



Management “inspired by nature” –

Misunderstanding the basic tenet of Industrial Ecology and how to avoid popular shortcomings

Ralf Isenmann
Institute for Project Management and Innovation
(Chair: Prof Dr Martin G. Möhrle)

ralf.isenmann@innovation.uni-bremen.de



- **Introduction**

Basic tenet of Industrial Ecology and its popular misunderstandings:
“Industrial Ecology looks to the natural world for models of highly efficient use of resources, energy and byproducts” (JIE 2005)
⇒ *Nature as a model*

- **Proposal**

How to avoid popular shortcomings:
- clarification
- lessons to be learnt

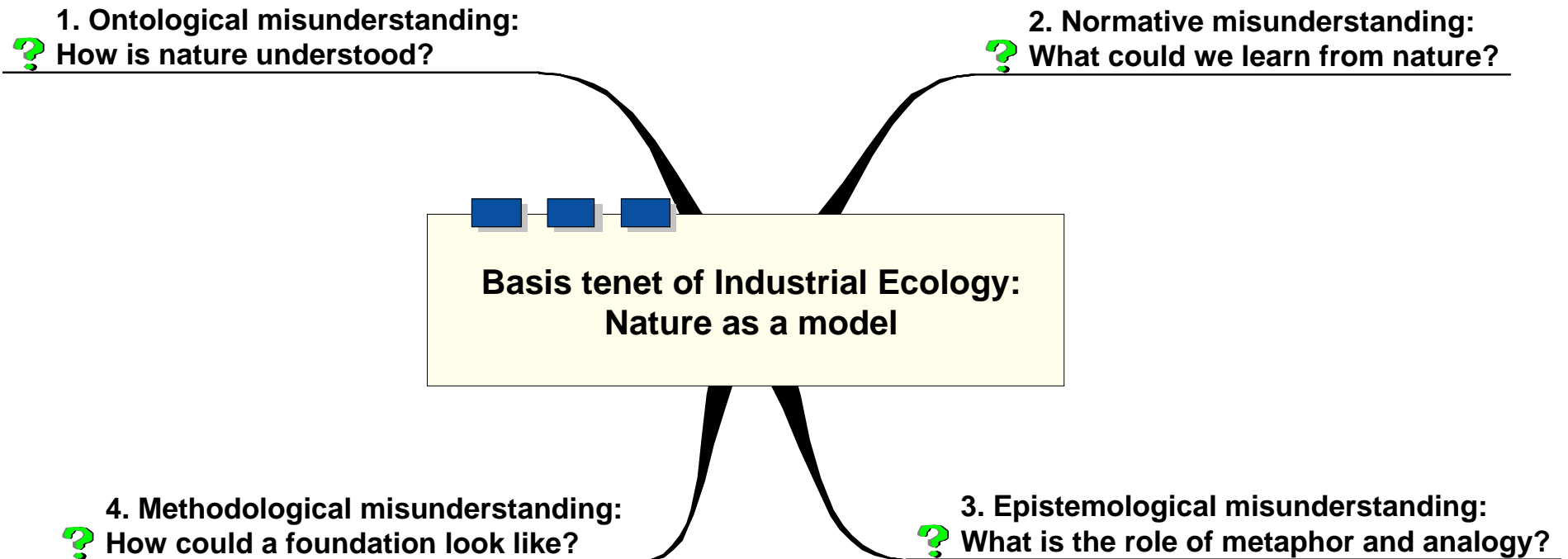
- **Conclusions**

- **Comments to the former presentations**

Literature review: References to “nature as a model”

