FernUniversität in Hagen

Research in Judgment and Decision Making: Methodological Challenges and Theoretical Developments

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My first SPUDM: Stockholm 2005

PhD student, publication record ≈ 0

Robin Hogarth 

Eric Johnson 

Nigel Harvey 

John Maule 

My first SPUDM: Stockholm 2005

- What did I believe in back than?
  - coherence-based models are right and can explain the world
  - fast-and-frugal heuristics are wrong
  - better not specify your own model too precisely, it could be falsified
  - my findings can be replicated
  - long hair is the thing …
  - short hair is good too
- Learned anything? What do I believe in today?
  - further updates follow …

Judgment and Decision Making Today

- flourishing interdisciplinary field
  - journals
    - JDM, Decision, JBDM, OBHDP, JRU, MS, PsyRev, JEcPs, TaR, JBEE…
  - conferences
  - workshops funded by EADM
- many young scholars
  - EADM summer schools
  - young scholar event
  - PhD workshops and networks
- societies
  - EADM, SJDM, IAREP

common aim: advance knowledge concerning J/DM

what do we have to consider?

- (A) Methodological Challenges
  - ① Reproducibility
  - ② Theory Specification and Prediction
  - ③ Consolidation of Empirical Findings
- (B) Theoretical Developments
  - ④ Coherence-Based Models

- (A) Methodological Challenges
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Methodological Developments

- process tracing methods (Schulte-Mecklenbeck / Kühberger / Ranyard)
  - attention / eye-tracking / pupil dilation (Ashby / Orquin / Krajbich / S. Fiedler)
- formal model estimation / comparison methods
  - (hierarchical) Bayesian methods (Scheibehenne / Wagenmakers / Pachur / Rieskamp / Newell)
  - multinomial models (Heck / Erdfelder / Hilbig)
  - order-constraint inferences (Regenwetter / Hilbig)
  - refined strategy classification methods (Bröder / Glöckner)
- EADM fosters these developments
  - SPUDM → direct exchange and networking
  - summer schools → competence in young scholars

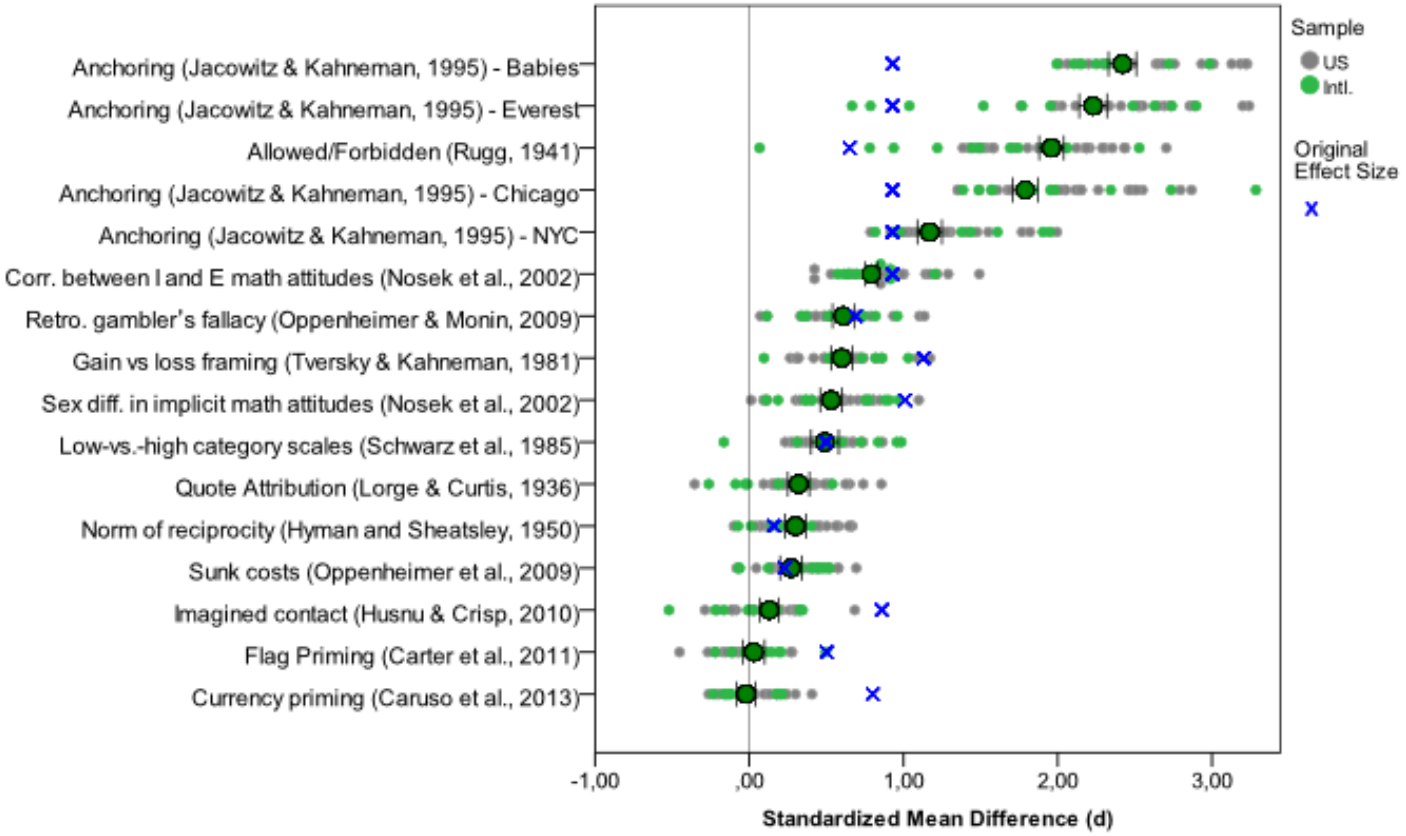
What are the methodological challenges?

