



# CAT AND TOP THINKING FOR INDUSTRIAL SOLUTIONS

Congress on Categorical Methods  
in Algebra and Topology


August 20-26, 2000  
Bremen, Germany

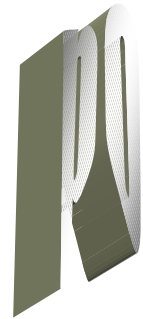
UNIVERSITÄT  
BREMEN





## agenda

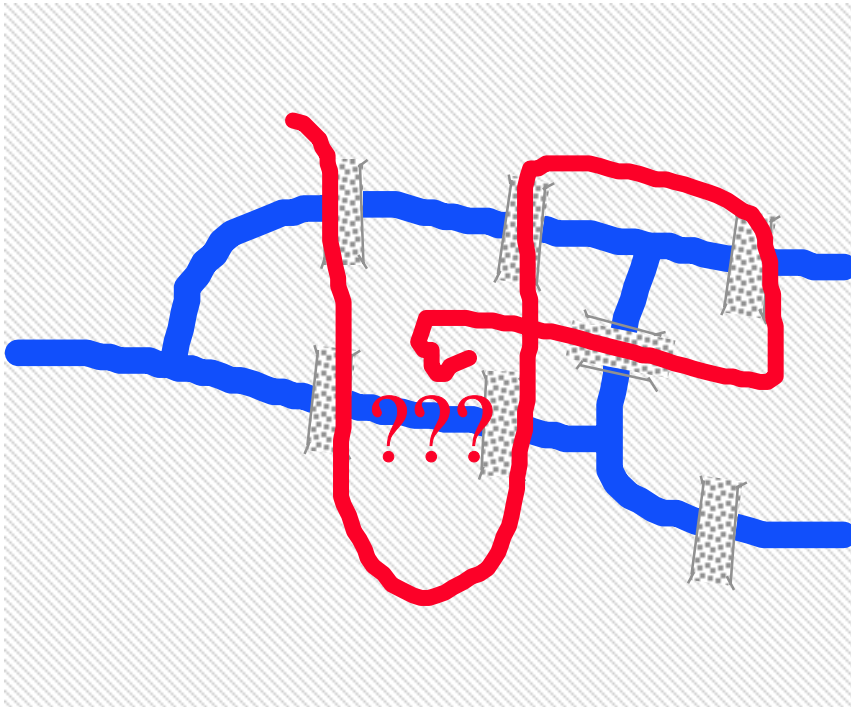
- **C**ats
- **a**pplications
- **t**ops
- **M**eteorology
- **A**nti „vogue“
- **T**heory  but realisation still open problem
- **2000** program for visualisation





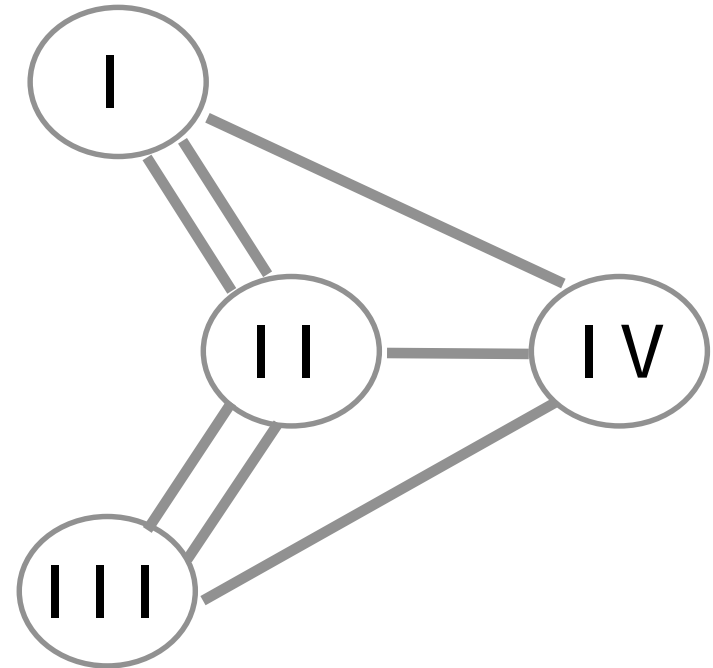
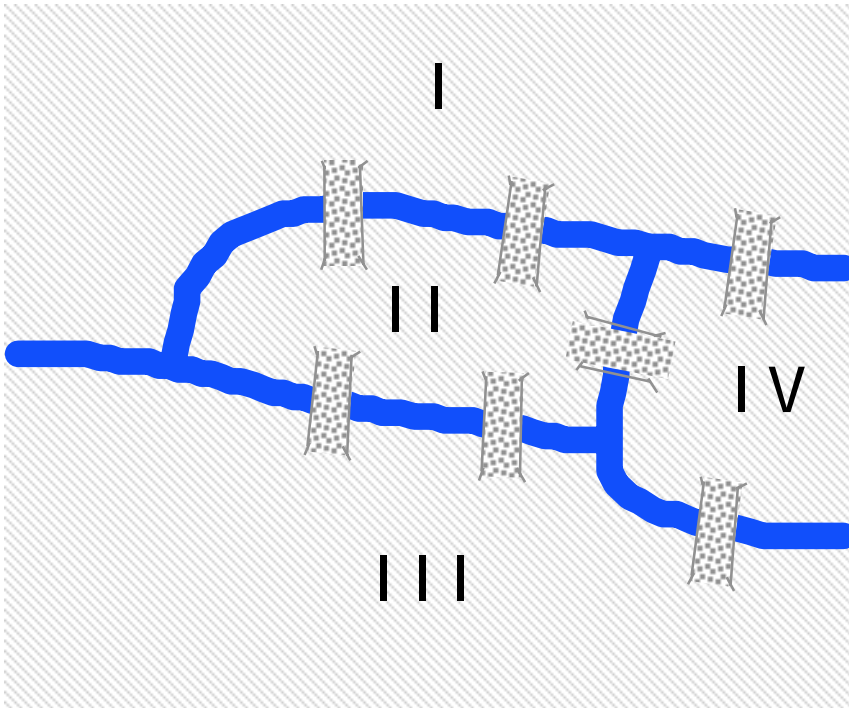
# Cat and Top Thinking for Industrial Solutions

## L. Euler (1707-1783): "Königsberger Brückenproblem"





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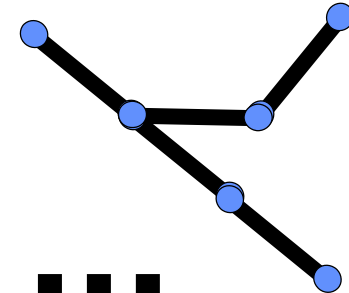
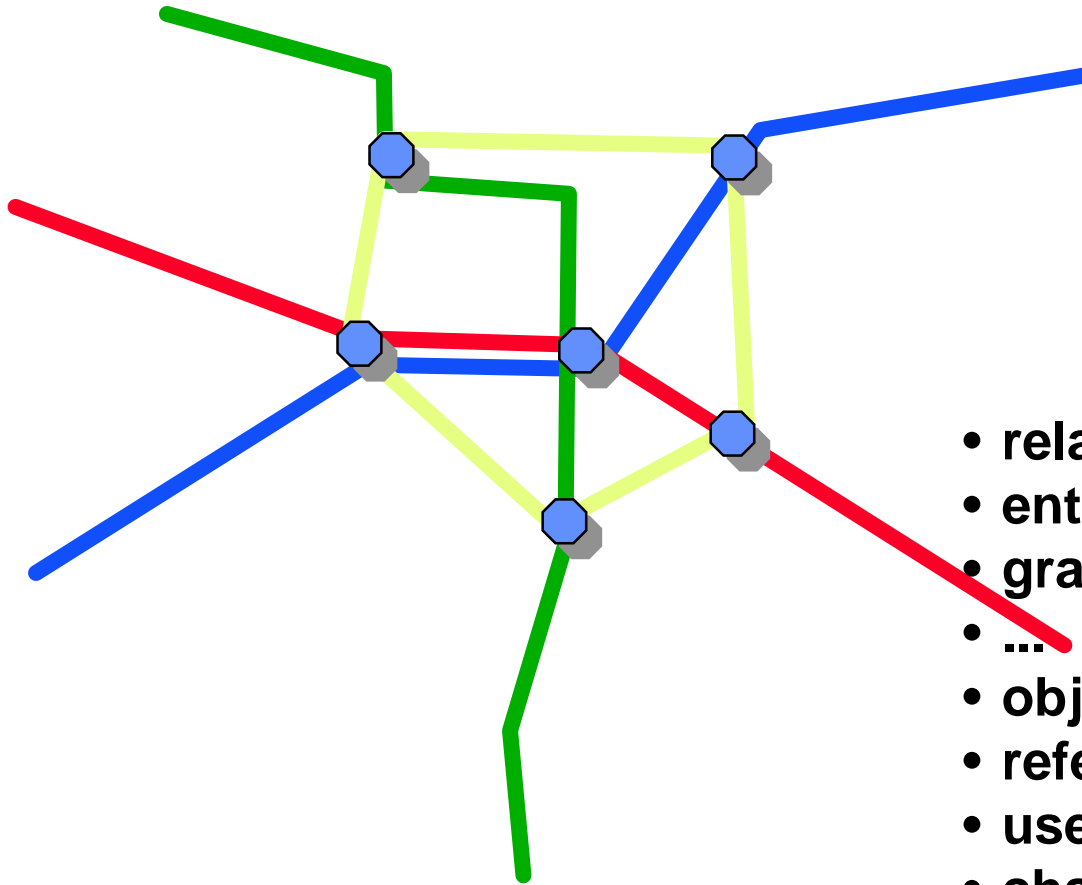


"topological view" (simplified visualisation)

- ✧ traffic grids
- ✧ pipeline networks
- ✧ power networks
- ✧ biochemistry, knot theory, ...



