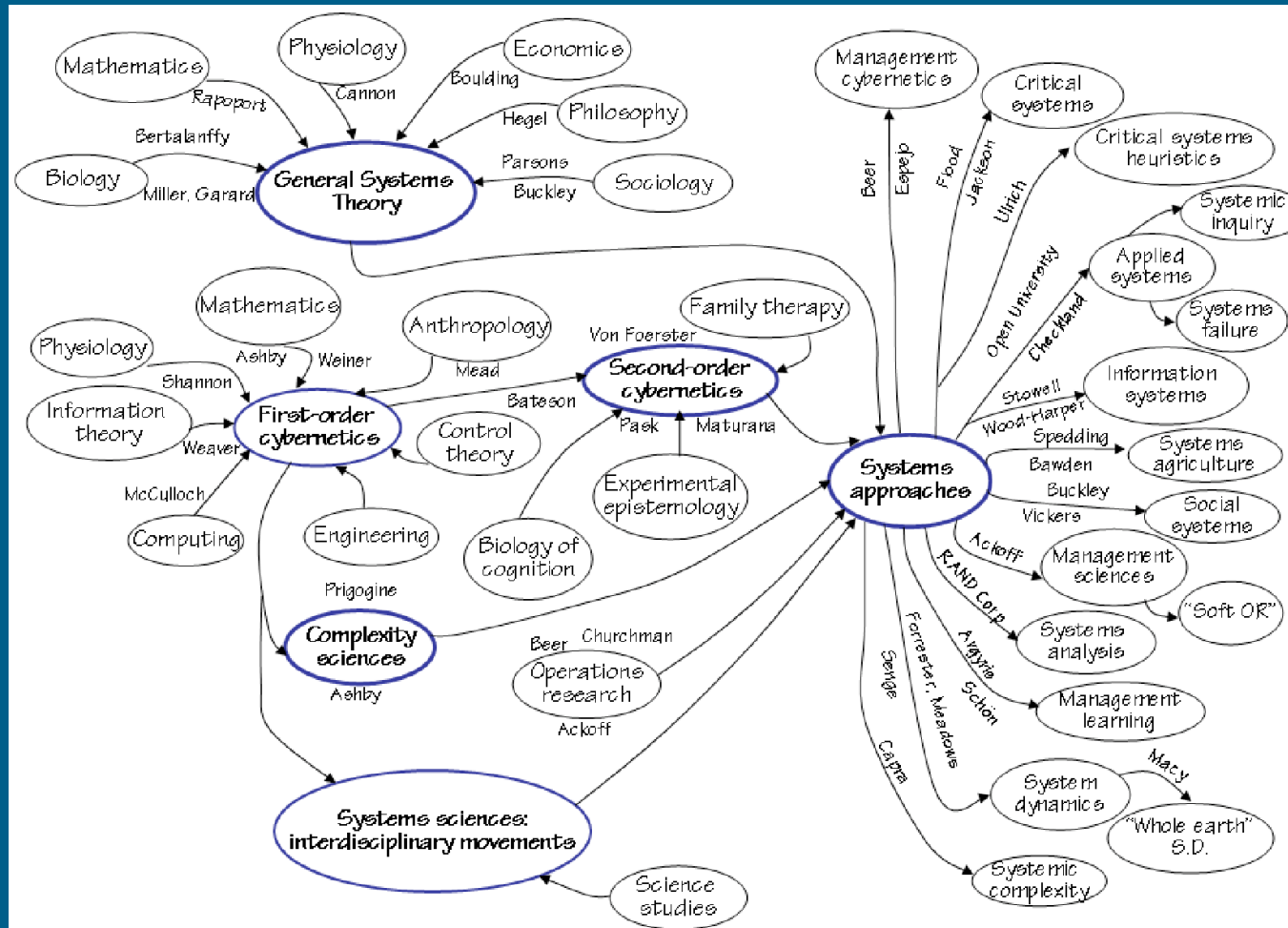


# Cognitive skill 3: Meta-reflection

- 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



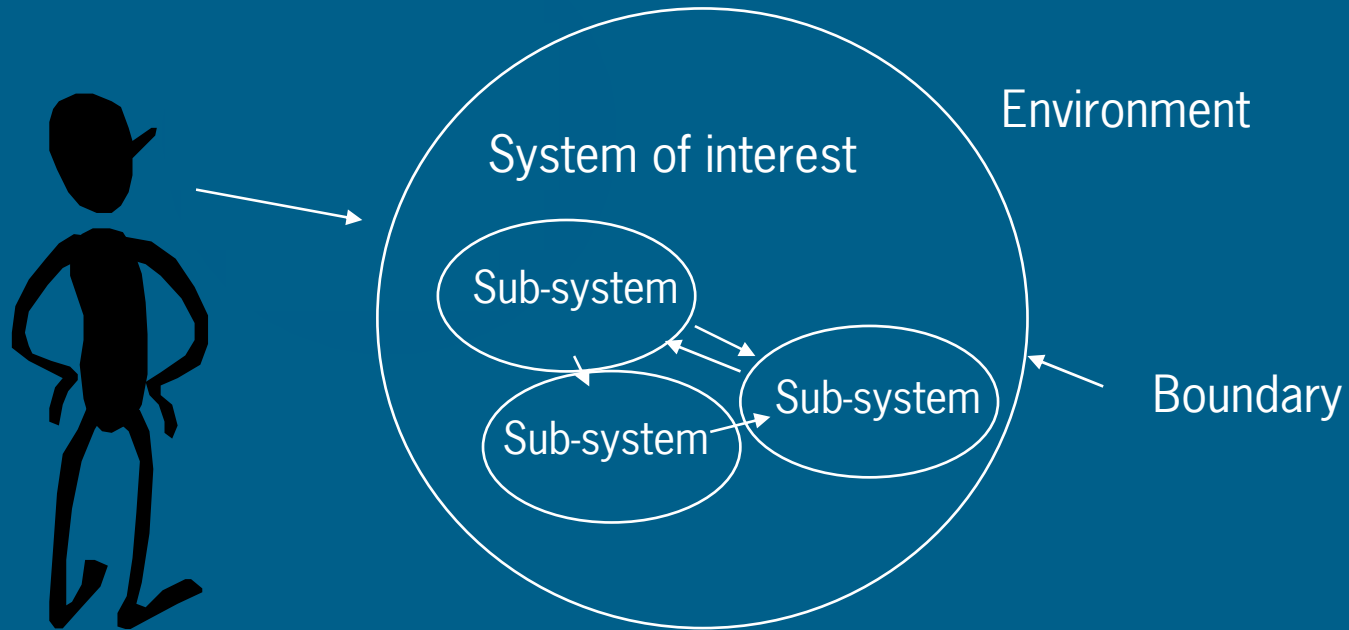
