Our life and work with 

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Prague University of Economics & Business, Czech Republic

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Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic

J. A. Symposium, MFF UK, Prague, May 12, 2023

A pair of exciting topics. . .

- Practice: Modelling durability of dairy products (cheese, ice-cream, yoghurt)

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- Life: Joint research projects (Czech Science Foundation)

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- Theory: Interval-valued data, set-valued estimators
- EIV-regression
- Algorithms for robust regression (current project)
- Life: Joint research projects (Czech Science Foundation)
- A bit of exotic travelling

Part I

Our recent work

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- M.Č., M.H. and J.A. *On the possibilistic approach to linear regression models involving uncertain, indeterminate or interval data* (Inform Sci)

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- M.Č. and M.H. *Antoch: a new LaTeX package without which it's impossible to typeset a good paper in statistics* (J Stat Softw)

Package Antoch

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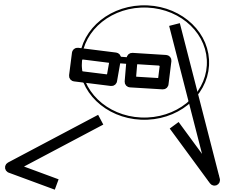

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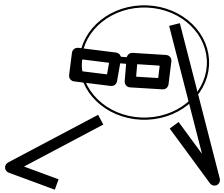

Marc Chagall, Portrait of an Unknown Soldier of Mathematics, MOMA NYC

Package Antoch (continued)

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» \AntochAfterMasterExams

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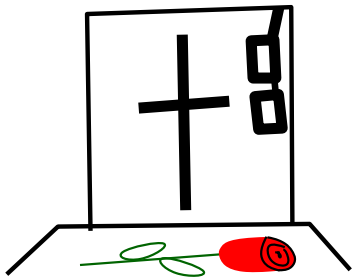

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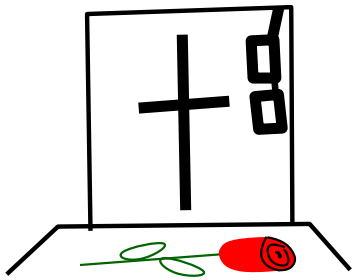

» \AntochAfterMasterExamsDayThree

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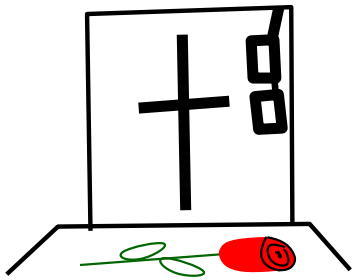

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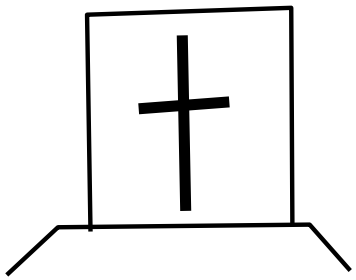

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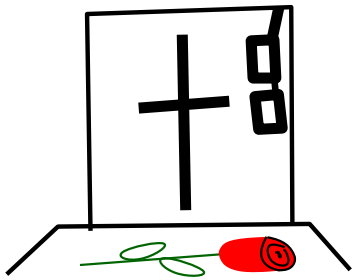

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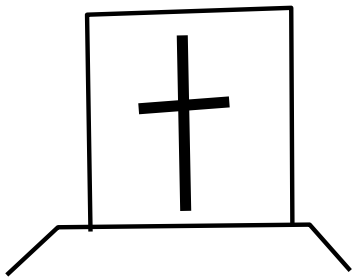

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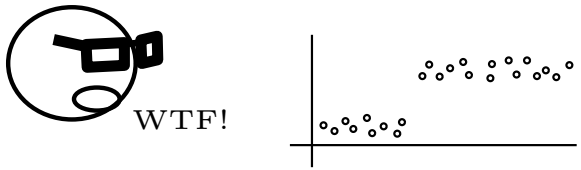