Authors	References
Frosch/Galloopoulos 1989	Industrial ecology would function "as an analogue of the biological system"
Tibbs 1992	Industrial ecology "takes the pattern of the natural environment as a model"
Allenby/Cooper 1994	"Sustainable structure will resemble a mature ecological community"
Andrews/Berkhout/Thomas 1994	Nature is "instructive to explore in some detail what an industrial ecosystem could involve"
Graedel 1994	"The ideal anthropogenic use of ... materials ... would be one similar to the biological model"
Richards/Allenby/Frosch 1994	"Natural ecosystems as no-waste ecology"
Graedel/Allenby 1995	Nature is understood as "master of recycling"
Ayres/Ayres 1996, Ayres 2002	"Industrial ecosystems, designed from 'scratch' to imitate nature"
Erkman 1997	The "industrial system can be seen as a certain kind of ecosystem"
Wernick/Ausubel 1997	Industrial ecology "implies that models of non-human biological systems ... are instructive for industrial systems"
Allenby 1999	"The concept of industrial ecology ... [is] based here on the biological analogy"
Cleveland 1999	It is characteristic for industrial ecology to "look to the natural world for models of ... efficient use of resources"
Manahan 1999	"Industrial ecology mimics natural ecosystems"
Chertow 2000	"The underlying concept of industrial symbiosis is the metaphor of an industrial ecosystem that mimics a natural ecosystem"
	"Famously, industrial ecologists look to biological ecosystems as analogues or metaphors in the study of production and consumption"
Côte 2000	"In biological systems, materials are cycled by a complex web of species that includes not only producers and consumers, but also scavengers and decomposers"
Ehrenfeld 2000	"Natural ecosystems ... offer the only ... example of long-lived, robust, resilient living systems"
Erkman 2001	"Just as in the food chain processes of natural ecosystems, we must create networks of resource and waste use in industrial ecosystems"
Chertow 2002	"We ... call ... networks "industrial ecosystems" because, like nature's ecosystems, they involve a web of connections based on the cycling and adaptive use of energy and material"
Lifset 2002	"Natural systems cycle resources extensively"
Allenby 2003	"An obvious part of the attraction of ... "industrial ecology" is the suggestion that industrial systems can fruitfully be analogized to natural ecosystems"
Cohen-Rosenthal 2003	"(I)ndustrial ecology dream that, as in natural systems, waste equals food and that linking one company's 'throw-aways' to another's need will provide better environmental and business outcomes"
Deutz/Gibbs 2004	"Industrial Ecology is a strategy to promote the reduction of the environmental impact of industry by learning from an analogy with natural systems"
Durney 2004	"The industrial metabolism concept can be applied ... so that it resembles most closely that of a sustainable biological organism, with low material input, throughput and output"
Journal of Industrial Ecology 2005	Industrial ecology "looks to the natural world for models"

Introduction





Misunderstanding:

Industrial ecologists don't share the mainstream understanding of nature, i.e.: "sack of resources" (Hampicke 1977).

Instead, as critics argue, they refer to a speculative interpretation, i.e.: understanding *nature as a model*.

Clarification:

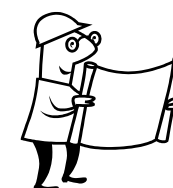
Industrial ecologists are regarding nature from a less orthodox perspective compared with other disciplines or schools of thought respectively.

■ Industrial ecologists take a refreshingly different and unorthodox perspective on nature



	Perspective 1		Perspective 2	Perspective 3	Perspective 4
Different schools and disciplines	Neoclassical environmental and resource economics		Spaceship economics	Industrial ecology	Bioeconomics
Comprehension of nature (theory)	Nature as object		Nature as limit	Nature as model	Nature as partner
Treating nature (practice)	Utilising nature	Taking care of nature	Avoiding use of nature	Learning from nature	Coevolution with nature
Epistemological interest in nature (metatheory)	Intervene in nature	Preserve nature	Respect for nature	Orientation by nature	Mitproduktivität (Co-productivity) of nature

Source: (Isenmann 2003)



