THE UNIVERSITY OF
ALABAMA IN HUNTSVILLE

Large Language Models as Trust in Automation Analysis Tools

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Challenge, Metacognition, and Perception Lab

Metacognition

Challenge

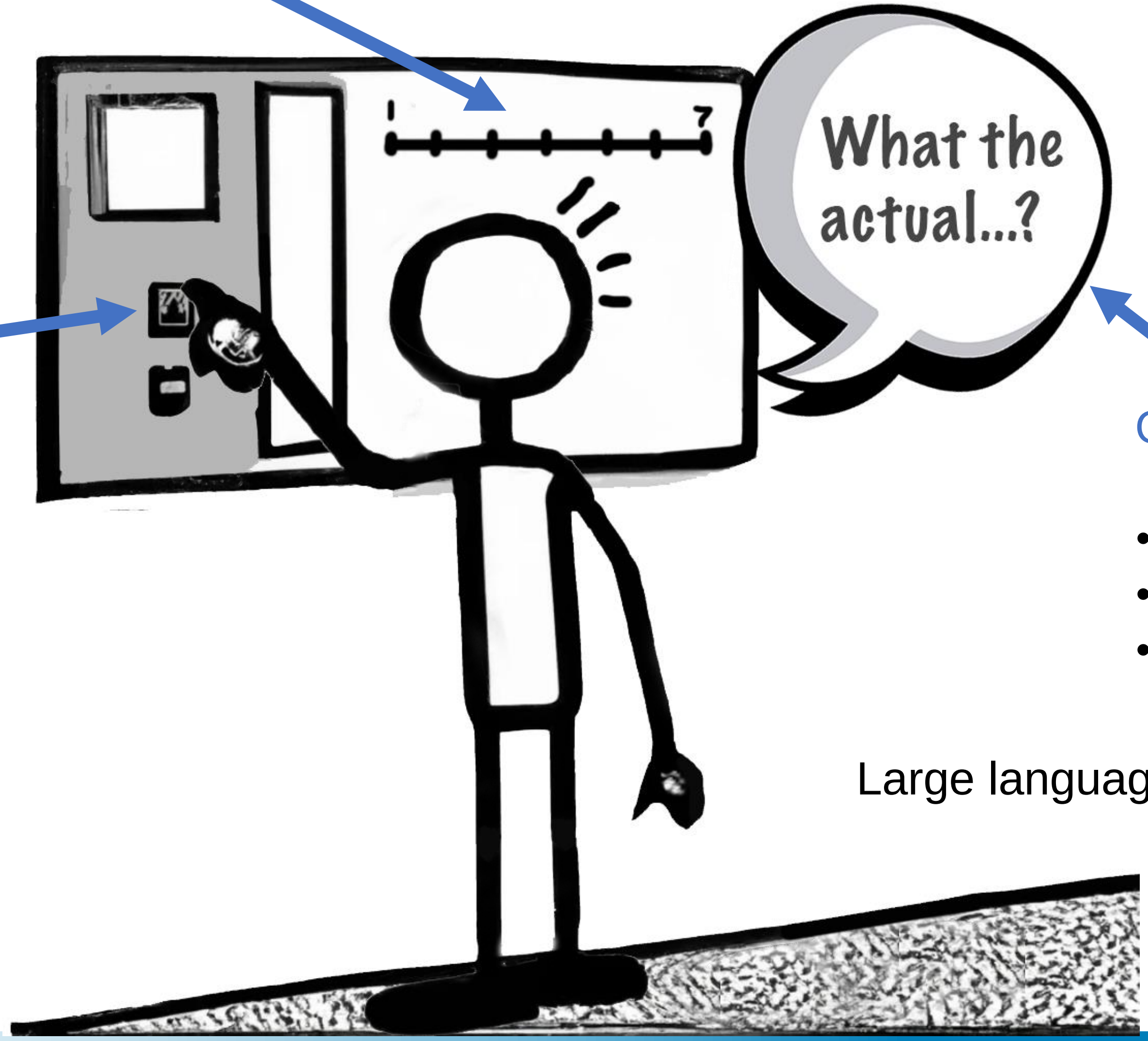
Perception

ChaMP Lab

The Why

Quantitative Self-Report Measures

Behavioral Measures



Qualitative Self-Reports

- Time-consuming analysis
- Subjective reliability
- Inter-rater reliability

Large language models as analysis tools?
(Lau et al., 2018)