Challenge I: Reproducibility

- Can we trust published results?
  - reproducibility project psychology (Open Science Collaboration, 2016, Sci)
    - replication of 100 studies from JPSP, PsySc, JEP:LMC with power > .80
    - 38% of findings replicated
  - economics: 49% / 66% (Chang & Li, 2015 [59]; Camerer et al., 2016, Sci [18])
  - substantial differences between fields
  - many lab reproducibility projects
    - ego depletion effect = CI incl. zero (Hagger et al., 2016, PPS)
    - facial feedback effect = CI incl. zero (Wagenmakers et al., 2016, PPS)
    - …
      [don't forget to update your lecture slides]

Challenge I: Reproducibility

- How reproducible are findings in J/DM?
  - Many Lab Study I: Klein et al. (2015, SoPs)



Challenge I: Reproducibility

- How reproducible are findings in J/DM?
  - Hagen Cumulative Science Project (Jekel, Glöckner et al., in progress)
    - replication of 50 articles from *Judgment and Decision Making* by students
      - feasible studies 2015 to 2017
    - huge effort – but we learned a lot
      - half-time report -

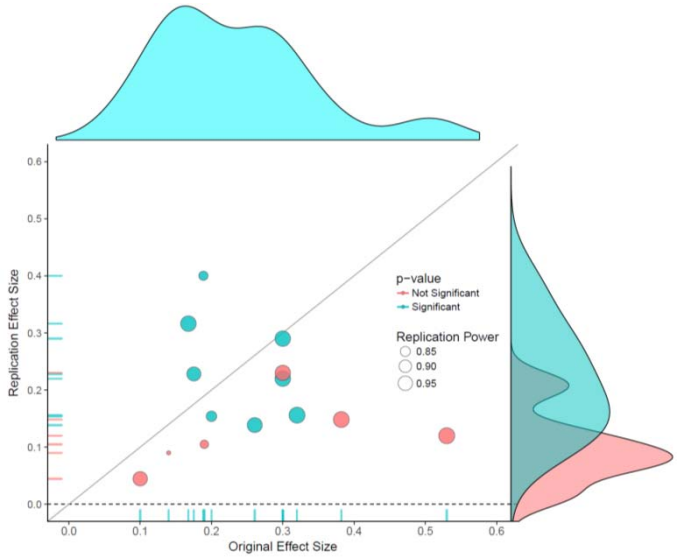


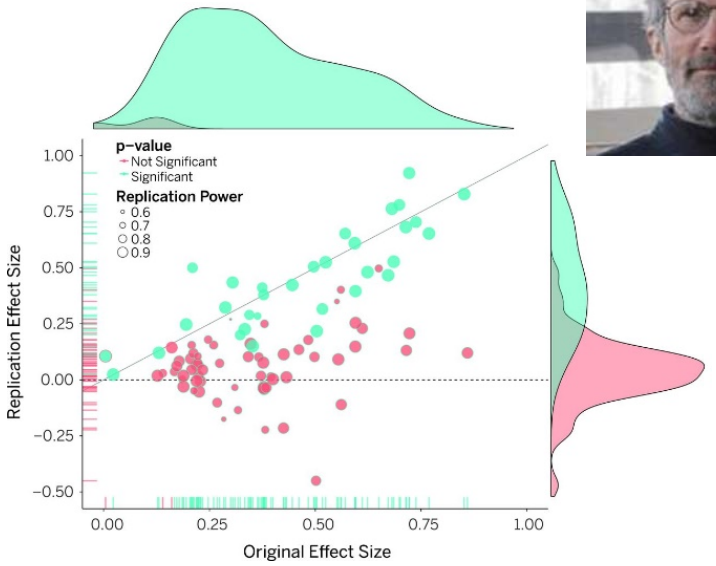



1. Lu, X., Xie, X., & Liu, L. (2015). Inverted U-shaped model: How frequent repetition affects perceived risk. JDM, 10, 219-224.
2. Sirota, M., & Juanchich, M. (2015). A direct and comprehensive test of two postulates of politeness theory applied to uncertainty communication. JDM, 10 (3), 232-240.
3. Deppe, K. D., Gonzalez, F. J., Neiman, J. L., Jacobs, C., Pahlke, J., Smith, K. B., & Hibbing, J. R. (2015), Reflective liberals and intuitive conservatives: A look at the Cognitive Reflection Test and ideology. JDM, 10(4), 314-331
4. Calvillo, D. P., & Burgeno, J. N., (2015), Cognitive reflection predicts the acceptance of unfair ultimatum game offers. JDM, 10, 332-341.
5. Weisberg, D. S., Taylor, J. C., & Hopkins, E. J. (2015). Deconstructing the seductive allure of neuroscience explanations. JDM, 10(5), 429-441.
6. Wiss, J., Andersson, D., Slovic, P., Västfjäll, D., & Tinghög, G. (2015). The influence of identifiability and singularity in moral decision making. JDM, 10(5), 492-502.
7. Heintz, C., Celse, J., Giardini, F., & Max, S. (2015). Facing expectations: Those that we prefer to fulfil and those that we disregard. JDM, 10 (5), 442-455.
8. Krijnen, J., Zeelenberg, M., & Breugelmans, S. (2015). Decision importance as a cue for deferral. JDM, 10(5), 407-415.
9. Hohle, S. M. & Teigen, K. H. (2015). Forecasting forecasts: The trend effect. Judgement and Decision Making, 10, 416-428.
10. Pennycook, G., Cheyne, J. A., Barr, N., Koehler, D. J., & Fugelsang, J. A. (2015). On the reception and detection of pseudo-profound bullshit. JDM, 10(6), 549-563
11. Davidai, S., & Gilovich, T. (2016). The tide that lifts all focal boats: Asymmetric predictions of ascent and descent in rankings. JDM, 11(1), 7-20.
12. McGraw, A. P., Davis, D. F., Scott, S. E., & Tetlock, P. E. (2016). The price of not putting a price on love. JDM, 11(1), 40-47.
13. Peetz, J., Simmons, M., Chen, J., & Buehler, R. (2016). Predictions on the go: Prevalence of spontaneous spending predictions. JDM, 11(1), 48-61.
14. Noori, M. (2016). Cognitive reflection as a predictor of susceptibility to behavioral anomalies. JDM, 11(1), 114-120.
15. Bahník, S., & Strack, F. (2016). Overlap of accessible information undermines the anchoring effect. JDM, 11(1), 92-98.
16. Wiese, J., Buehler, R., & Griffin, D. (2016). Backward planning: Effects of planning direction on predictions of task completion time. JDM, 11(2), 147-167.
17. Rubinstein, A., & Salant, Y. (2016). "Isn't everyone like me?": On the presence of self-similarity in strategic interactions. JDM, 11 (2), 168–173.
18. Eriksson, K., & Jansson, F. (2016). Procedural priming of a numerical cognitive illusion. JDM, 11(3), 205-212.
19. Basehore, Z. & Anderson, R. B. (2016). The Simple Life: New experimental tests of the recognition heuristic. JDM, 11(3), 301–309.
20. Buchanan, J., Summerville, A., Lehmann, J., & Reb, J. (2016). The Regret Elements Scale: Distinguishing the affective and cognitive components of regret. JDM, 11(3), 275–286.
21. Millar, C., Starmans, C., Fugelsang, J., & Friedman, O. (2016). It's personal: The effect of personal value on utilitarian moral judgments. JDM, 11(4), 324-331.
22. Lu, J., Liu, Z., & Fang, Z. (2016). Hedonic products for you, utilitarian products for me. JDM, 11(4), 332-341.
23. Hütter, M., & Ache, F. (2016). Seeking advice: A sampling approach to advice taking. JDM, 11(4), 401-415.
24. Landy, J. F. (2016). Representations of moral violations: Category members and associated features. JDM, 11(5), 496-508.
25. Mata, A. (2016). Proportion dominance in valuing lives: The role of deliberative thinking. JDM, 11(5), 441-448.
26. Newall, P. W. S. (2016). Downside financial risk is misunderstood. JDM, 11(5), 416–423.
27. Schneider, S., Kauffman, S., & Ranieri, A. (2016). The effects of surrounding positive and negative experiences on risk taking. JDM, 11(5), 424-440.
28. Wang, X., Geng, L., Qin, J., Yao, S. (2016). The potential relationship between spicy taste and risk seeking. JDM, 11(6), 547–553.

