

Balancing Multiple Criteria to Improve Validity and Fairness in Educational Assessment

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An Experimental Comparison of the Seven-Point- and Visual Analogue Scale in Intensive Assessment

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ORIGINAL MANUSCRIPT



Comparing Likert and visual analogue scales in ecological momentary assessment

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Within-person perspective

Blume et al., 2022; Blume & Schmiedek, 2024

Idiography ~~vs.~~ & nomothetics
Molenaar & Valsiner, 2009

Please indicate to what extent you feel the following mood states and physical sensations at this moment:

Sad

Not at all Extremely

Tap on the line to start!

Control of trait variation
Hamaker et al., 2007

Assessment of dynamics
Haslbeck & Ryan, 2022

Methodology: Commonly unjustified/intuitive
Haslbeck et al., 2023

Please indicate to what extent you feel the following mood states and physical sensations at this moment:

Sad

Not at all Extremely

Tap on the line to start!

Typical approach:
7-step Likert or visual analogue scale,
linear mixed model or ML-SEM
Haslbeck et al., 2023

**Earlier studies: Mainly cross-sectional,
increased reliability with > 4 response
categories** (see Simms et al., 2019; Fritz et al., 2024)

Research question:
How does the response scale affect...
1) Univariate statistics/distributions
2) Multivariate statistics/distributions
3) Relations with external covariates
4) Subjective ratings

Often studied

Often used

Often studied

Context: Emotions, single items, university students (few clin. diagnoses)

Positive (happy, satisfied,..., 5 items) and negative (stressed, worried,... 9 items)
valence

7-step response scale vs. visual analogue scale (101-step)

As far as possible parallel (e.g., only endlables for 7-step scale)

App limitations:

7-step vertical, VAS horizontal

7-step = not at all, 2, 3, 4, 5, 6, extremely

Between-person (avoiding carry-over effects/reactance):

Two weeks, 3x daily, either always 7-step or VAS

Please indicate to what extent you feel the following mood states and physical sensations at this moment:

Sad

☐ Not at all

☐ 2

☐ 3

☐ 4

☐ 5

☐ 6

☐ Extremely

Please indicate to what extent you feel the following mood states and physical sensations at this moment:

Sad

Not at all Extremely

Tap on the line to start!

$n(\text{Likert}) = 63$

$n(\text{VAS}) = 56$

$M(\text{age}) = 22$ ($SD = 4$)

Models:

Bayesian multilevel modeling in brms

0-1 normalization

Inter-individual distributions of descriptive statistics per person:

e.g. within-person means: Zero-one inflated beta

Fixed effects:

Response format (contrast coding, baseline = Likert),
valence (effects coding) + interaction

Random effects:

Intercept across persons, slopes across items

Full distributional models:

Fixed effects on all distributional parameters (zero- & one-shares, both beta-parameters)

Please indicate to what extent you feel the following mood states and physical sensations at this moment:

Sad

☐ Not at all

☐ 2

☐ 3

☐ 4

☐ 5

☐ 6

☐ Extremely

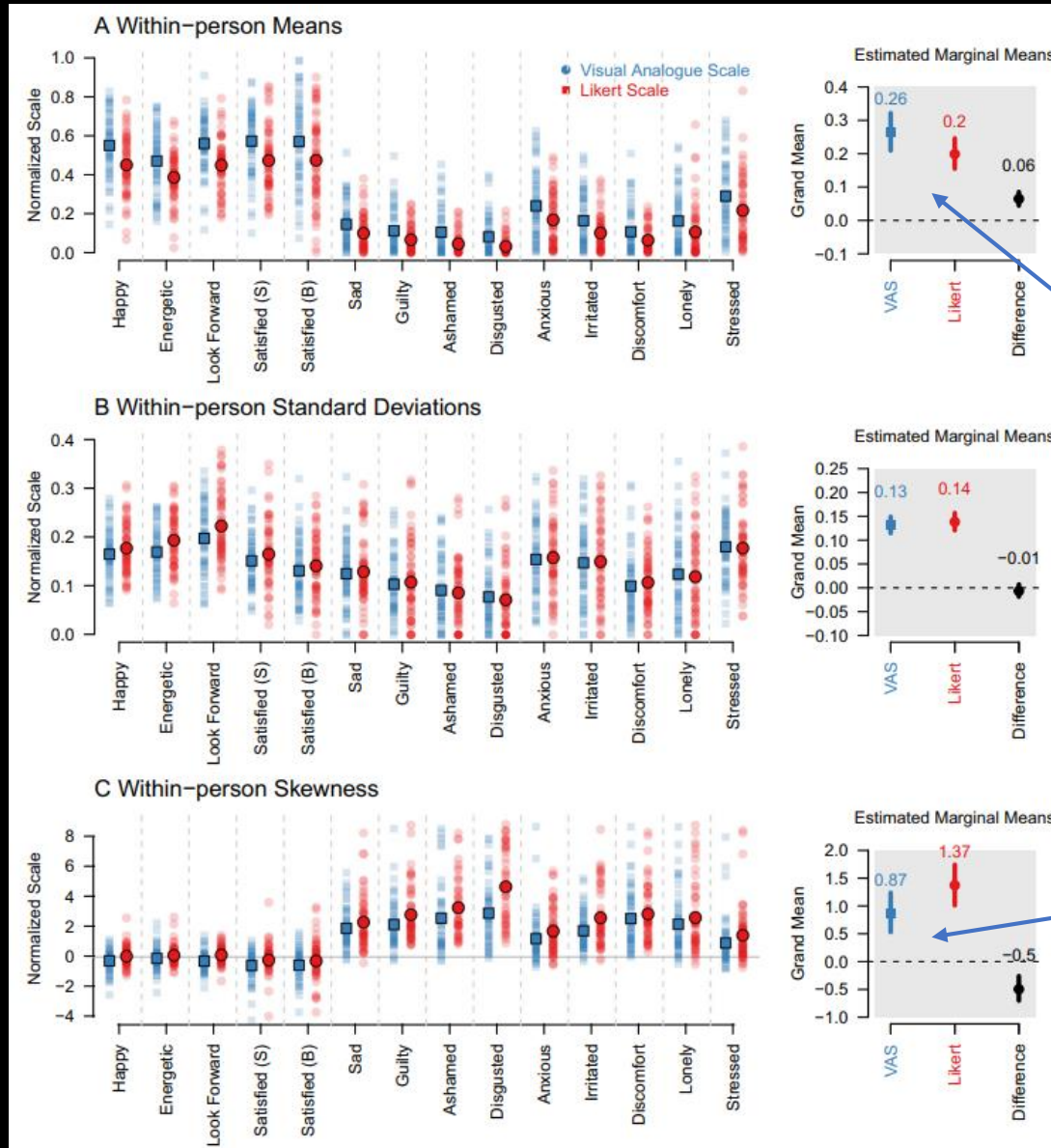
Please indicate to what extent you feel the following mood states and physical sensations at this moment:

Sad

Not at all Extremely

Tap on the line to start!

Results: Descriptive distributional parameters



7-step

Please indicate to what extent you feel the following mood states and physical sensations at this moment:

Sad

☐ Not at all

☐ 2

☐ 3

☐ 4

☐ 5

☐ 6

☐ Extremely

VAS

Please indicate to what extent you feel the following mood states and physical sensations at this moment:

Sad

Not at all

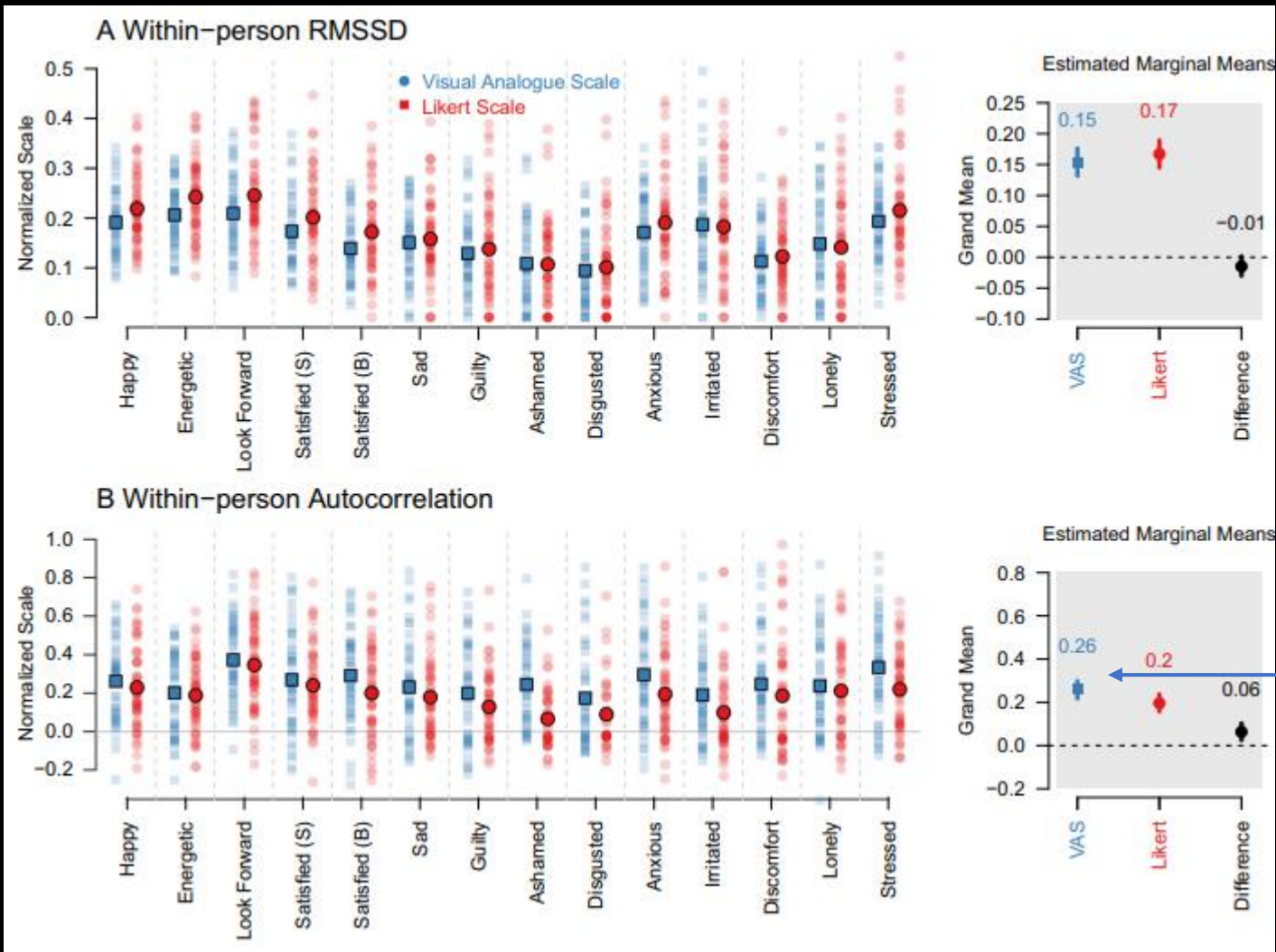
Extremely

Tap on the line to start!

Higher means

Lower skewnesses

Results: Descriptive distributional parameters



7-step

Please indicate to what extent you feel the following mood states and physical sensations at this moment:

Sad

- ☐ Not at all
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ Extremely

VAS

Please indicate to what extent you feel the following mood states and physical sensations at this moment:

Sad

Not at all Extremely

Tap on the line to start!

