From Vopěnka's Phenomenology to a Modeling Framework

Peter Vojtas

Dpt. Software Engineering, School of Comp. Sci., Charles University Prague

Overview

- What I have heard/learned from Peter Vopenka
  - My memories, my interpretation, subjective, rosy retrospection, ... (* denotes places especially deeply personal ...)
  - I do not touch set-theory developments before 1968-9
  - Shock of 1968 invasion, isolation like after 1620
  - Philosophy reading seminar Arriaga, Bolzano, Husserl, Heidegger, Patocka, Polivka, … maybe Edith Stein, Grothendieck listening/sensing forms
  - Vopenka's phenomenology and modeling
  - Vopenka's theoretical cybernetics
- A modeling framework

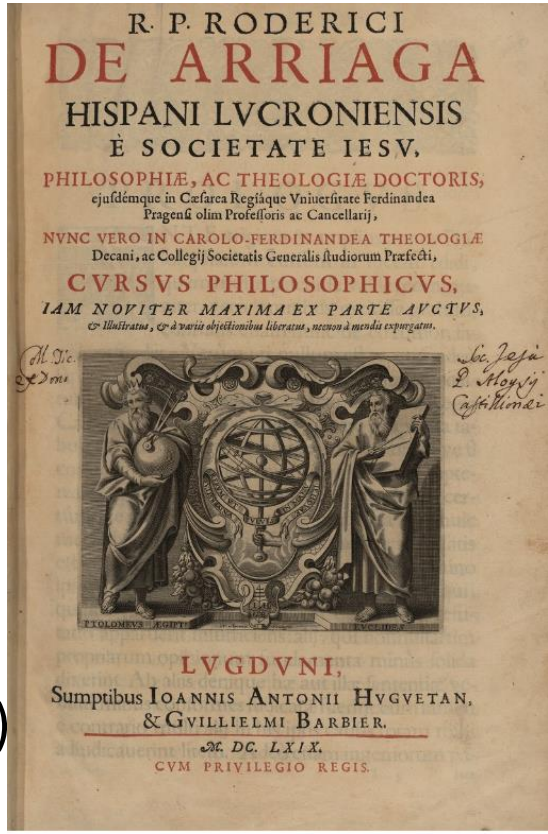
Isolation

- Analogy of situation after 1620 Battle of White Mountain
  to that of 1968 after soviet invasion
- Vopenka's feeling *:

isolation in hostile surrounding
  at least the official ecosystem was hostile/partly tolerating

Incompleteness (theologically) possible

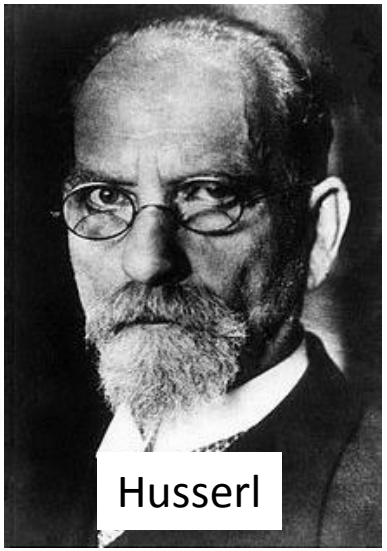
- Rodrigo de Arriaga (Logroño 1592 – in Prague, Bohemia, from 1626 on, + 1667)
- de Arriaga R., 1632: *Cursus philosophicus*.
- which came out before the conclusion of the Galileo process could present all theories about arrangement of the universe as equivalent
- That tradition lived in Prague University (1348)
- Continued in Bernard Bolzano (Husserl adheres to a version of Platonism that he derived from ideas of Hermann Lotze and especially Bernard Bolzano)
- Philosophy reading seminar started before Heidegger's Springer interview published 1976, before Charta'77 and Kurt Goedel (+1978) still alive

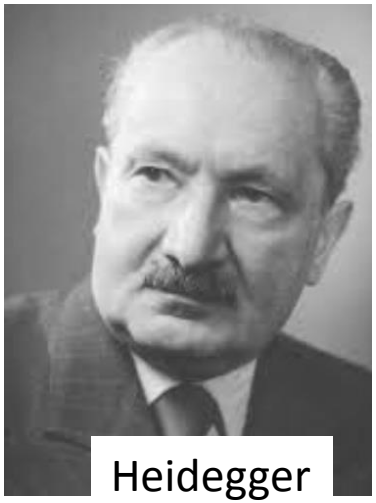

R. P. RODERICI
DE ARRIAGA
HISPANI LVCRONIENSIS
È SOCIETATE IESV,
PHILOSOPHIÆ, AC THEOLOGIÆ DOCTORIS,
ejusdémque in Cæsarea Regiáque Vniuersitate Ferdinandea
Pragensi olim Professoris ac Cancellarij,
NVNC VERO IN CAROLO-FERDINANDEA THEOLOGIÆ
Decani, ac Collegij Societatis Generalis studiorum Præfecti,
CVRSVS PHILOSOPHICVS,
IAM NOVITER MAXIMA EX PARTE AVCTVS,
& Illustratus, & à variis objectionibus liberatus, necnon à mendis expurgatus.
LVGDVNI,
Sumptibus IOANNIS ANTONII HVGVETAN,
& GVILLIELMI BARBIER.
M. DC. LXIX.
CVM PRIVILEGIO REGIS.