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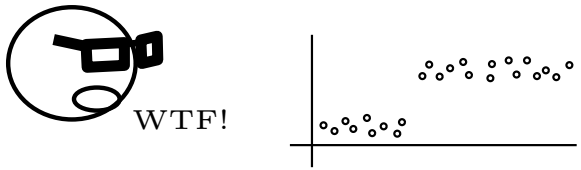

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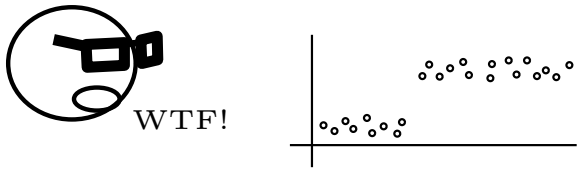

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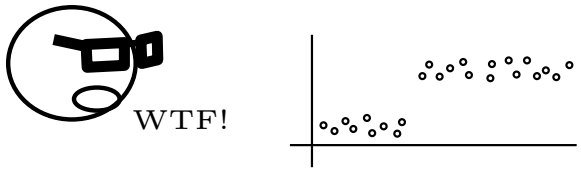

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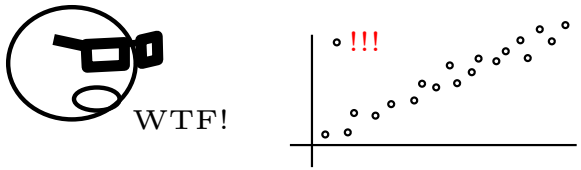

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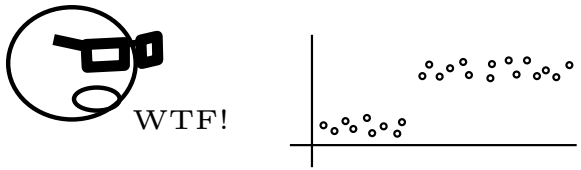

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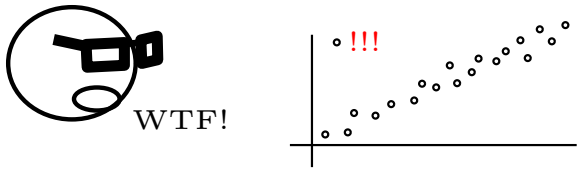

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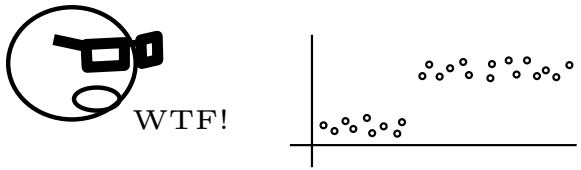

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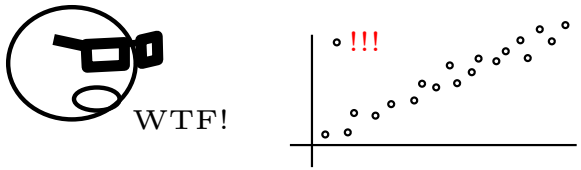

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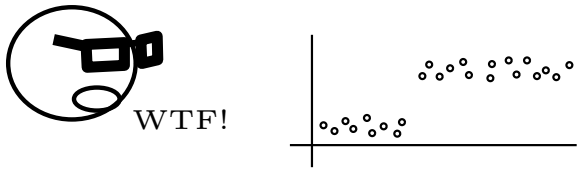

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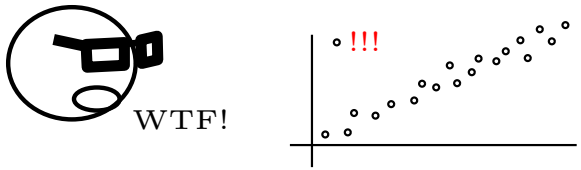

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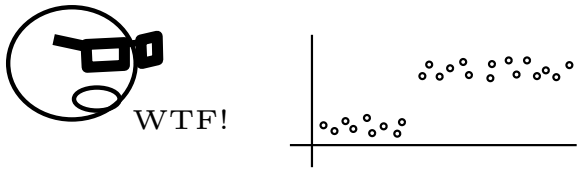