# Rich history of systems approaches



(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?

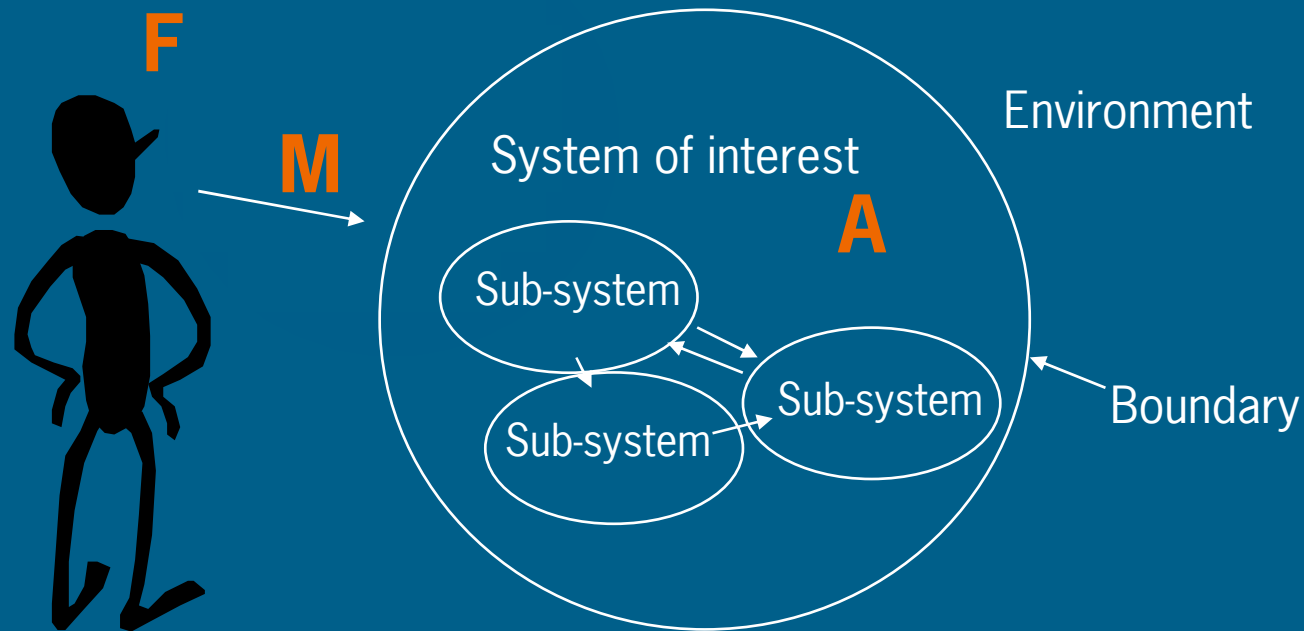
## *Cognitive skill 2: Understanding & connecting disciplines*