Vopenka's philosophical reading seminar


Arriaga

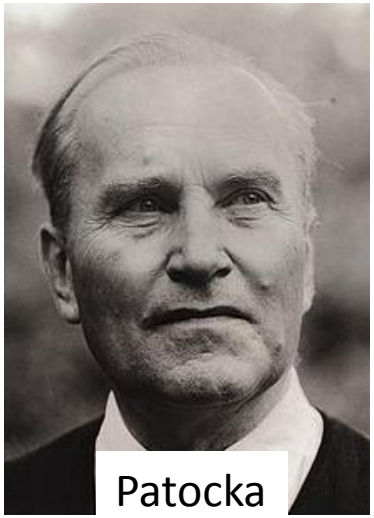

Bolzano


Husserl


Heidegger


Stein

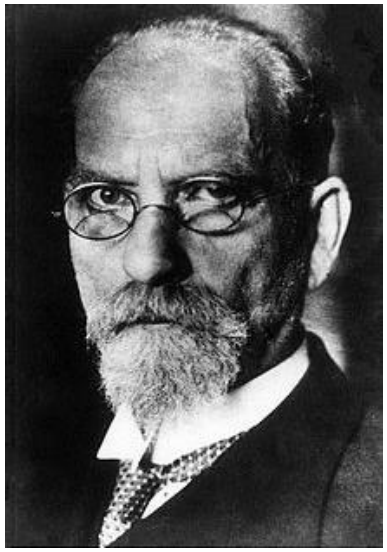

Goedel


Patocka

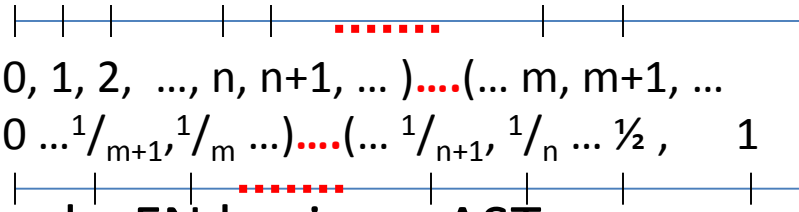

Polivka


Vopenka

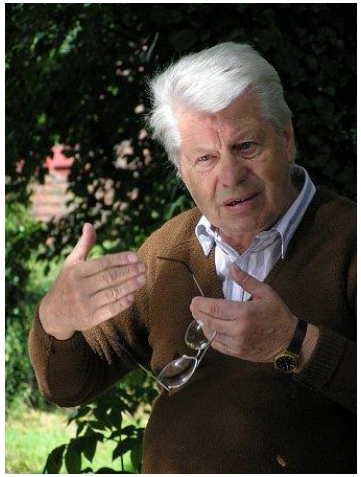
Philosophical/mathematical horizons

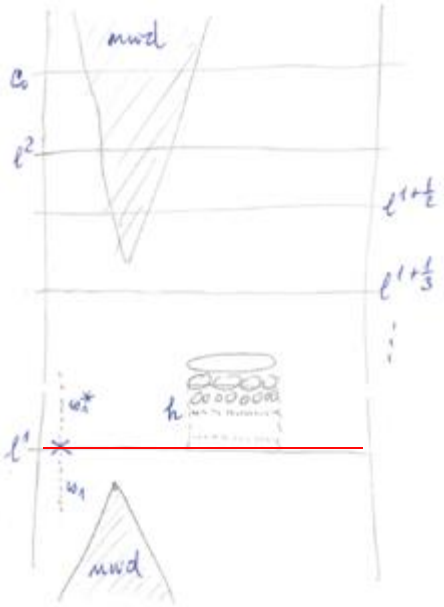


- Edmund Husserl (his mentor was Thomas Masaryk) phenomena of horizons



- Petr Vopěnka infinitesimals, FN horizon, AST
- My horizon between absolutely convergent/divergent series, ↑directed/↓Boolean order, Hausdorff gap, various ways of approaching/measure horizon

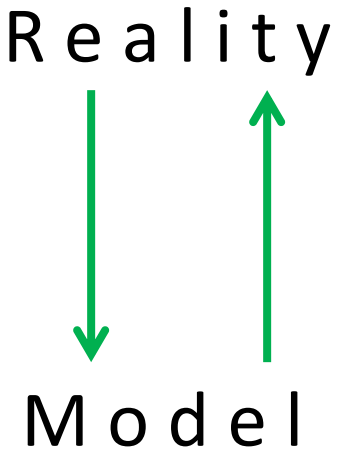




- 1995 (conference of Vopenka's 60 birthday) told me "if Bolzano would have knew ... "
- 2000 retirement from Charles University (*) under not usual/customary circumstances

Vopenka's phenomenology and modeling

- I visually remember Vopenka to write/draw on blackboard:



A phenomenological model is a scientific model that describes the empirical relationship of phenomena to each other, in a way which is consistent with fundamental theory, but is not directly derived from theory. In other words, a phenomenological model is not derived from first principles (Wikipedia). Grothendieck listening/sensing form ...

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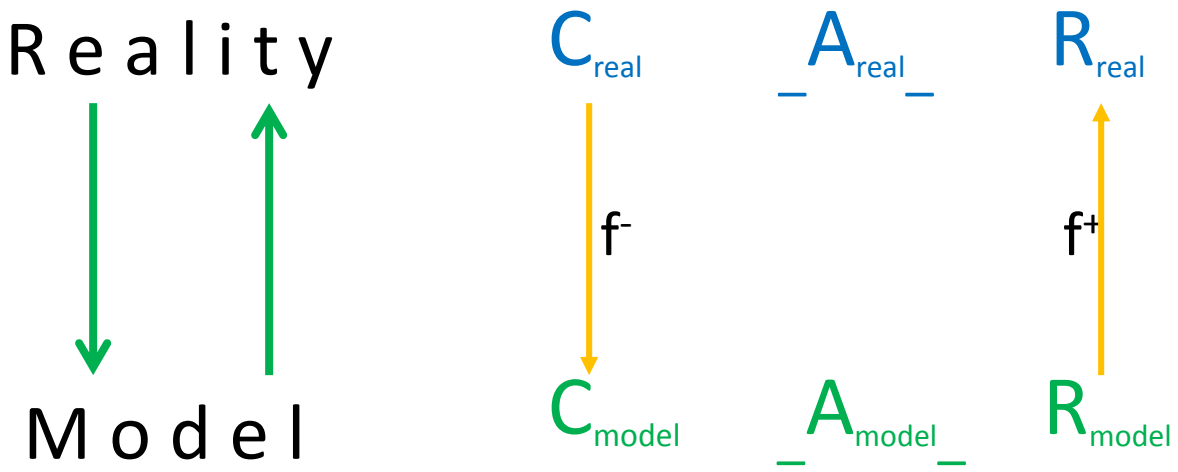

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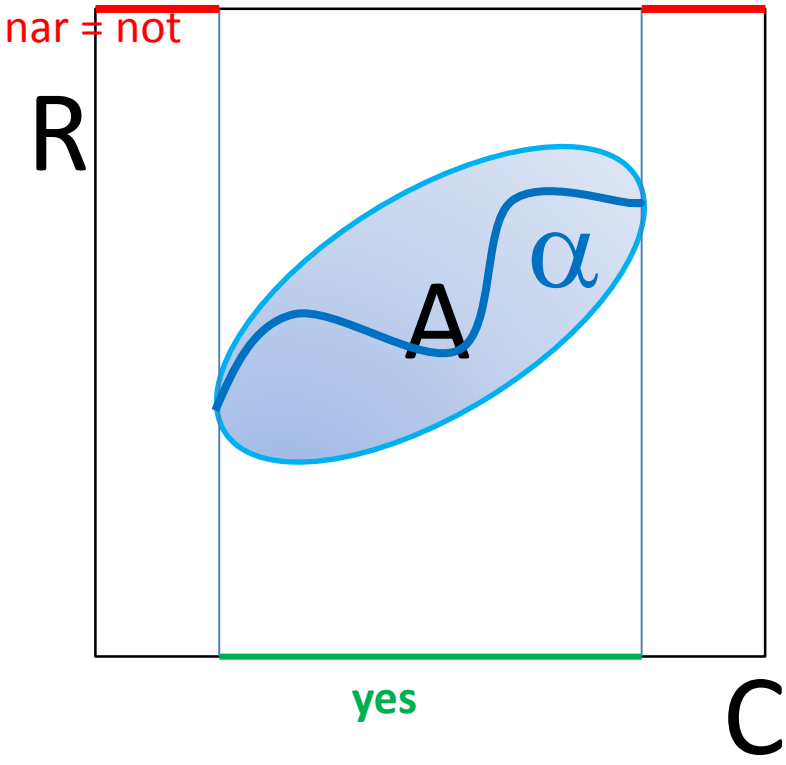
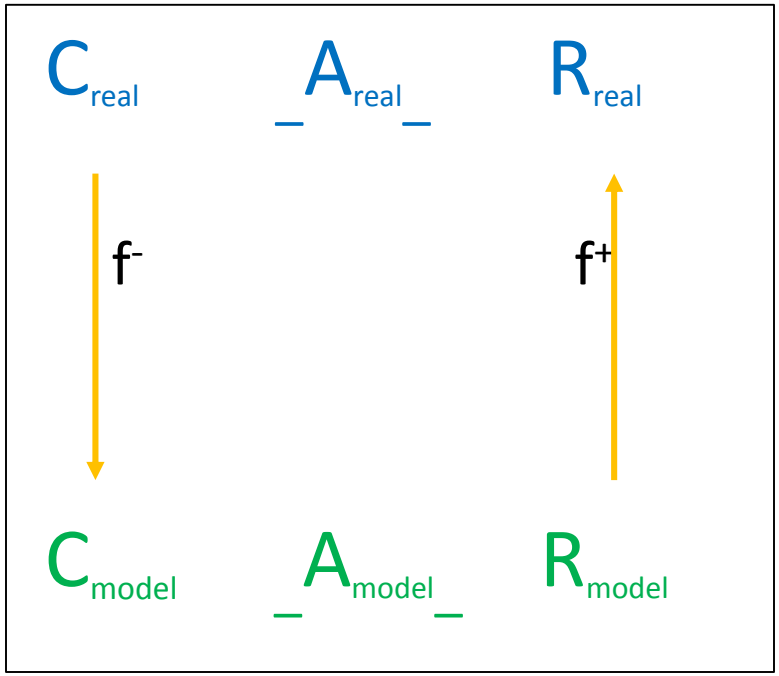
ChRF-Challenge Response Framework