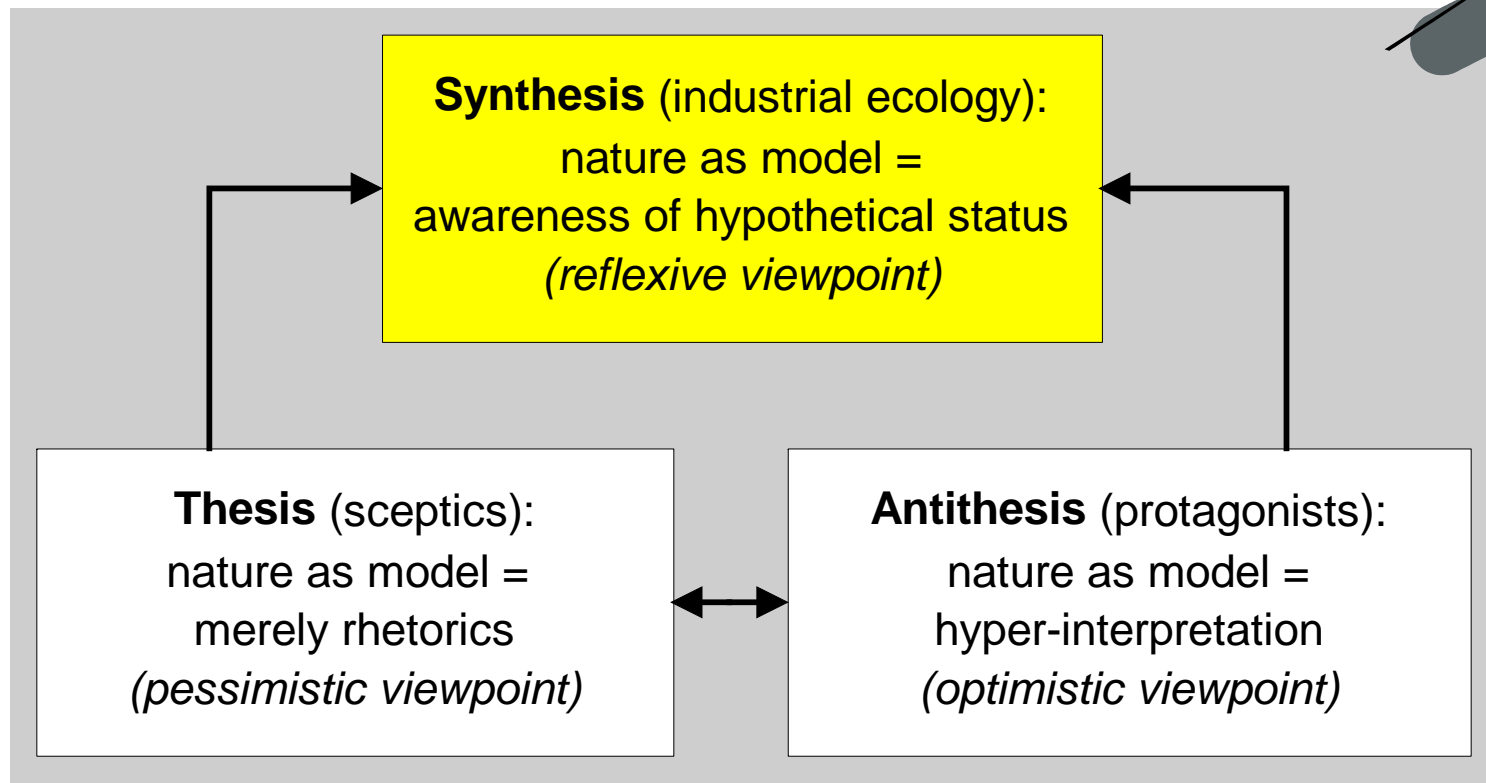
**Misunderstanding:**

Industrial ecologists understand nature as a *mature cyclical no waste economy*, using nature as a *blueprint* for designing industrial systems.

Clarification:

Industrial ecologists are regarding nature as a model in parts, intended to learn from nature while using its smart phenomena, evolutionary strategies and ecological principles. Nature *could* be viewed as a model – *hypothetically*.

- Industrial ecologists build a bridge to a promising discipline of humans as an integral part of nature



3. Epistemological misunderstanding



Misunderstanding:

Industrial ecologists overemphasise natural ecosystems *metaphors* and biological *analogies* in science and research, perhaps as a matter of logical proof.