## points vs relations



- relational DBs
- entity relationship models
- graph theory in comp. sc.
- ...

- object orientation (oop)
- referential integrity
- user's view
- chaos in big info systems

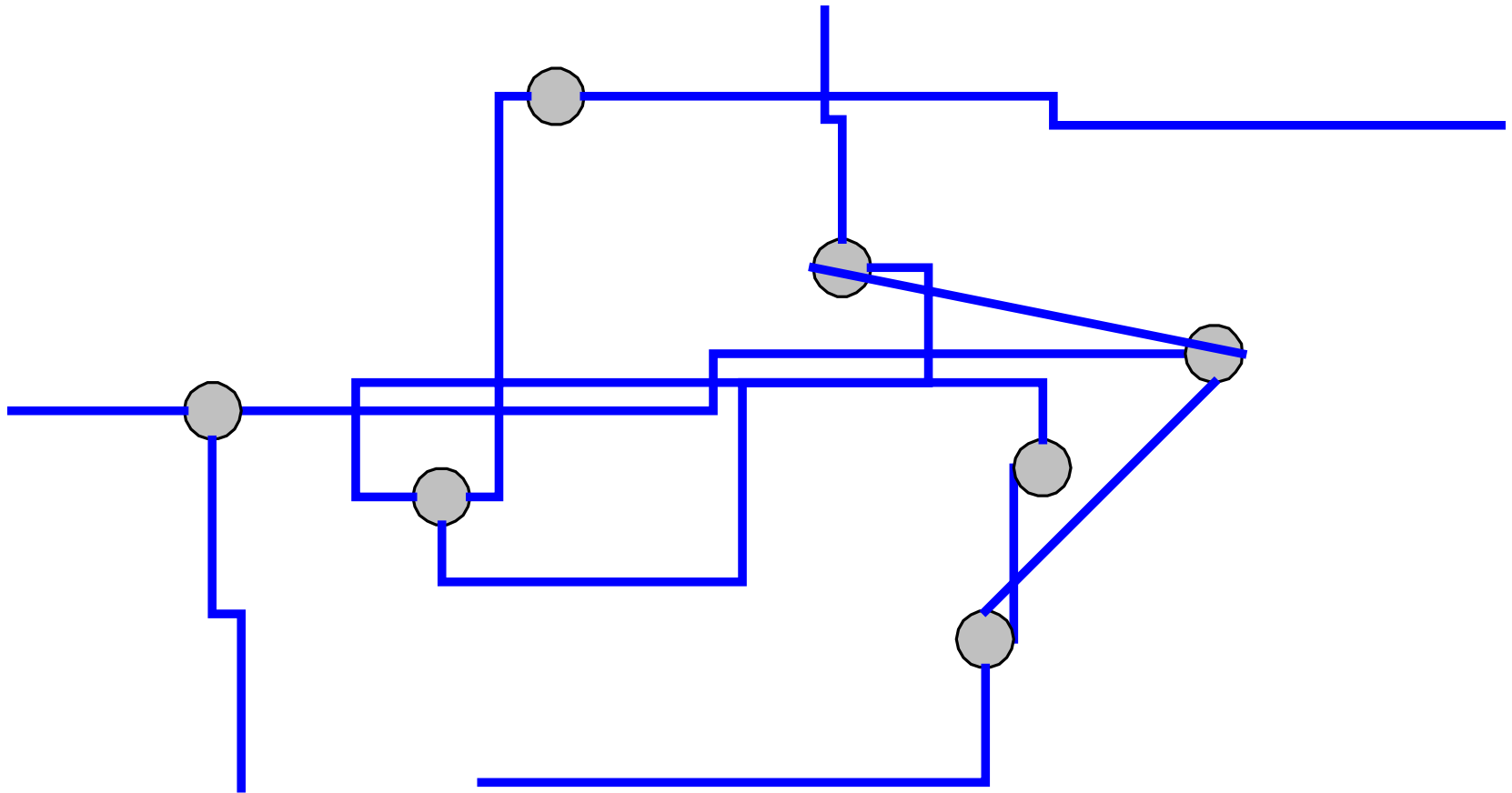
**need of cat top assistance**





# Cat and Top Thinking for Industrial Solutions

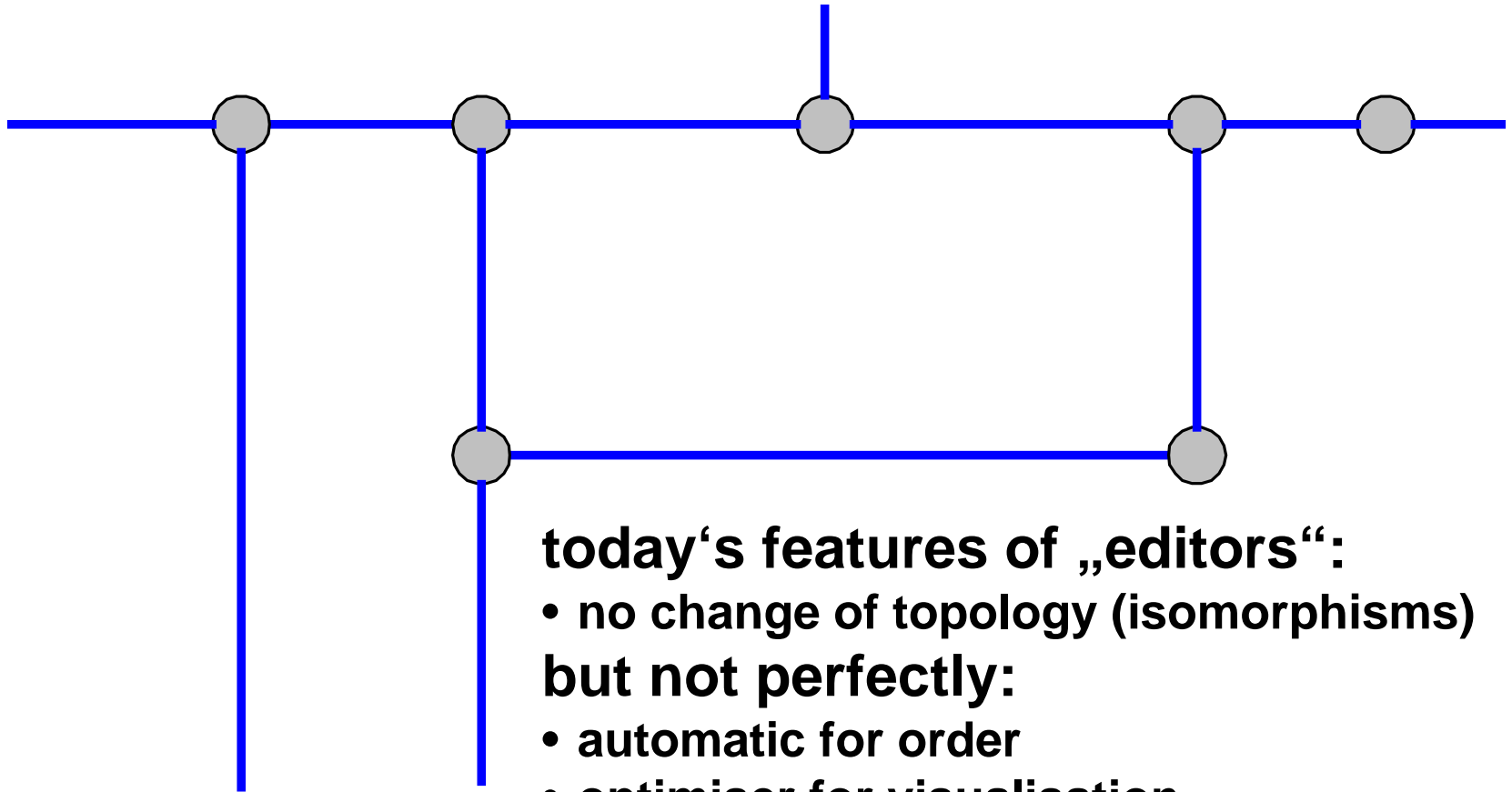
## pipelines ...







