Criticism of induction-based theories

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2.3 Belief in theories

3. Structuring theories
3.1 Inflation and names of theories – The chaos in Popper's World 3
3.2 Reduction of theories to axioms (core ideas, conceptual clarity)

Goal

Insight: Inductively derived theories cannot be proved,
you can only verify a certain probability

Consequence: Necessity of analytic thinking on the basis
of many different theories and a lot of experience

Advantage: to take better and more reliable decisions,
not to be the sacrifice of dogmas, ideologies and extremism
(which are based on a very restricted number of theories)

"Disadvantage": you have to know a lot until you know
that you do not know anything

Introductory example

Treatment of sports injuries

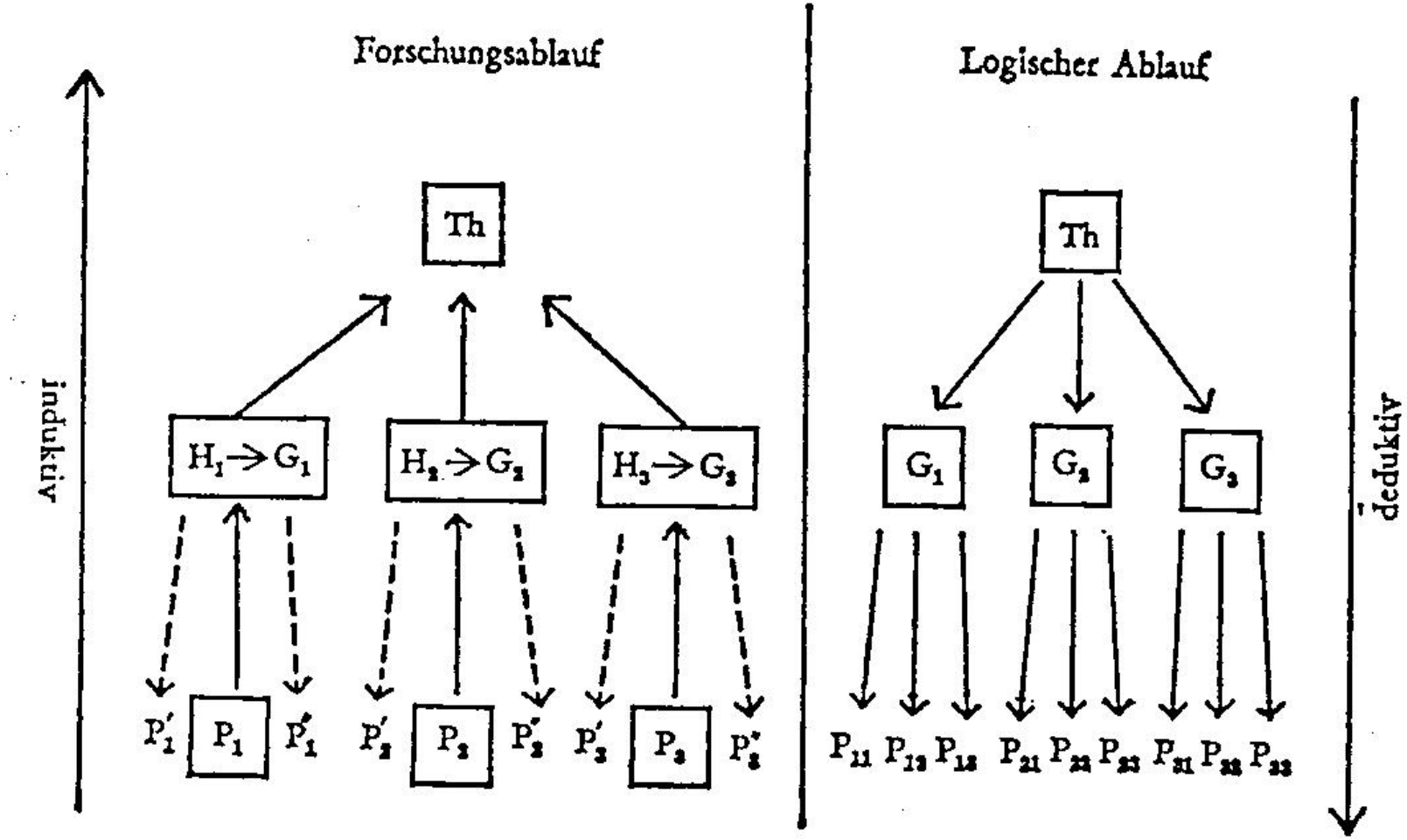
Theory 1: cold, training

Theory 2: warm, rest

Improved theory (umbrella theory) with case distinction:
Light injury ⇒ Theory 1
Severe injury ⇒ Theory 2
(inductive theory construction based on theories!!!)

