

- **Title: Digital Society – Lost in Complexity?**

Die Komplexität von Software Systemen hat in den letzten Jahren stetig zugenommen und gleichzeitig ist Software das Nervensystem unserer Gesellschaft geworden. In Anbetracht der zu erwartenden gewaltigen ökologischen, gesellschaftlichen, politischen und in Folge ökonomischen Herausforderungen der kommenden Jahrzehnte, ist es von fundamentaler Bedeutung diese zunehmend kritische Infrastruktur nachhaltig und vor allem resilient zu gestalten.

Schon heute stecken viele von Software abhängige Organisationen und Unternehmen in der Krise: Fehler, im schlimmsten Fall Ausfälle, mangelnde Wartbarkeit, Sicherheitsprobleme, stetig steigende Betriebskosten aber auch ethische Probleme können zur existenziellen Bedrohung der Infrastruktur und damit auch der Betreiber werden.

Wie sind wir in diese Komplexitäts-Falle geraten? Welche treibenden Faktoren kann man beobachten und, vor allem: welche Rolle spielen menschliche und organisatorische Faktoren um zu nachhaltigen und resilienten Softwaresystemen zu gelangen.

- ▼ **Introduction**

- ▼ **About myself**

- TU, Chemie, Software Engineering of complex softwaresystems
- Startup: Sophisystems
- Deloitte
- MD: Biac/TF – IT-Tochter der Vienna Insurance Group
- SBA and free mind

- ▼ **Contact / Infos**

- <https://www.schatten.info>
- <https://sichten.blogspot.com>
- <https://podcast.zukunft-denken.eu>  
coming soon – stay tuned!
- [https://twitter.com/alex\\_buzz](https://twitter.com/alex_buzz)
- <http://photos.schatten.info>

- ▼ **A Meta-Thought**

- ▼ **What are conferences good for?**

- Information?
- Connection!
- → so this is a fishing trip

## ▼ What ist the problem?

- **Core thesis: »We lost control of our complex IT-systems (or are very close)«**

### ▼ We?

- First lesson: **Software Systems are not just the technical part!** (even though this alone is complex enough)

#### ▼ Software Systems

##### ▼ Technical Components

- different technical parts
- on different locations
- in different responsibilities

##### ▼ People (with tacit knowledge)

- Devs
- Ops
- Domain-experts
- Customers
- Management

##### ▼ other stakeholder

- Society
- Politics and other structures

### ▼ Symptoms can be observed everywhere

#### ▼ **Failure** of large projects

- Lidl writes off 500mio € (SAP)
- VIG writes off 180mio € (SAP)

#### • **Quality** Issues

#### • **Performance** problems

#### • **Bloatware** – massive systems for trivial functions

#### • Constantly rising **IT costs** without adequate progress

#### ▼ **Ethical and societal** problems

- lack of data protection

- automation (financial trading systems, ...)
- tracking
- manipulation (fake news, deep fake)
- attention seeking systems – addiction / distraction

▼ **massive security issues!**

- Deloitte hacked 2017  
<https://www.theguardian.com/business/2017/sep/25/deloitte-hit-by-cyber-attack-revealing-clients-secret-emails>
- British Airways Leak 2018
- Facebook 2018: large number of companies have full access to customer data
- Marriott data theft 2018 (halbe Milliarde Kundendaten)
- 35C3 – Gesundheitsakte Deutschland  
[https://media.ccc.de/v/35c3-9992-all\\_your\\_gesundheitsakten\\_are\\_belong\\_to\\_us](https://media.ccc.de/v/35c3-9992-all_your_gesundheitsakten_are_belong_to_us)

▼ **Lets focus on the problem not the symptom!**

- → Figure

▼ **We saw it coming – since 50 years...**

▼ → »Software Crisis« (1968)

- Nato Software Engineering Conference (1968): [https://en.wikipedia.org/wiki/NATO\\_Software\\_Engineering\\_Conferences](https://en.wikipedia.org/wiki/NATO_Software_Engineering_Conferences)
- Edsger Dijkstra, The Humble Programmer, ACM Turing Lectures (1972)
- Melvin E. Conway, How do Committees Invent?, Datamation (1968)

▼ → »Wicked Problems« (1973)

- Rittel, Webber, Dilemmas in a General Theory of Planning, Policy Sciences 4 (1973)
- Steve Easterbrook, From Computational Thinking to Systems Thinking, Proceedings of the 2nd International Conference on Information and Communication Technologies for Sustainability (ICT4S'2014)