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



# What can systems approaches offer?

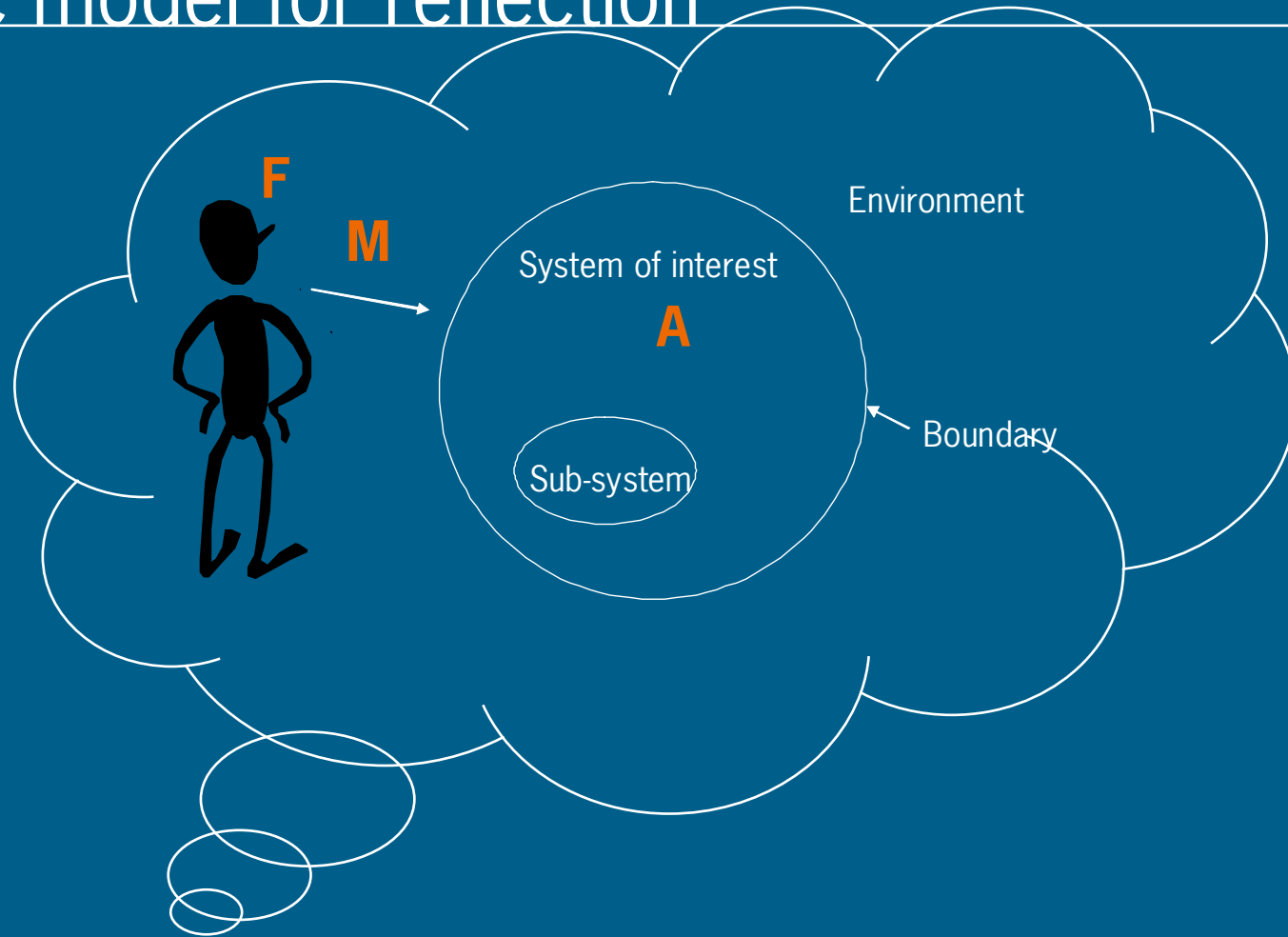
## *Cognitive skill 3: Meta-reflection*



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)