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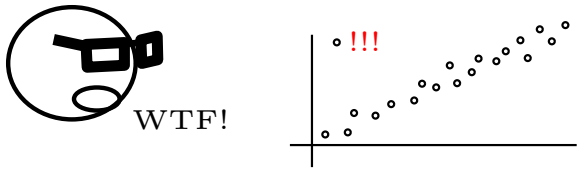

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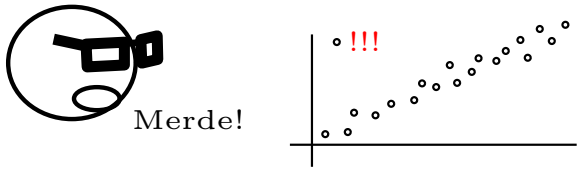

How to configure your Antoch (continued)

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» `\usepackage[RedWineLover=On]{Antoch}`

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» \Antoch

Hey dude!
Don't make it bad!
Turn on the red option!

How to configure your Antoch (continued)

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» `\Antoch`

» `\usepackage[WhiteWineLover=On]{Antoch}`
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» `\usepackage[WhiteWineLover=On, Russian=On]{Antoch}`

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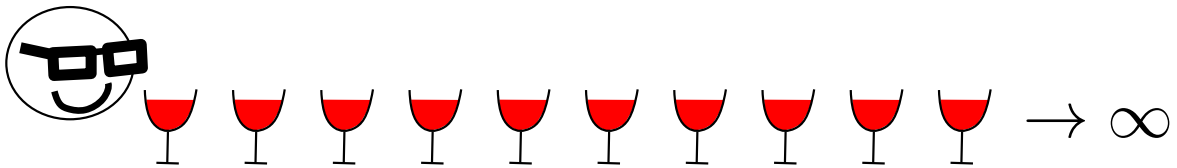

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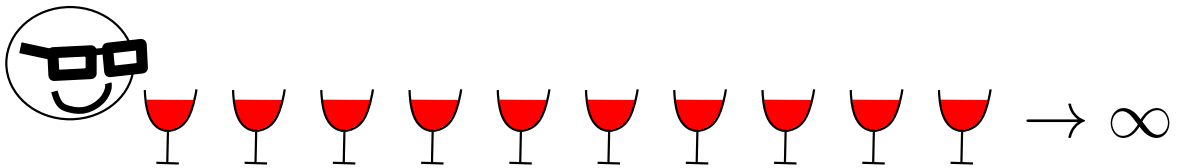

Part II

How  **influenced the world and people**

Research project

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- Czech Science Foundation (GAČR)

Research project

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- Panel P415 *History, theory and applications of* 
- Project 19-00907S *How*  *influenced the world and society?* (2019-2022)
- PI: Milan Hladík

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Main result:

Research project

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Main result: **Insufficiently.**

Details to appear in *Acta Antochologica*, currently available as online-first.