Challenge I: Reproducibility

- How reproducible are findings in J/DM?
  - Hagen Cumulative Science Project (Jekel, Glöckner et al., in progress)
    - replication of 50 articles from *Judgment and Decision Making* by students
      - feasible studies 2015 to 2017
    - currently finished: 26 replication studies
      - N = 5,373 (MD = 163)
    - **preliminary replication rate: 16 from 26 (62%)**





Note: Some studies not yet included.

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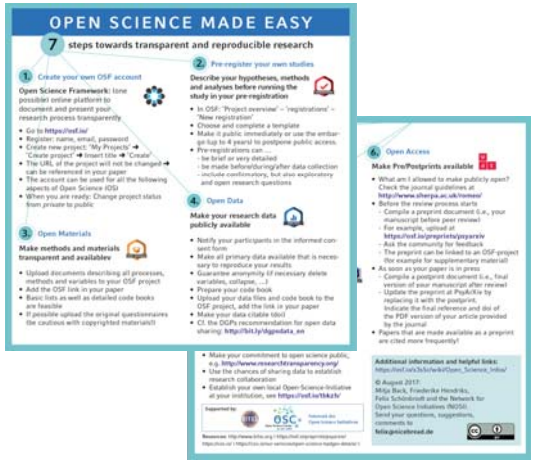
    - currently finished: 26 replication studies
      - N = 5,373 (MD = 163)
    - **preliminary replication rate: 16 from 26 (62%)**
      - open data enforced by editor
      - large sample sizes [original studies: N = 5,615]
  - already better in J/DM than in other fields
    - but should be further improved

Challenge I: Reproducibility

- measures to increase reproducibility for J/DM
  - increased application of Open Science principles
    - pre-registration
    - a priori power-analysis
    - sharing data and materials
    - open and transparent reporting
  - teaching Open Science to students
  - changing incentives and policies
    - hiring, editing and reviewing
    - badges
    - open data policy for all journals in our field

flyer @ bit.ly/OpenScienceJDM



- **aim for my presidency #1: foster Open Science**

Challenge II: Theory Specification and Prediction

- reproducibility projects reveal shortcomings in theory specification
  - this is not a valid replication since
    - this finding might only hold for our ….
      - country / tasks / methods / "good" PhDs / senior researchers
  - not specified in theory section!
- scientific theory (Popper, 1934)
  - set of general implications of the form: $(x)(\varphi(x) \rightarrow f(x))$
    - all values *x* that satisfy the statement function $\varphi(x)$ [person, situation] also satisfy the statement function $f(x)$ [judgment, choice, behavior]
  - experiments are conducted to test (against) theories
  - replication valid as long as antecedence $\varphi(x)$ fulfilled
    - usually no restrictions

Challenge II: Theory Specification and Prediction

- How good are theories in J/DM? (Glöckner & Betsch, 2011, JDM)
  - many formalized theories in J/DM → allow prediction (Erev / Ert)
  - empirical content of a theory = how much it forbids → predictions
    - generality and precision
  - challenges for empirical content
    - lack of construct specification / operationalization
    - as-if theories: lack predictions for process measures
    - theories with free parameters: flexibility of parameter problem (overfitting?)
    - theories with various strategies: strategy selection problem (underspecified?)

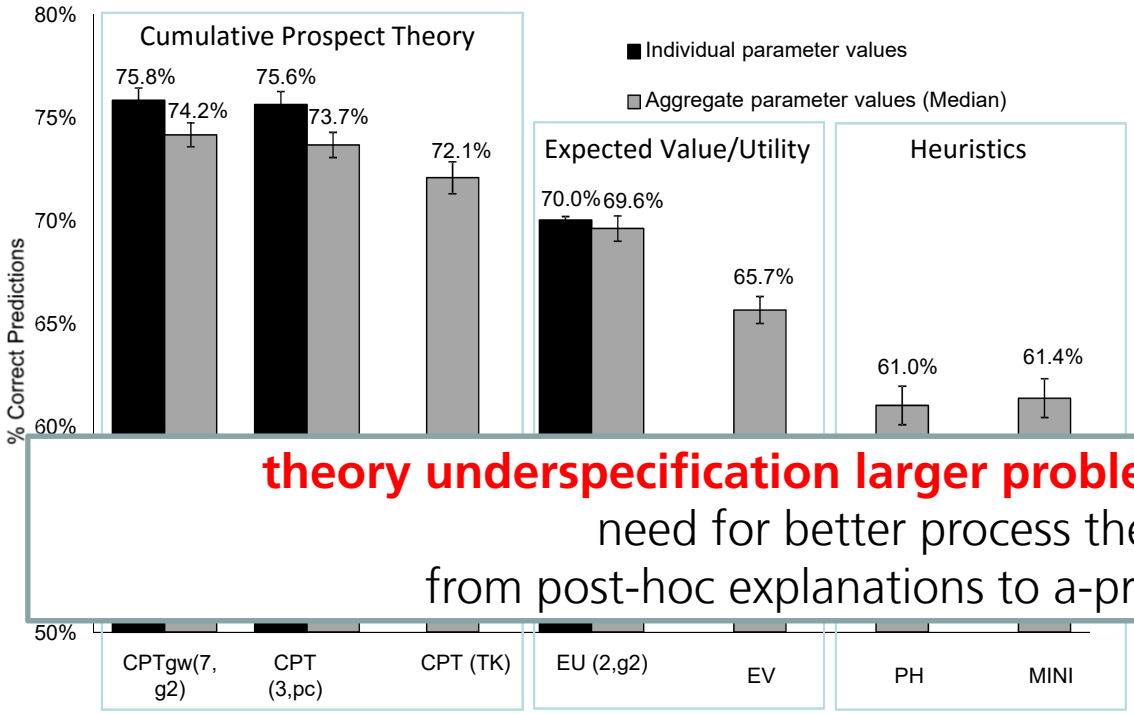
Model-Comparison: Predicting Risky Choice