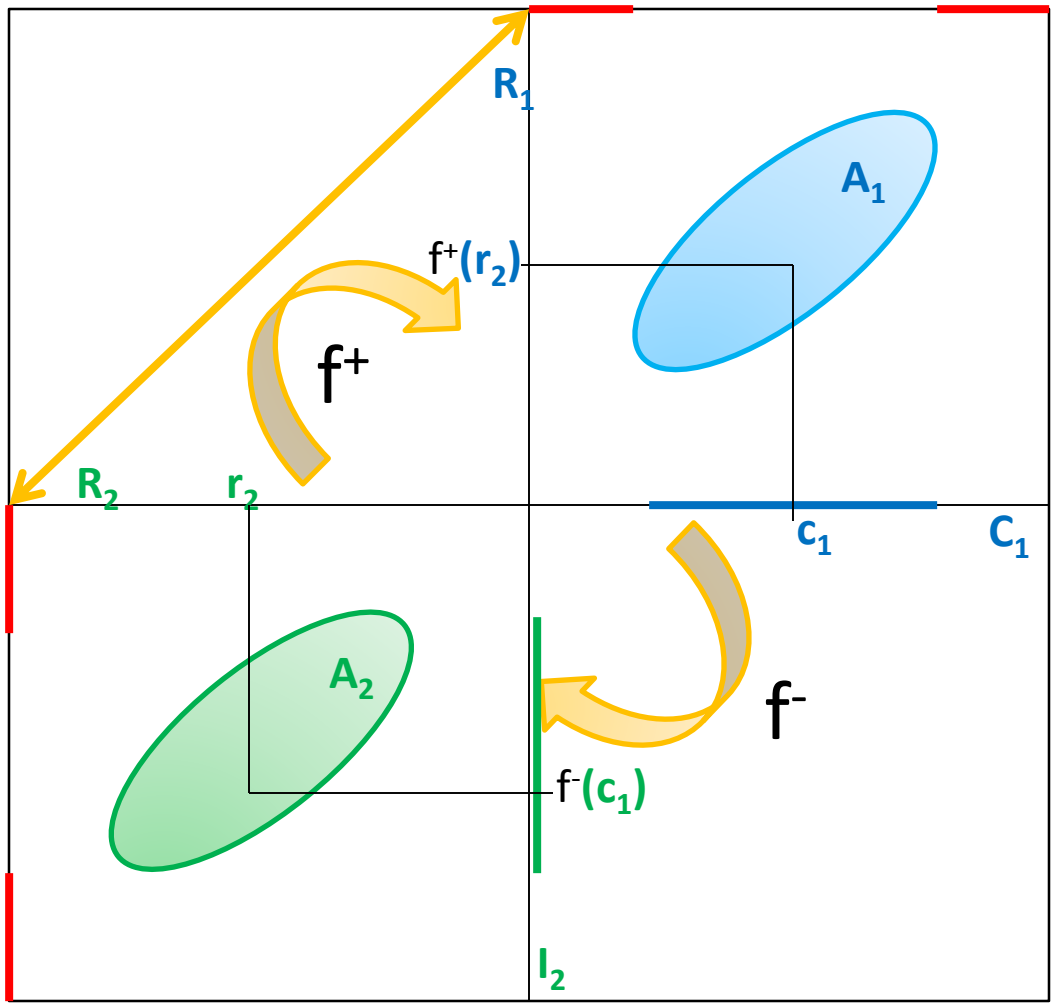




P. Vojtas. Generalized Galois-Tukey connections between explicit relations on classical objects of real analysis, Israel Math. Conf. Proc. 6 (1993) 619-643

A. Blass. Questions and Answers - A Category Arising in Linear Logic, Complexity Theory, and Set Theory. Advances in Linear Logic, eds. J.-Y. Girard etal. London Math. Soc. Lecture Notes 222 (1995) 61-81

Challenge Response reduction

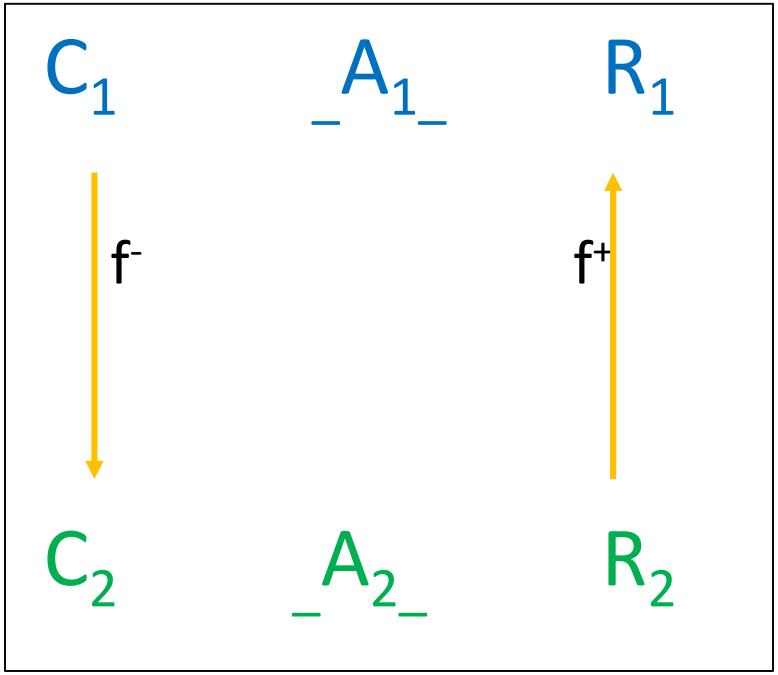


ChR reduction of a situation $S_1 = (C_1, R_1, A_1)$ to a situation $S_2 = (C_2, R_2, A_2)$ consists of a pair of functions (f^-, f^+) such that $f^- : C_1 \rightarrow C_2$, $f^+ : R_2 \rightarrow R_1$, and $f^+(nar_2) = nar_1$, $f^+(r_2) = nar_1$ implies $r_2 = nar_2$ and following holds: $(\forall c_1 \in C_1)\ (\forall r_2 \in R_2)$

$$A_2(f^-(c_1), r_2) \Rightarrow A_1(c_1, f^+(r_2)) \quad (*)$$

i.e. response r_2 of reduced challenge instance $f^-(c_1)$ can be transformed to solution $f^+(r_2)$ of original problem instance i_1, validity of (*) is depicted