Case study I: Young people and chats

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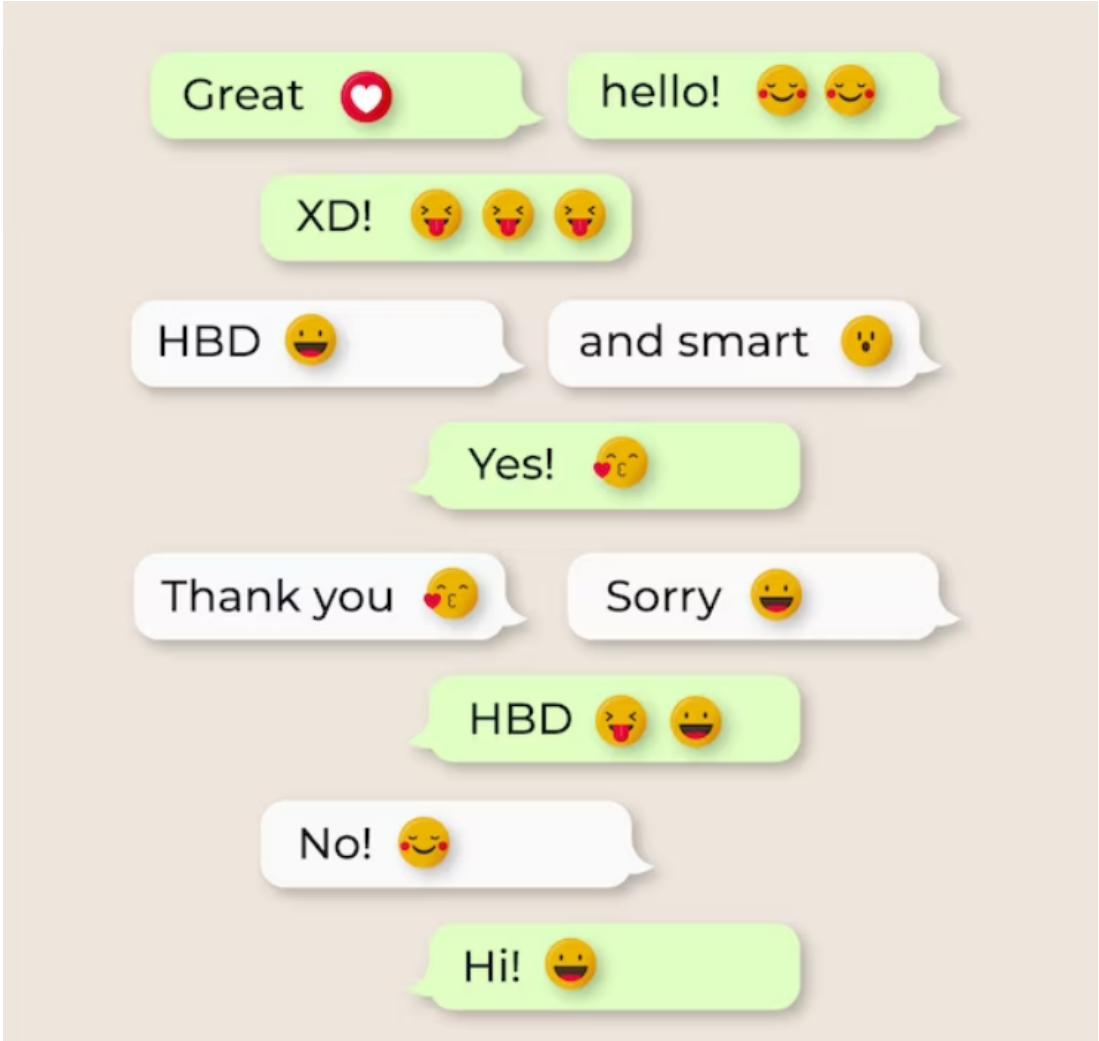

Teenagers and chats: Example of Anežka & Betty (11y)

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» Sure! 