(Glöckner & Pachur, 2012, Cognition)

- risky choice

  (N = 66; T1 – T2 with 1 week interval; 2 x 138 decisions; incentiviced; choice reliability = 79%)

Gamble 1			Gamble 2		
A	50%	10€	**A**	65%	-4€
B	50%	-5€	**B**	35%	18€



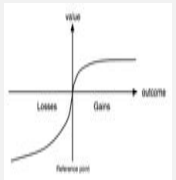
Cumulative Prospect Theory (CPT)

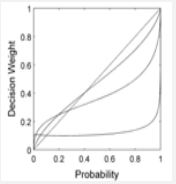
$$v(x) = x^{\alpha} \quad \text{if } x \geq 0$$

$$v(x) = -\lambda(-x)^{\beta} \quad \text{if } x < 0$$

$$w^{+}(p) = \frac{p^{\gamma}}{(p^{\gamma} + (1-p)^{\gamma})^{1/\gamma}} \quad \text{if } x \geq 0$$

$$w^{-}(p) = \frac{p^{\delta}}{(p^{\delta} + (1-p)^{\delta})^{1/\delta}} \quad \text{if } x < 0$$





theory underspecification larger problem than overfitting!

need for better process theories

from post-hoc explanations to a-priori prediction

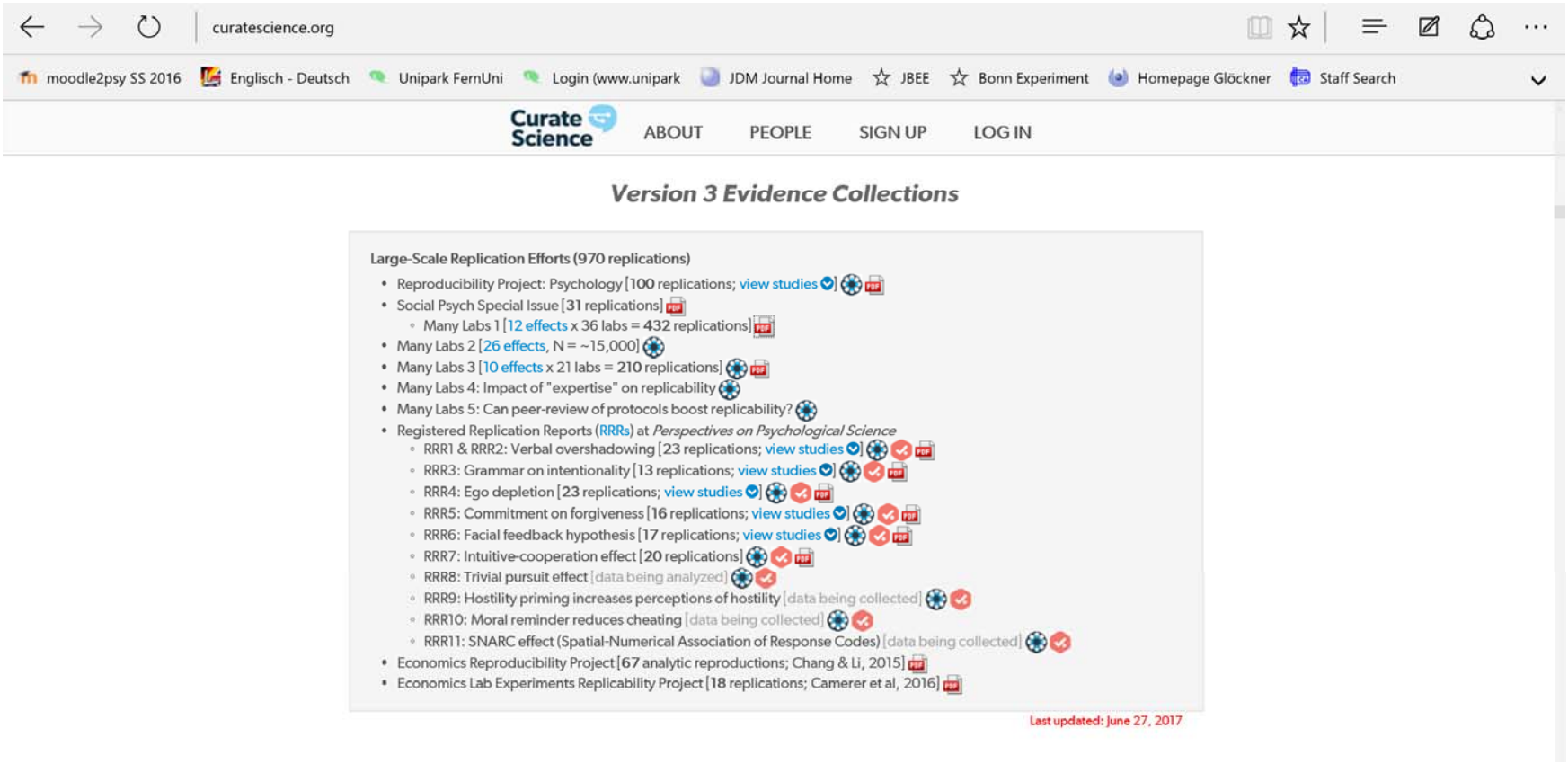
Challenge II: Theory Specification and Prediction

- culture of theory specification and revision
  - theory specification
    - operational definition of all concepts
    - formal specification of antecedence $\varphi(x)$ and consequence $f(x)$
  - revision
    - if challenged: no problem / don't take it personally
    - improved or new theory (version) → online databases
- changing incentives
  - publication guidelines for theories
  - possibility to publish theory specification papers (e.g., in JDM)
- **aim for my presidency #2: foster theory specification and theory revision culture**