# pipelines ... topology editors



**today's features of „editors“:**

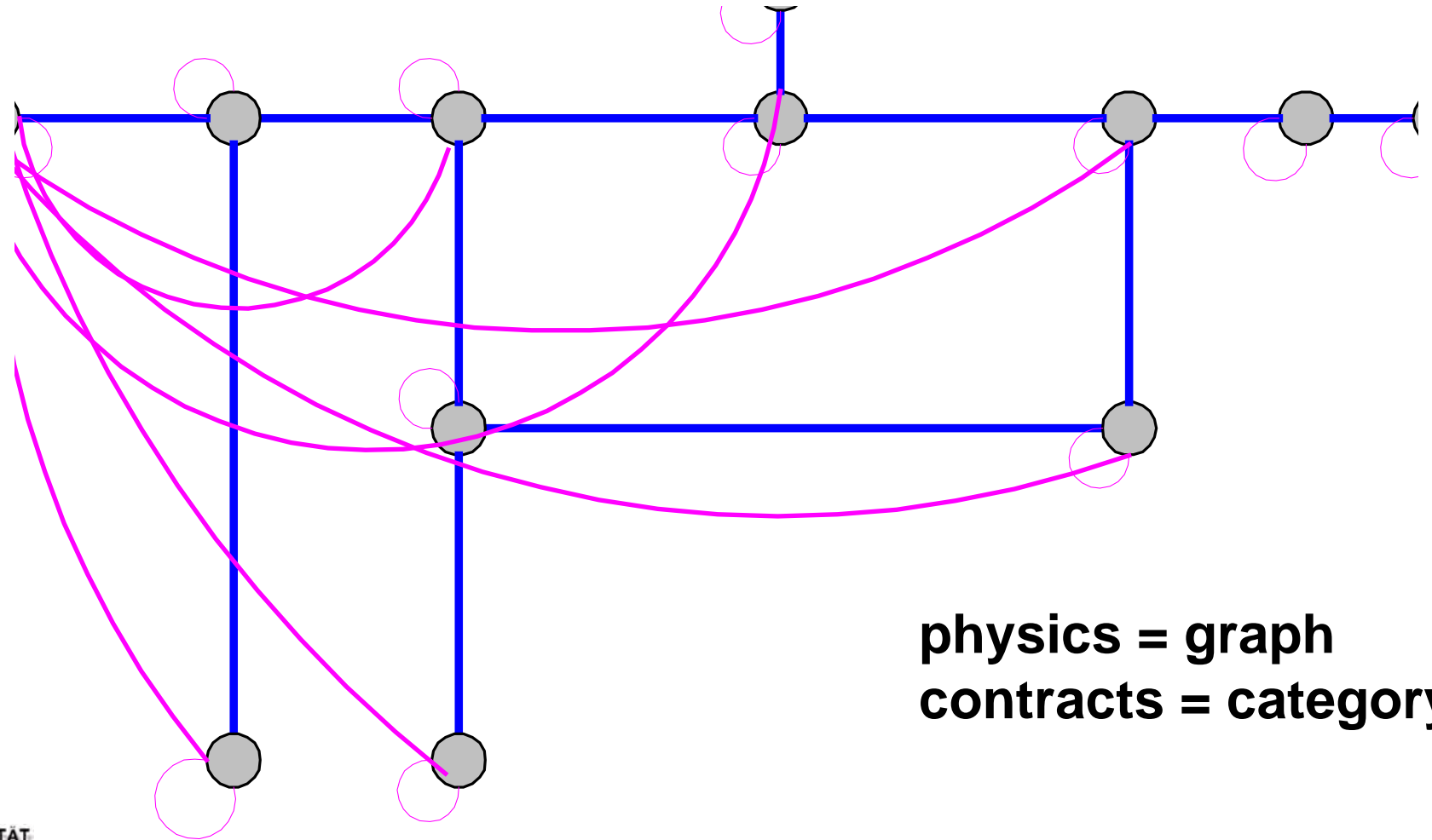
- no change of topology (isomorphisms)

**but not perfectly:**

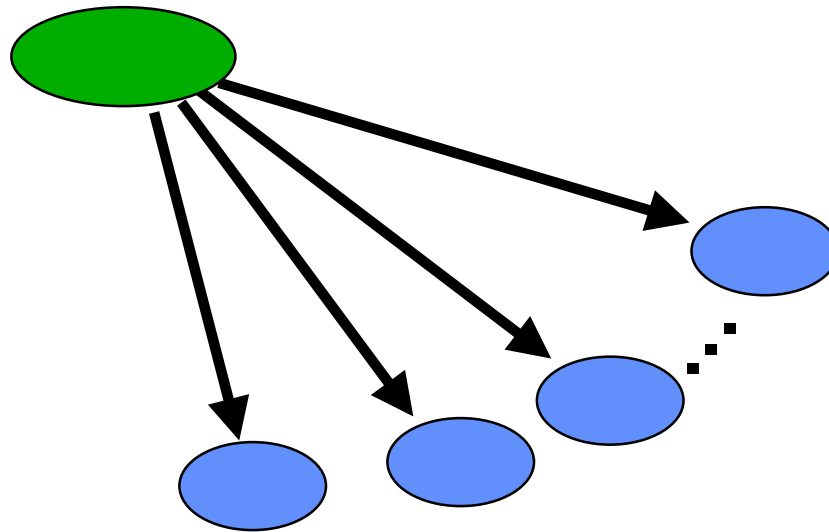
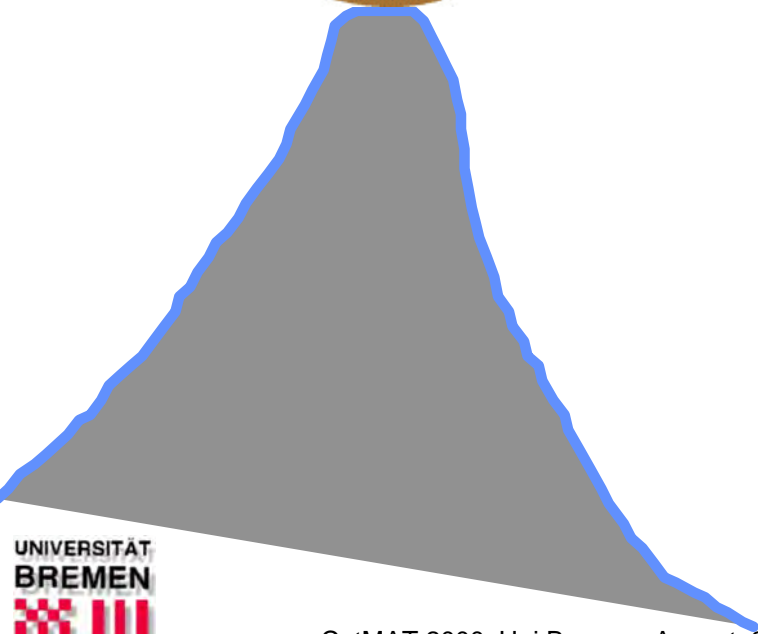
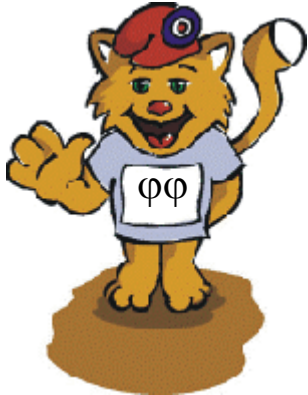
- automatic for order
- optimiser for visualisation