We are not fooled assuming only one direction of implication (*)



Note that

$$A_2(f^-(c_1), nar_2) \Rightarrow A_1(c_1, nar_1)$$

is equivalent to

$$\neg A_2(f^-(c_1), nar_2) \Leftarrow \neg A_1(c_1, nar_1)$$

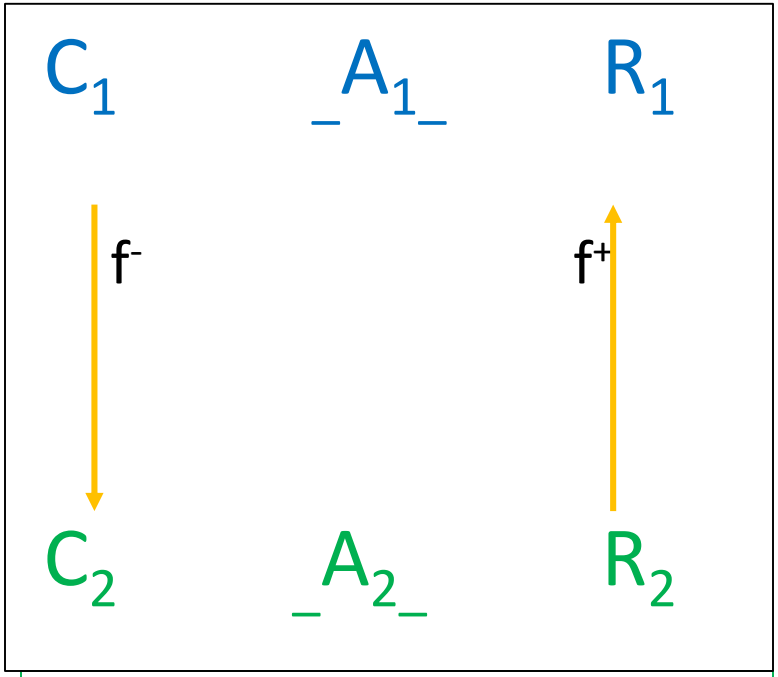
and this to

$$(\exists r_1 \in R_1 \setminus \{nar_1\})(A_1(c_1,r_1)) \Rightarrow$$
$$(\exists r_2 \in R_2 \setminus \{nar_2\})(A_2(f^-(c_1),r_2))$$

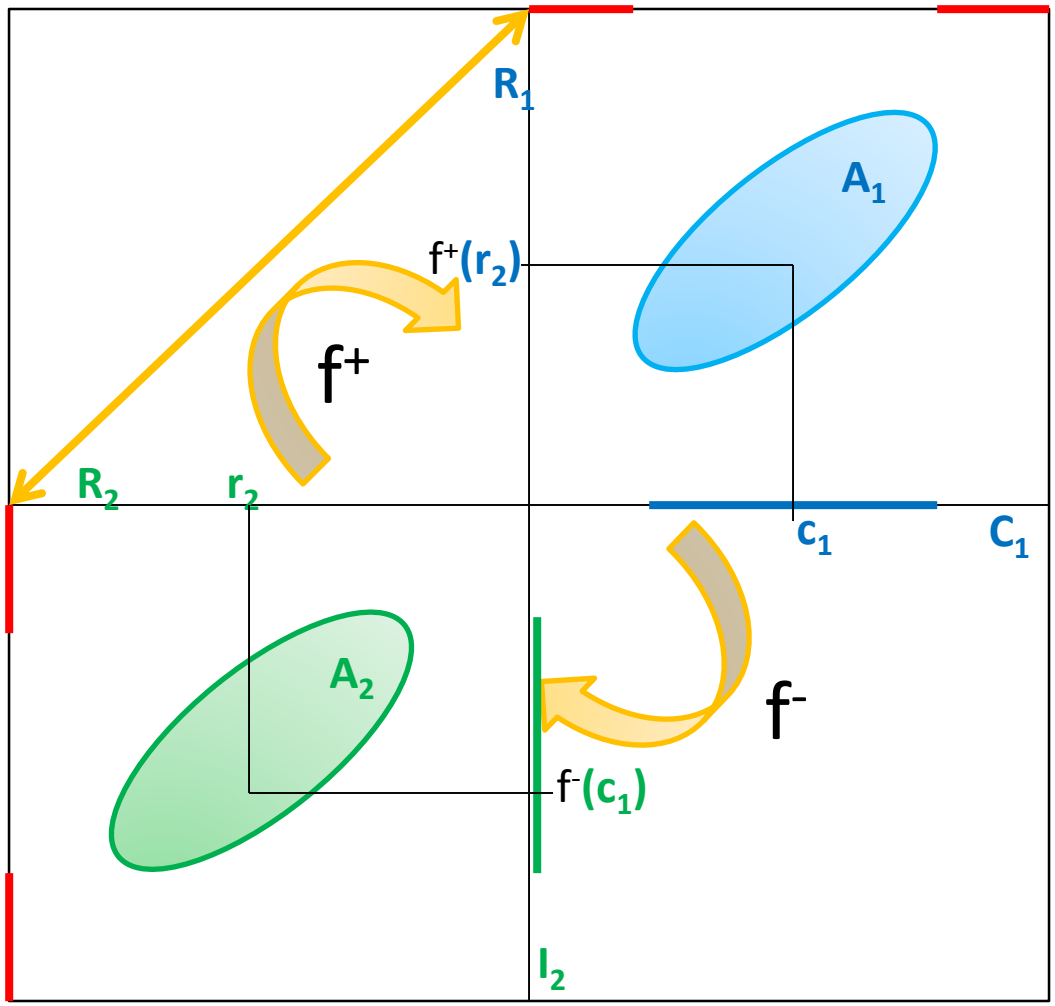
i.e. reduction f^- cannot "cheat" in the sense that for c_1 (*) will be true, and still $f^+(r_2)$ will not be acceptable.

