WIRTSCHAFTS UNIVERSITÄT WIEN VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS

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Quantitative Research Methods
Introduction
Very brief summary

http://statmath.wu.ac.at/courses/m1bw/m1bw_en.html

Topics

	Presentation topics
Unit 1 **23 OCT**	[1] **Theoretical Foundations** [2] **Sampling**
Unit 2 **30 OCT**	[3] **Measurement**
Unit 3 **6 NOV**	[5] **Scaling and Index Construction** [4] **Survey Research**
Unit 4 **13 NOV**	[6] **Design** [7] **Experimental Design** [8] **Quasi-experimental Design**
Unit 5 **27 NOV**	[9] **Analysis I** [10] **Analysis II**
EXAM Unit **4 DEC**	***Final exams, wrap-up***

Quantitative Research Methods

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Philosophical foundation 1

Study design: Sampling 2

Quiz 3

Scales and Indexes 5

Survey research 4

Quizzes 6-8

Data analysis 9 + 10

Quizzes 1-2

Measurement 3

Quizzes 4-5

Design
Experimental design
Quasi-experimental design
6 + 7 + 8

Quizzes 9-10

Missed quizzes, if any

Canceled quizzes, if any

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How We Deal with these Topics

- Preparation and presentation of the topics by the course participants
  - Text book as the basis
  - Add at least one additional literature source (can also be something from the internet)
  - Challenge Trochim whenever you disagree
- Presenter(s)
  - Aim is to provide an introduction into the topic, stimulate a discussion
  - Expose issues that are unclear to you
  - Try to involve the audience; e.g. by presenting a task, a game, etc., something entertaining, stimulating
- Audience
  - A successful unit needs good presenter(s) and active audience
  - Be prepared and participate in the discussion

Text Book by Trochim & Donelly: The Research Methods Knowledge Base

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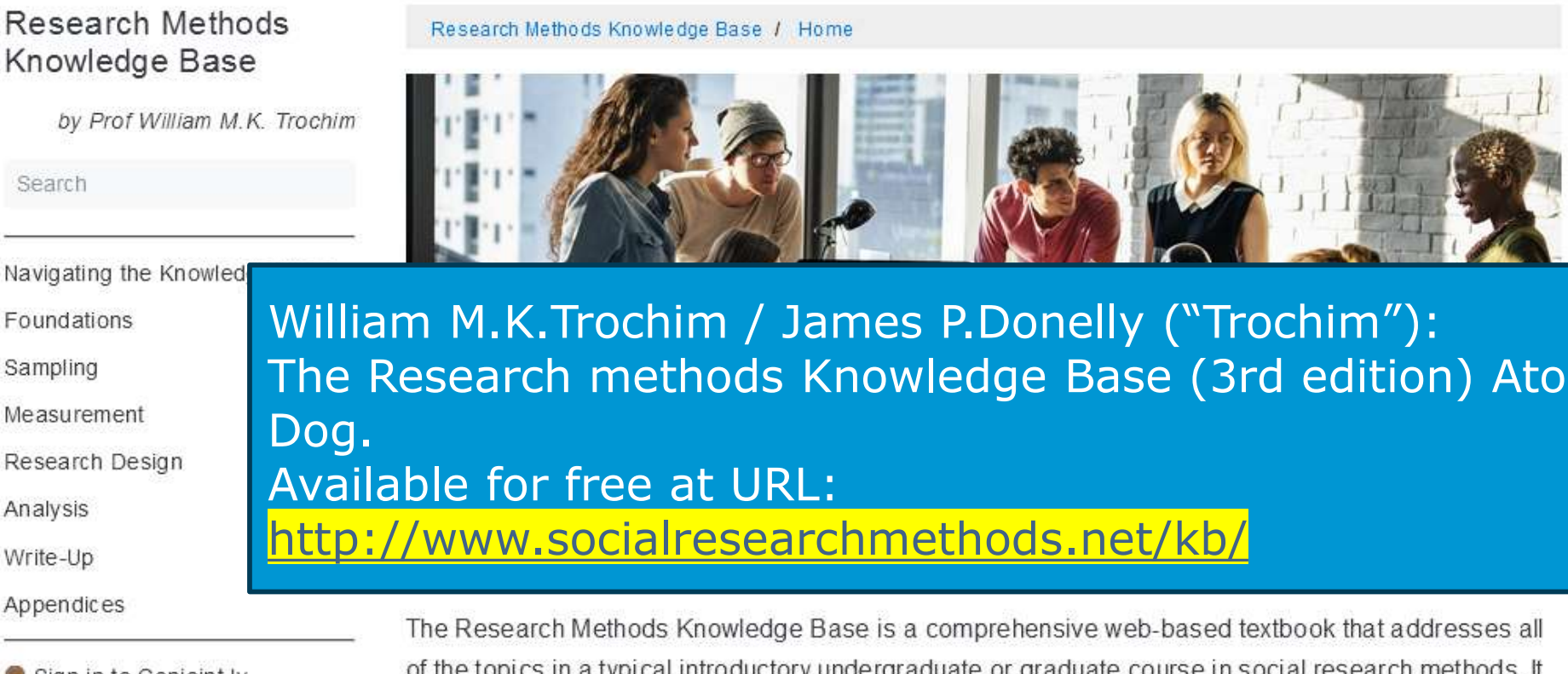

