Factfulness in biostatistics education

Teaching master students computational and communication skills necessary to ensure adequate quality in research projects

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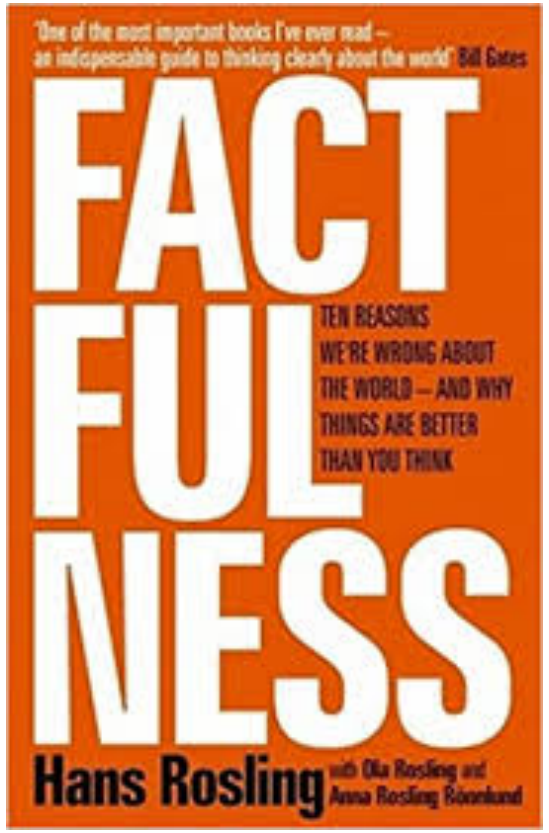
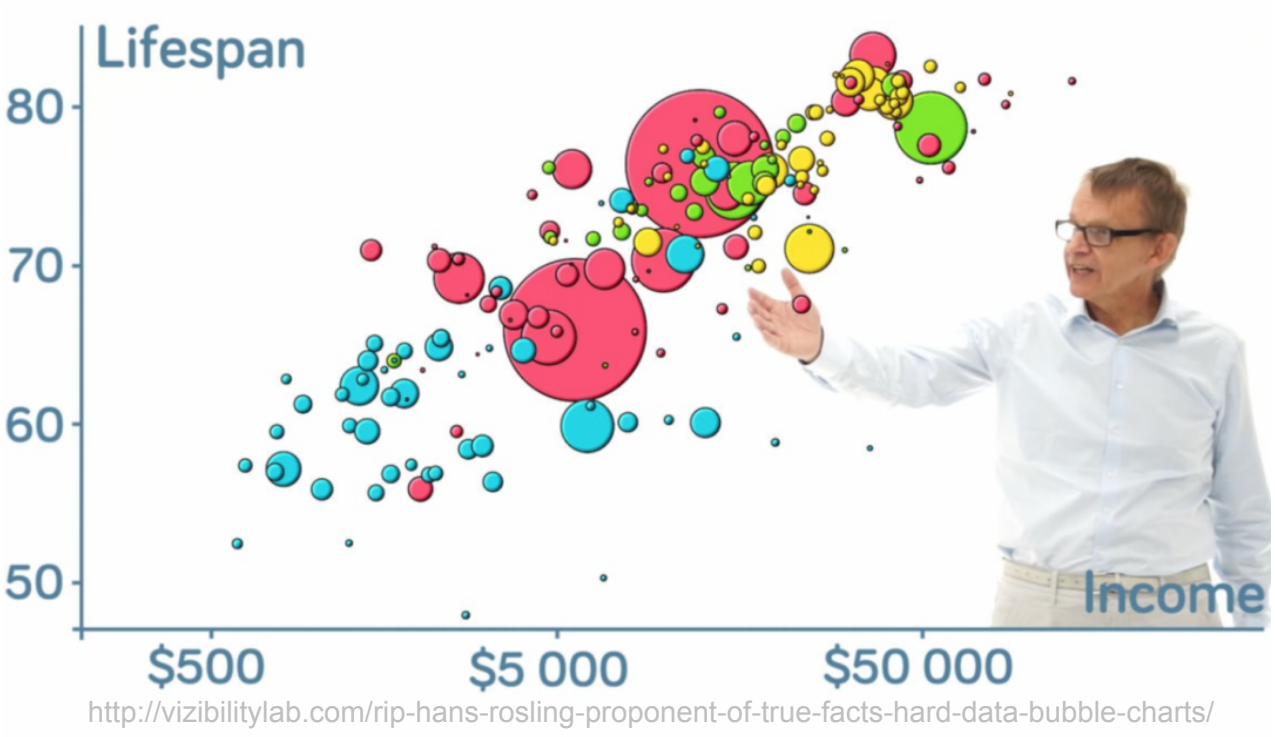
In the footsteps of a giant