Hence, (*) means that solution of reduced instance is transformed to an acceptable solution of original problem instance

So, illustration is correct

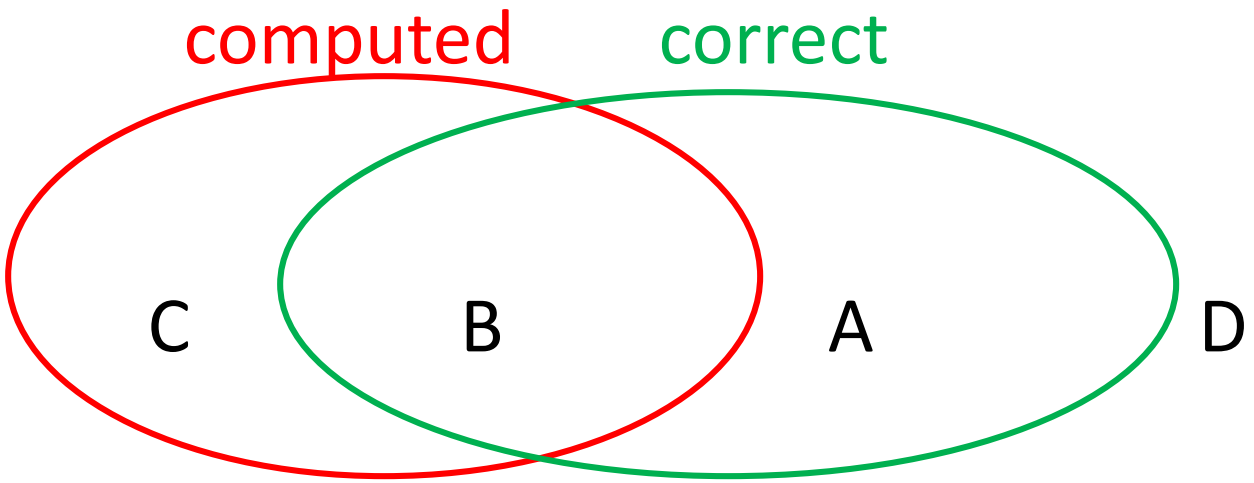


3CNF	true	2^{Var}
Graph	3COL	3^{V}
query	answer	
input	output	
item	attributes	
user	recommendation	



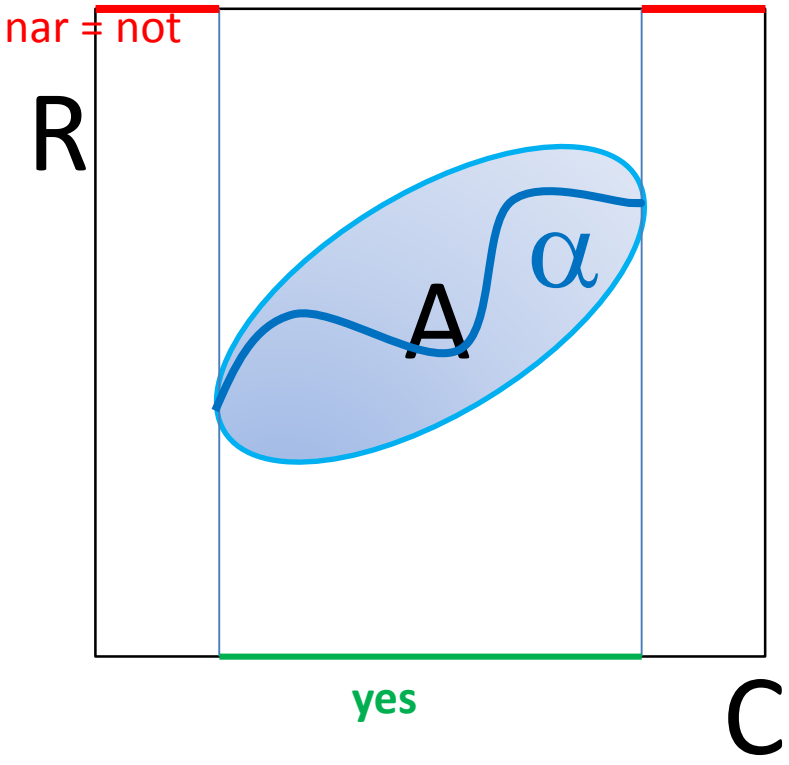
Metric and truth of $\Rightarrow$

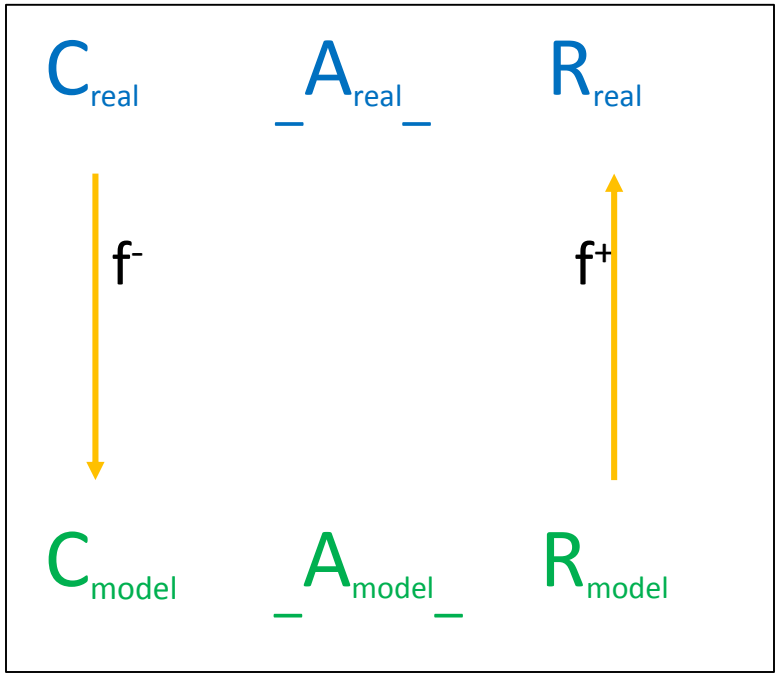
- $\mathbf{A_2(f^-(c_1), r_2) \Rightarrow A_1(c_1, f^+(r_2))}$

- 

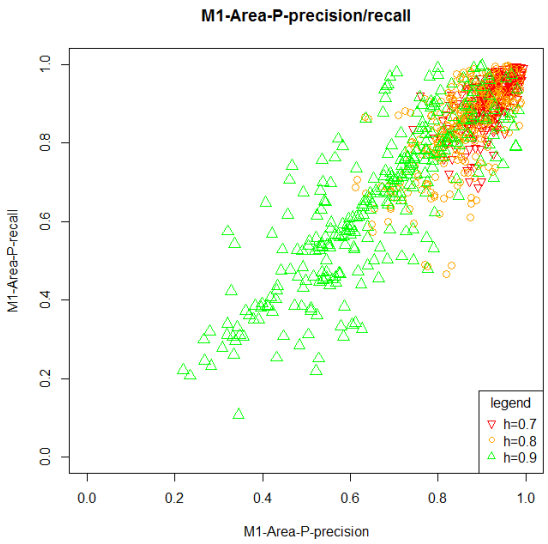
- Precision = B / (B + C) – how many **computed** are **correct**
- Recall = B / (A + B) - how many correct are found by computation
- So we do not need to calculate both