## ▼ What is at stake?

- **Everything.**
- ▼ **Even though we are too clumsy to manage them properly, we made IT Systems the nervous systems of our society**
  - »Software is eating the world«, Marc Andreessen  
<https://www.wsj.com/articles/SB10001424053111903480904576512250915629460>
- ▼ **Criticality of IT systems is constantly increasing**
  - ▼ short term
    - food supply chains
    - water
    - electricity
    - mobility
    - medical supply and services
    - governmental systems
    - police
    - military
  - ▼ mid and long term
    - political and economic threat
    - complexity was and is steadily rising
  - ▼ we need to be able to
    - keep access to data from legacy systems
    - keep important processes running
    - in a safe and reliable environment
- ▼ **...and also: let's not mix up the terms progress and innovation**
  - what we want is progress, not innovation
  - Innovation is marketing talk in the absence of progress

## ▼ Complexity?

### ▼ Let's try a Definition

- ▼ many individual parts / agents
  - interact
  - modify each other in the process
- new patterns of behaviour emerge
- → system functionality is notably a bottom up effect
- "Simple objects are more dependent on (physical) constraints than on history. As complexity increases, history plays the greater part.", Francois Jacob

### ▼ Ok, examples needed → figure

- inspired by Rich Hickey, he, however, mostly focuses on *avoidable* complexity, which is only part of the story

<https://www.infoq.com/presentations/Simple-Made-Easy>

### ▼ Characteristics of complex systems

- thinking in cause and effect do not make much sense
- ▼ more general
  - prediction very hard if possible at all
  - ▼ we tend to vastly overestimate our capabilities to predict and control complex systems
    - Siehe z.B. Philip Tetlock, Dan Gardner, Superforecasting – The Art and Science of Prediction
  - we make heroes out of survivorship bias
- ▼ scale-effects
  - a village is not a large family
  - a city is not a large village
  - a country is not a large village
  - the global society is not a large country
  - → „global village“ slogan is nonsense
- ▼ behaviour follows other characteristics
  - ▼ feedback loops
    - Donella H. Meadows, Thinking in Systems: A Primer

- ▼ attractors and tipping points
  - Barnosky et al, Approaching a state shift in Earth's biosphere (Nature Review)
- ▼ resilience vs. fragility
  - Zoll, Healy, Resilience, When Things bounce back
- ▼ systemic archetypes
  - ▼ z.B. [https://thesystemsthinker.com/wp-content/uploads/2016/03/Systems-Archetypes-I-TRSA01\\_pk.pdf](https://thesystemsthinker.com/wp-content/uploads/2016/03/Systems-Archetypes-I-TRSA01_pk.pdf)
    - fixes that fail
    - tragedy of the commons
- ▼ in business and political practice we often face „wicked problems“
  - there is no simple description of the problem
  - ▼ there is no stop-condition (when the goal is reached), no simple correct/wrong solution
    - we stop when resources are over or
    - when we reaches some progress
  - wicked problems are unique
  - a wicked problem expands: it can be the symptom of another wp or the source of another
- in complex software systems: no one is actually capable to describe the current functionality and context of the system

## ▼ And now?

### ▼ Conclusion

- complex software systems show **emergent behaviour**, which we do not understand sufficiently
- „static“ viewpoints do not work well → dynamic behaviour is what counts, we are yet not good at thinking that way
- „classical“ management practices do not work well either
- most have not even understood the problem as yet

### ▼ Three suggestions as a teaser – more at the buffet

#### ▼ 1. New phenomena need new pictures and narratives

- CSS is not a pile of „simple“ software
- CSS much more organic systems than „deterministic“ machines – surprise for many!

#### ▼ think

- garden
- ecosystem

#### ▼ 2. Humility

- we know less than we think we do
- we can predict less than we think we do
- Resilience instead of (perceived) stability
- Everything can break or be corrupted at any point in time

#### ▼ 3. „Software Ecosystem Management“

##### ▼ first steps done or in progress

- agile

##### ▼ evolutionary architectures

- avoid unnecessary complexity
- manage unavoidable complexity

- ~~waterfall~~ → beyond budget

- incentive systems: ~~traditional management KPIs, boni~~ → objectives and key results