William M.K.Trochim / James P.Donelly ("Trochim"):
The Research methods Knowledge Base (3rd edition) Atomic Dog.
Available for free at URL:
http://www.socialresearchmethods.net/kb/

You may download a pdf version of the chapters from (link is also on the HTML page of the course):
http://statmath.wu.ac.at/~salzberger/quantmeth/pdfdownloaddirectory/

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Grading

- Attendance and active participation is required and expected
- Presentation
  - Up to 20 credits per presentation (presenters do not need to take the quiz for that chapter, 8 points will be credited automatically)
- Tests (quizzes):
  - 10 quizzes (one per topic), mostly multiple choice format at the beginning of the next class (prior to online sessions, dedicated time period)
  - 8 credits per quiz, thus 10x8=80 credits
  - Missed quizzes can be done in the final unit or by alternative arrangement
  - Up to 2 quizzes can be cancelled and re-done in the final unit (upgrade)
    - Alternative arrangement for the last two quizzes on analysis I and II
- Grading schemes:
  - Different schemes depending on the number of presentations as max points vary; doing more presentations is rewarded

Sample quiz

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Typical MC or MR question

Doctoral Program: Quantitative Research Methods

Quiz Topic 1 (Chapter 1): Foundations

Name: _____ Date: _____

Multiple choice questions: choose the answer which you think is the best given the presented options. There is only one right answer in questions 1 to 4.
You may explain your choice briefly to avoid misunderstandings.

1) Which of the following research practices gives participants the *greatest degree* of privacy when participating in a study?

☐ [a] Confidentiality
☐ [b] Randomization
☐ [c] Anonymity
☐ [d] Informed consent

2) When evaluating whether a particular management style influences job satisfaction of employees, the research is primarily interested in which of the following kinds of relationship?

☐ [a] Descriptive
☐ [b] Ecological
☐ [c] Relational
☐ [d] Causal

3) Researchers investigating the relationship of disposable income and the satisfaction with a particular product have found that very low and very high income are associated with very low satisfaction but medium levels of income are associated with higher satisfaction. This is an example of what kind of pattern of relationship?

