A preregistered replication of motivated numeracy

Read & presented by Martine Jansen, for the Reading Group “Statistics Communication and (in)numeracy”

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Articles

Discussed will be:

**Title** - A preregistered replication of motivated numeracy

**Authors** - Emil Persson, David Andersson, Lina Koppel, Daniel Västfjäll, Gustav Tinghög

**Published** - Elsevier, Cognition, Volume 214, September 2021

**DOI** - [https://doi.org/10.1016/j.cognition.2021.104768](https://doi.org/10.1016/j.cognition.2021.104768)  
Data etc - [https://osf.io/pzwta/](https://osf.io/pzwta/)

Replicated from:

**Title** - Motivated numeracy and enlightened self-government

**Authors** - Dan Kahan, Ellen Peters, Eria Cantrell, Paul Slovic

**Published** - Cambridge University Press, May 2017

**DOI** - [https://doi.org/10.1017/bpp.2016.2](https://doi.org/10.1017/bpp.2016.2)

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Intro

- Assumption: people accept empirical facts and interpret new information unbiased
- But people often assess information to protect their own valued beliefs: **motivated reasoning**
- Kahan & co coined **motivated numeracy**: “More numerate subjects would use their quantitative-reasoning capacity selectively to conform their interpretation of the data to the result most consistent with their political outlooks”
- Persson & co tried to replicate this

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Scenario’s Kahan 2017

(A) Rash Got Worse  Rash Got Better

Patients who did use the new skin cream
223  75

Patients who did not use the new skin cream
107  21

Rash Decreases

(B) Rash Got Better  Rash Got Worse

Patients who did use the new skin cream
223  75

Patients who did not use the new skin cream
107  21

(B) Rash Increases

(C) Increase in crime  Decrease in crime

Cities that did ban carrying concealed handguns in public
223  75

Cities that did not ban carrying concealed handguns in public
107  21

Crime Decreases

(D) Decrease in crime  Increase in crime

Cities that did ban carrying concealed handguns in public
223  75

Cities that did not ban carrying concealed handguns in public
107  21

Crime Increases

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Subjects were better at interpreting data:

- when correct interpretation of scenario congruent with their political ideology,
- effect more pronounced among subjects with high numeric ability.

Figure 7. Predicted probabilities of correctly interpreting the data. Density distributions derived via Monte Carlo simulation from regression Model 3, Table A1, when predictors for Conserv_Repub set at $-1$ SD and $+1$ SD for ‘liberal Democrat’ and ‘conservative Republican’, respectively, and numeracy set at three and seven correct answers for ‘low numeracy’ and ‘high numeracy’, respectively (King et al., 2000)
Methods - Participants

- Participants were randomly assigned to 1 of 4 scenario’s
- Answered a question about the fictitious data presented
  - Outcome, either correct = 1, incorrect = 0
- 9 Numeracy questions → score 0 - 9, 9 is best
- 2 Political orientation questions
  - each on 7p likert, each standardized, then summed and again standardized
  - final var, + is more conservative
- background questions & attention check

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Methods - Statistics

- Kahan 2017
  - LRI: Correct $\sim$ Numeracy $\times$ Scenario
  - LRII: ,, + Numeracy$^2$ $\times$ Scenario
  - LRIII: ,, + PolitOri$\times$Scenario + Numeracy$\times$PolitOri$\times$Scenario

- Persson 2022
  - per scenario
    - LRI: Correct $\sim$ Numeracy + Political Orientation
    - LRII: ,, + Numeracy : Political Orientation
Results 1/2

• 43% of subjects answered correct (Kahan2017: 41%)
• Positive effect of numeracy in all scenarios
• Crime Increase: PolitOri OR 1.37 (0.105), PolitOrie:Numeracy
• Crime Decrease: PolitOri, PolitOrie:Numeracy OR 0.84 (0.030)
• “However, given that we found no overall effect of motivated reasoning in this scenario (CrDecr), this effect is difficult to interpret, and is not by itself in line with the hypothesis of motivated numeracy”

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Results 2/2

Crime increase:
- No tendency for increasing gap in PolitOri in crime-increase scenario: lines almost parallel (gap even smaller at higher num)

Crime decrease:
- Interaction, “contrary to what we expected ex-ante, LD performed worse than CR did up and until numeracy score of six, and only beyond that level is pattern reversed and thus consistent with motivated numeracy”

Rash: should be baseline

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Conclusions (from article)

- Positive correlation numeracy and likelihood correct answer
- General effect of motivated reasoning, at least in one of the two polarizing scenarios
- No replication of main finding from Kahan2017, i.e., that motivated reasoning increases with numeracy.
  - In crime-increase scenario, CR indeed better at interpreting the data
  - but the estimated gap vis-`a-vis LD did not increase with numeracy
  - and in crime-decrease scenario, overall effect of political orientation was of the wrong sign for more than half of the numeracy scale.

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