Factfulness is a term introduced by the late Hans Rosling

What does it mean for our program?



http://vizibilitylab.com/rip-hans-rosling-proponent-of-true-facts-hard-data-bubble-charts/

Background: about the program

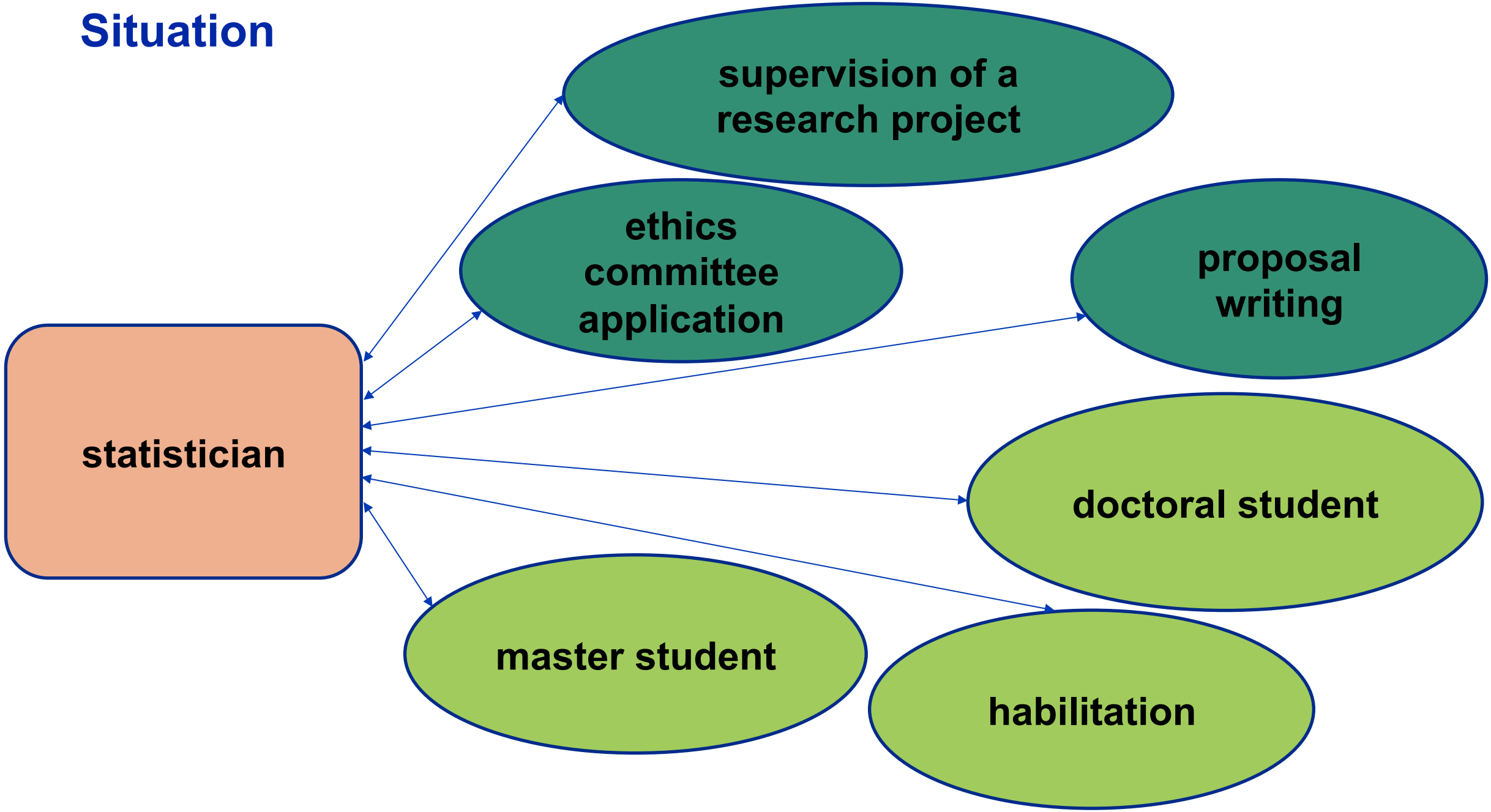
Master Program in Biostatistics at the University of Zurich: 3 semesters after a bachelor in mathematics, biology, psychology, etc.