Case study II: Florida

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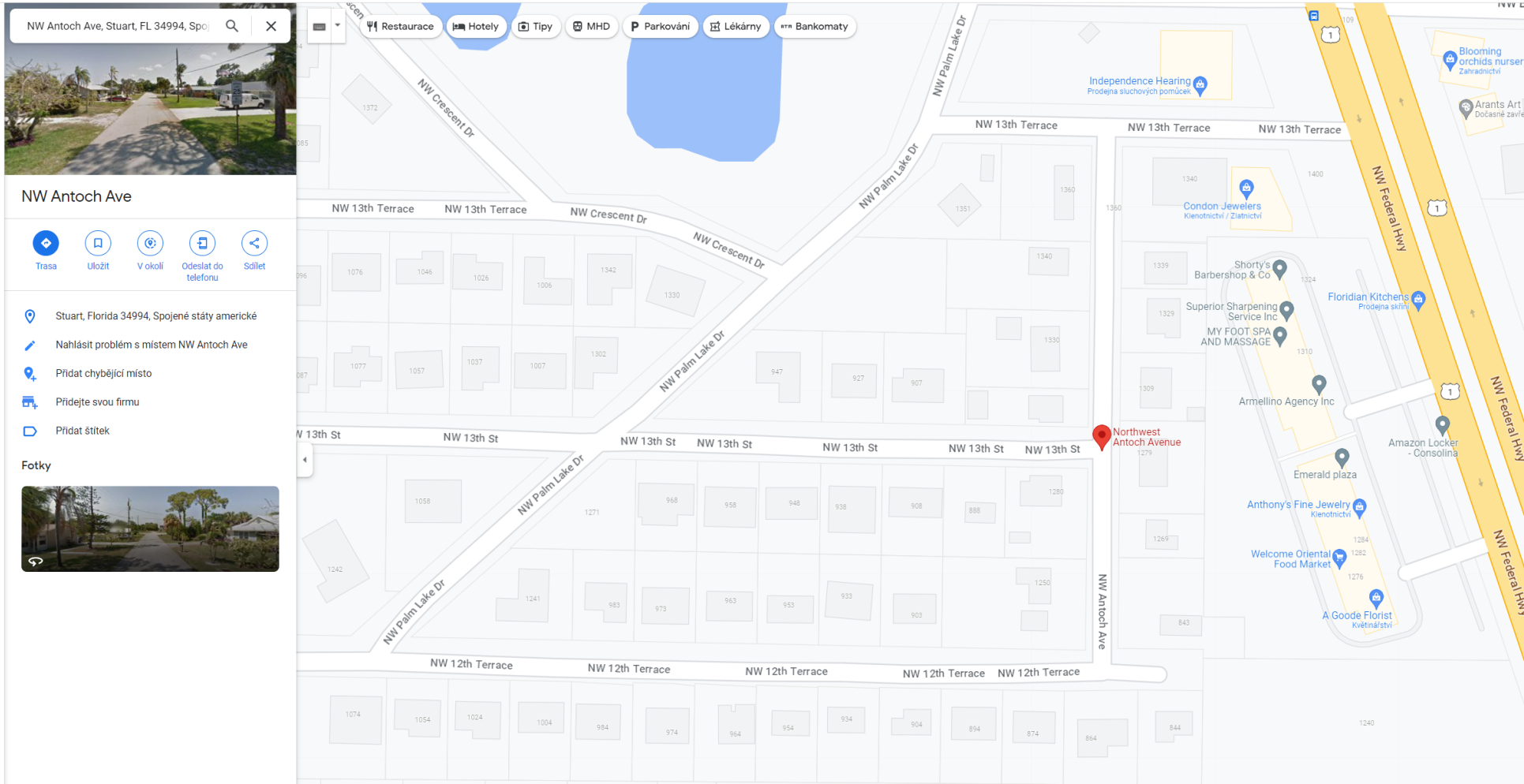