Large Language Model

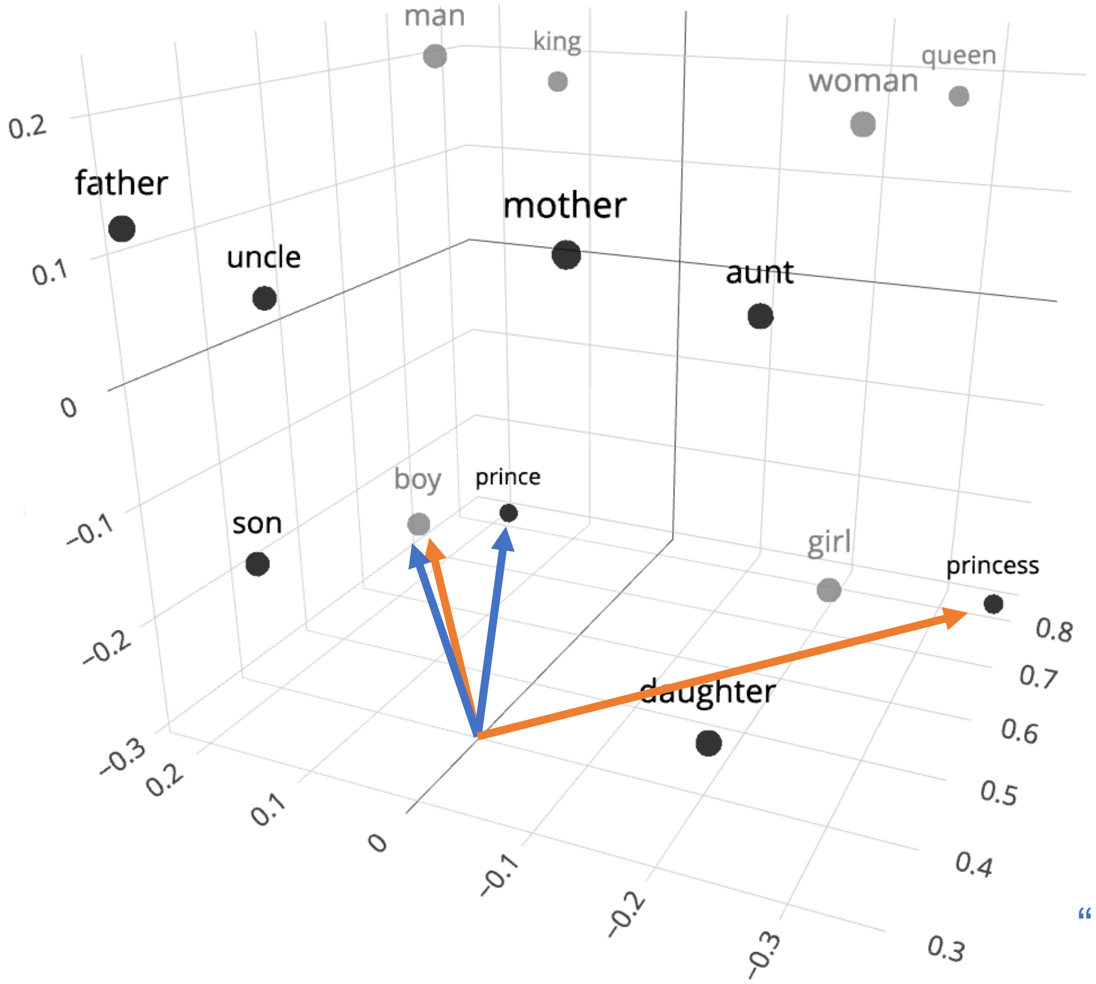
"man" is to "king" as "woman" is to "____________"?

Large language models contain latent semantic patterns.

$$\overrightarrow{king} - \overrightarrow{man} + \overrightarrow{woman} \approx \overrightarrow{queen}$$

(Mikolov et al., 2013)

Large Language Model



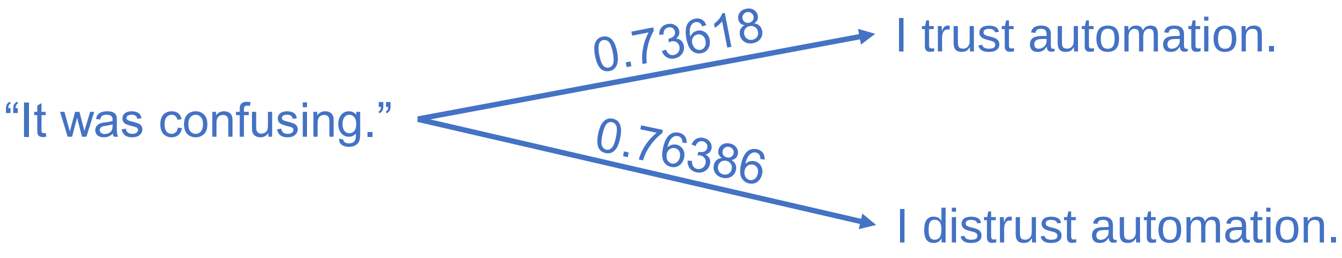
(Bandyopadhyay et al., 2022)

Unit of text (e.g., word, sentence) = a point in a high-dimensional space

low dimensional spaces: (x, y, z)
high dimensional: (p_1, p_2, p_3, …, p_{1536})

Cosine similarity

- measurement of angular distance
- high cosθ indicates similar semantic features



“It was confusing.”

0.73618

I trust automation.