☐ [a] A positive linear relationship
☐ [b] A negative linear relationship
☐ [c] A curvilinear relationship
☐ [d] No relationship

4) In a purely cross-sectional study, which of the following is necessarily NOT the case? *(Note: every item below might not apply in a particular cross-sectional study. Tick the option that never applies.)*

☐ [a] observations are made in only one country
☐ [b] observations of the same participants are made at two or more points in time
☐ [c] observations are made by two or more observers (representing the researcher)
☐ [d] observations are made based on objective evidence (e.g., observed time spent in a supermarket rather than asking the consumer)

Doctoral Program: Quantitative Research Methods

5) Connect the terms (to the left) and the definitions/explanations in the boxes to the right and at the bottom correctly with a line (4 credits total). Beware! One term cannot be linked to any definition, while for one definition there is no correct term listed. Cross the term and the definition that cannot be linked.

Inductive/Induction	Bottom-up reasoning that begins with specific observations and measures and ends up as general conclusion or theory
Causal relationship	Process of translating a construct into the real world (e.g. translate the idea of what you want to measure into the real measure)
Ecological fallacy	Faulty reasoning that results from making conclusions about individuals based only on analyses of group data.
Critical realism	
Operationalization	
Exception fallacy	A faulty conclusion reached as a result of basing a conclusion on exceptional or unique cases
Constructivism	
	No one, including the researchers, will be able to link data to a specific individual
All observations are theory-laden and scientists are always biased by their experience, world view, etc.	There is a reality independent of a person's thinking which we can study but we can never know that reality with perfect accuracy.

Exceptional question type (only Q1 and Q2)

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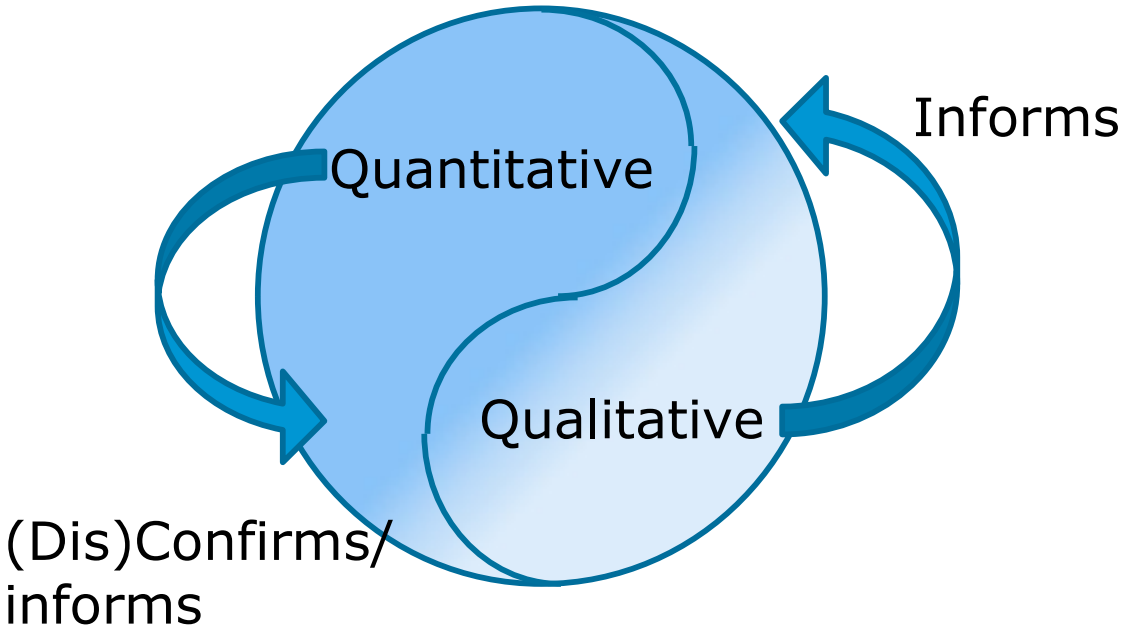
Quantitative and Qualitative Research Methods



- **Quantitative research: validity crucial (measurement, study design)**
- **Confirmation (lack of disconfirmation) or disconfirmation also depends on the specificity of the theory**

Quantitative Science as a Success Story (Natural sciences)