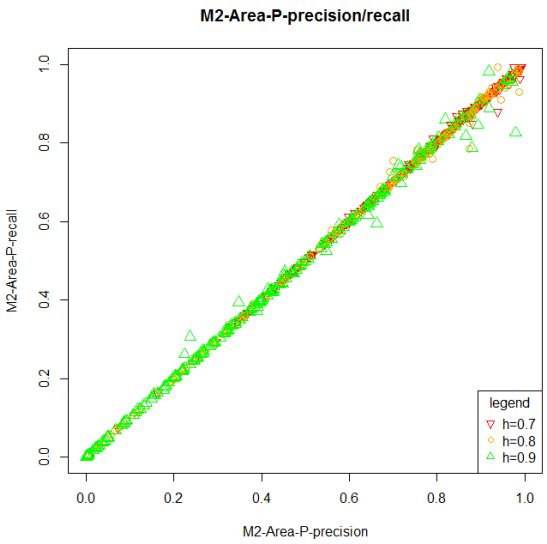
ChRF-Challenge Response Framework

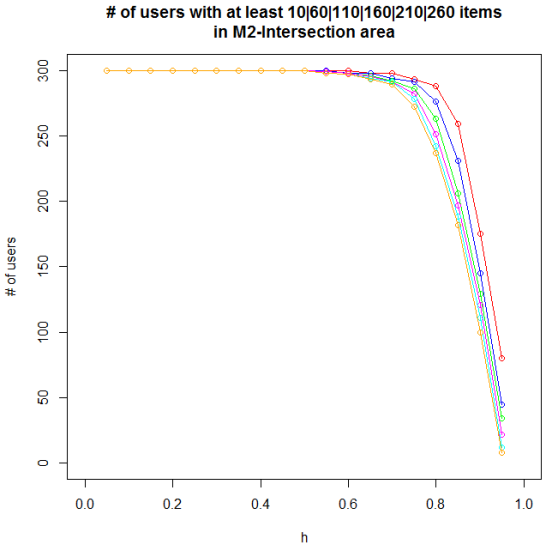


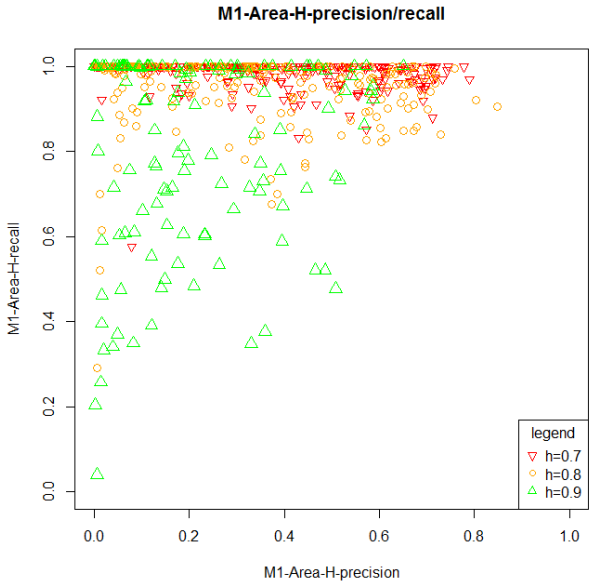


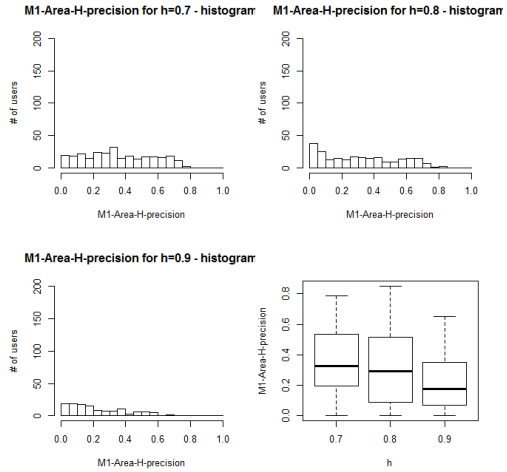
M. Kopecky, P. Vojtas. Graphical E-Commerce Values Filtering Model in Spatial Database Framework. In: Welzer T. et al. (eds.) New Trends in Databases and Information Systems. ADBIS 2019. Communications in Computer and Information Science, vol 1064. Springer, Cham 2019, pp 210-220

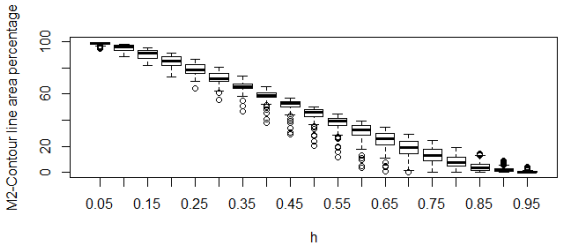

M1-Area-P-precision/recall
M1-Area-P-recall
M1-Area-P-precision
legend
h=0.7
h=0.8
h=0.9

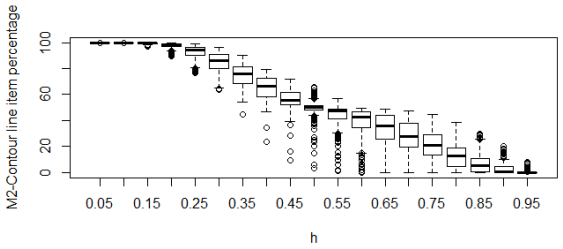

M2-Area-P-precision/recall
M2-Area-P-recall
M2-Area-P-precision
legend
h=0.7
h=0.8
h=0.9