0.76386

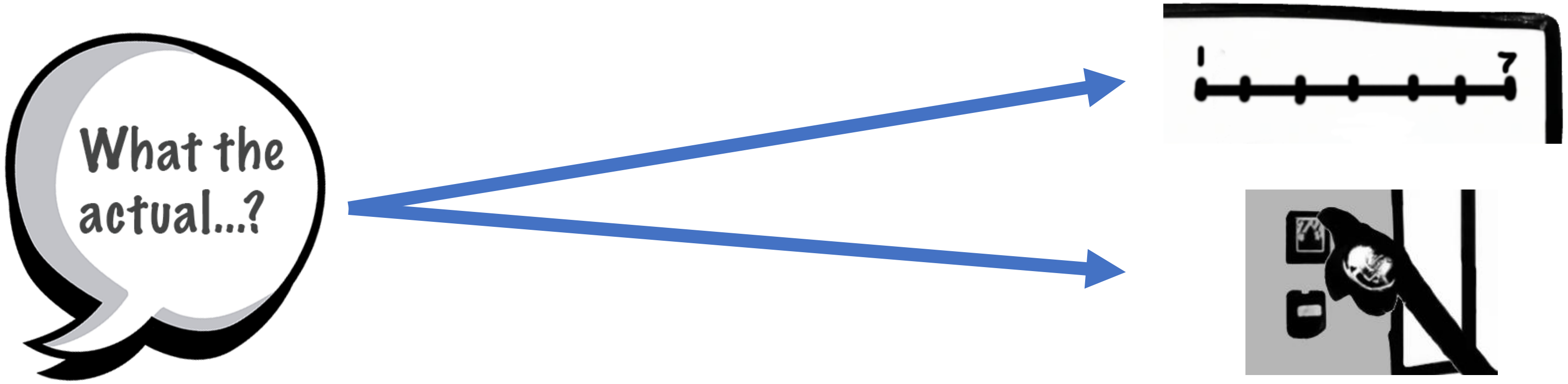
I distrust automation.

Exploratory Research Questions

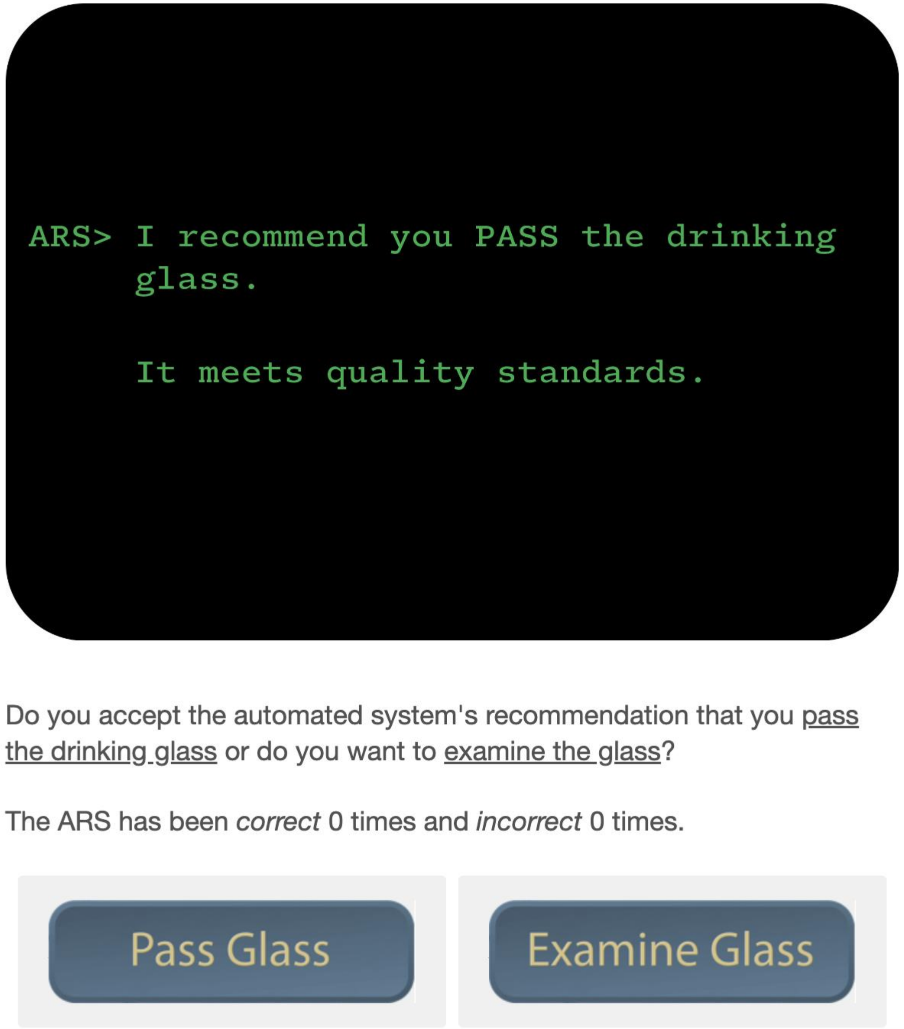
Can cosine similarities calculated against trust/distrust sentences predict a self-report Likert rating of trust?

Can cosine similarities calculated against trust/distrust sentences predict a behavioral measure of trust?

What sample size is necessary to achieve a well-trained model for prediction?