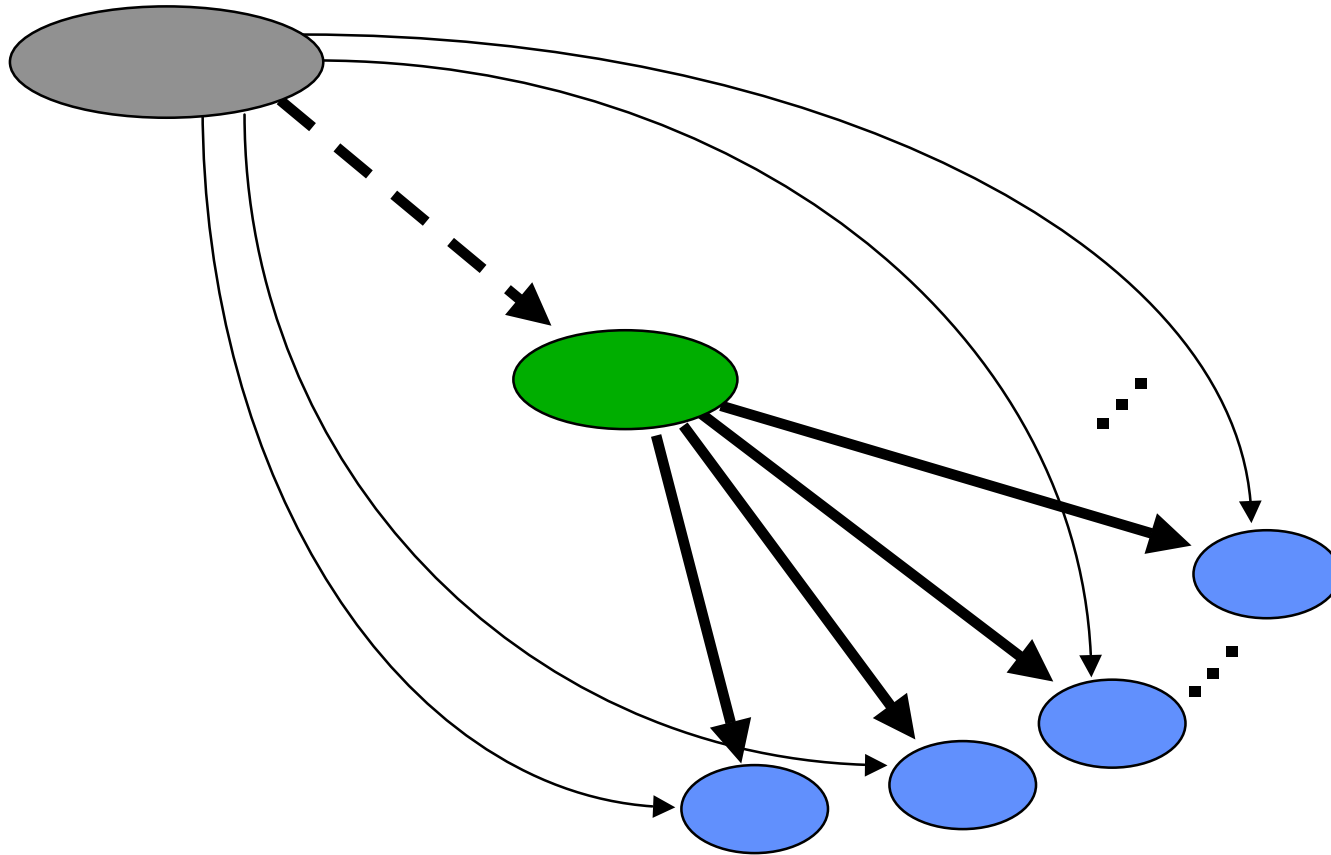
**but definitely not:**

- limits and colimits ...



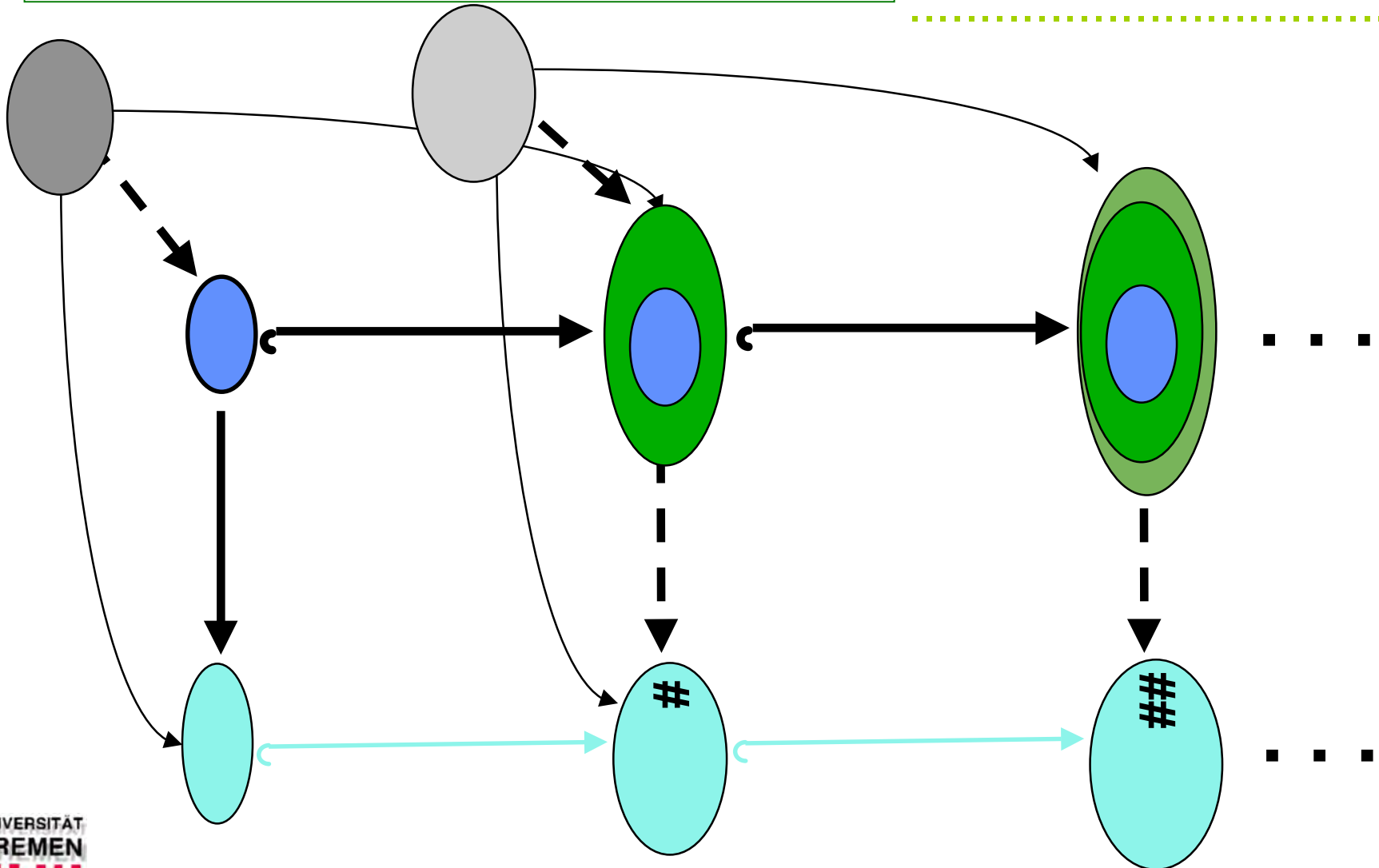
**physics = graph**  
**contracts = category**