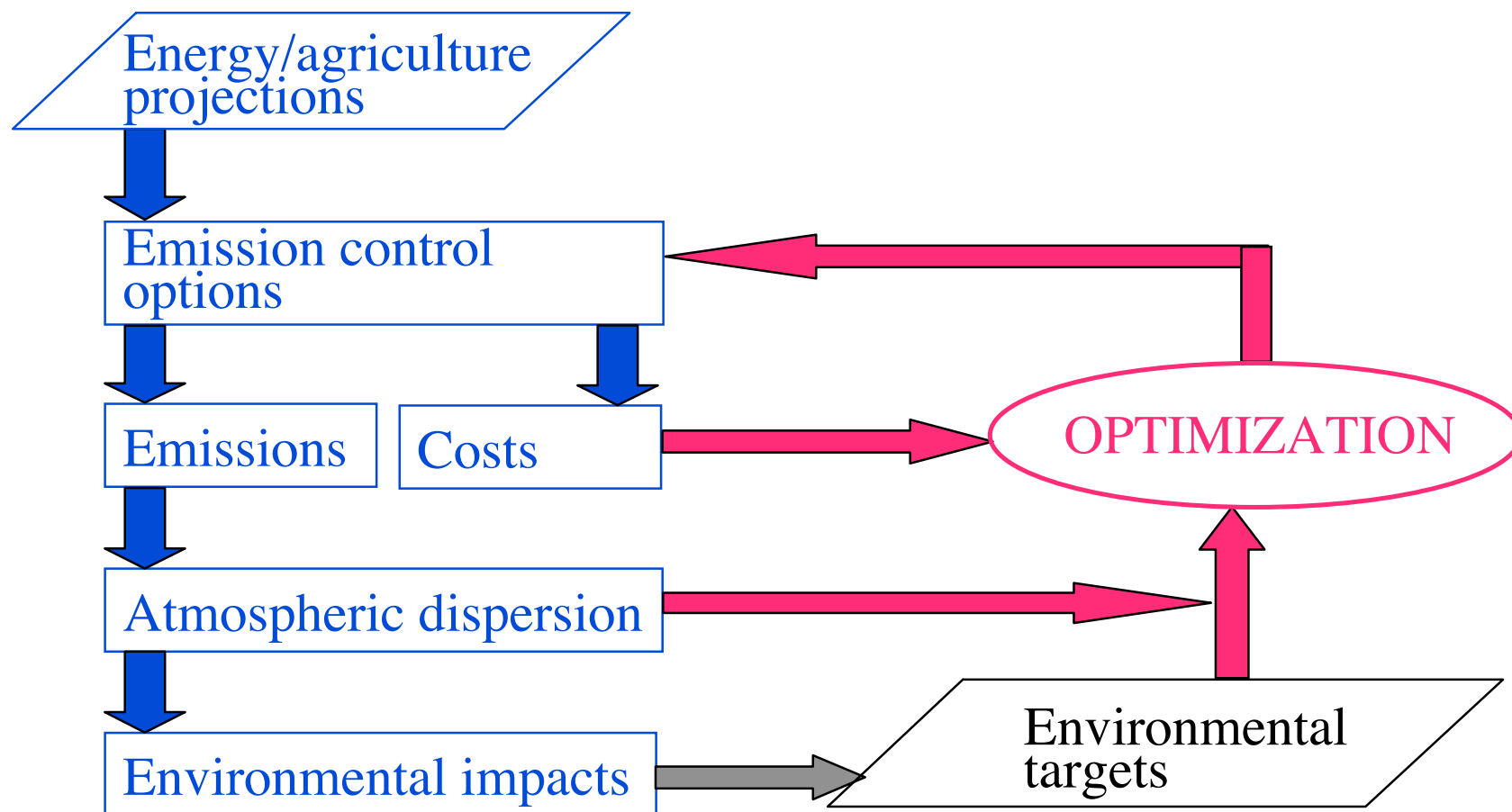
# How are 'systems elements' implemented?

- General lectures
- 'RAINS week'
- Group assignment



# The model: RAINS

developed by IIASA



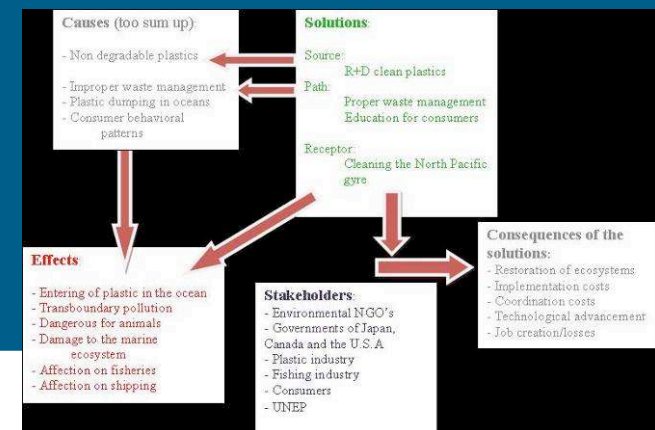


# 'RAINS week'

- 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