Gamified Survey



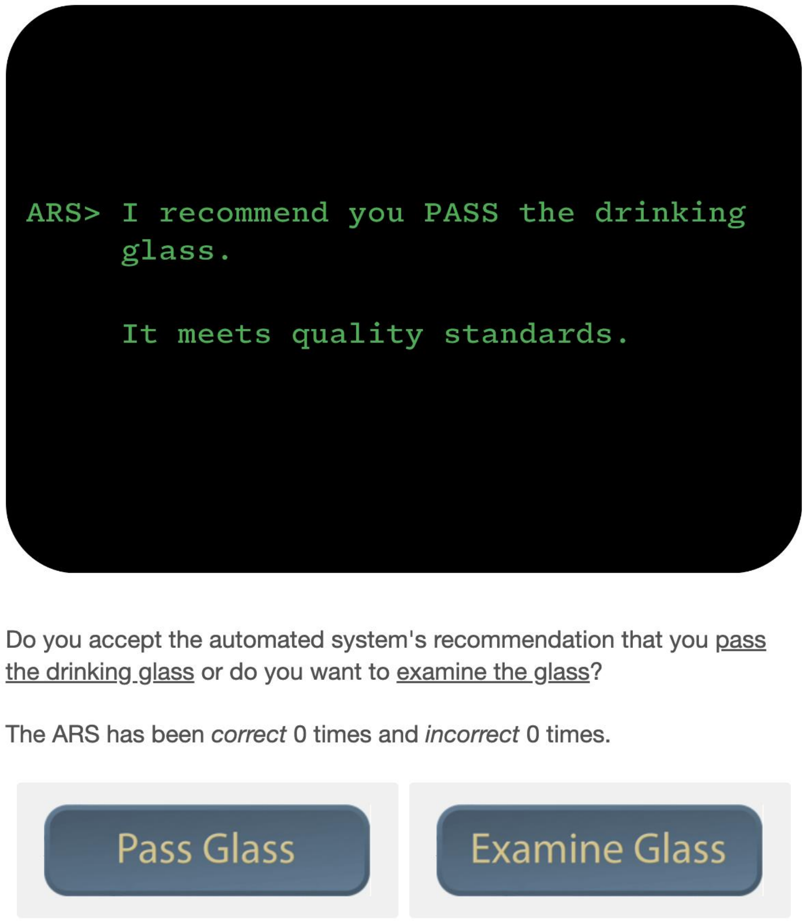
```
ARS> I recommend you PASS the drinking
     glass.

     It meets quality standards.
```

Do you accept the automated system's recommendation that you pass the drinking glass or do you want to examine the glass?

The ARS has been *correct* 0 times and *incorrect* 0 times.

(Yu et al., 2017)

Gamified Survey



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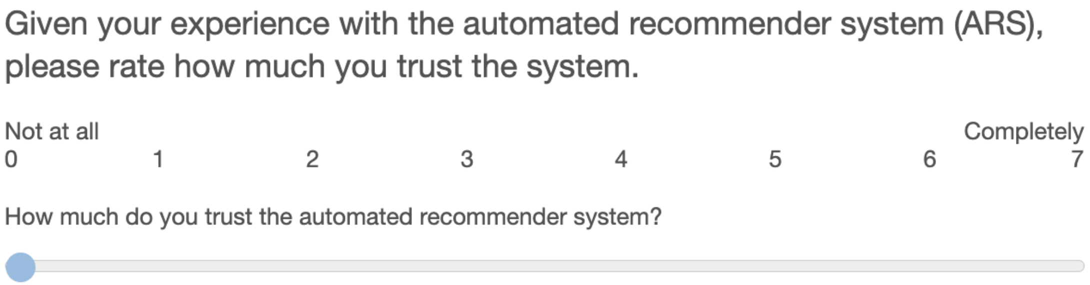
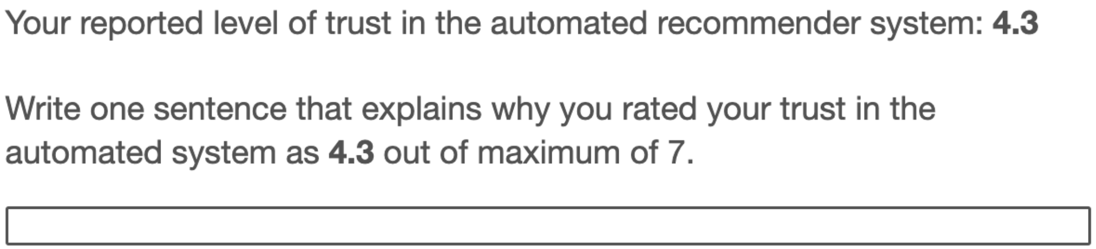
Behavioral measure



Given your experience with the automated recommender system (ARS), please rate how much you trust the system.

How much do you trust the automated recommender system?

Self-report rating



Your reported level of trust in the automated recommender system: **4.3**

Write one sentence that explains why you rated your trust in the automated system as **4.3** out of maximum of 7.