- 1st semester: ground laying lectures in biostatistics
  ➔ learn about critical thinking

- 2nd semester: more lectures but also get more independent
  ➔ start to apply critical thinking under supervision

- 3rd semester: master thesis
  ➔ think critically

Situation


supervision of a research project
ethics committee application
proposal writing
statistician
doctoral student
master student
habilitation

Factfulness in biostatistics education

Statisticians are gatekeepers!

Our students need to be able to report **the facts** in research projects to the best of their knowledge

➔ Provide them with the appropriate tools!

Today:
Report about our approach and get your feedback

Background: target modules (2nd semester)

- *STA421 Bayesian Data Analysis*: miniprojects with presentations
- *STA480 Biostatistics Journal Club*: present one topic to the others, write a summary and produce a booklet containing all summaries
- *STA490 Statistical Consulting*: choose a real consulting project from (mainly) researchers at the university hospital, communicate with the client, perform the data analysis, write a report and present results (under supervision)

Approach: intervention modules

– *STA470 Good Statistical Practice: Computational Skills* (1st semester)

Message to students: fact finding

– *STA471 Good Statistical Practice: Communication Skills* (2nd semester)

Message to students: precision, clarity, brevity

➔ But not a rigorously controlled experiment!

Notes of caution

- Evidence is only anecdotal, the experiment has not been formally controlled nor has an outcome been precisely measured
- Program is too small to run suitably sized studies, we did the best we could
- Teaching approach does not scale well to larger audiences, especially the communication part

Intervention on computational skills

Necessary technical skills to ensure high-quality and reproducible statistical computing and reports

- Task automation in R: writing good code and efficient functions
- Programming and simulations: systematic task completion
- Automated report generation: R Markdown, LaTeX, knitr
- Version control: GitLab

Computational skills: learning goals

Message to students:

Correct, systematic and transparent fact finding is achieved with appropriate tools and techniques

➜ Be certain to get the facts, the correct facts and all the facts as a basis for any communication

Intervention on communication skills

Necessary communication skills to adequately transfer results in reports and presentations through best practice guidelines for

- reports of statistical results (including structure, code, tables and figures)
- presentations (oral and poster)
- scientific writing
- oral communication

Communication skills: learning goals

Message to students:

Precision: content and targeting audience
Clarity: ask right question and answer it
Brevity: get to the point and nothing more

➜ Professional communication is a crucial component in the strive for factfulness

Results: *STA421 Bayesian Data Analysis*

Design (by chance): 3 students of *STA421* who took at least one of *STA470/STA471* courses (intervention group) vs 4 students who took none

Subjective opinion of the *STA421* lecturer while evaluating student performance:

Impact of Computational skills in intervention group:

- more efficient solutions
- more efficient handling of R, knitr and R Markdown
- better coding/programming

Impact of Communication skills in intervention group:

- better structured reports
- better readable and more concise reports
- better structured presentations
- better and more focused oral presentations of the solutions

Results: *STA480 Biostatistics Journal Club*

Design (by chance): module run in the same modus in spring 2018 after students were taught Computational Skills compared to spring 2017 when they were not

Subjective opinion of the *STA480* lecturer regarding students' need for technical assistance in the creation of the summaries booklet using knitr and GitLab

Impact of Computational Skills teaching in intervention group:

- the bulk of students as independent as students in the control group who happened to have already acquired the technical skills
- the journal club tasks allowed to detect the students who did not succeed to digest the messages from *STA470*
- much more focus could be given to the content of the journal club topic with a similar amount of teaching hours from lecturer and assistant
- the more involved topic of spring 2018 (spatial epidemiology) would not have been possible to be satisfyingly covered otherwise