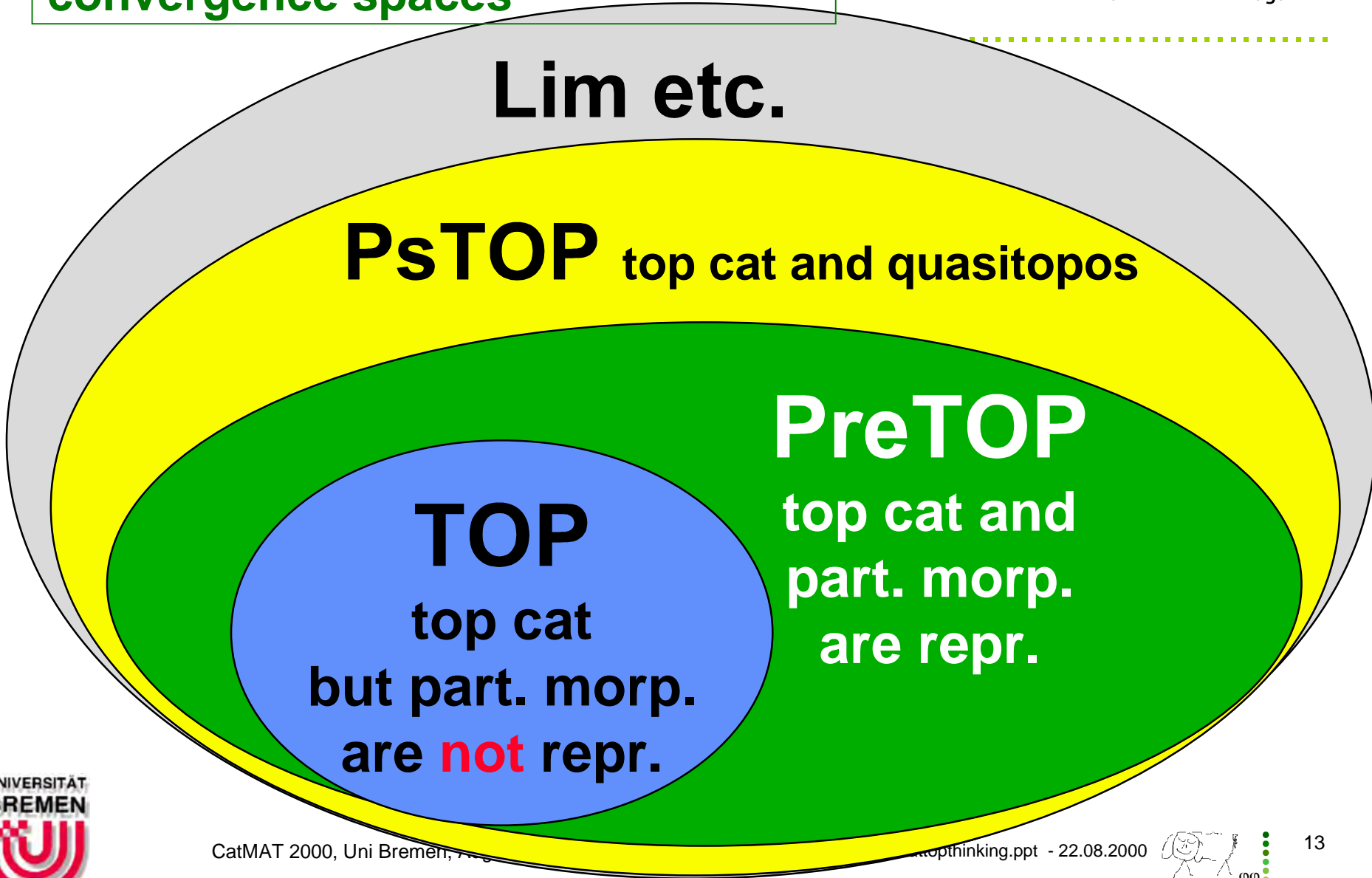


## quasitopoi - partial morphisms





**convergence spaces**





**viva PreTOP ...**

**in practice:**

- 👁️ look for non idempotent hull operators
- 👁️ look for “partial knowledge”
- 👁️ look for extensions

**pretopologies have the “build in”  
iterative process, in particular  
needed, if no direct solutions are  
possible and/or known !!!**





## applications

✌ wired circuit boards

✌ space technology

✌ logistics (“distribution”)

✌ balancing of production

✌ pattern recognition

✌ ...

**traditional and modern things:**

- net flow algorithms
- gas net flow simulation
- linear programming (simplex algorithm)
- fem
- rulebased systems
- expert systems
- in general artificial intelligence tools

**very popular at the moment:**

- fuzzy logic
- neural nets

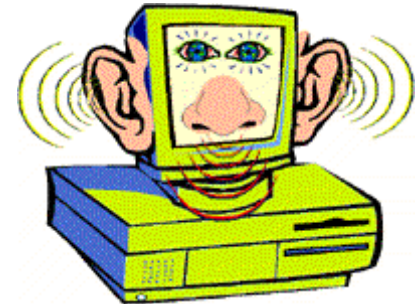


# Human Interface Supervision System

## Seeing



- External influences due to unauthorised persons/ fire/storm damage
- Formation of ice on parts of plants (leaks)
- Accumulations of liquids



## Smelling



- Detection of small leaks
- Detection of the key substances benzene and hydrogen sulphide
- Separation of plant-specific smells from external smells (e.g. sour gas/liquid manure)

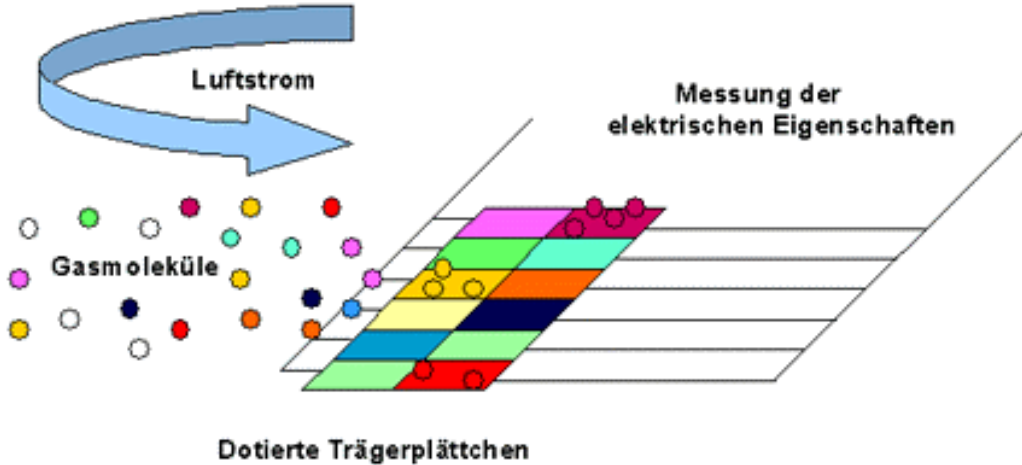
## Hearing



- Detection of small leaks (emissions of gases)
- Detection of faults (e.g. damage to pumps, bearings, etc.)
- Detection of malfunctions from the prevailing ambient noises