Self-report sentence

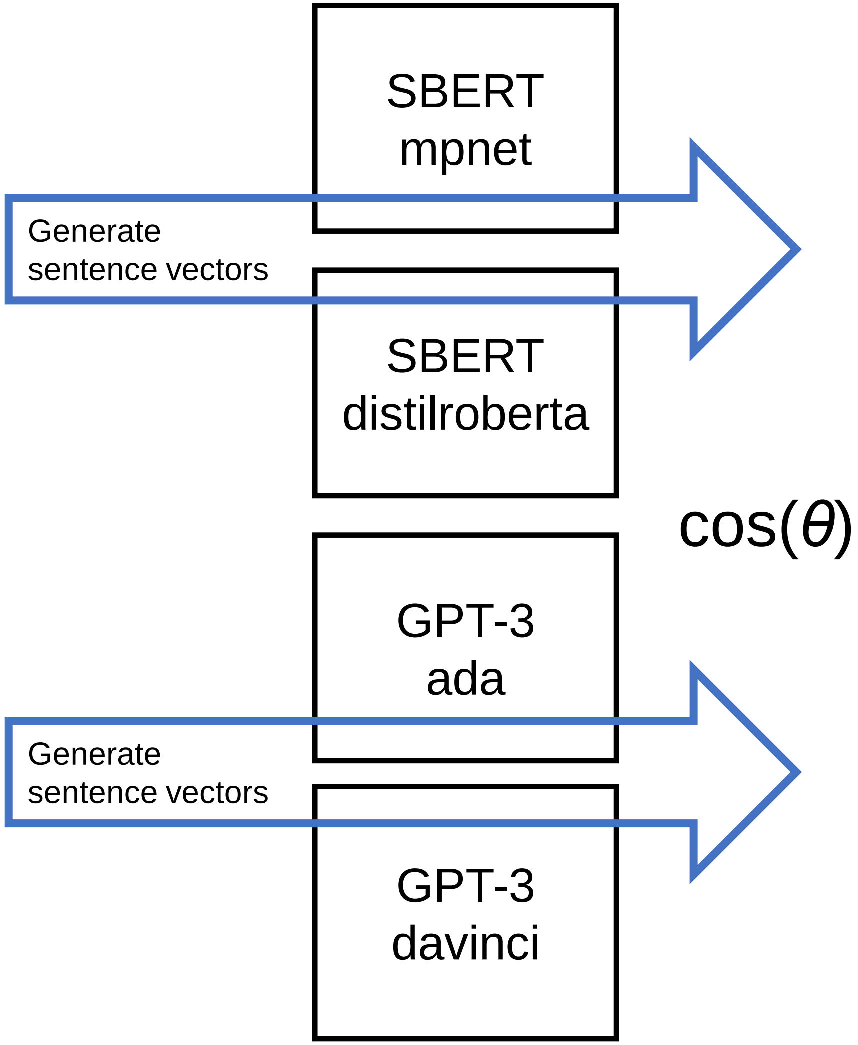
Analysis

N = 80

IS: n = 60

10 Sentence Sets
n = 15
n = 20
n = 25
n = 30
…
n = 60

8 Reference
I trust automation. I distrust automation.
…
I trust automated systems completely. I distrust automated systems completely.



Generate sentence vectors

SBERT mpnet

SBERT distilroberta

Generate sentence vectors

GPT-3 ada

GPT-3 davinci

cos(θ)

8 Similarity Scores for each sentence
0.829466819772240
0.837044959128676
…
0.808963624141162
0.817807812100523

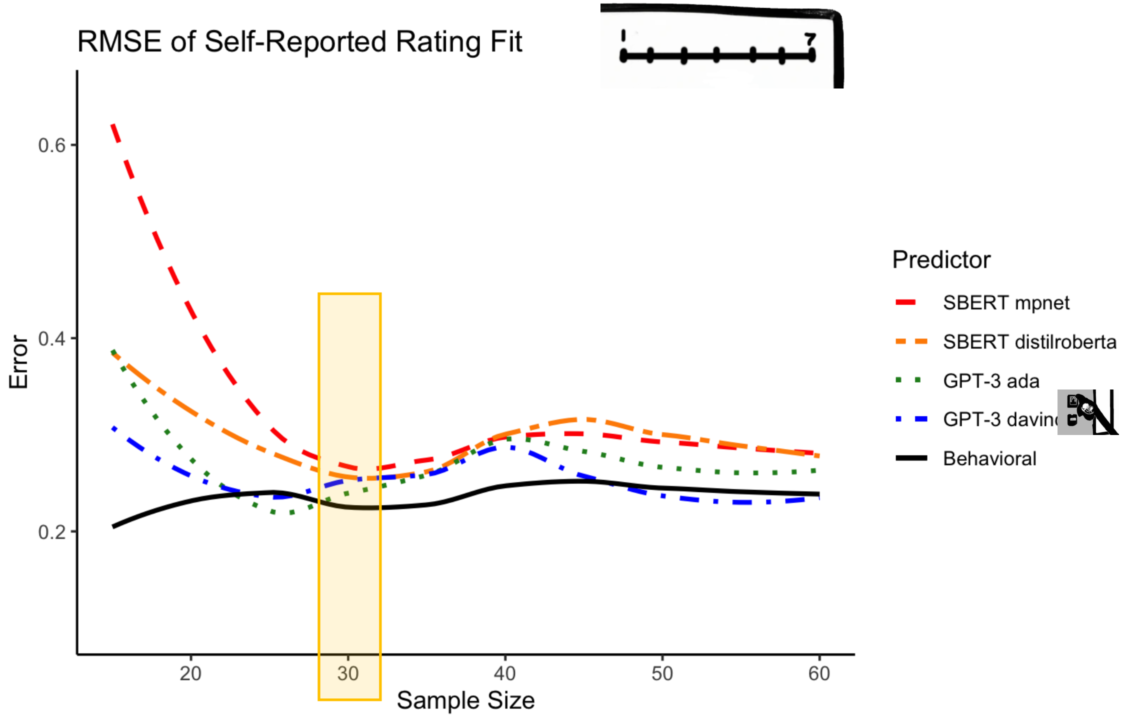
OOS: n = 20

Self-report Rating Linear Regression Models
Criterion
Self-report rating
Predictors
Similarity scores [or] Behavioral measure