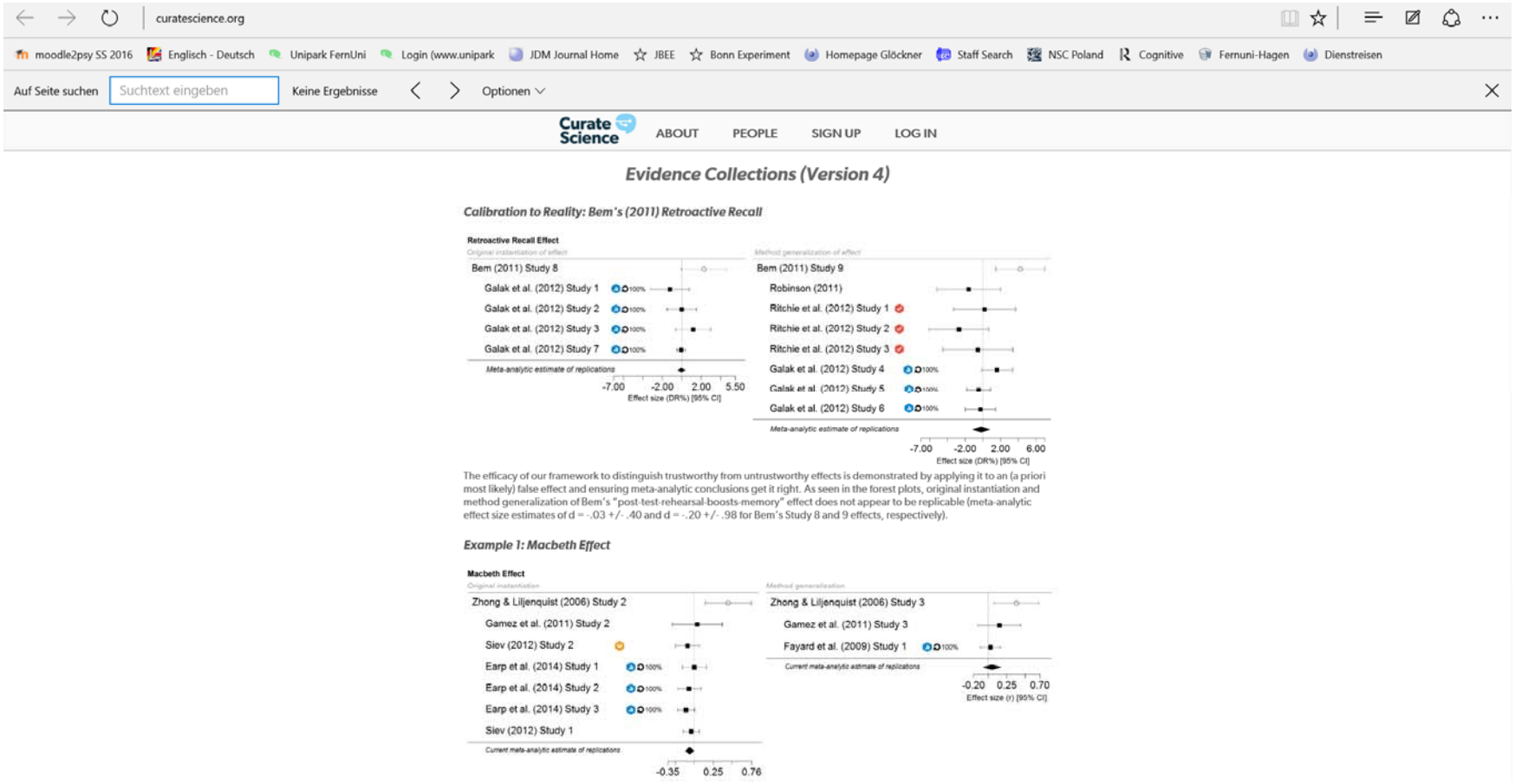
Challenge III: Consolidation of Empirical Findings

- convergence = shared understanding of findings
  - many lab replications
  - adversarial approaches
  - critical replication to assure stability of findings
    - DE-gap reversal (Glöckner et al., 2016, JEP:G); replicated by Kellen, Pachur & Hertwig (2016, Cog)
  - open data → allows tests for other theories
- constructive debates at conferences
- cumulative science
  - databases for empirical data → continuous meta-analyses (http://curatescience.org/)

curatescience.org



curatescience.org



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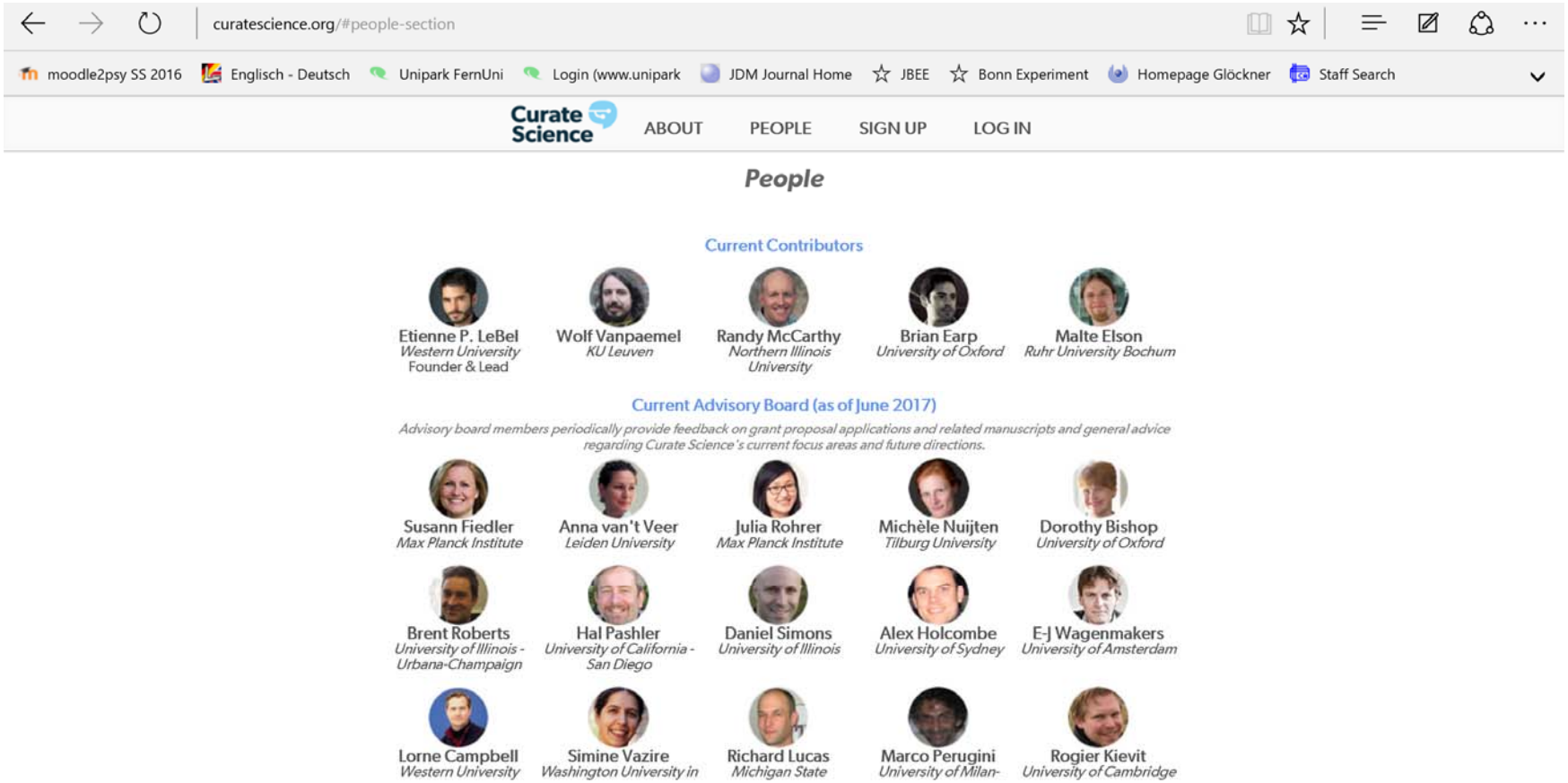
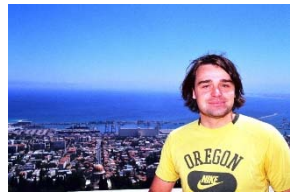