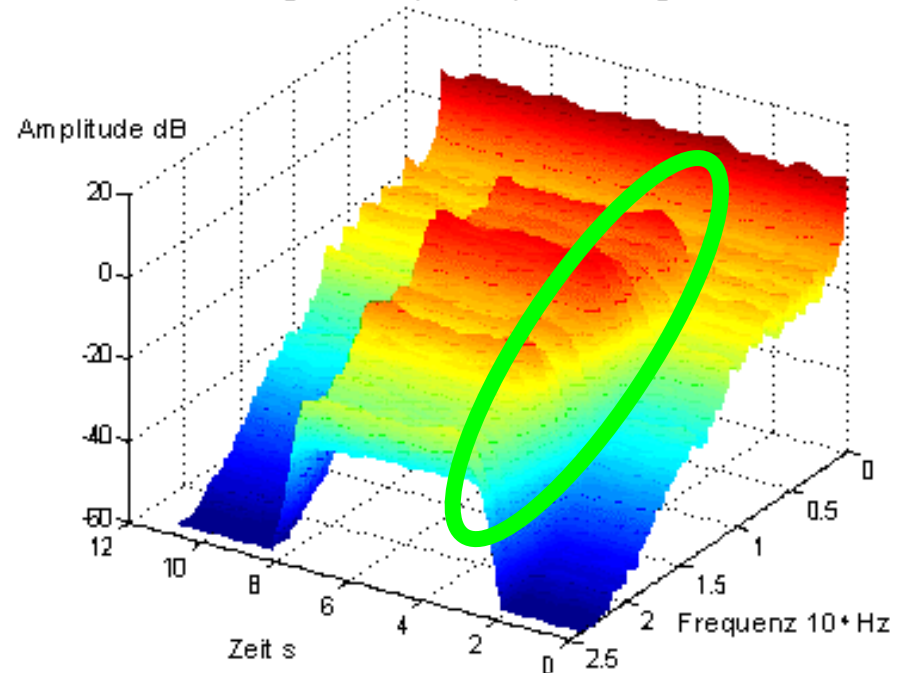


## HISS



**pattern recognition:  
fuzzy logic & neural nets  
better => PreTOPs**

Ausströmgeräusch (5Nm<sup>3</sup>/h) mit Grundgeräusch



<http://www.beb.de>



Intelligente Erdgasförderung

EXPO2000 HANNOVER

Registriertes Projekt der Weltausstellung





# Cat and Top Thinking for Industrial Solutions

## forecasting energy over temperature

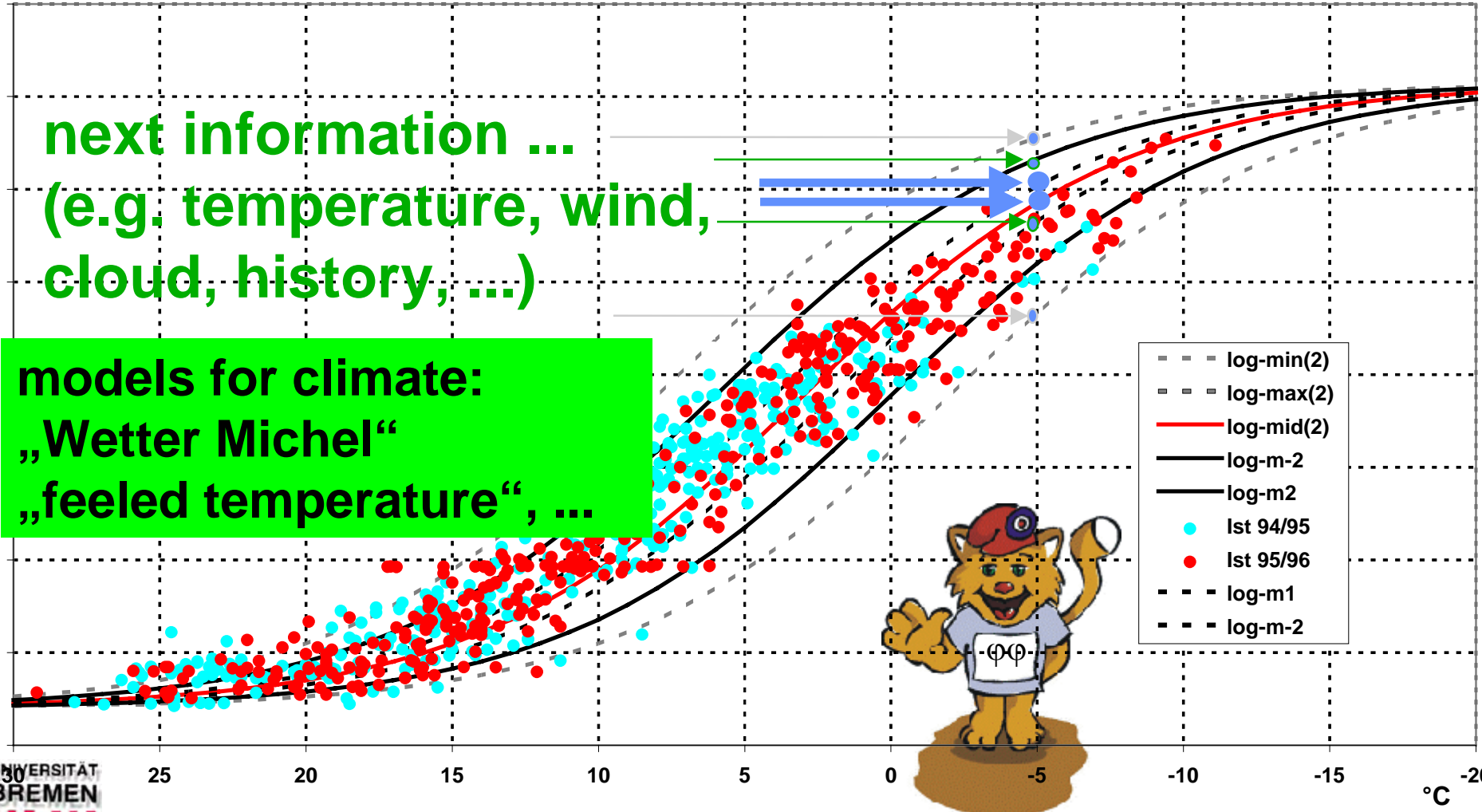


Unternehmen Erdgas

m<sup>3</sup>/d

next information ...  
(e.g. temperature, wind,  
cloud, history, ...)

models for climate:  
„Wetter Michel“  
„feeled temperature“, ...

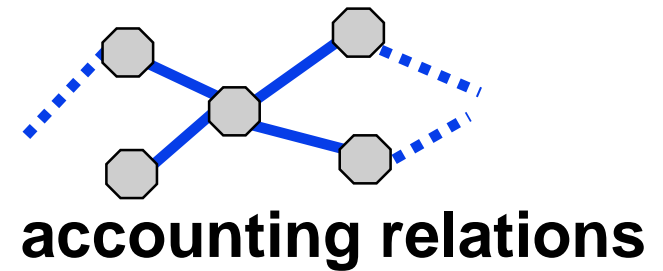
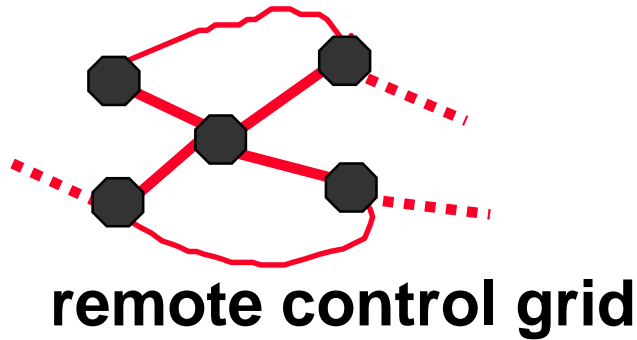
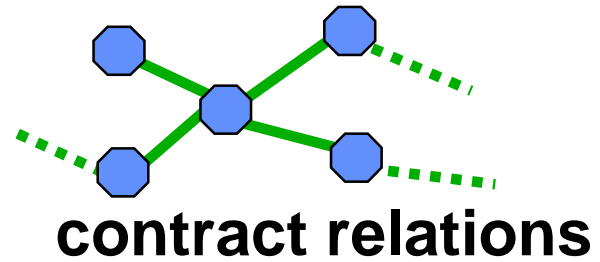
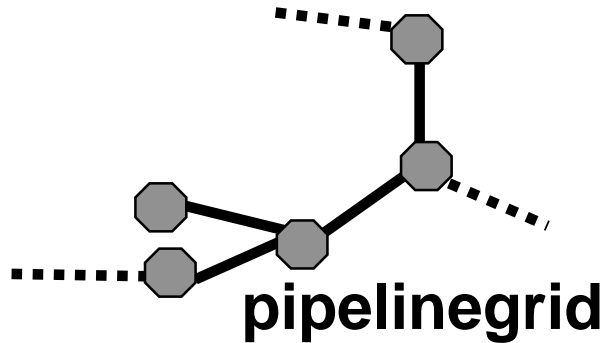


- - - log-min(2)
- - - log-max(2)
- log-mid(2)
- log-m-2
- log-m2
- Ist 94/95
- Ist 95/96
- - - log-m1
- - - log-m-2