Results: *STA490 Statistical Consulting*

Some project situations in spring 2018:

Objective: combining different studies into a individual patient meta analysis

But: studies not comparable enough

Objective: establishing a new measurement gold standard

But: few data only result in limited confidence

Objective: validate decision system of former study and optimize

But: results of former study cannot be reproduced

Results: *STA490 Statistical Consulting*

Some project situations in spring 2018:

Objective: combining different studies into a individual patient meta analysis

But: studies not comparable enough

Objective: establishing a new measurement gold standard

But: few data only result in limited confidence

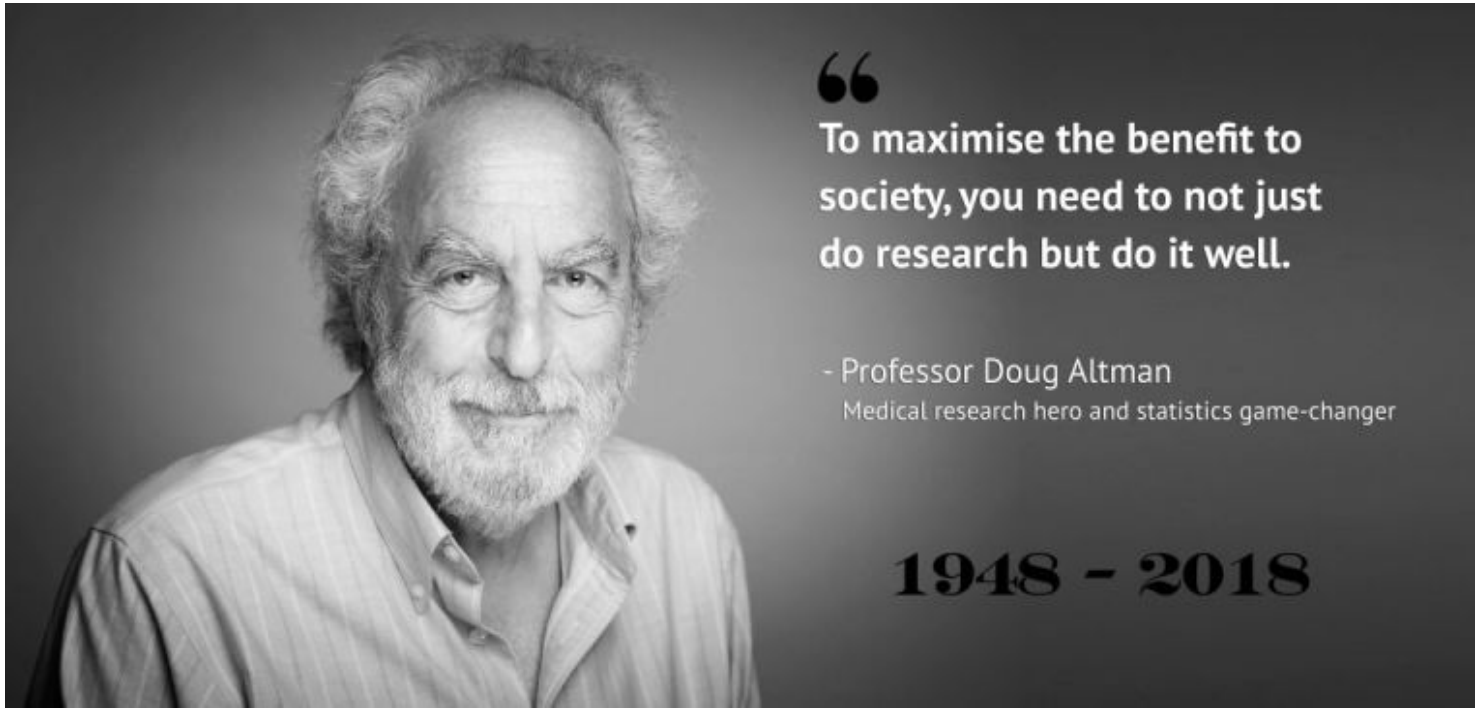
Objective: validate decision system of former study and optimize

But: results of former study cannot be reproduced

Nevertheless: all clients and students happy!

Conclusion

It is worthwhile teaching the necessary tools to achieve factfulness!



Thank you for listening!

Do you have feedback?

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