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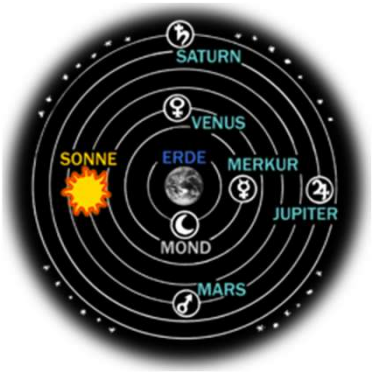
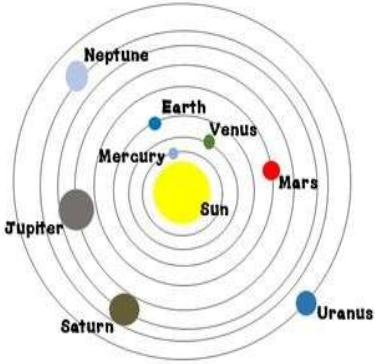
- Mathematical methods
  - Quantitative theories predict a specific outcome (something bold, specific for that theory; cf. Popper's bold conjectures)
- Empirical evidence
  - Theory must predict something that can be tested empirically (at least in principle, perhaps only in the future)





GREAT SCIENTISTS...ARE MEN OF BOLD IDEAS, BUT HIGHLY CRITICAL OF THEIR OWN IDEAS: THEY TRY TO FIND WHETHER THEIR IDEAS ARE RIGHT BY TRYING FIRST TO FIND WHETHER THEY ARE NOT PERHAPS WRONG. THEY WORK WITH BOLD CONJECTURES AND SEVERE ATTEMPTS AT REFUTING THEIR OWN CONJECTURES.

- KARL POPPER -

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Quantitative Science as a Success Story (Natural sciences)

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- Einstein's General theory of relativity (theory of gravity) proposed in 1915

Doc. 21

[p. 778] Plenary Session of November 4, 1915

On the General Theory of Relativity

[1] My efforts in recent years were directed toward basing a general theory of relativity, also for nonuniform motion, upon the supposition of relativity. I believed indeed to have found the only law of gravitation that complies with a reasonably formulated postulate of general relativity; and I tried to demonstrate the truth of precisely this

Doc. 25

[p. 844] Session of the physical-mathematical class on November 25, 1915

The Field Equations of Gravitation

by A. Einstein

In two recently published papers[1] I have shown how to obtain field equations of gravitation that comply with the postulate of general relativity, i.e., which in their general formulation are covariant under arbitrary substitutions of space-time variables.

character only under linear transformations. After a simple rearrangement, one gets from (20a) and (19a)

$$t_\sigma^\lambda = \frac{1}{2}\delta_\sigma^\lambda \sum_{\mu\nu\alpha\beta} g^{\mu\nu}\Gamma_{\mu\beta}^\alpha \Gamma_{\nu\alpha}^\beta - \sum_{\mu\nu\alpha} g^{\mu\nu}\Gamma_{\mu\sigma}^\alpha \Gamma_{\nu\alpha}^\lambda. \quad (20b)$$

Finally, it is of interest to derive two scalar equations that result from the field equations. After multiplying (16a) by $g^{\mu\nu}$ with summation over μ and ν, we get after simple rearranging

$$\sum_{\alpha\beta}\frac{\partial^2 g^{\alpha\beta}}{\partial x_\alpha \partial x_\beta} - \sum_{\sigma\tau\alpha\beta} g^{\sigma\tau}\Gamma_{\sigma\beta}^\alpha \Gamma_{\tau\alpha}^\beta + \sum_{\alpha\beta}\frac{\partial}{\partial x_\alpha}\left(g^{\alpha\beta}\frac{\partial \lg\sqrt{-g}}{\partial x_\beta}\right) = -\kappa\sum_\sigma T_\sigma^\sigma. \quad (21)$$