Challenge III: Consolidation of Empirical Findings

- **aim for my presidency #3: foster shared understanding of findings and collaborations between groups with opposing theoretical views**

My first SPUDM: Stockholm 2005



- What did I believe in back than?
  - coherence-based models are right and can explain the world
  - fast-and-frugal heuristics are wrong
  - ~~better not specify your own model too precisely, it could be falsified~~
  - ~~my findings can be replicated~~
  - ~~long hair is the thing …~~
- Learned anything? What do I believe in today?
  - short hair is good too
  - precisely specify my theory, to learn where it is wrong and improve it
  - I have to check whether my findings are reproducible [or others]

- (A) Methodological Challenges
  - ① Reproducibility
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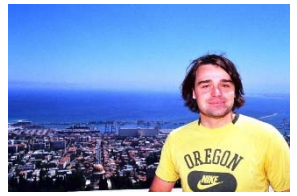


- What did I believe in back than?
  - ~~coherence-based models are right and can explain the world~~
  - ~~fast-and-frugal heuristics are wrong~~
  - ~~better not specify your own model too precisely, it could be falsified~~
  - ~~my findings can be replicated~~
  - ~~long hair is the thing …~~
- Learned anything? What do I believe in today?
  - short hair is good too
  - precisely specify my theory, to learn where it is wrong and improve it
  - I have to check whether my findings are reproducible [or others]
  - all theories are wrong
  - coherence-based theories promising general process models [among others]

Why do I (still) believe in coherence-based models?

- theoretically plausible
  - integrate core ideas from cognitive psychology, social psychology and J/DM
  - important people said so
- empirical findings
  - supported in many different research paradigms
  - successful in predicting many behavioral variables
    - high empirical content
  - evidence becomes stronger with better methods
- [although it is a pain to present such complex models]

Coherence-based Models

- John Maule presidential address (SPUDM, 2005)
  - **mental representation** of a decision task: presented ≠ perceived
- associative coherence core mechanism of intuitive judgment
  (Morewedge & Kahneman, 2011, TiCS, p435)

  "A stimulus evokes a coherent and self-reinforcing pattern of reciprocal activation in associative memory"
  - can explain confirmation bias, egocentric bias, anchoring, framing…
- accentuation and dominance structuring processes in judgment and choice
  (Svenson, 1992, ActaPsy) / (Montgomery, 1989)
- BUT: construction of detailed models of cognitive processes (Gigerenzer, 1993, PsyRev)

Coherence-based Decision Making

the process

maximizing coherence operational process of decision making
(Thagard & Millgram, 1995; D. Simon, Snow & Read, 2004;
cf. Koffka, 1936; Festinger, 1967; Montgomery, 1989; Pennington & Hastie, 1992)

the principle

automatic weighing of alternative interpretations of the evidence
→ accentuation of the most likely interpretation
= mental representation

Excellent idea, but …

how to formally specify a theory from that?