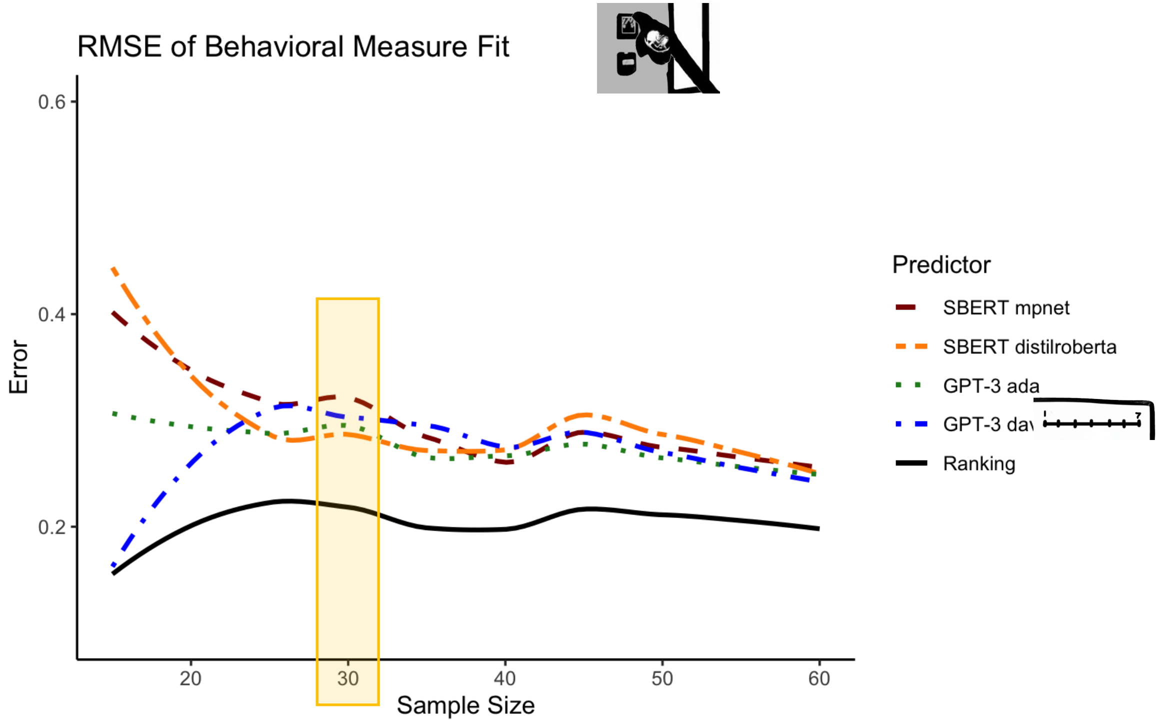
Behavioral Measure Linear Regression Models
Criterion
Behavioral measure
Predictors
Similarity scores [or] Self-report rating

Results

What size sample is necessary to achieve a well-trained model for prediction?

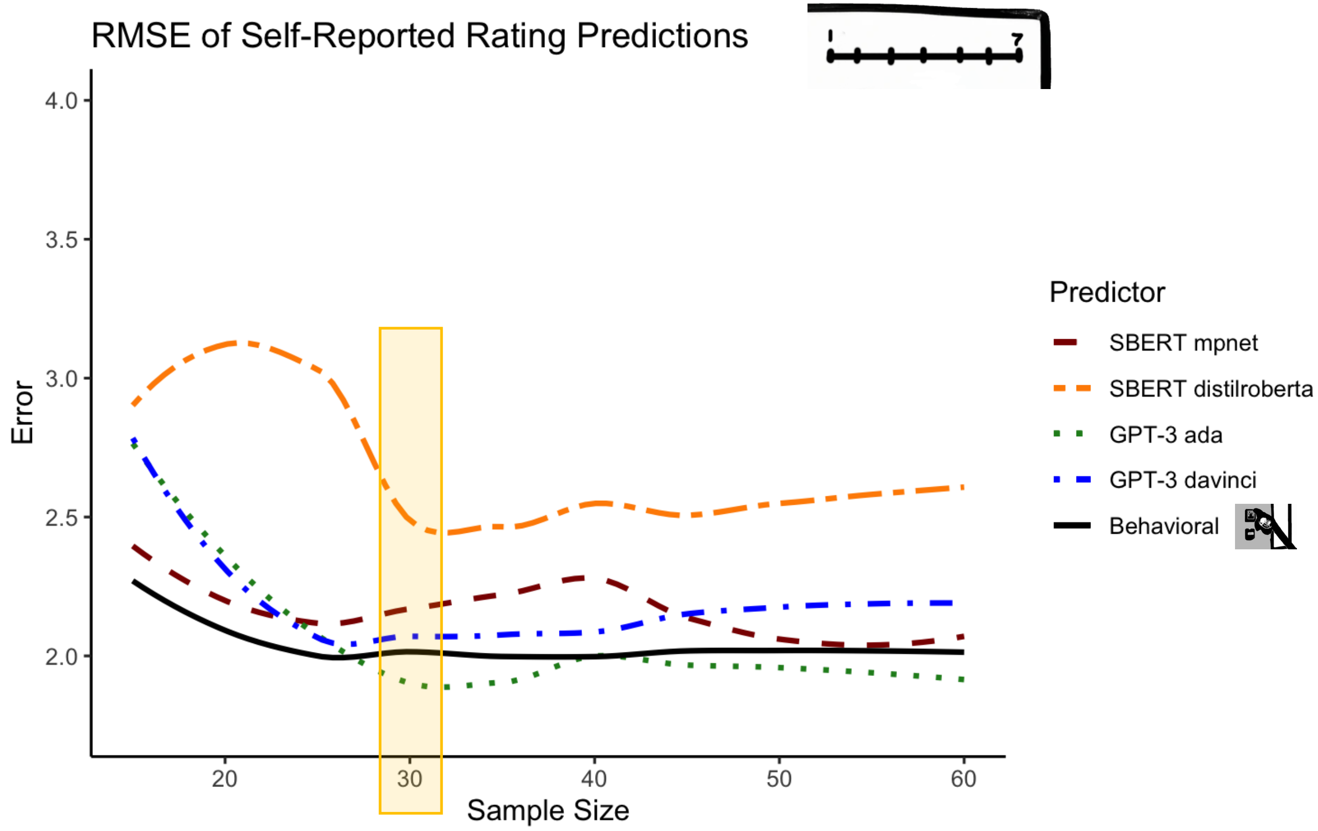


Note: Self-report rating criterion variable normalized for cross-chart comparisons