Mathematical interpretation:
A theory is a function which can be applied to certain situations
Function: Theory (injury) = treatment

1. Induction-based theory construction



Die Abkürzungen bedeuten: Th = Theorie, G = Gesetz, H = Hypothese, P = Protokollaussage.

(Seiffert, Wissenschaftstheorie 1, 1991, 167)

1. Induction-based theory construction

A theory can be understood as mathematical function.
The description of the function is derived
from a very small discrete domain of training objects.
Then the function is expanded to a larger domain.

E.g. the classification function which can identify objects as tables
is derived from a very small number of different tables (training objects).
Then, however, this function has to be applied to other objects,
that is, the starting domain has to be extended to a larger domain.

f: {objects} → {Boolean}
f (table) = yes
f (no table) = no

1. Induction-based theory construction – Examples

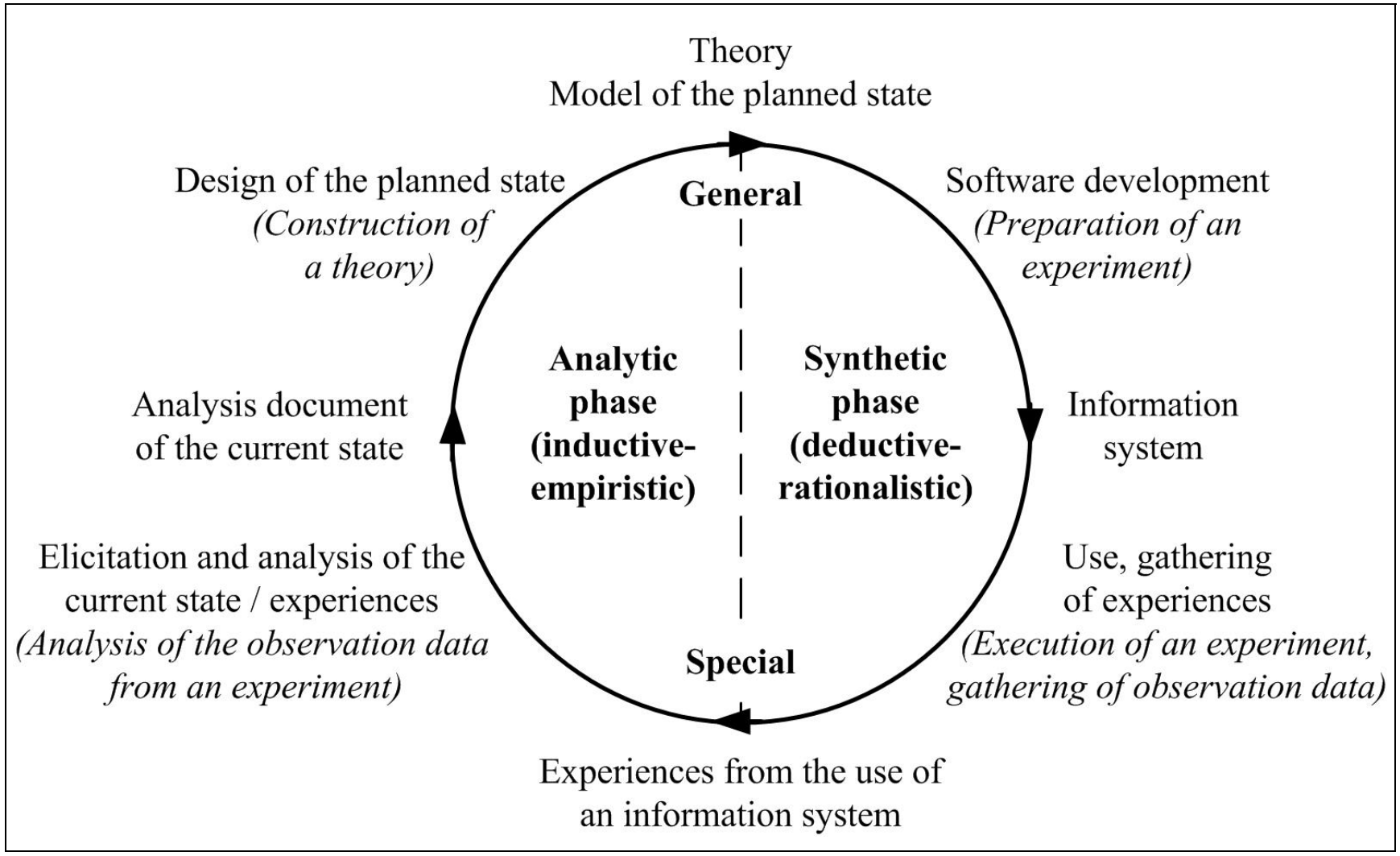
Different perspectives on technology

	Primary use	Secondary use
	(training objects)	(expansion, transfer)
	Good	Bad
Bow and arrow	Hunt deer	Kill people
Internet	Democratizing	Fakes, lies, nonsense

Existence of free will

Starting point: “simple” examples from neuroscience

1. Induction-based theory construction – Improvement



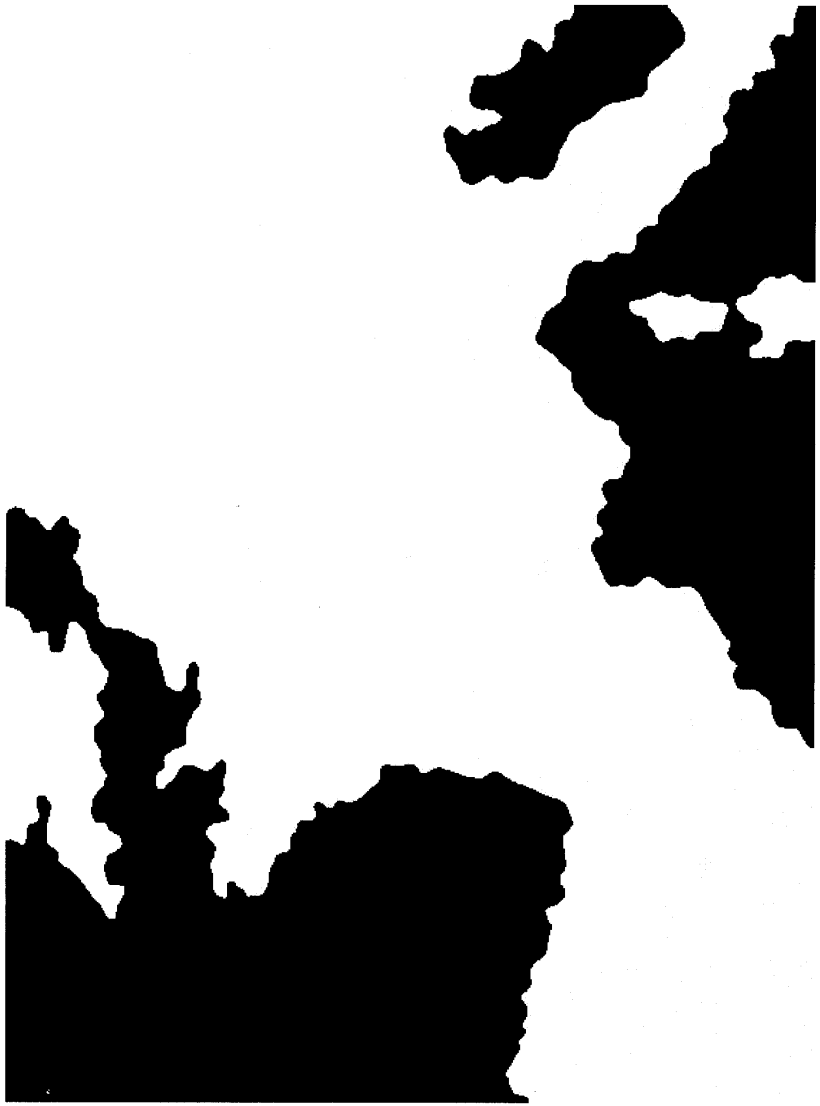
(Holl / Paetzold / Breun, IS anti-aging, 2008; according to Holl, 1999, 175)

1.1 Observations as starting point for induction-based theory construction: Do we see what we see?

Naive realism vs. critical realism and moderate constructivism
Descriptive categories vs. immanent categories

→ Details in "Epistemological approaches"