On the other hand, multiplying (16a) by $g^{\nu\lambda}$ and summing over ν, we get

$$\sum_{\alpha\nu}\frac{\partial}{\partial x_\alpha}(g^{\nu\lambda}\Gamma_{\mu\nu}^\alpha) - \sum_{\alpha\beta\nu} g^{\nu\beta}\Gamma_{\nu\mu}^\alpha \Gamma_{\beta\alpha}^\lambda = -\kappa T_\mu^\tau,$$

or, also considering (20b),

$$\sum_{\alpha\nu}\frac{\partial}{\partial x_\alpha}(g^{\nu\lambda}\Gamma_{\mu\nu}^\alpha) - \frac{1}{2}\delta_\mu^\lambda \sum_{\mu\nu\alpha\beta} g^{\mu\nu}\Gamma_{\mu\beta}^\alpha \Gamma_{\nu\alpha}^\beta = -\kappa(T_\mu^\lambda + t_\mu^\lambda).$$

Taking (20) into account, and after simple rearranging, this yields

$$\frac{\partial}{\partial x_\mu}\left[\sum_{\alpha\beta}\frac{\partial^2 g^{\alpha\beta}}{\partial x_\alpha \partial x_\beta} - \sum_{\sigma\tau\alpha\beta} g^{\sigma\tau}\Gamma_{\sigma\beta}^\alpha \Gamma_{\tau\alpha}^\beta\right] = 0.$$

owever, we demand somewhat beyond that:

$$\sum_{\alpha\beta}\frac{\partial^2 g^{\alpha\beta}}{\partial x_\alpha \partial x_\beta} - \sum_{\sigma\tau\alpha\beta} g^{\sigma\tau}\Gamma_{\sigma\beta}^\alpha \Gamma_{\tau\alpha}^\beta = 0, \quad (22)$$

pon (21) becomes

$$\sum_{\alpha\beta}\frac{\partial}{\partial x_\alpha}\left(g^{\alpha\beta}\frac{\partial \lg\sqrt{-g}}{\partial x_\beta}\right) = -\kappa\sum_\sigma T_\sigma^\sigma. \quad (22a)$$

(21a)

https://www.einsteinrelativelyeasy.com/index.php/einstein/83-the-einstein-field-equations-series

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Quantitative Science as a Success Story (Natural sciences)

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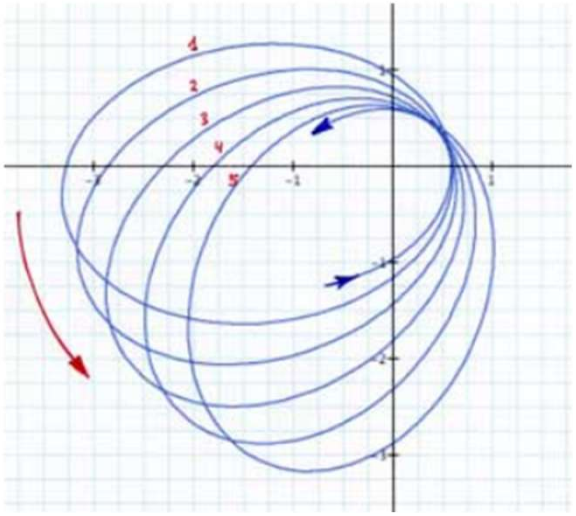
- Einstein's General theory of relativity (theory of gravity) proposed in 1915 confirmed countless times
- From movement of Mercury in 1915



112 DOC. 24 PERIHELION MOTION OF MERCURY

Doc. 24

Explanation of the Perihelion Motion of Mercury from the General Theory of Relativity

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Merkur	532.08	575.19	43.11 ± 0.45	43.03