Clarification:

Industrial ecologists make intensive use of metaphors and analogies, seen as core elements of the field, preferably used for *mind propelling* and *eye opening*.

- **Industrial ecologists use metaphors and analogies to gain fruitful insights (discovery) and to deliver new insights (application)**



Context of ...	discovery	justification	application
Characteristics			
Key question	How do researchers discover, gain, explore, obtain new insights?	What are the constraints of discovered insights, how well grounded are proclaimed conclusions?	What should be considered consequences and what effects resulting from new insights for theory and practice?
Drivers	Traditions, beliefs, credos, societal circumstances, cultural background, economic interests	Scientific validity, rigour, logical consistency, methods of proof, empirical confirmation	Interrelation between science and the Lebenswelt (lifeworld)
Criterion	Adequacy	Truth	Relevance and responsibility
Proper use of metaphor and analogy?	yes	no	yes

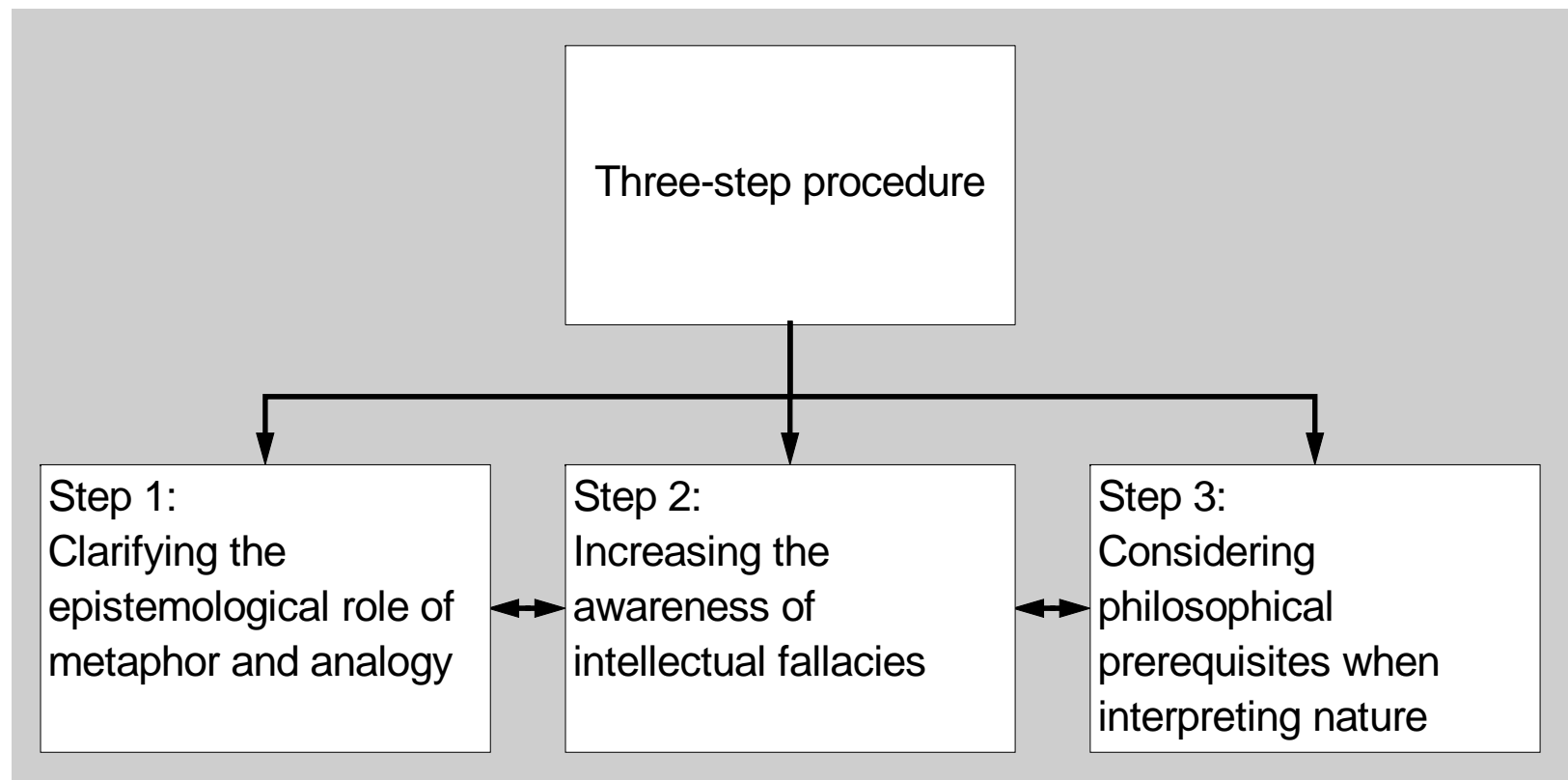
**Misunderstanding:**

The understanding of nature as a model characteristic for Industrial Ecology relies on a *shaky basis* and *unfounded ground*.

Clarification:

There are some efforts to clarify Industrial Ecology's understanding of nature, intended to contributing to a *solid and interdisciplinary body of theory* (e.g. ecological engineering, thermodynamics, economics, philosophy)

- **Industrial ecologists made progress in uncovering and exploring the unique understanding of nature typical for the field's identity**



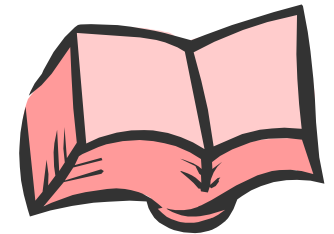


- Refreshingly *different* and *unorthodox* perspective of understanding nature as a model
- Understanding nature as a model is *not imperative*, but helpful to
 - overcome orthodox perspectives (sack of resources, limit) and to
 - learn from nature's smart phenomena, strategies and principles.
- Metaphors and analogies are excellent research instruments for *discovery* and *application*, but not for justification.
- As a young scientific community and emerging discipline, Industrial Ecology makes *considerable efforts* to contribute to a solid body of theory how nature is understood and interpreted.