1.1 Observations: Do we see what we see?

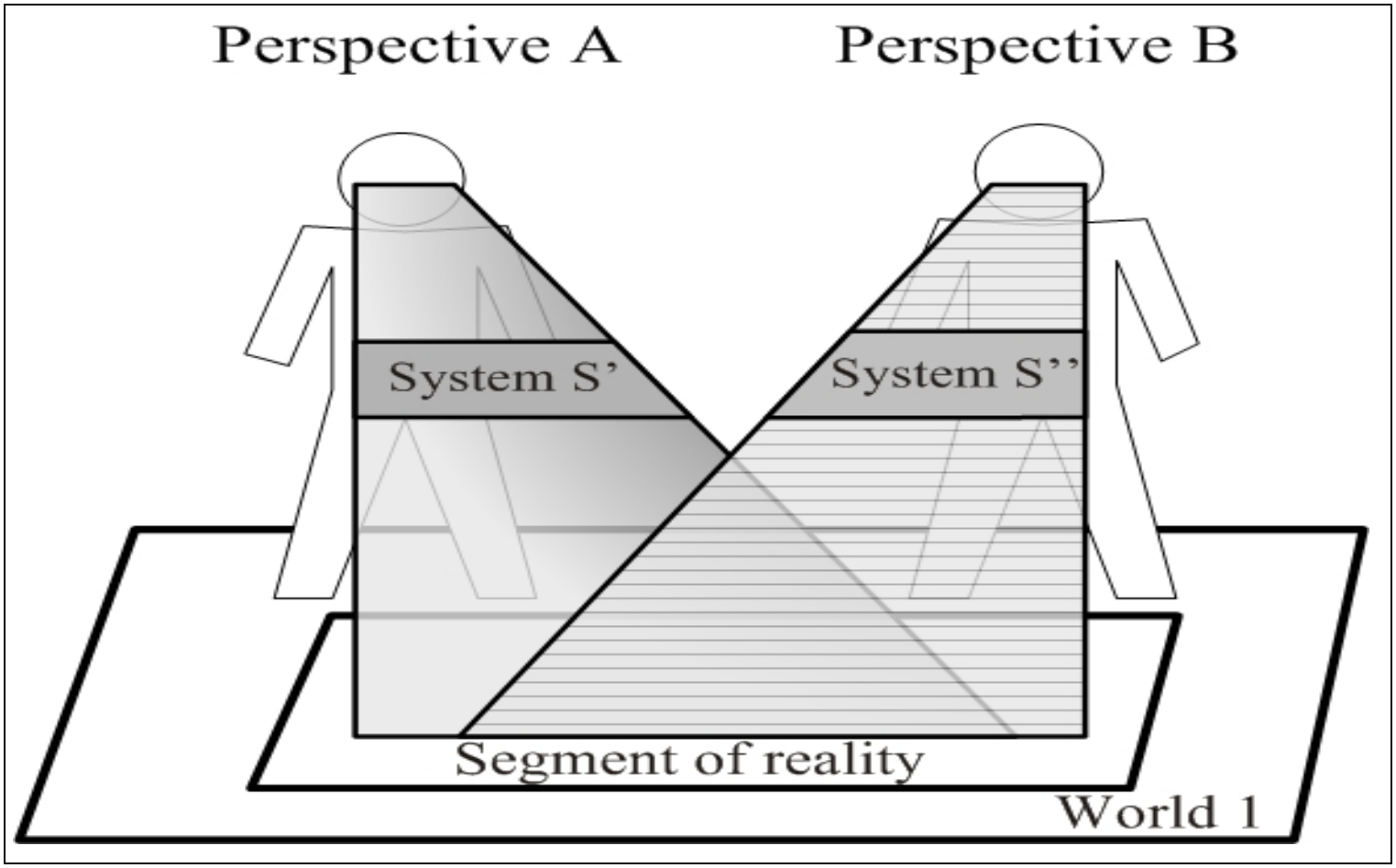


1.1 Observations: Do we see what we see?

(Hajos, Wahrnehmungspsychologie, 1991, 18)

1.1 Observations: Do we see what we see?

multi-perspectivity of IS experts and organization / domain experts



Systems are relative to perspectives (adapted from Steinmüller 1993, 168)

1.1 Observations: Do we see what we see?

Several steps of interpretation and abstraction!