Paul Thagard

Stephen Read

Dan Simon

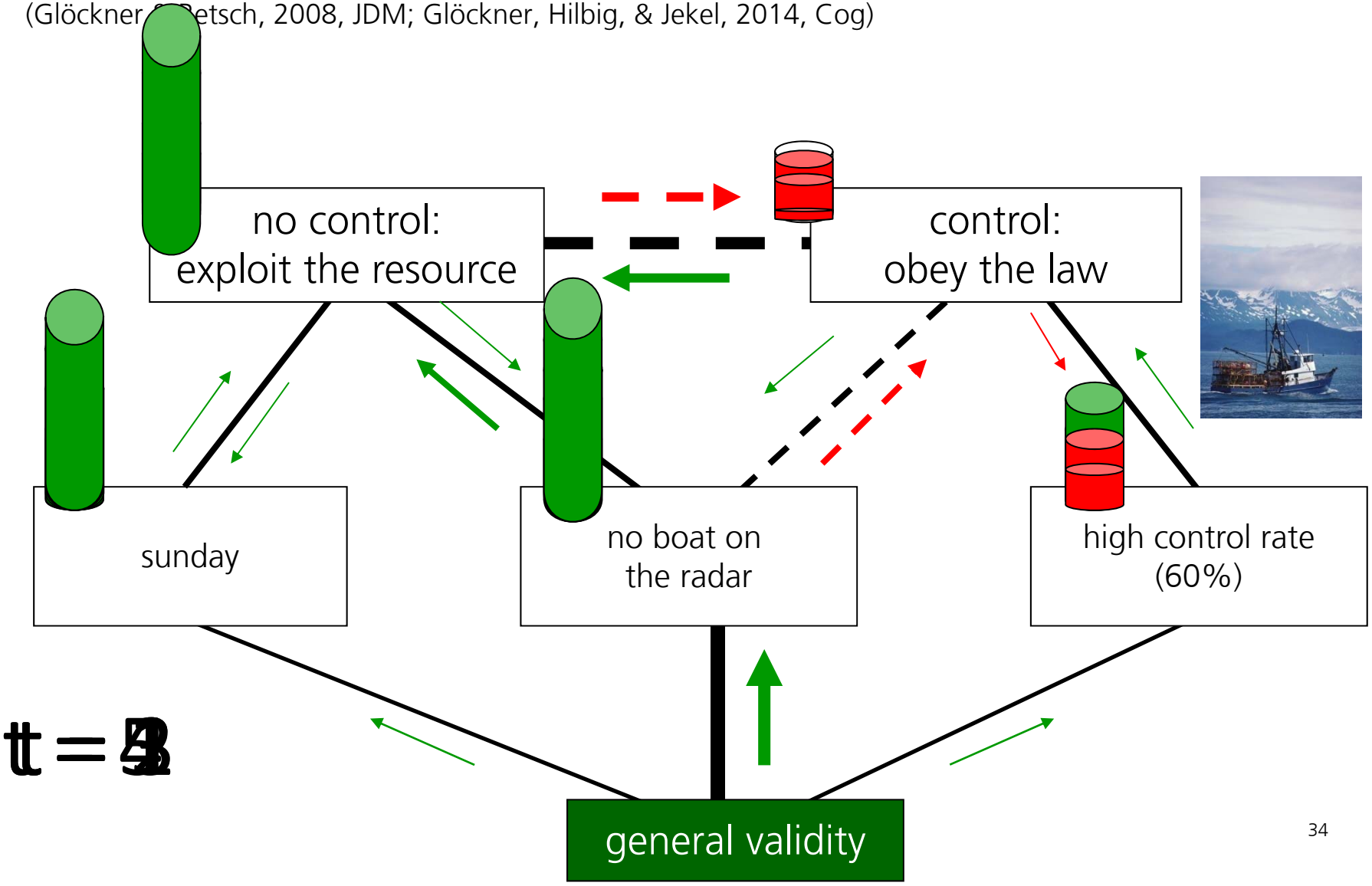
Keith Holyoak

Will there be a control?

	yes	no
Cue 1 (high frequency 60%)	+	-
Cue 2 (no boat on radar)	-	+
…		
Cue n (sunday)	-	+

The Parallel Constraint Satisfaction Model for Decision Making (PCS-DM)

(Glöckner & Betsch, 2008, JDM; Glöckner, Hilbig, & Jekel, 2014, Cog)



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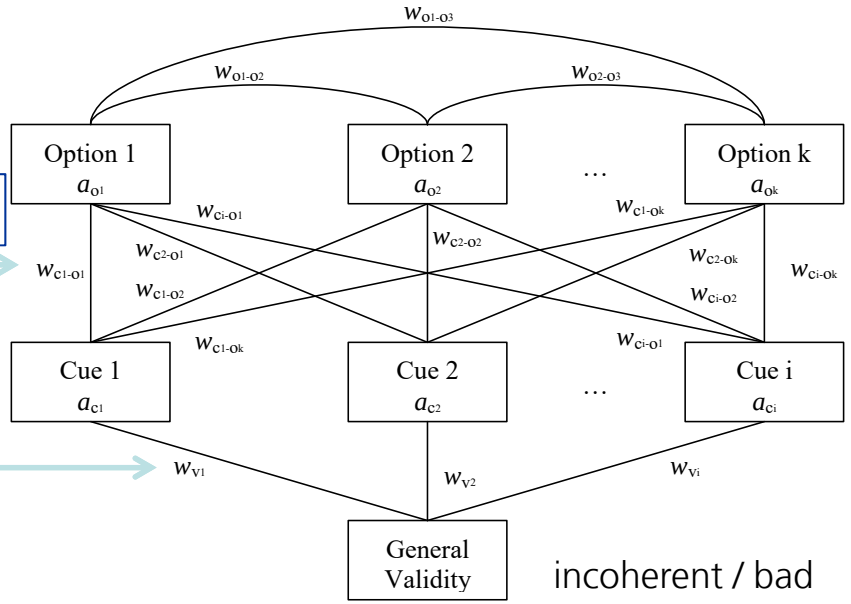
Will there be a control?

	yes	no
Cue 1 (high frequency 60%)	+	-
Cue 2 (no boat on radar)	-	+
…		
Cue n (sunday)	-	+

$w_{ci\text{-}oj} = .01 / -.01$

$w_{v(i)} = (v_i - 0.5)^p$



incoherent / bad interpretation

Parallel Constraint Satisfaction - Mechanism (McClelland & Rumelhart, 1981; 1986):

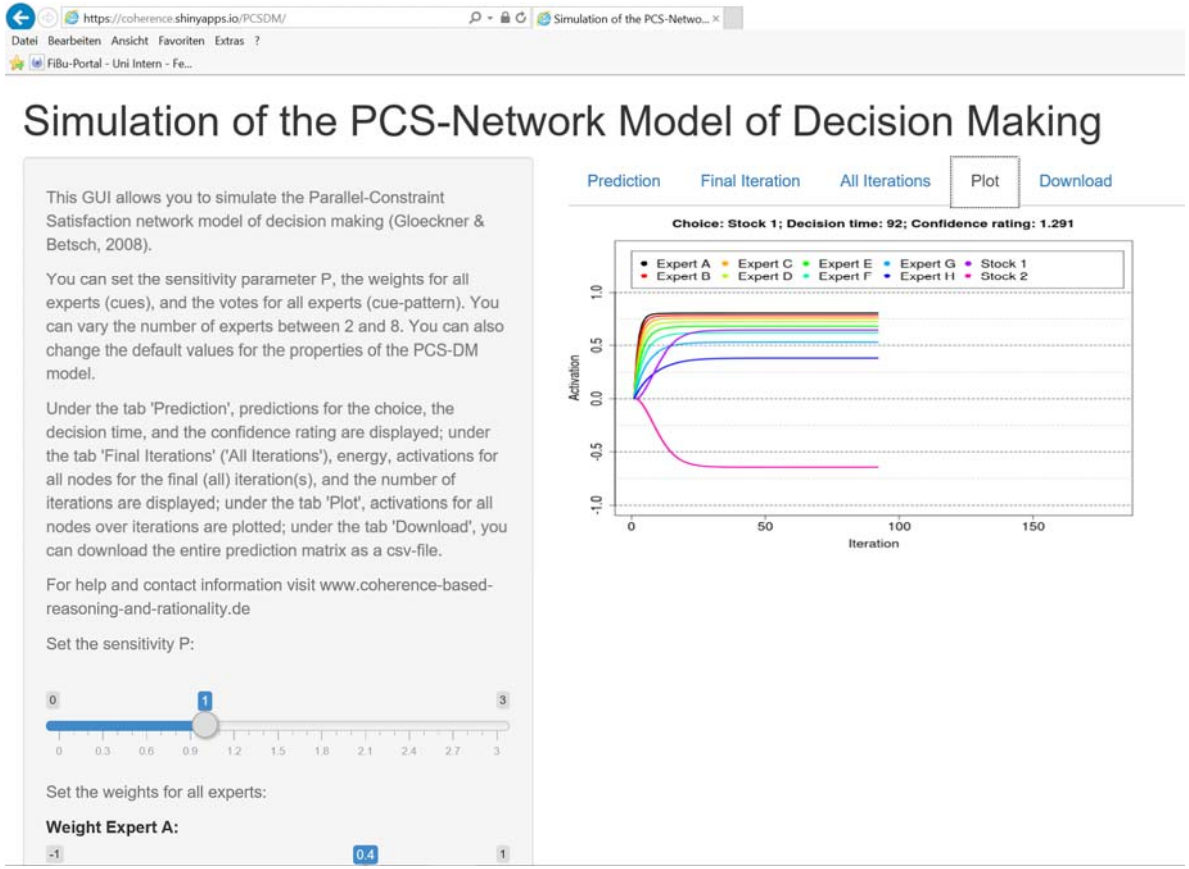
$$a_i(t+1) = a_i(t) * (1 - decay) + \begin{cases} if & input_i < 0 & input_i * (a_i(t) - floor) \\ if & input_i \geq 0 & input_i * (ceiling - a_i(t)) \end{cases}$$