Results

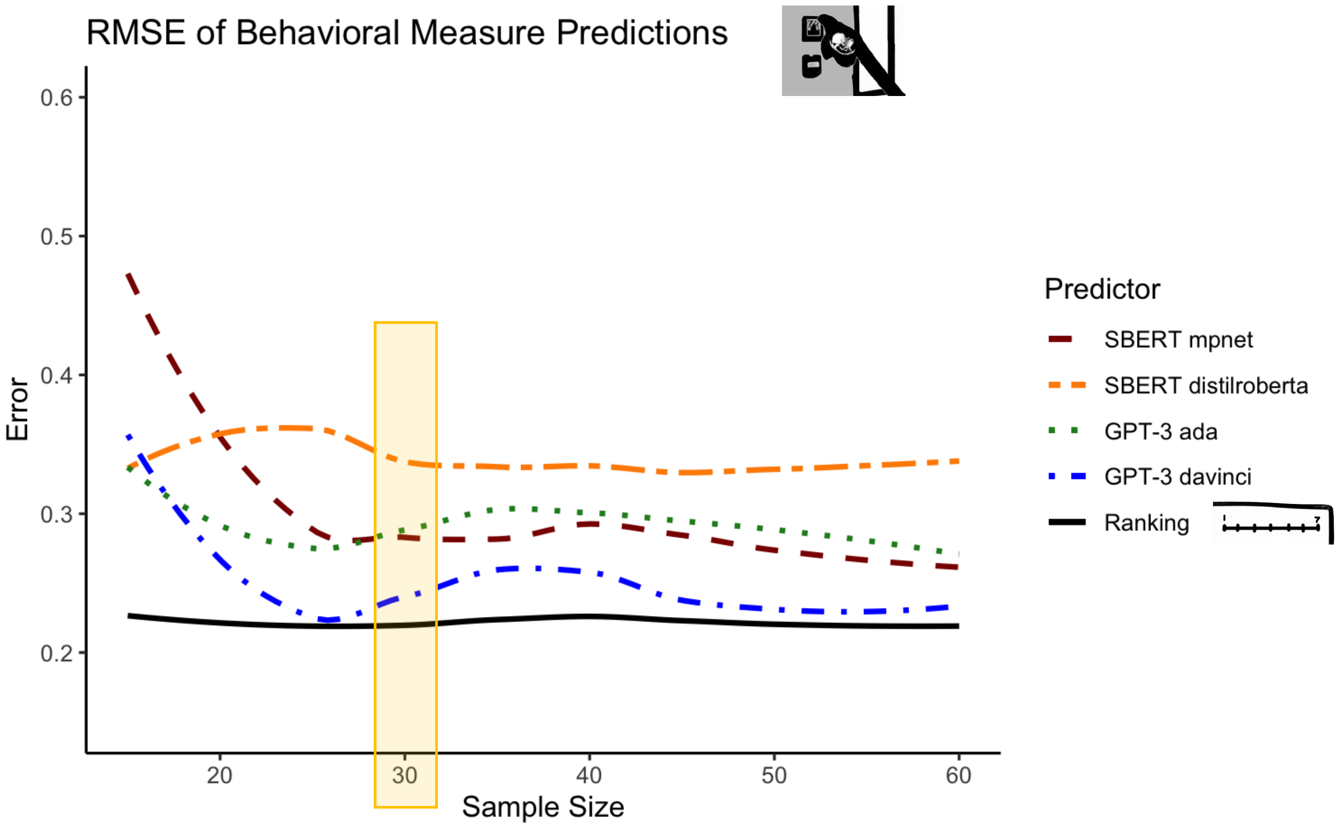
Can cosine similarities calculated against trust/distrust sentences predict a self-report Likert rating of trust?



	Sample Size					
	30		45		60	
Model	RMSE	MAE	RMSE	MAE	RMSE	MAE
GPT-3 ada	1.77	1.49	2.03	1.59	1.91	1.52
SBERT mpnet	1.98	1.71	2.33	1.87	2.09	1.72
GPT-3 davinci	2.19	1.73	2.30	1.89	2.19	1.81
SBERT distilroberta	2.22	1.71	2.55	2.02	2.61	2.03
Behavioral measure	2.04	1.69	2.03	1.61	2.02	1.53

Results

Can cosine similarities calculated against trust/distrust sentences predict a behavioral measure of trust?



	Sample Size					
	30		45		60	
Model	RMSE	MAE	RMSE	MAE	RMSE	MAE
GPT-3 davinci	0.23	0.19	0.25	0.20	0.23	0.19
SBERT mpnet	0.26	0.22	0.29	0.23	0.27	0.21
GPT-3 ada	0.29	0.24	0.29	0.23	0.27	0.21
SBERT distilroberta	0.32	0.25	0.33	0.26	0.34	0.26
Self-report ranking	0.22	0.16	0.22	0.18	0.22	0.17

Questions?