Observations are based on perception
Perception is based on previous knowledge
Perception is selective (regarding "important" features), not complete

Observations have to be described using natural language
Natural language is based on culture, conventions

Observations have to be modeled/formalized using formal language
"Important" features are selected
Structural similarity, analogy of different observations required

And that's what we put into inductive theory construction!
Do we include all of the "important" / "relevant" parameters of a situation?

1.1 Observations: Do we see what we see?

There aren't any models without model designers.
Models are the result of cognitive processes
where model designers unconsciously use cognitive strategies.

Epistemological, cognitive dilemma:
We must derive theories in order to understand "the world"
although inductively derived theories cannot be proved.
We cannot do anything else.
We are condoomed to deriving theories (French existentialism).
Therefore:
We have to be careful with theories.
We have to derive theories in a conscious and well reflected way.

1.2 Automatic theory construction

Neural networks (implicit theory construction)

Data mining
– process mining with WFMS -> example: a certain employee works badly
    observed parameters (often quantitative): errors, velocity etc.
    not observed parameters (often qualitative):
        quality of working-space, technical infrastructure, ergonomics

Market research
– individual / personalized advertising
– profiling

Security
– preventive policing
– secret services / agencies and their “selectors”

Big data, NoSQL databases, data privacy …

1.3 Influences on theories

Main stream (money for research projects!)
– greenhouse effect
– work-integrated learning

Employers (money!)
– pharmacy

University life (money!)
– publish or parish
– quotation indexes
– science marketing

Paradigm changes

(Paul Feyerabend)

1.3 Influences on theories

Third party funding at German universities

2. Profit and danger of theories

2.1 Reliability and value of theories

Quality of the underlying observations and their description
Quality of the selection of "relevant" observations
Quality of the selection / definition of "relevant" features
Representativity of the sample?

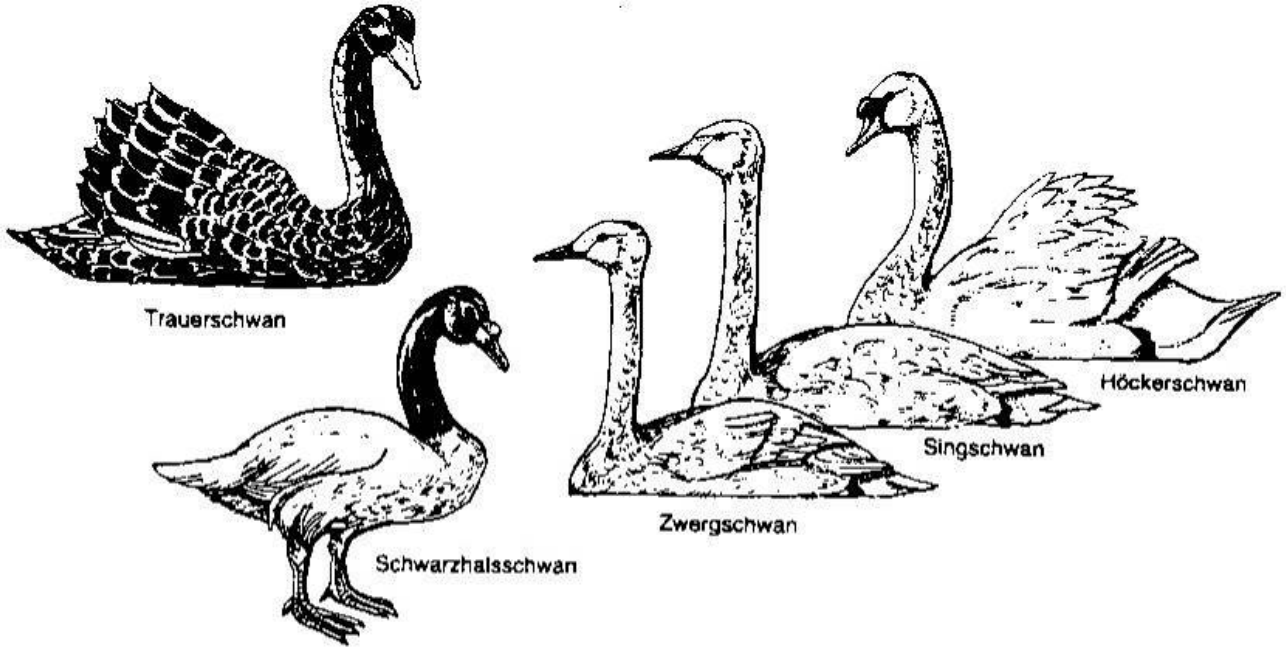
Quality of the selection and application of the methods used

Epistemological value?