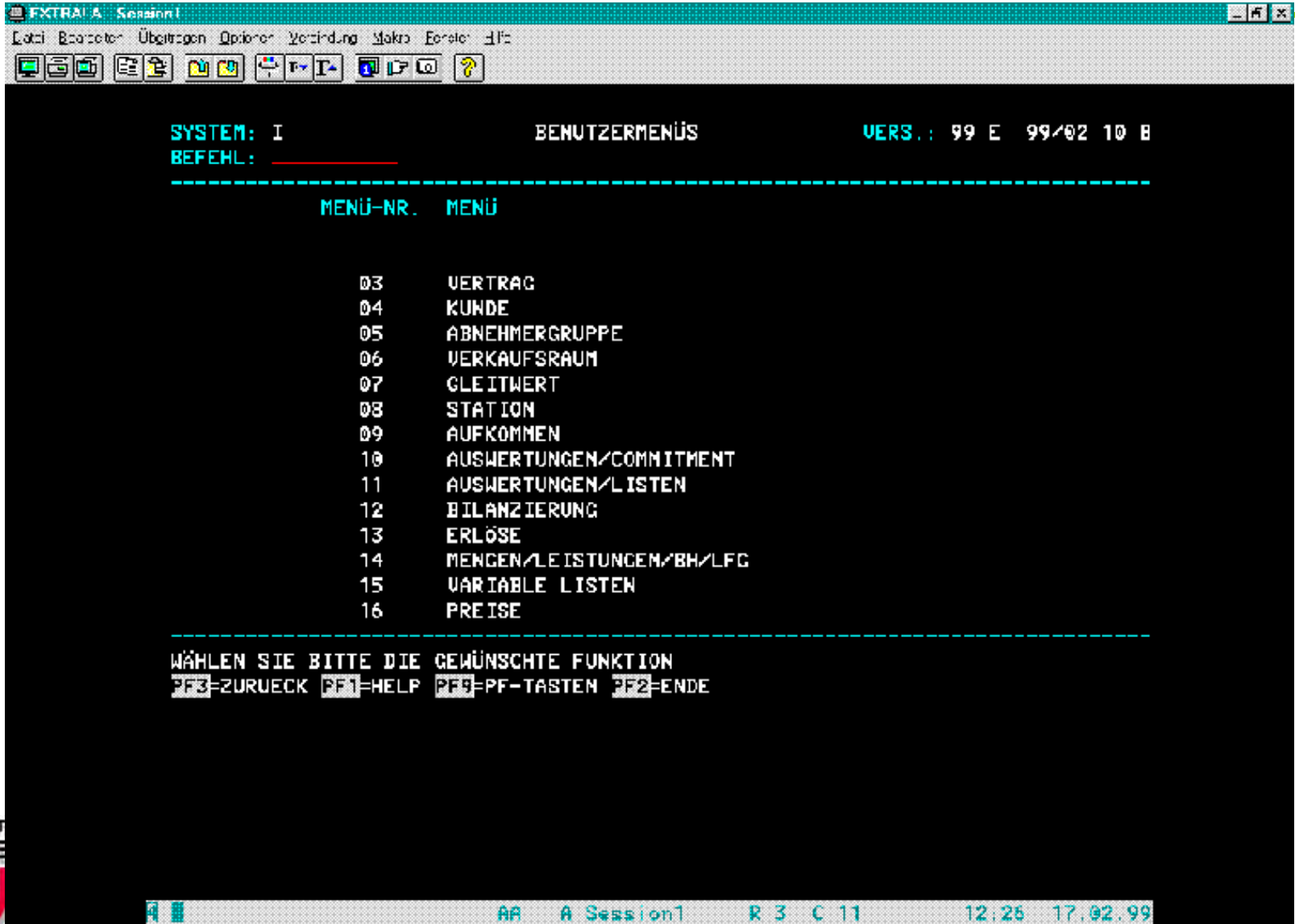


## urgent help from cat top ?





## visualisation 80-ies





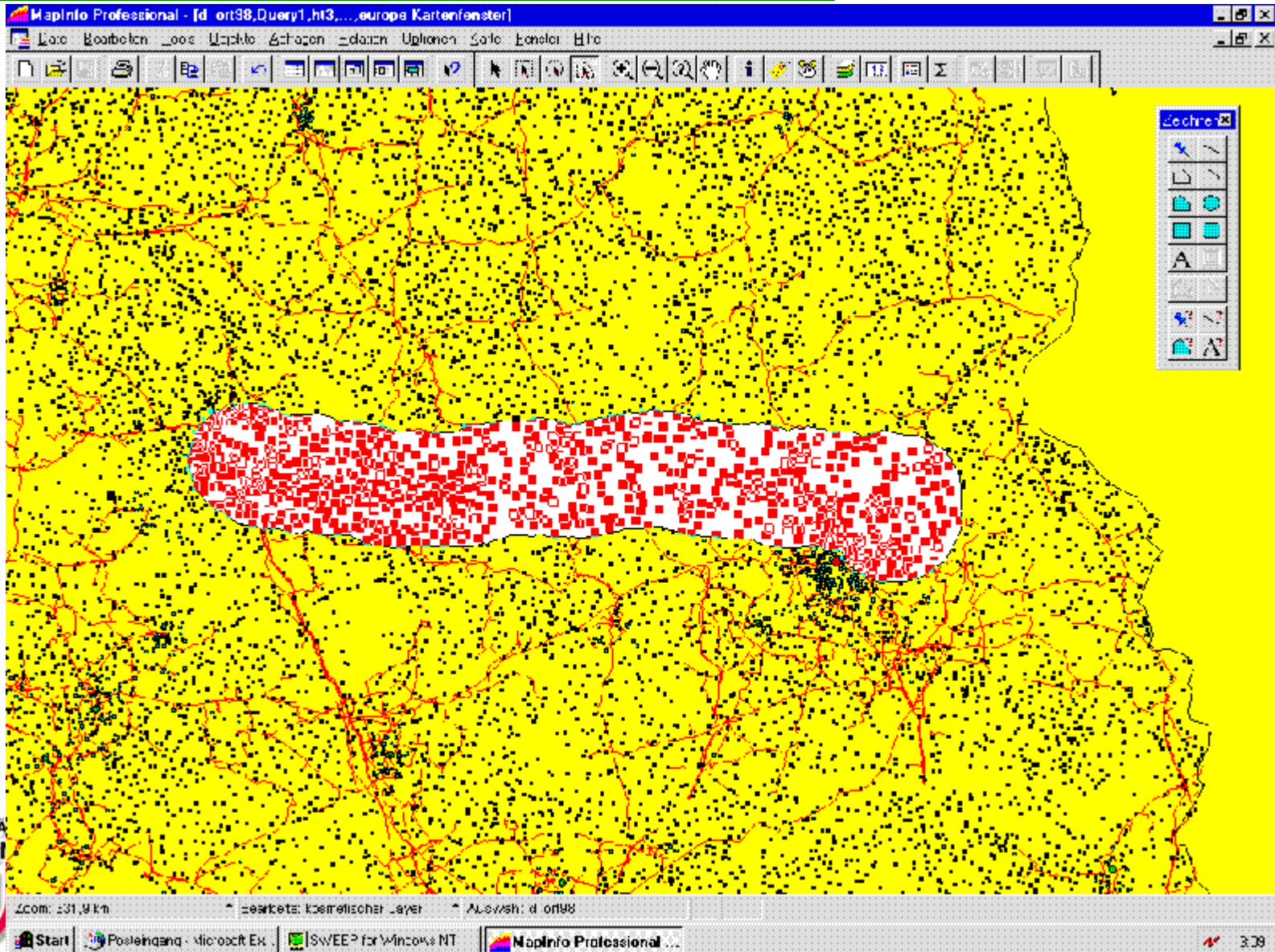


## visualisation 90-ies

The screenshot displays a Windows 95 desktop environment. On the left is a file explorer showing a directory structure with folders like 'Winword', 'Xvision', and 'Arollis'. The main window is a calendar application for February and March 1999, showing a Gantt-style view of tasks as vertical bars across days. The tasks are labeled with times like 09:00, 10:00, 11:00, 12:00, 13:00, 14:00, and 15:00. A bottom panel shows a weather forecast for Friday, Saturday, Sunday, and Monday, with icons representing clouds and rain. The address bar shows the URL [http://www.efa.de/grh\\_set.htm](http://www.efa.de/grh_set.htm).



## visualisation GIS (geo info sys's)





## visualisation GIS

**Objektklassen Menü**

Ok

Darstellungsmaßstab : 1:25000

- 000 ? Gie (Smallworld Datenbank)
  - 000 ? Betriebsmittel
    - 000 1 FG Armatur
    - 000 1 FG Behörde
    - 000 1 FG Bereichsgrenze
    - FG Beteiligung
    - 000 1 FG Bohrloch
    - 000 1 FG Drainage
    - 000 1 FG Verbindung
    - 000 1 FG Fremdleitung
    - 000 1 FG Fremdl. Kennz.
    - 000 1 FG Höhenpunkt
    - 000 1 FG Kilometerpunkt
    - 000 1 FG Kreuzung
    - 000 1 FG Leitung
    - 000 1 FG Leitung Kennz.
    - 000 1 FG Leitungsabschnitt
    - 000 1 FG LA Kennz
    - 000 1 FG LA Kennz. 1:25000
    - 000 1 FG Meisterbereich
    - 000 1 FG Merkstein
    - 000 1 FG Moßstelle
    - 000 1 FG Netzbereich
    - 000 1 FG Rohr
    - 000 1 FG Rohrformatücke
    - 000 1 FG Rohr-schaden