References

Bandyopadhyay, S., Xu, J., Pawar, N., & Touretzky, D. (2022). Interactive visualizations of word embeddings for K-12 students. *Proceedings of the AAAI Conference on Artificial Intelligence*, *36*(11), 12713–12720. https://doi.org/10.1609/aaai.v36i11.21548

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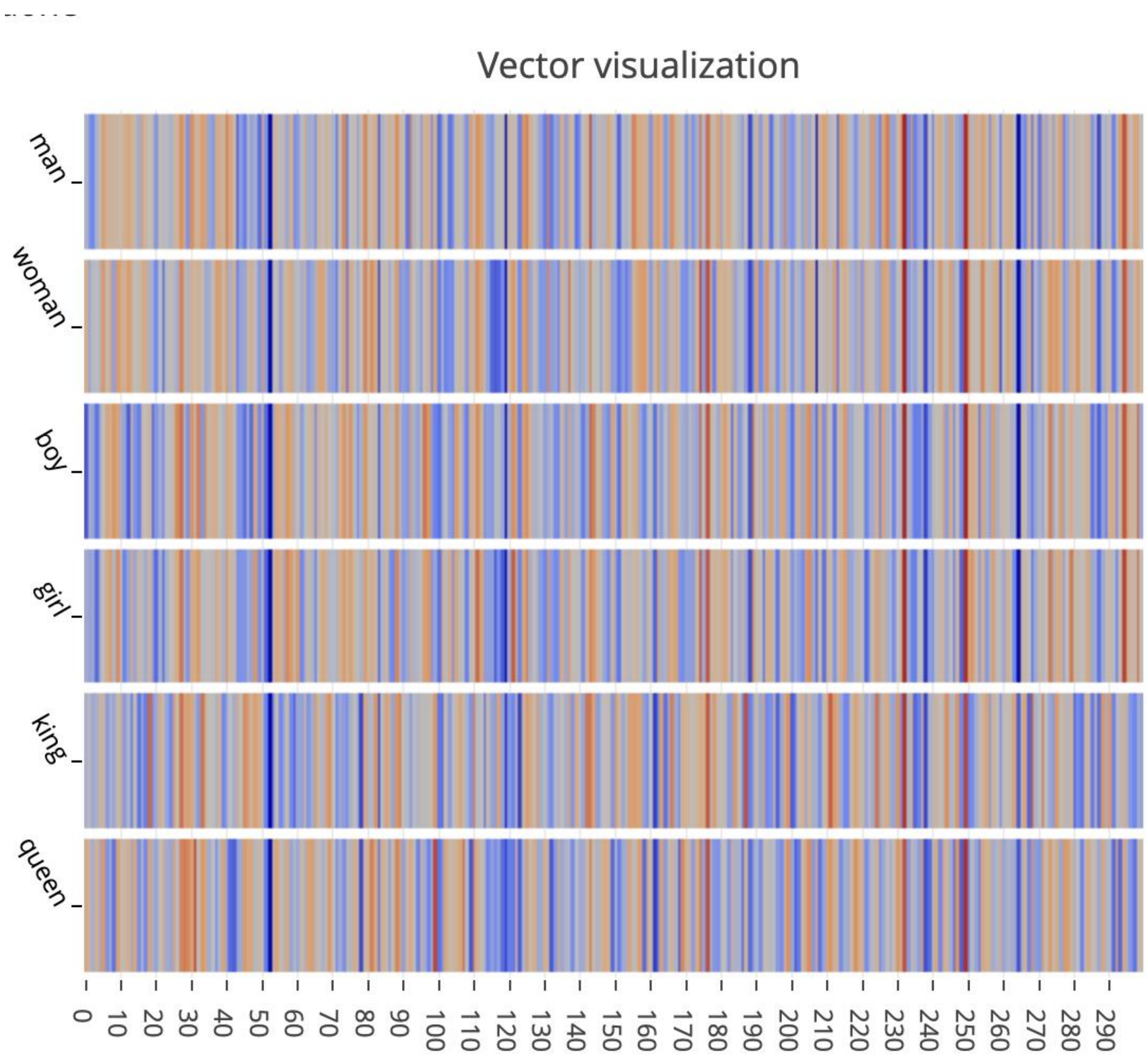
Mikolov, T., Yih, W., & Zweig, G. (2013). Linguistic regularities in continuous space word representations. *Proceedings of the 2013 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies*, 746–751.

Yu, K., Berkovsky, S., Taib, R., Conway, D., Zhou, J., & Chen, F. (2017). User trust dynamics: An investigation driven by differences in system performance. *Proceedings of the 22nd International Conference on Intelligent User Interfaces*, 307–317. https://doi.org/10.1145/3025171.3025219

Latent Semantic Patterns



Cosine Similarity Function

$$\cos(\theta) = \frac{\vec{a} \cdot \vec{b}}{\parallel \vec{a} \parallel \parallel \vec{b} \parallel} = \frac{\sum_{i=1}^{n} a_i b_i}{\sqrt{\sum_{\mathrm{i=1}}^{\mathrm{n}} \mathrm{a}_{\mathrm{i}}^{2}} \sqrt{\sum_{\mathrm{i=1}}^{\mathrm{n}} \mathrm{b}_{\mathrm{i}}^{2}}}$$