Problem (forbidden generalization):
People who think that a theory derived from some examples can effectively be applied to any possible example.

2.2 Provability of theories – Karl Popper's fallibilism

Theories can only be falsified, but not proved!



Species of swans; the European species are contrasted with those from the southern hemisphere (left); with the Australian black swan and the Black-necked swan from Southern Chile and Tierra del Fuego (Riedl, Biology of Knowledge, 1984, 162)

2.3 Blind belief in theories?

1. Self-fulfilling prophecy: fear, vision, prejudice/bias
Fear of falling stock prices → sales orders → falling stock prices

2. Effect of estimated parameter values in mathematical formulae:
Formulae in economics look exact although they are based on estimations.
This pseudo-exactness can produce a crisis in economics, e.g.
– real estate crisis, bank crisis

Example: gross domestic product GDP

$$\Delta BIP_t = \beta_0 + \beta_1 GL_{t-6} + \beta_2 GE_{t-6} + \beta_3 TREND + \beta_4 \log(DAX)_{t-6} + \beta_5 \Delta \log(AUFTRAG)_{t-8} + \varepsilon_t$$

$$\widehat{\Delta BIP_{t+6}} = \hat{\beta}_0 + \hat{\beta}_1 GL_t + \hat{\beta}_2 GE_t + \hat{\beta}_3 TREND + \hat{\beta}_4 \log(DAX)_t + \hat{\beta}_5 \Delta \log(AUFTRAG)_{t-2} + \varepsilon_{t+6}$$

3. Structuring theories

3.1 Inflation and names of theories – The chaos in Popper's World 3

World 1: "nature", even physical artifacts created by humans;
(immanent categories)

World 2: "human", world of phenomena, individual experiences;

World 3: "culture": world of models, concepts, ideas; contains
dependent re-constructions and independent constructions
– dependent concepts with empirical basis: descriptions
– independent concepts without empirical basis: ideas, νούμενα
(descriptive categories)

Upward compatible theories in experimental physics
(e.g. classical mechanics, relativistic mechanics etc.) vs. other fields

THEORIES OF INFORMATION BEHAVIOR

Edited by Karen E. Fisher, Sanda Erdelez, & Lynne (E. F.) McKechnie
Forthcoming Spring 2005
Published by Information Today, Medford, New Jersey

ASIST SIG USE Website: www.asis.org/SIG/SIGUSE/

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3.1 Inflation and names of theories – The chaos in Popper's World 3

Similar:
List of theories established by the Association of Information Systems
aisnet.org

3.2 Reduction of theories to axioms – Conceptual clarity

Chaos of different methods to select suppliers in business

well-sounding names
give the impression of extreme differences, of non-comparability

What's the profit?

Abschnittsnummer	Eigenschaften / Verfahren	Bewertung von Einzelkriterien				Gewichtung	Kategorisierung			Graphische Darstellung	Soll-Ist-Werte	Transformations-formel
		Ja/Nein - Bewertung	Notensystem	Punktbewer-tungssystem	K.O.-Kriterien		Anzahl der Kategorien-ebenen	Hauptkriterien (Kategoriengru	Teilkriterien (Kategorie)			
4.2.2.2	Qualifiziertes Notensystem	-	X	-	-	-	1	-	-	-	-	-
4.2.2.3	Prozentbewertungssystem	-	-	X	-	X	1	-	-	-	-	-
4.2.2.4	100-Punkte-Bewertungsverfahren (Höchstpunktzahlverfahren)	-	-	X	X	X	1	-	-	-	-	-
4.2.2.5	Profilanalyse	-	-	X	X	-	1	-	-	X	-	-
4.2.2.6	Dreidimensionale Lieferantenauswahl	-	X	-	-	X	2	X	X	-	-	-
4.2.2.7	Drei-Noten-System	-	X	-	-	-	2	X	X	-	-	-
4.2.2.8	Indexsystem	-	X	-	-	-	2	X	X	-	X	-
4.2.2.9	Scoring Modell	-	-	X	-	X	2	X	X	-	-	-
4.2.2.10	Nutzwertanalyse	-	-	-	-	X	2	X	X	-	X	X
4.2.2.11	Checklistenverfahren	X	X	-	X	X	3	X	X	-	-	-