$$input_i(t) = \sum_{j=1 \rightarrow n} w_{ij} * a_j(t)$$

coherent / good interpretation

PCS-DM Modelling

https://coherence.shinyapps.io/PCSDM/



Capacity Hypothesis

- quick weighted compensatory information integration
  - probabilistic inferences
    (e.g., Glöckner & Betsch, 2008, JEP:LMC; Glöckner, Hilbig & Jekel, 2014, Cog)
  - other choice paradigms
    - risky choices
      (e.g., Glöckner & Betsch, 2008, OBHDP; Glöckner & Pachur, 2012, Cog; Glöckner et al., 2016, JEP:G)
    - recognition-based inferences
      (e.g., Glöckner & Bröder, 2011, 2014, JDM; Heck & Erdfelder, 2017, PsyRev)
- high capacity for information integration

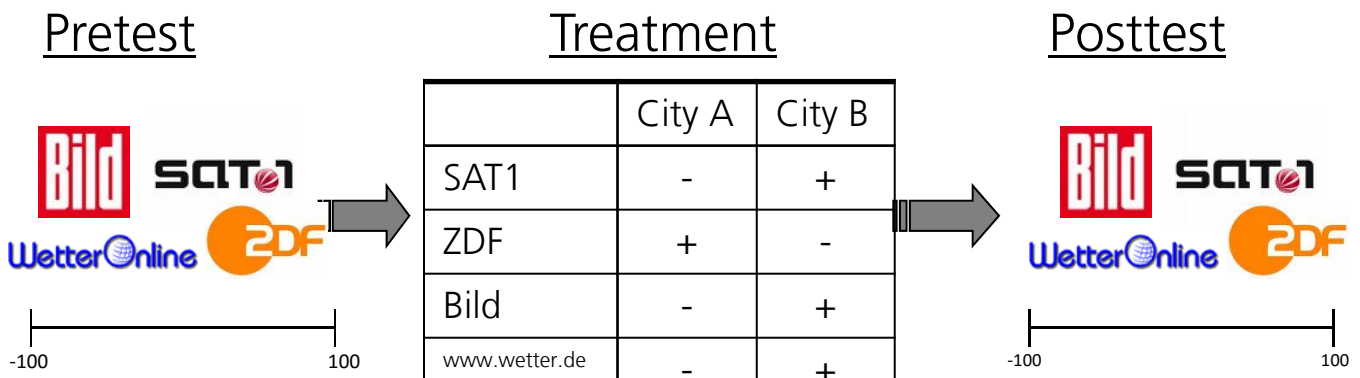
	Option A Choose	Option B Choose
Cue 1 (90% correct)	+	-
Cue 2 (60% correct)	-	+
Cue 3 (70% correct)	-	+
Cue 4 (75% correct)	-	+
Cue 5 (65% correct)	-	+
Cue 6 (55% correct)	-	+

weighted comp: 79%
(vs. TTB, EQW, RAND)

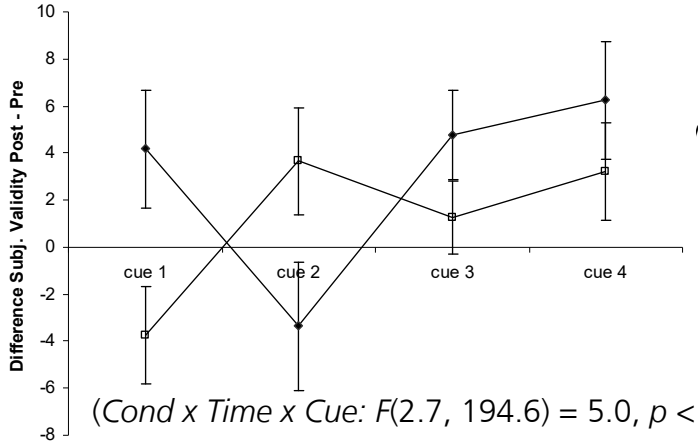
MD(RT) = 3.71 sec

Construction Hypothesis

- changes of cue evaluations in the decision process = coherence effect
  (Glöckner et al., 2010, JBDM)



- also without e
- evidential judg
  (e.g., Holyoak & D. Si
  Glöckner, 2013, JBDM

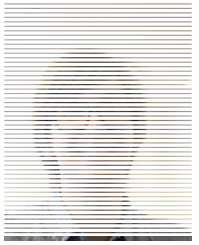


(*Cond x Time x Cue: F*(2.7, 194.6) = 5.0, $p < .01$)

et al., 2009, OBHDP; Engel &

Further Findings

- coherence drives
  - decision time and confidence
    (e.g., Glöckner & Betsch, 2012, AP; Glöckner, Hilbig & Jekel, 2014, Cog)
  - attention and information search [TALK: Glöckner, Tue, 9:00 (Ses#5)]
    (e.g., Glöckner & Herbold, 2011, JBDM)
  - arousal
    (Hochman, Ayal, & Glöckner, 2010, JDM)
- better quantitative predictions of behavior than competing formalized models
  (e.g., Glöckner, Hilbig & Jekel, 2014, Cog)
- spreading activation effects: no ignorance of information
  (e.g., Heck & Erdfelder, 2017, PsyRev)



→ evidence supports coherence-based theories

- Parallel Constraint Satisfaction model (PCS-DM) formalized process model

Developments and Perspectives

- further model specification for search
  - integrated COherence based model for DEcision making and Search (iCODES; Jekel, Glöckner & Bröder, under review)
  - attraction-search effect [2 x TALKS: Wed, 11:00: Jekel, Scharf, Ses#9]
- to do's
  - specification as formal model to predict biases = overarching process theory
  - further critically testing / model comparisons
- **consider specifying coherence-based theory**
- **consider testing against coherence-based theory**
  - **it is wrong [as all other theories]**
  - **and I am keen to learn in which respect to be able to improve it**

[you find our data and materials at OpenScienceFramework: osf.io/g2qup]