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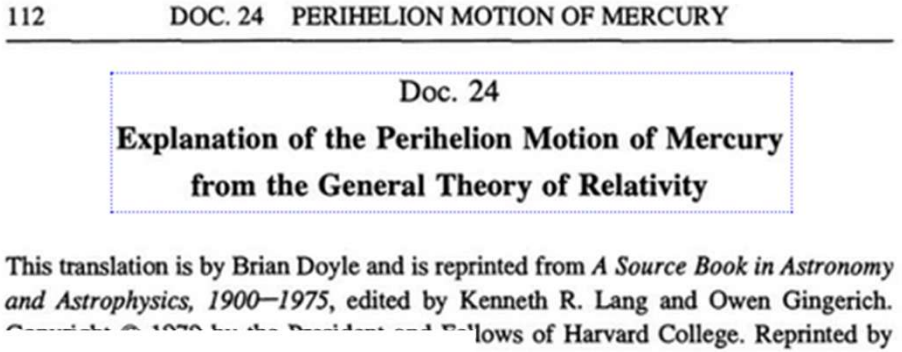
https://www.relativity.li/de/epstein/lesen/i0_de/i1_de

Quantitative Science as a Success Story (Natural sciences)

WIRTSCHAFTS UNIVERSITÄT WIEN VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS

- Einstein's General theory of relativity (theory of gravity) proposed in 1915 confirmed countless times
- From movement of Mercury in 1915
- Up until today



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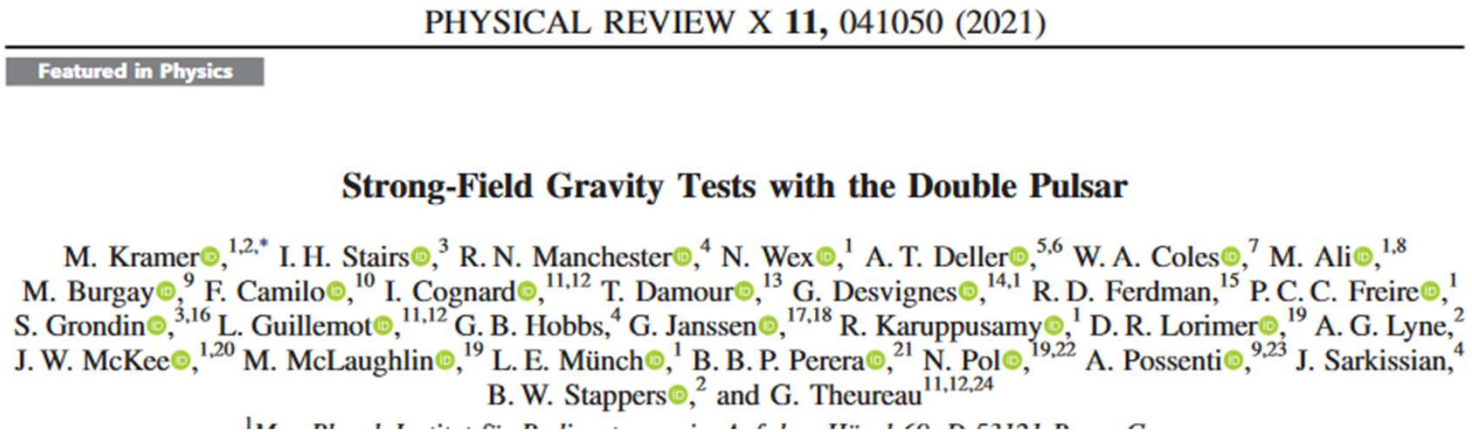

PHYSICAL REVIEW X **11,** 041050 (2021)

Featured in Physics

Strong-Field Gravity Tests with the Double Pulsar

M. Kramer,[1,2,*] I. H. Stairs,[3] R. N. Manchester,[4] N. Wex,[1] A. T. Deller,[5,6] W. A. Coles,[7] M. Ali,[1,8] M. Burgay,[9] F. Camilo,[10] I. Cognard,[11,12] T. Damour,[13] G. Desvignes,[14,1] R. D. Ferdman,[15] P. C. C. Freire,[1] S. Grondin,[3,16] L. Guillemot,[11,12] G. B. Hobbs,[4] G. Janssen,[17,18] R. Karuppusamy,[1] D. R. Lorimer,[19] A. G. Lyne,[2] J. W. McKee,[1,20] M. McLaughlin,[19] L. E. Münch,[1] B. B. P. Perera,[21] N. Pol,[19,22] A. Possenti,[9,23] J. Sarkissian,[4] B. W. Stappers,[2] and G. Theureau[11,12,24]