# of users with at least 10|60|110|160|210|260 items
in M2-Intersection area
# of users
h

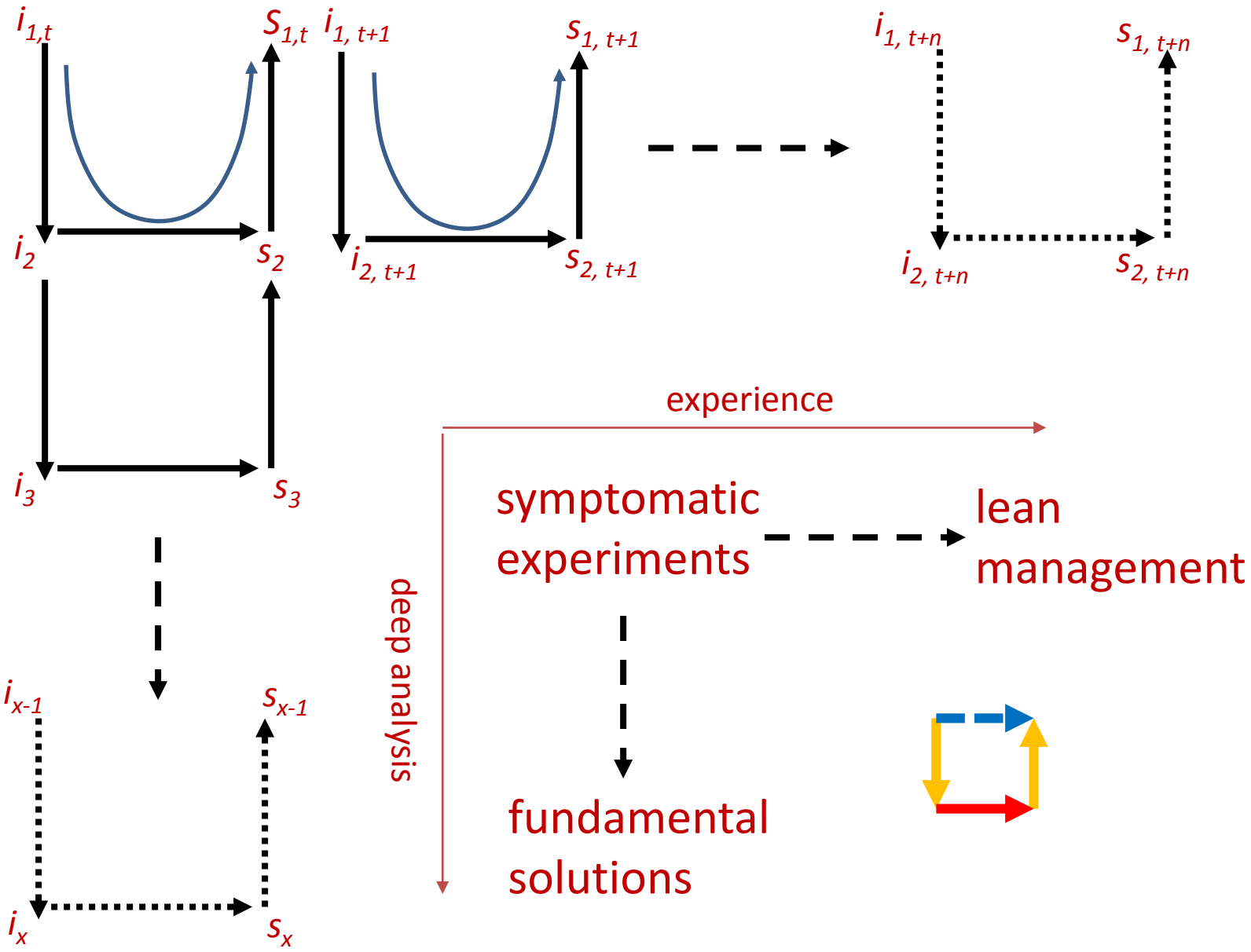

M1-Area-H-precision/recall
M1-Area-H-recall
M1-Area-H-precision
legend
h=0.7
h=0.8
h=0.9


M1-Area-H-precision for h=0.7 - histogram
M1-Area-H-precision for h=0.8 - histogram
M1-Area-H-precision for h=0.9 - histogram
# of users
M1-Area-H-precision
h


M2-Contour line area percentage
h

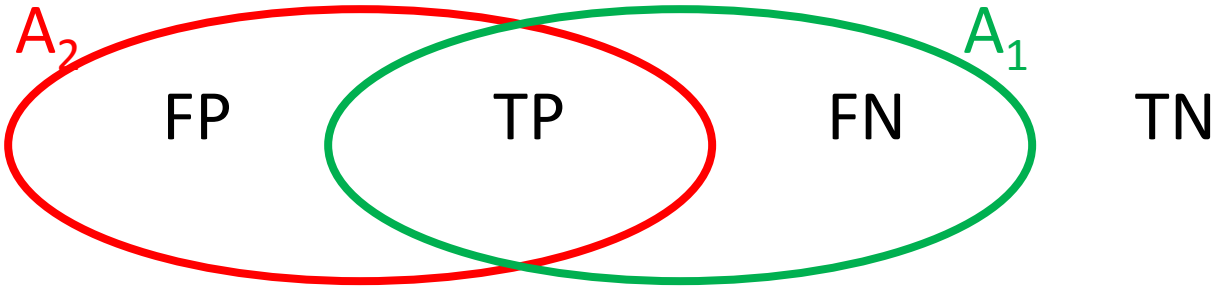

M2-Contour line item percentage
h

Learning and management strategies



ChR as a general epistemic reasoning method?

- What is the "truth value" $A_2(r(i_1), s_2) \Rightarrow A_1(i_1, t(s_2))$?
- A_1 - target, hypothesis, event, reality, deployment,
  A_2 - source, model, evidence, test, experiment,
- A_1 - declarative, correct, semantics, truth, tautology
  A_2 - procedural, computed, syntax , proof
- Preferential logic; Hájek's comparative notion of truth; Bayes; Hájek's observational logic, 4ft, IR; user studies; formal proofs



$$\frac{(A_2, b), (A_1 \leftarrow A_2, r)}{(A_1, C_{\rightarrow}(b, r)} \qquad Pr(A_1 | A_2) = \frac{Pr(A_2 | A_1) * Pr(A_1)}{Pr(A_2)} \qquad \frac{\#\text{ true positive}}{\#\text{ all}}$$

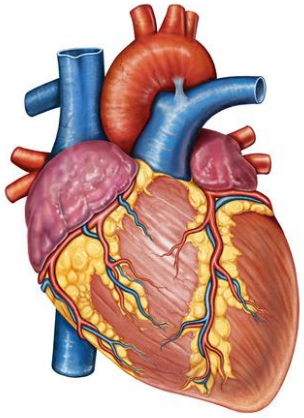
Abstract is more formally oriented ...

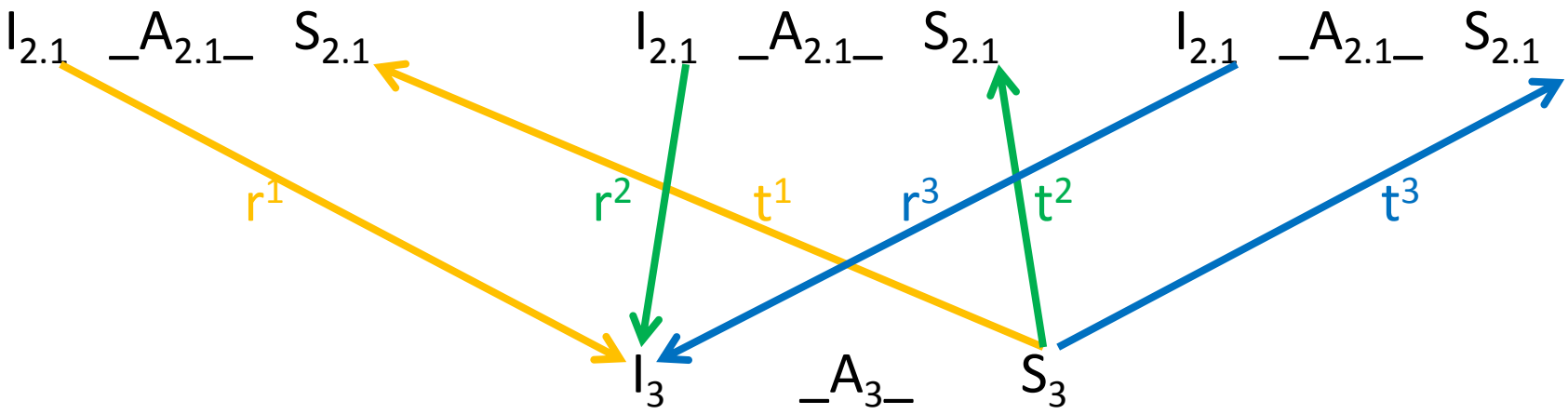
- Motivated by Hromkovic and N. Megiddo, Ch. H.Papadimitriou On total functions, we introduce a method how to convert a search problem (typically a one that is not total) to a total functional problem.
- Notice, that our A (e.g. in 3SAT, 3COL) is computable (as there are plenty of exponential algorithms for this), polynomialy balanced but need not be polynomialy recognizable (in contrast to TF class), hence our class TF+ is an extension of class of TF problems
- Our Galois-Tukey category appeared also in work of de Paiva, motivated by
- K. Gödel. 'Ueber eine bisher nicht benützte Erweiterung des finiten Standpunktes', Dialectica 12 (1958), 280–287
- [MP] N. Megiddo, Ch. H.Papadimitriou. On total functions, existence theorems and computational complexity. TCS 81,2 (1991) 317-324
- [P] V. C. V. de Paiva. A dialectica-like model of linear logic. In Category Theory and Computer Science (D. H. Pitt et al eds.) Lecture Notes in Computer Science 389, Springer Verlag, 1989, pp 341-356
- Any comments, questions are welcome