- a lot is still unclear

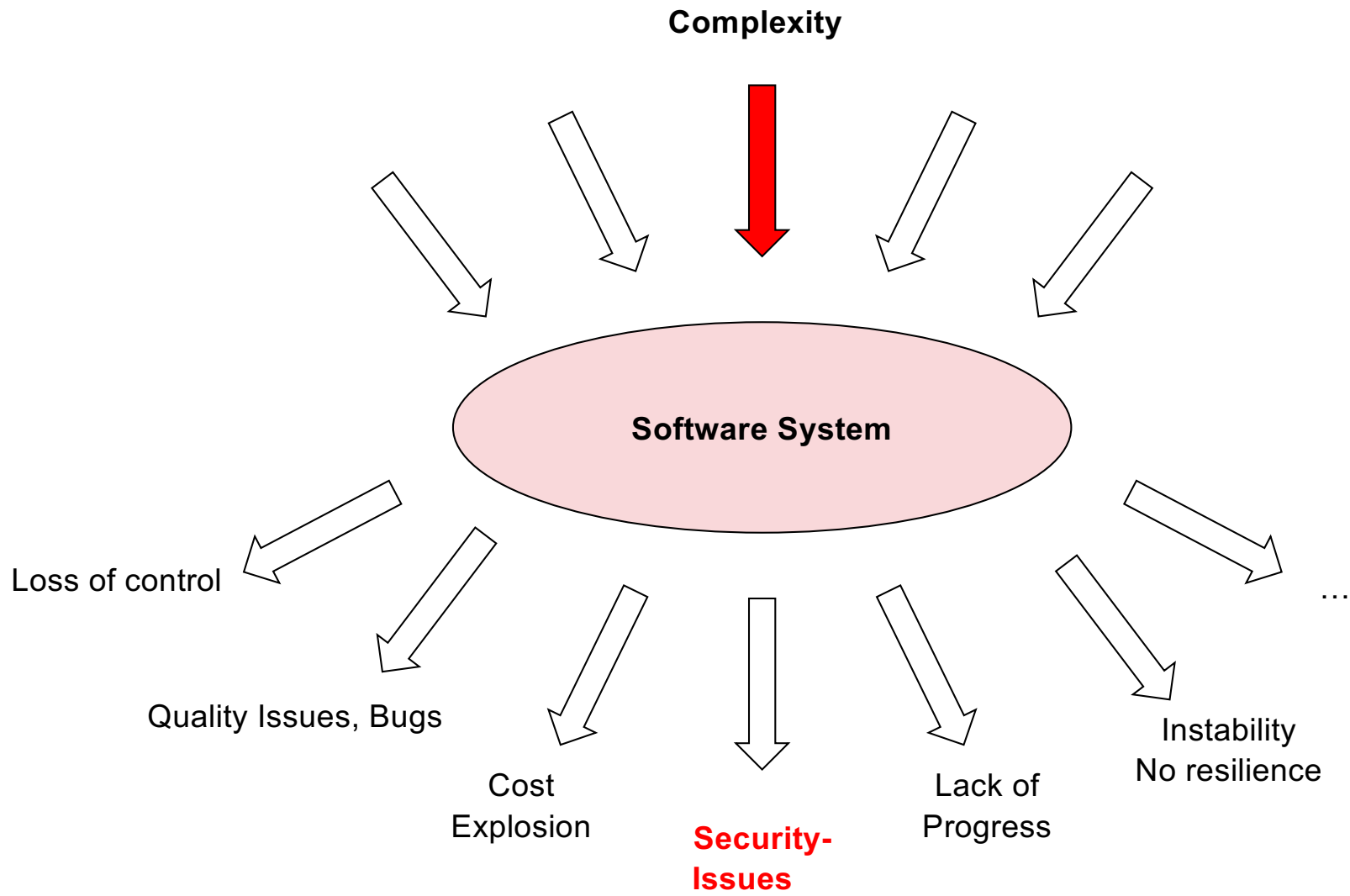
# Digital Society – Lost in Complexity

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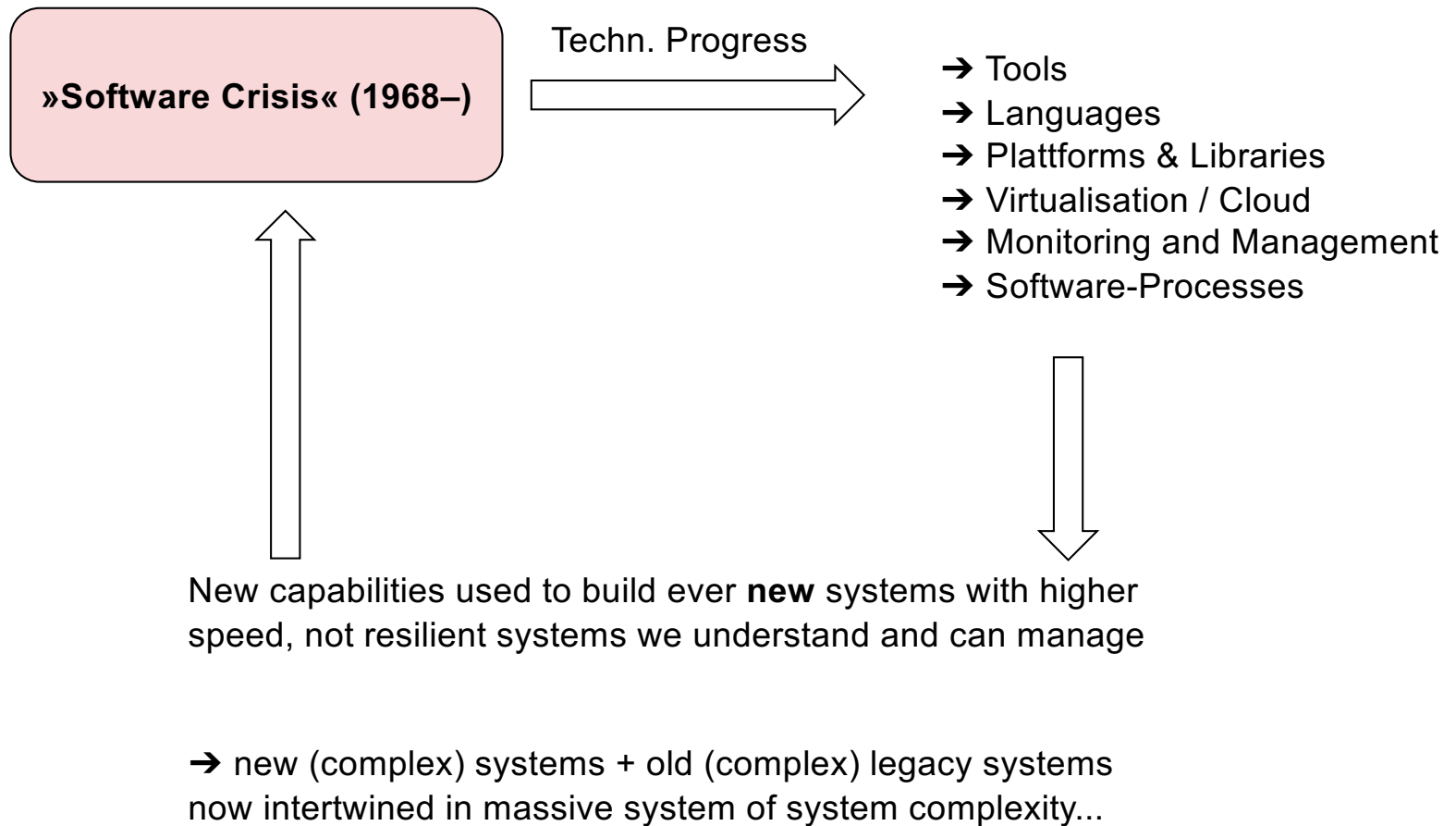
“A system is a set of things-people, cells, molecules, or whatever-interconnected in such a way that they produce their own pattern of behavior over time.”

**Donella Meadows, Thinking in Systems**





# »Balance of Dread«



***Subjective Properties*** *(in relation to ...)*

Easy

Complicated

Simple

***Systemic  
Properties***

Complex

*Subjective Properties* (in relation to ...)

Easy

Complicated

*Systemic  
Properties*

Simple

<p>«Angry Birds»</p> <p>»Mensch ärgere dich nicht«</p> <p>»one food stall«</p>	<p>»space probe«</p> <p>»flight traffic«</p> <p>»mechanical watch«</p> <p>»car (1970)«</p>
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Complex