Conclusions

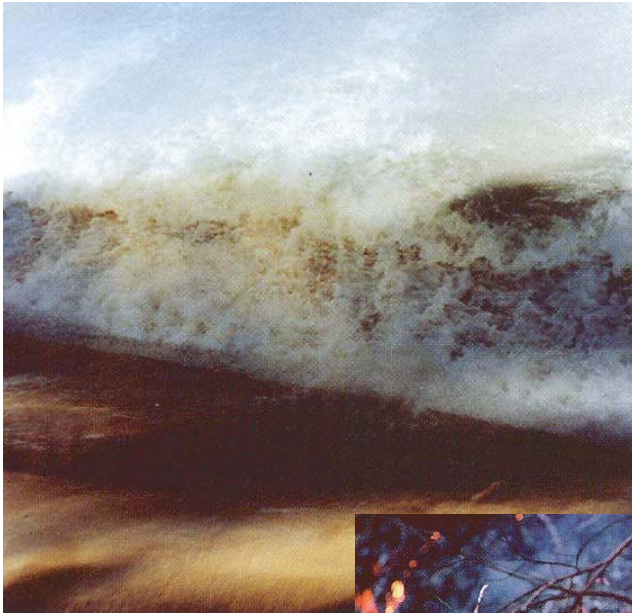


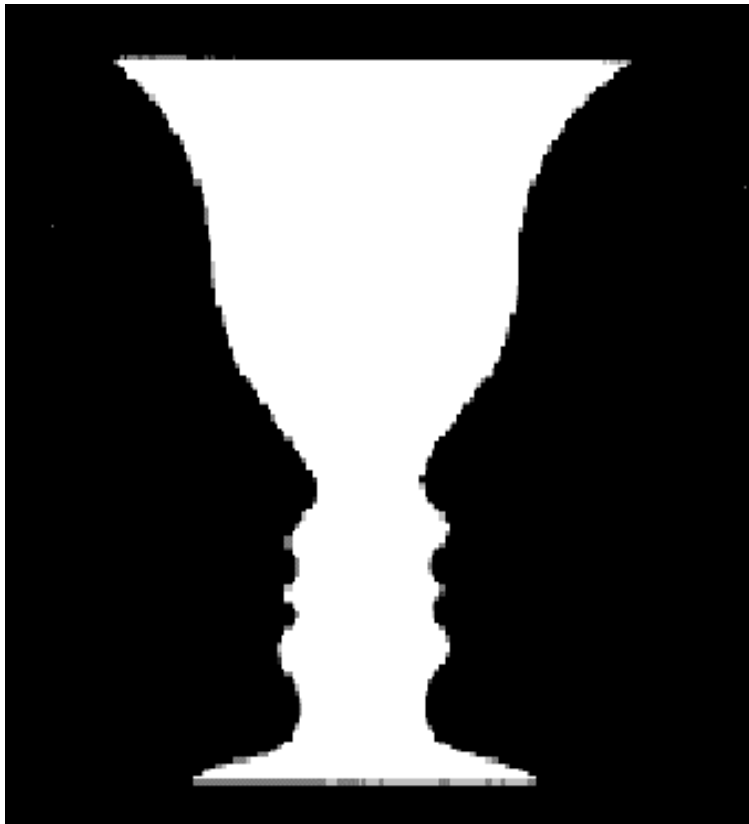
- ... is *not a straightforward* process of observing nature merely by empirical research: “Myth of pure inquiry” (Haila and Levins 1992)
- ... requires an understanding of both the reader and the process of reading (Kant 1787; Löw 1990).
- Hence, in the mirror of nature, humans see ultimately themselves. „So blickt man klar, wie selten nur, ins Herz der Forscher der Natur“ (Valsangiacomo 1998)
- Industrial Ecology has the potential to represent a promising and proper *scientific way* to carry out such an interpretation.







Conclusions

Considerations to “threats from nature”