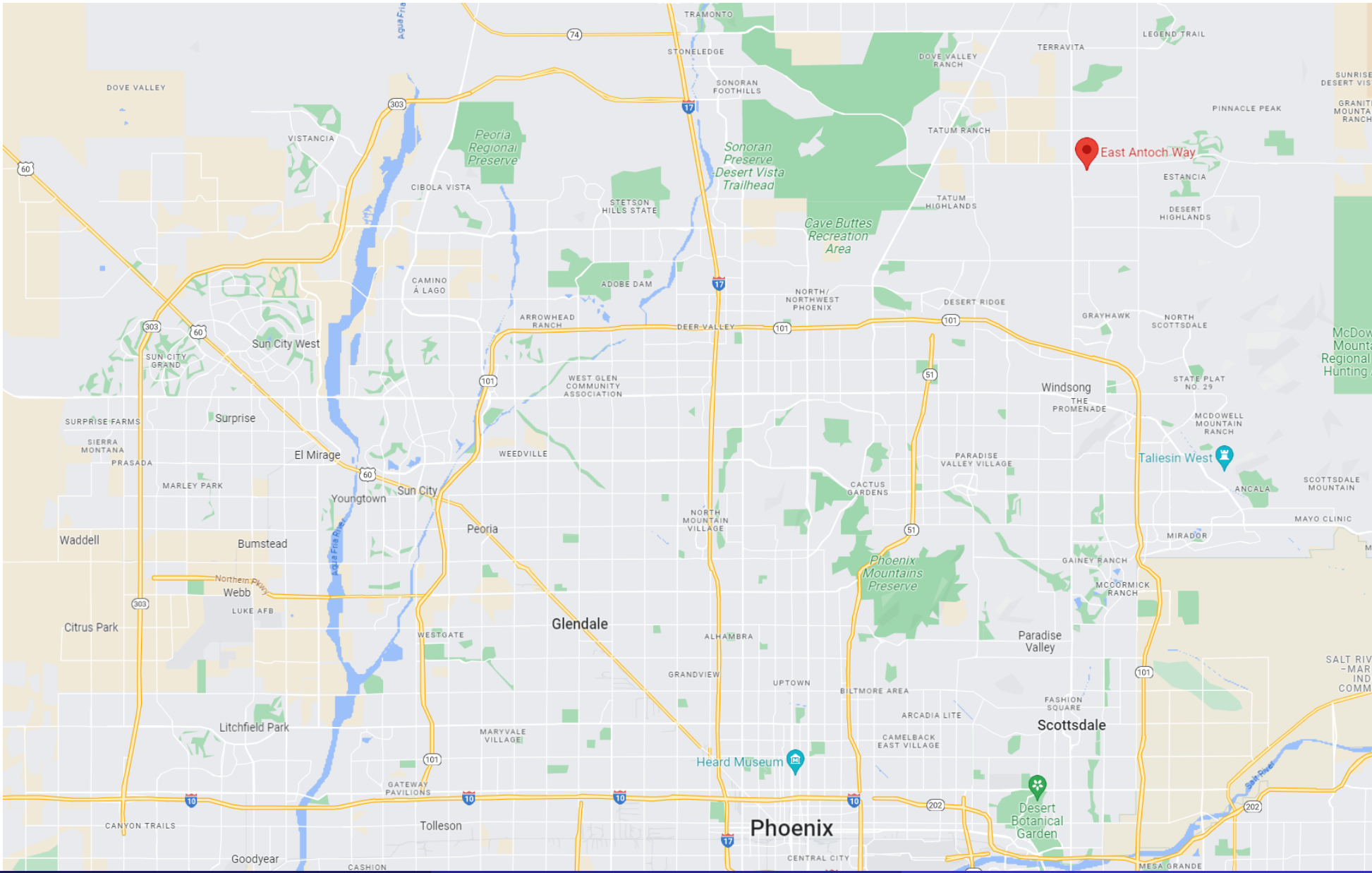
Antoch Avenue — Stuart City, Florida, USA