[1] [illegible]

https://www.einsteinrelativelyeasy.com/index.php/einstein/83-the-einstein-field-equations-series

https://journals.aps.org/prx/pdf/10.1103/PhysRevX.11.041050

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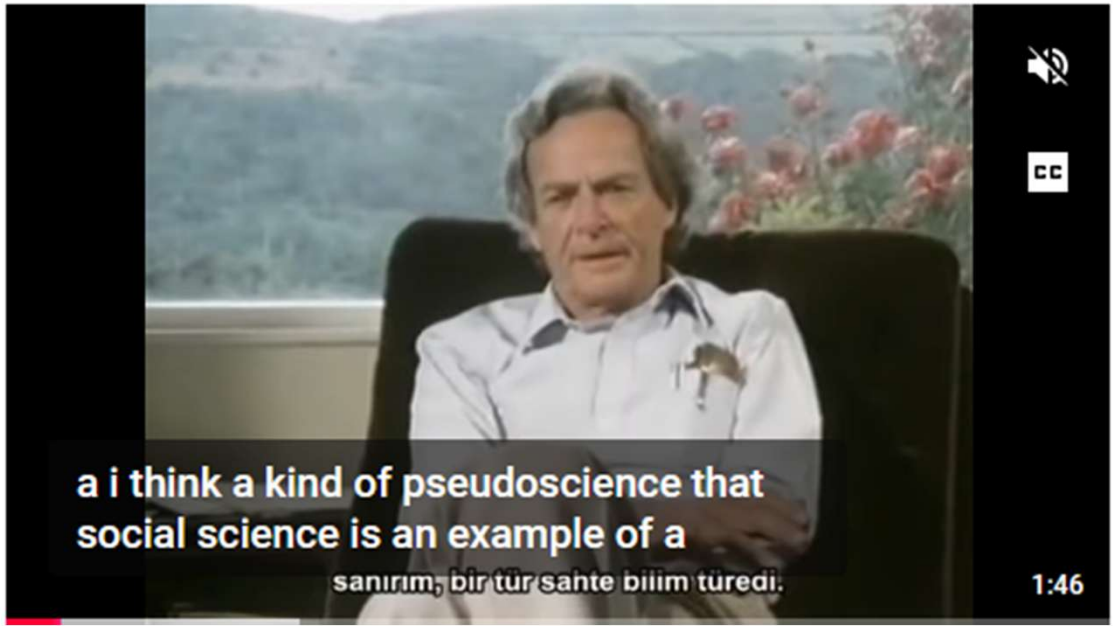
A Quantitative Theory in Business sciences?

Pseudoscience?



Richard Feynman on Pseudoscience

345.948 Aufrufe • vor 8 Jahren

J Jacob Edward

- *https://www.youtube.com/watch?v=tWr39Q9vBgo*

On String Theory:

"I do feel strongly that this is nonsense!

… I don't like that they don't check their ideas. I don't like that for anything that disagrees with an experiment, they cook up an explanation— a fix-up to say, "Well, it might be true."

"String theorists don't make predictions, they make excuses."

Richard Feynman

https://www.youtube.com/watch?v=BnCDVrBSDFk ~ 5'20"

This is why physics is dying

Sabine Hossenfelder
1,51 Mio. Abonnenten
Mitglied werden
Abonniert
68.759
Teilen
Thanks
Clip

 https://www.youtube.com/watch?v=cBIvSGLkwJY&t=6s