Higher autocorrelations

Results: Descriptive multivariate parameters

7-step

Please indicate to what extent you feel the following mood states and physical sensations at this moment:

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☐ 5

☐ 6

☐ Extremely

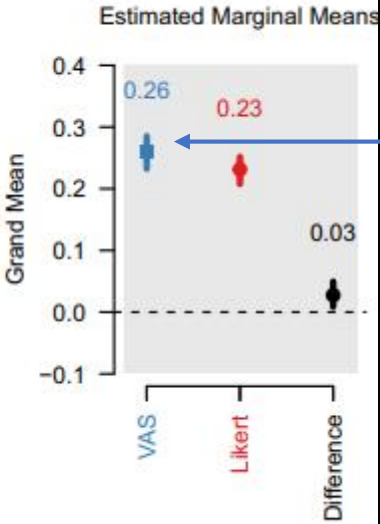
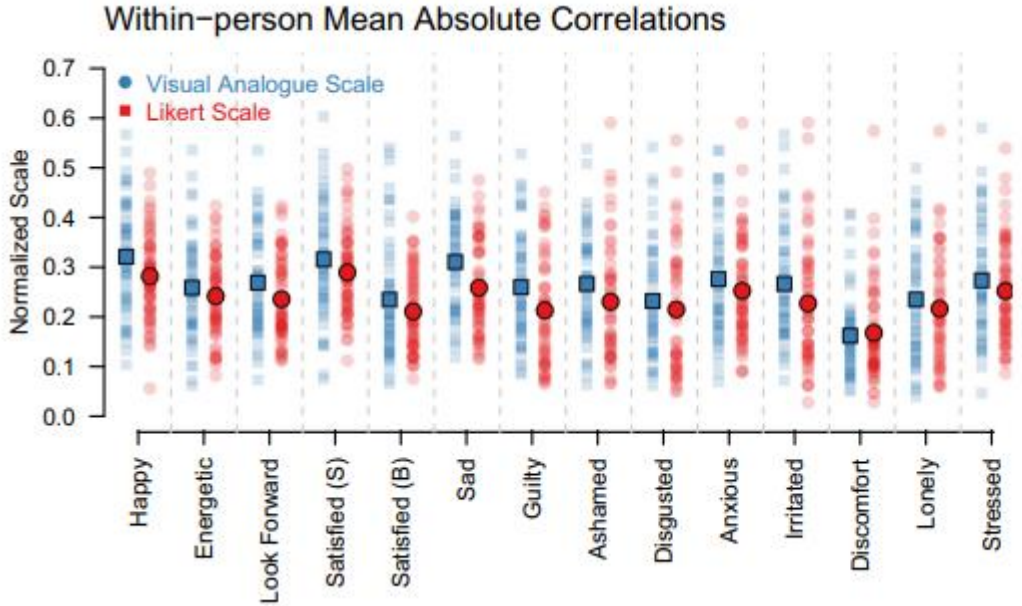
VAS

Please indicate to what extent you feel the following mood states and physical sensations at this moment:

Sad

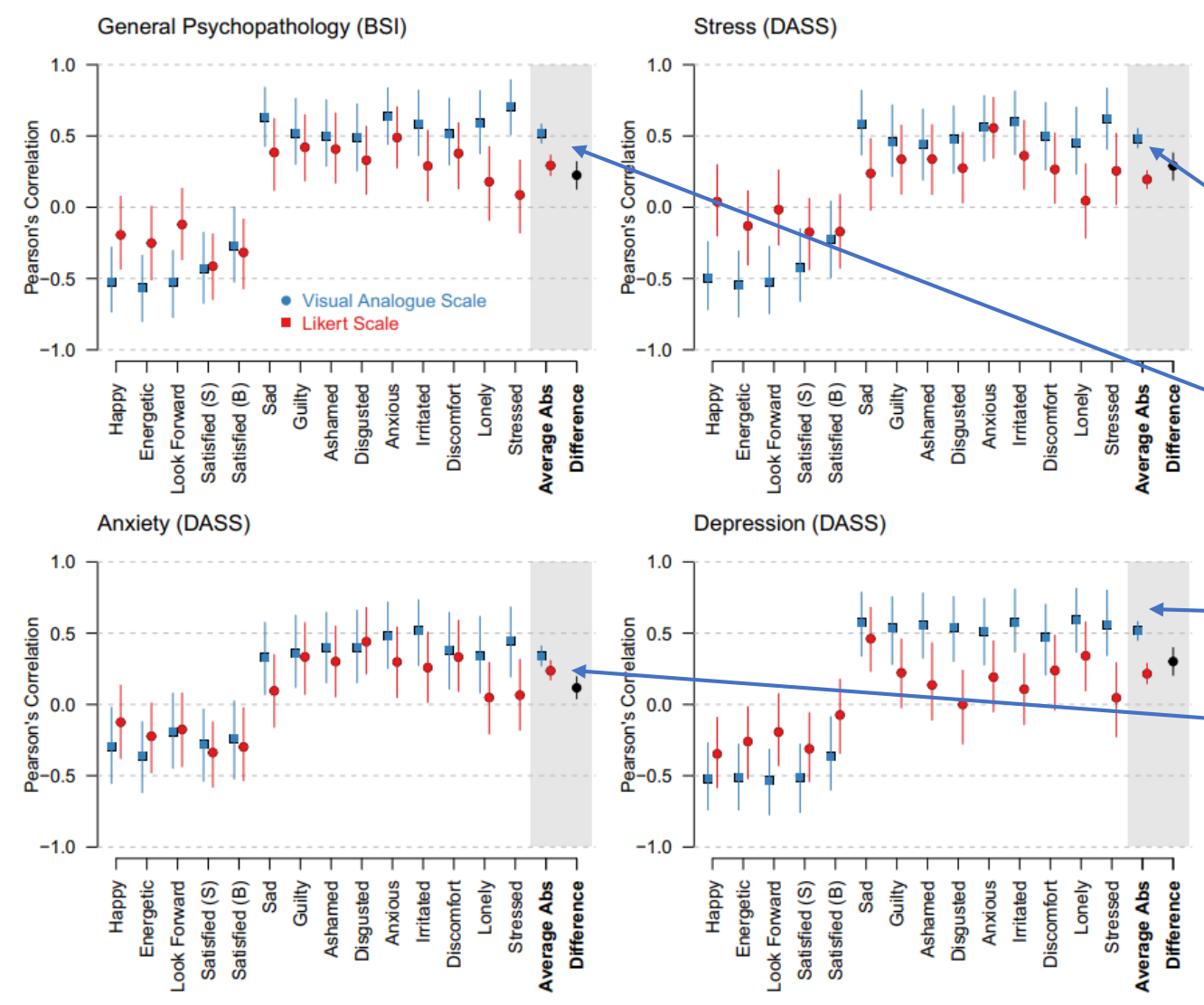
Not at all Extremely

Tap on the line to start!



Slightly stronger within-person item correlations

Results: Correlations with external criteria: General psychopathology and depression/anxiety/stress



7-step

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☐ 4

☐ 5

☐ 6

☐ Extremely

VAS

Please indicate to what extent you feel the following mood states and physical sensations at this moment:

Sad

Not at all

Extremely

Tap on the line to start!