Case study II: Phoenix

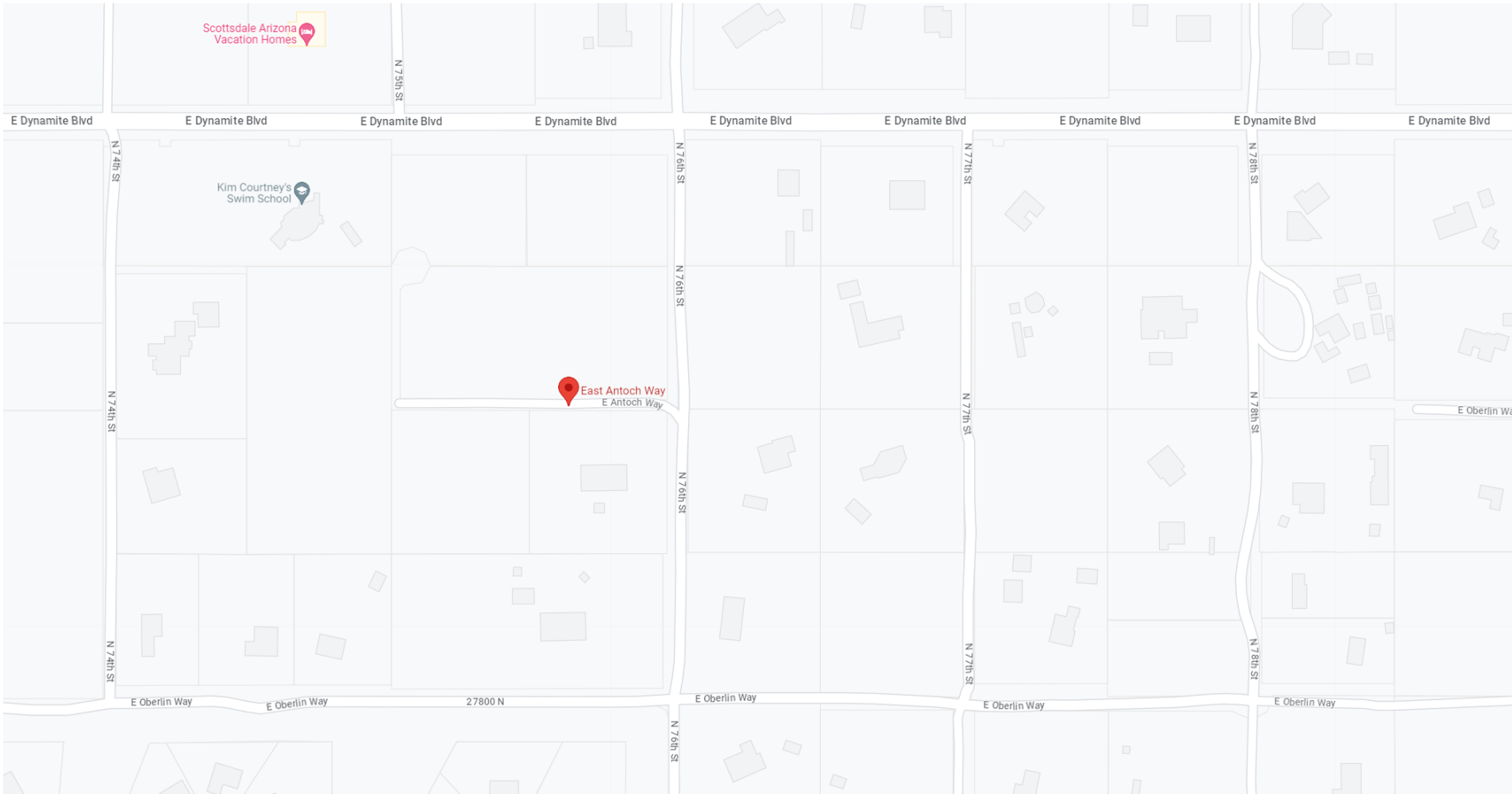
Case study II: Phoenix

Phoenix, Arizona, USA



Case study II: Phoenix

Phoenix, Arizona, USA (detail)



Case study II: Czechia?

And the Czech Republic?

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And the Czech Republic? Nothing!

Case study II: Czechia?

And the Czech Republic? **Nothing!**

Milan Hladík's project:

- 1884 – 1922 Jungmann Avenue

Case study II: Czechia?

And the Czech Republic? **Nothing!**

Milan Hladík's project:

- 1884 – 1922 Jungmann Avenue
- 1922 – 1940 Foch Avenue

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And the Czech Republic? **Nothing!**

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Part III

My personal experience

My first meeting with statistical thinking

Durability of dairy products (cheese, yoghurt, ice-cream, . . .)