Vopenka and theoretical cybernetics

- From 1969 on, studying mathematics at Faculty of Mathematics and physics one could choose to specialize in theoretical cybernetics
- State exam consists of
  - probability and statistics
  - algorithms, programming
  - logic, set theory
- In my opinion there is a connection between Wiener's cybernetics and Vopenka's theoretical cybernetics

Wiener - Cybernetics – control, feedback



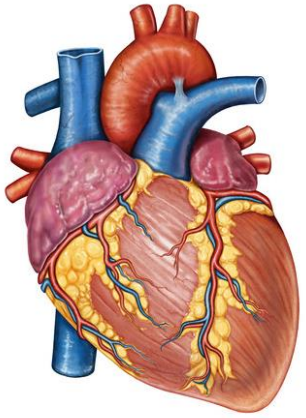


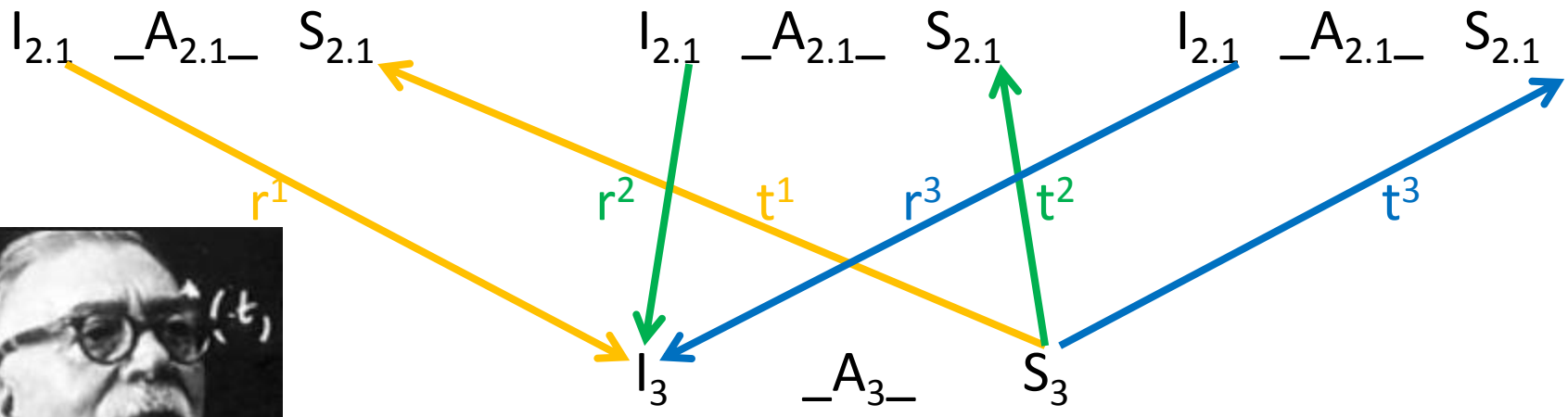
Control rudder too brusque → overshoot → oscillation

Pick a pencil and write – if purpose tremor(illness) – oscillation

Heart – healthy, ill -

Wiener - Cybernetics – control, feedback

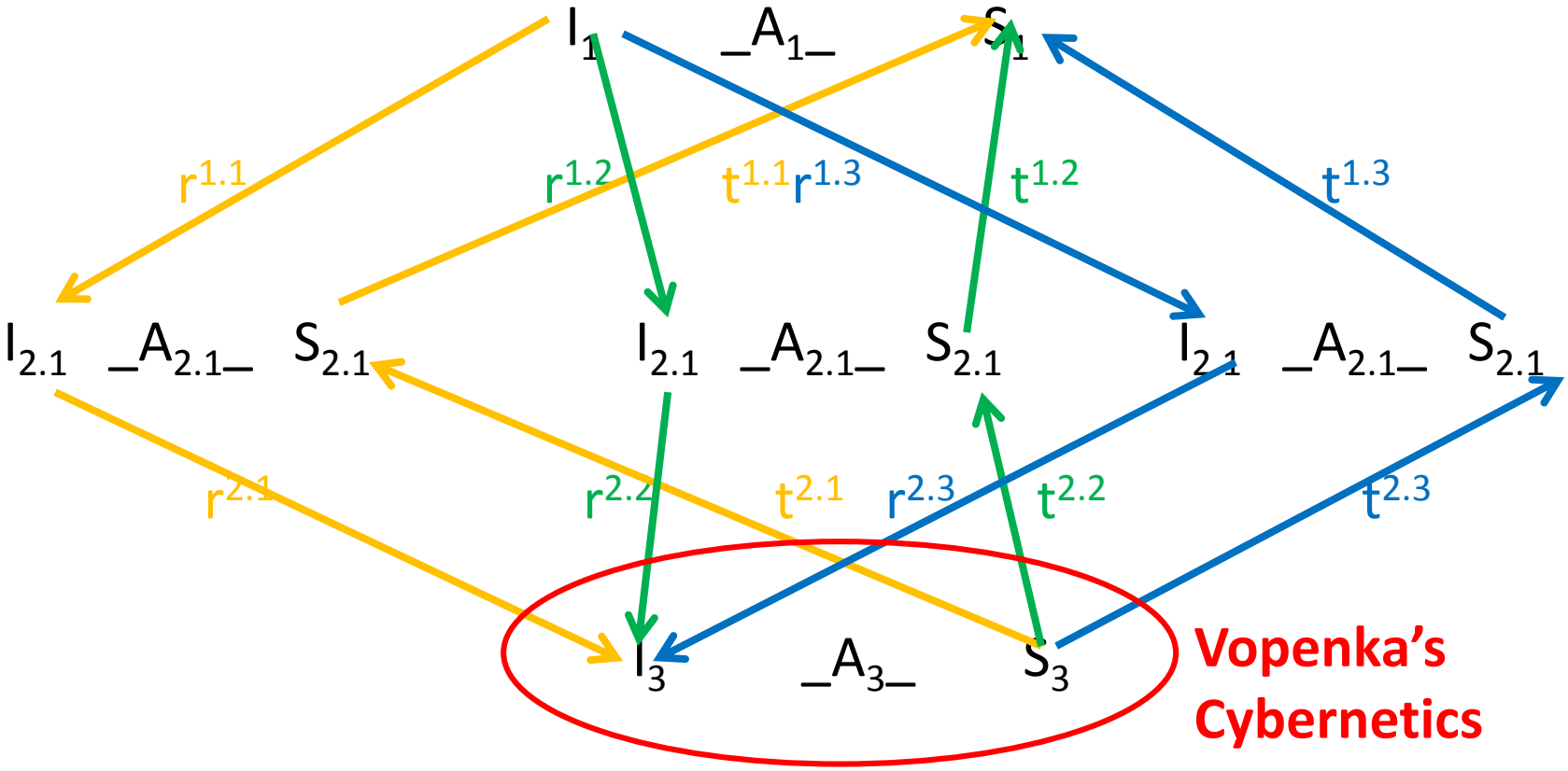




$$\frac{d^2\theta}{dt^2} = c_1\phi - c_2\frac{d\theta}{dt}$$

$$u + iv = -k_1 i y^3 - k_2 y^2$$

Vopenka and theoretical cybernetics



Upper level – real situations

Middle level – probability, statistics; algorithms, programming; logic, set theory

Lower level – integration, study of theoretical cybernetics

Thank you

Questions? Comments?