Brutally stronger correlations

Results: Self-reports

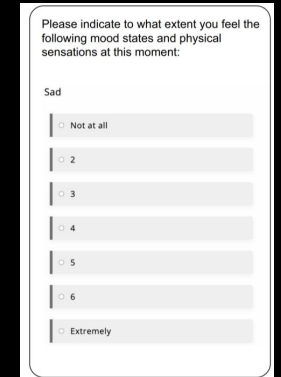
Subjective ratings quite similar; descriptively, VAS slightly more exhausting and confusing

Little multimodality on both scales (Haslbeck et al., 2023)

Missing data and response times similar

No *initial elevation bias* (Shrout et al., 2018)

7-step



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☐ 5

☐ 6

☐ Extremely

VAS



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Tap on the line to start!

Results: Interpretations

- Our VAS captures more systematic variation close to the scale minimum (Higher means, lower skewness, higher correlations with external criteria) – preliminary support for VAS in similar studies and populations

Limitations:

- 7-step scale: Second category „1“ instead of „2“?
- Labels (e.g., mildly/very little)
- We need replications and factorial study designs (number response options, label positions & contents, horizontal vs. vertical, initial slider point on VAS) randomize at once (Baribault et al., 2018), potentially within-person
- We also need cognitive surveys and formal models (explore & model the latent response process)
- Multi-item scales

7-step

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Baribault, B., Donkin, C., Little, D. R., Trueblood, J. S., Oravecz, Z., van Ravenzwaaij, D., White, C. N., De Boeck, P., & Vandekerckhove, J. (2018). Metastudies for robust tests of theory. *Proceedings of the National Academy of Sciences*, 115(11), 2607–2612.

<https://doi.org/10.1073/pnas.1708285114>

Blume, F., Irmer, A., Dirk, J., & Schmiedek, F. (2022). Day-to-day variation in students' academic success: The role of self-regulation, working memory, and achievement goals. *Developmental Science*, 25(6), e13301. <https://doi.org/10.1111/desc.13301>

Blume, F., & Schmiedek, F. (2024). It counts in every single lesson: Between-and within-person associations of teaching quality and student self-regulation. *Learning and Instruction*, 92, 101908.

Fritz, J., Piccirillo, M. L., Cohen, Z. D., Frumkin, M., Kirtley, O., Moeller, J., Neubauer, A. B., Norris, L. A., Schuurman, N. K., Snippe, E., & Bringmann, L. F. (2024). So You Want to Do ESM? 10 Essential Topics for Implementing the Experience-Sampling Method. *Advances in Methods and Practices in Psychological Science*, 7(3), 25152459241267912. <https://doi.org/10.1177/25152459241267912>

Hamaker, E. L., Nesselroade, J. R., & Molenaar, P. C. (2007). The integrated trait–state model. *Journal of research in personality*, 41(2), 295–315. Haslbeck, J. M. B., & Ryan, O. (2022). Recovering Within-Person Dynamics from Psychological Time Series. *Multivariate Behavioral Research*, 57(5), 735–766. <https://doi.org/10.1080/00273171.2021.1896353>

Haslbeck, J., Ryan, O., & Dablander, F. (2023). Multimodality and skewness in emotion time series. *Emotion*. <https://psycnet.apa.org/record/2023-72233-001>

Molenaar, P. C., & Valsiner, J. (2009). How generalization works through the single case: A simple idiographic process analysis of an individual psychotherapy. *YIS: Yearbook of idiographic science*, 1, 23–38.

Shrout, P. E., Stadler, G., Lane, S. P., McClure, M. J., Jackson, G. L., Clavé, F. D., Iida, M., Gleason, M. E. J., Xu, J. H., & Bolger, N. (2018). Initial elevation bias in subjective reports. *Proceedings of the National Academy of Sciences*, 115(1), E15–E23.

<https://doi.org/10.1073/pnas.1712277115>

Simms, L. J., Zelazny, K., Williams, T. F., & Bernstein, L. (2019). Does the number of response options matter? Psychometric perspectives using personality questionnaire data. *Psychological Assessment*, 31(4), 557–566. <https://doi.org/10.1037/pas0000648>

7-step

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