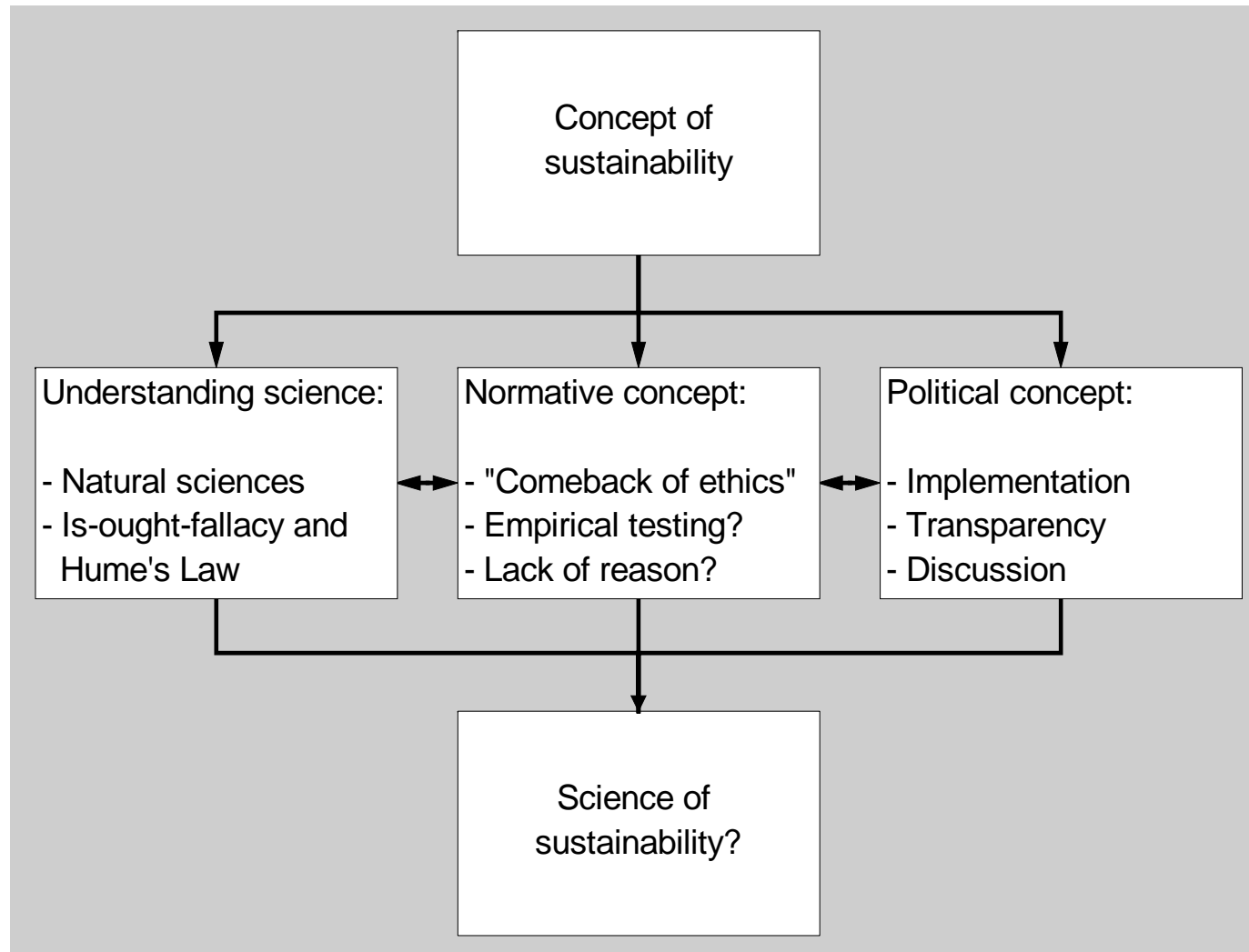




German survey: How do people understand “nature”?

Myths of nature	Strategy for management	Symbol	Survey in Germany		
			2004	2002	2000
Nature <i>benign</i> (Strapazierfähige Natur)	Nature is wonderful forgiving. ⇒ Laissez-faire		5 %	4 %	7 %
Nature <i>ephemeral</i> (Empfindliche Natur)	Nature is terrifyingly unforgiving. ⇒ Treat with great care		20 %	23 %	24 %
Nature <i>tolerant</i> (Tolerante Natur)	Nature is forgiving but vulnerable. ⇒ Regulate against unusual occurrences.		51 %	53 %	50 %
Nature <i>capricious</i> (Unberechenbare Natur)	Nature is a random world. ⇒ Manage with erratic events.		24 %	20 %	19 %

Source: (BMU 2004)



- A concept of sustainability must be a *normative-laden* concept covering ethical issues and dealing with norms, at least in its core.
- Terms like “sustainability science” or “science of sustainability” refer to an understanding of *science* which *does not exclude ethical issues* and normative presuppositions a priori as non-scientific.
- A pure understanding of hard sciences and natural sciences is *not sufficient* and does not provide a solid basis for a concept of sustainability.
- Normative issues and conceptual rigour are *no contradiction* in terms.

- Normative concepts are *the rule* and not the exception. Normative concepts propose what we should do and what not.
- In other words, sustainability science leads to the “*comeback of ethics*”.
- Given these insights of the fundamental interrelation of normative aspects and conceptual rigour, only then the terms like “sustainability science” or “science of sustainability” seem to make any sense and are thought to be *meaningful* at all.

- Hard sciences or natural sciences respectively must not derive conclusions (with normative implications) from pure facts (is-ought fallacy/Hume's law).
- A concept of sustainability must be a *political* concept, particularly when it is to implement solutions found by scientific research.
- As a political enterprise, the concept of sustainability needs to be made *transparent* to society and *discussed* publicly.
- I argue for a concept of sustainability whose *ethical and political* implications are made transparent. Any effort of introduction merely on the basis of description offered through the natural sciences seems to be at fault here.