*Subjective Properties (in relation to ...)*

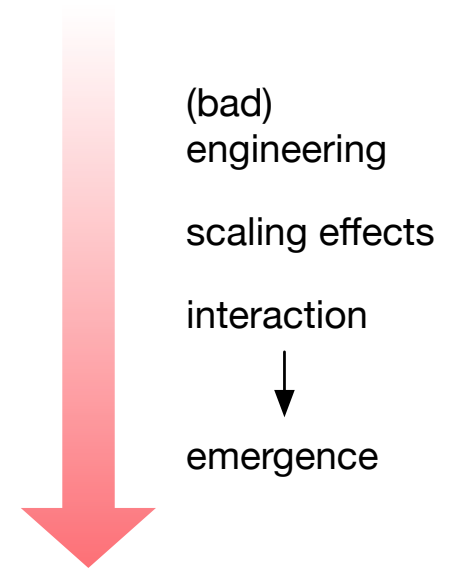
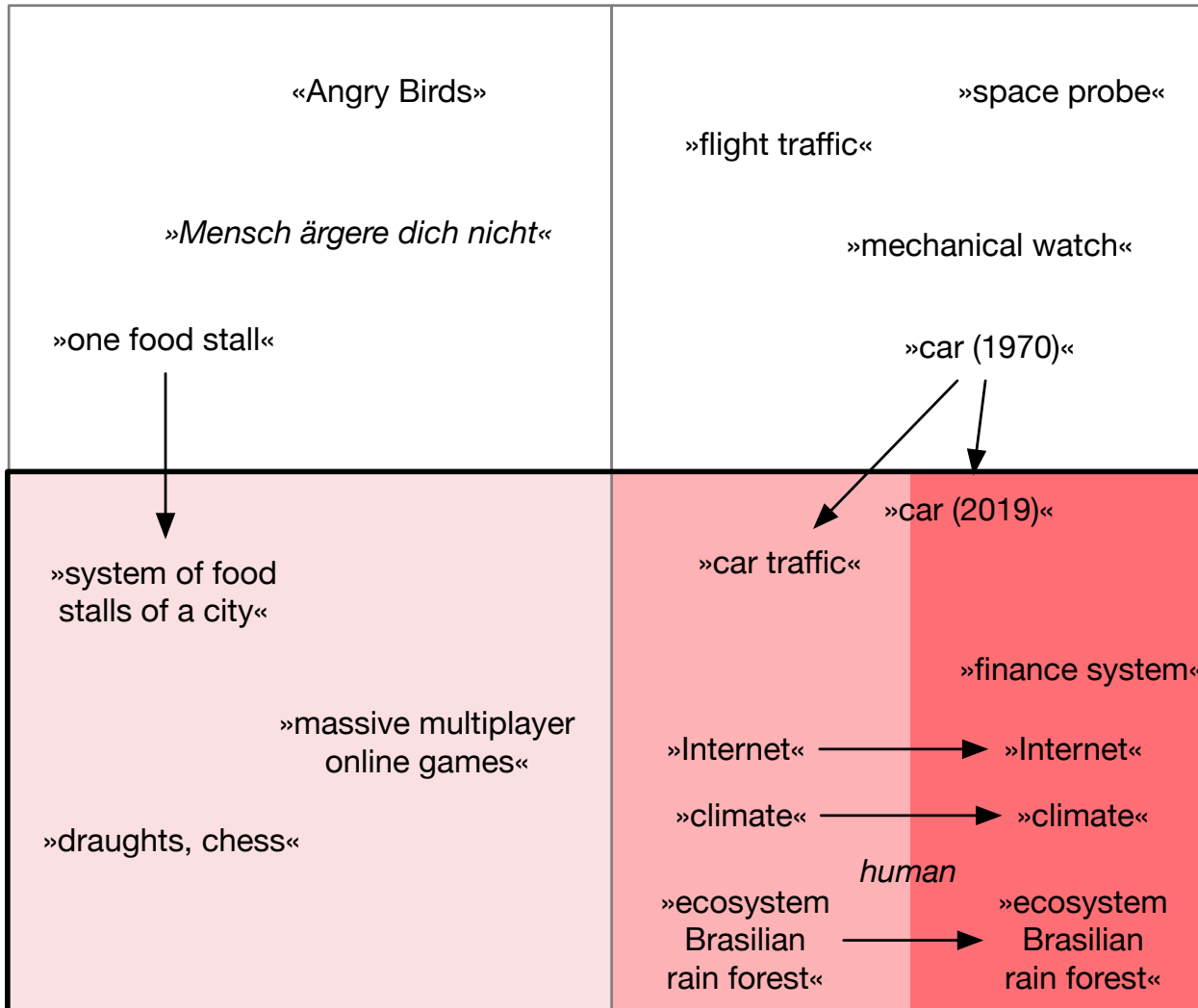
Easy

Complicated

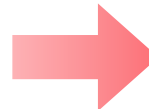
Systemic Properties

Simple

Complex



resilient



fragile

# And now? Too much complexity – too little time

## Contact

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- SBA
  - Security and Software Engineering
  - Management of Complex Software Systems
- Contact me for discussion!

»Der menschliche Verstand ist nicht dazu geschaffen,  
komplexe Systeme zu verstehen.«

Rupert Riedl, *Evolution und Erkenntnis* (1985)