- A model for biological growth process of pathogens (bacteria, fungi) in dairy products

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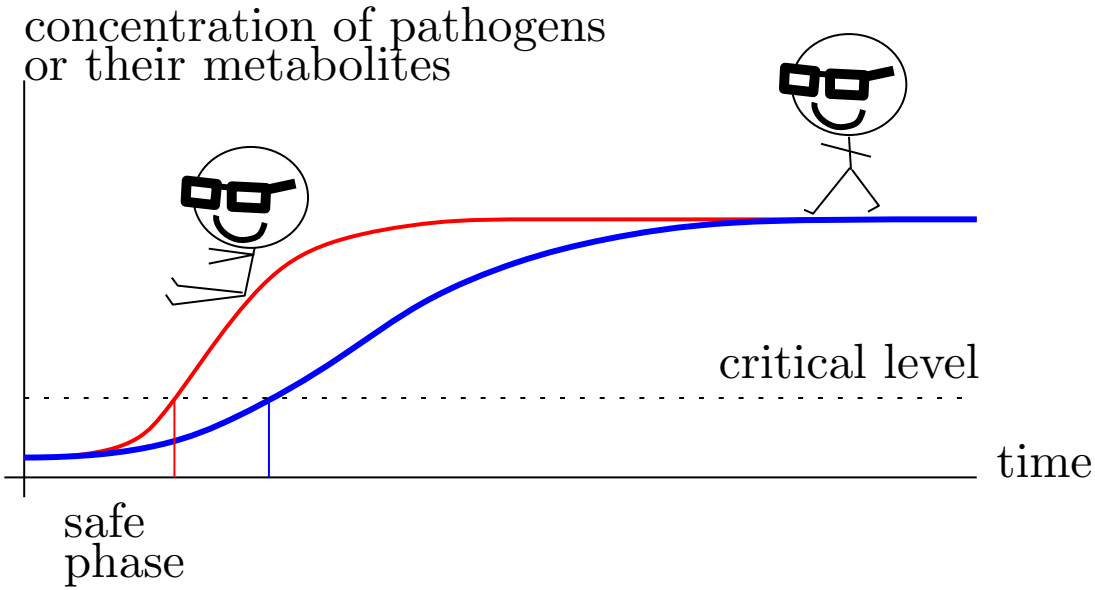

- Task: construct a model for the length of the initial phase as a function of:
  - citric acid, propionic acid, concentration of salts, water activity, temperature, pH, presence of "good" bacteria. . .

Then we did a lot of things

- My very first paper — a tiny contribution to changepoint 
- *Binary segmentation and Bonferroni-type bounds*

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- *Binary segmentation and Bonferroni-type bounds*
- Max-type statistics: bounds are often derived in terms of Bonferroni bounds

$$Pr\left[\bigcup_{i=1}^{n} A_i\right] \leqslant \sum_{i=1}^{n} Pr[A_i]$$

- One can get tighter lower and upper bounds by adding second-order terms

$$Pr\left[\bigcup_{i=1}^{n} A_i\right] \geqslant \sum_{i=1}^{n} Pr[A_i] - \sum_{k<\ell} \Pr[A_k \cap A_\ell]$$

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What we have been interested then...

Interval-valued data

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- M.Č., M.H. and  : *On the possibilistic approach to linear regression models involving uncertain, indeterminate or interval data* (Inform Sci)
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Remark. For the lovers of asymptotics: *if n is large enough*, then, with a very high probability, our method is extremely fast — almost a linear time algorithm. (However, the asymptotics works for $n \geqslant 10^{10^{10^{271}}} \ldots$)

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- **Remark:** Jaeckel's dispersion is a nonsmooth function
- J.D. Kloke and J.W. McKean: *Rfit: Rank-based Estimation for Linear Models* (The R Journal)
  - *`Rfit` uses package `optim` with option BFGS to minimize the dispersion function. We investigated other minimization methods (e.g., Nelder-Mead or CG), however the quasi-Newton method works well in terms of speed and convergence.*
  - The documentation of the `optim` package: *BFGS is a quasi-Newton method (...). It uses function values and gradients to build up a 'picture' of the surface to be optimized.*

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And the last slide...

Thanks for your attention!