Editor : Objekt... Darstellung... Abfrage

Schalte : Sichtbar  AUS

Zeichen-Priorität : + -

Speichern/Laden Zurücksetzen Hilfe Ende

**Hauptgrafikfenster BEB Erdgas und Erdöl**

System Ansicht Auswählen Bearbeiten Abfragen BEB Entwicklung

Maßstab: 1:25488

ROTA T1

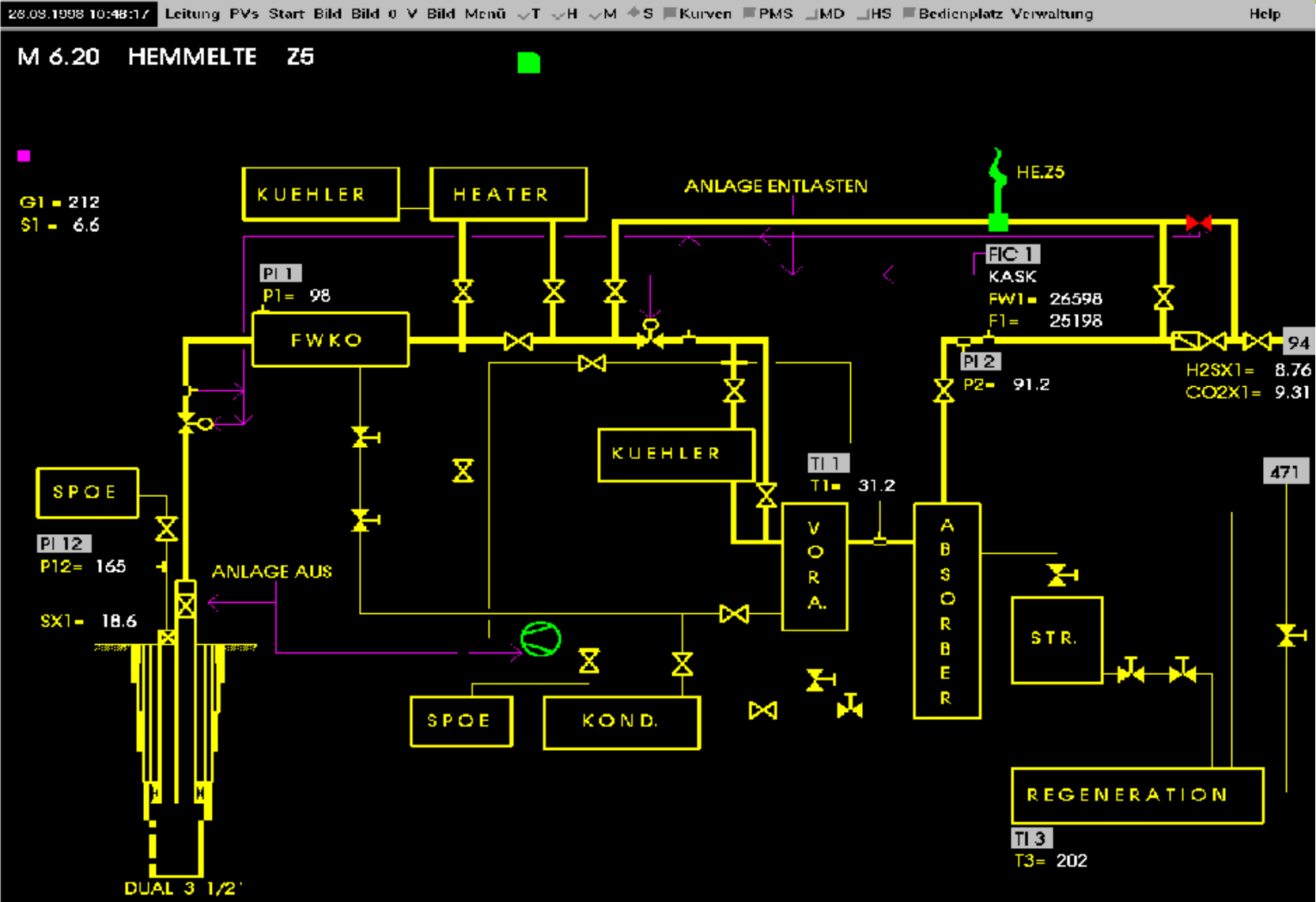
BTSN 26

ROGN 2

Maßstab: 1:25000 Geometrie ausgewählt Keine aktuelle Auswahl

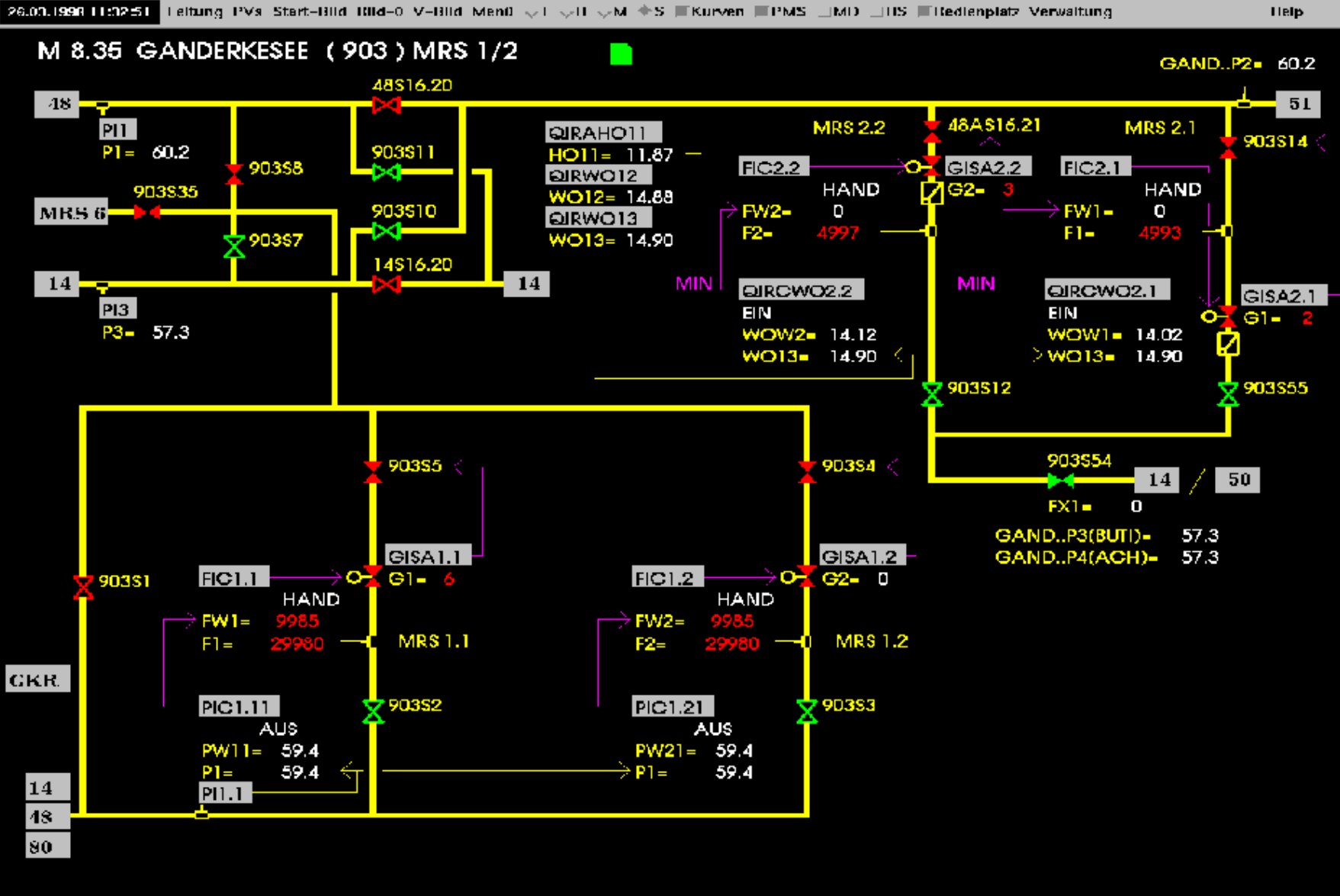


## visualisation SCADA





## visualisation SCADA





## where we have to go ... ?

### my 5-point-"edit"-program: computer assistance for

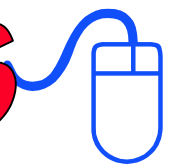
- ≅ better isos e.g. automation for combinatorial optimiser for visualisation, ...
- 👁 part of grid (sub-strates)
- 📄 gluing together of grids (coproducts)
- ❄ simplifying grids (quotients)
- 👋 product of grids (products)

# cattop editors

### my 5-point-"navigator"-program: computer assistance for

- ≅ "topology" of configuration (ref. integrity)
- 👁 arbitrary relation (or point/object) "enclosure" interaction
- 📄 neighbourhoods stepwise via morphisms
- ❄ alternative info ("fuzzy", "mess")
- 👋 "pattern" recognition (quick reconstruction/reuse of p...

# + cattop navigators

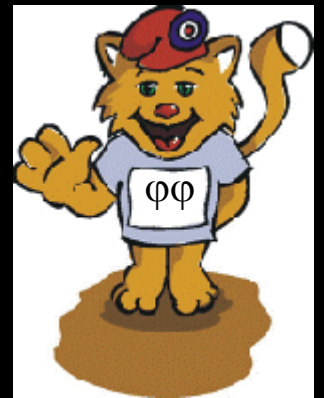


=> raw topological features re

# = Rollis 10-point-program



... thank you  
for your  
kind  
attention ...





agenda of **CATOP 2000**



- **K**itchen: cats and tops
- **L**ogic of topos
- **E**nergy
- **I**ndustry
- **S**ystems
- **L**ook for next century
- **I**nformation and forecasts

~~pe  
er~~



70<sup>th</sup> of Heinrich Kleisli

