

Background

Statistical graphs are used to communicate complex data for scientific topics (Hegarty, 2011).

Socio-scientific issues Sadler (2004) are controversial and politicized topics, like climate change, vaccinations, and genetically modified foods and are influenced by...

- Political identity (Gaines et al., 2007)
- Topic attitudes (Thacker et al., 2019)
- Topic knowledge (Anson, 2018)
- Values (Trevors et al., 2016)
- Graph comprehension skill (Hegarty, 2011)
- **Graphicacy:** Friel, Crucio, & Bright (2001)
- "a readers ability to derive meaning from graphs created by others or themselves".
- Requires three skills

Skill	Conceptual Definition	Operation
Translation	between representations	knowledge of conve
Interpretation	of the referent (graph) relative to the context.	extraction of a single extraction of multipl relationships
Interpolation Extrapolation	beyond the data depicted	holistic interpretation

Theoretical Framework



Research Questions

- Can individuals understand the graphs?
- If they cannot understand the graph does political identity influence their interpretations?
- What are the psychometric properties of our line graph comprehension measure?

Reading, and Reasoning Between and Across the Lines: Comprehension of Controversial Socio-Scientific Line Graphs

Neil G. Jacobson,¹ Gale M. Sinatra,¹ Ian Thacker,² Robert W. Danielson³ ¹University of Southern California, ²University of Texas San Antonio, ³Washington State University

Methods

I Definition

- entions
- e data point or le points or
- n of the data pattern

Study 1: Politics and controversial graphs N= 120 Mturk adults

- 18-item graphicacy measure 6-item beliefs about causes
- Political identity





Experimental Graphics



Climate change Autism rates Housing prices

Results

Graphicacy

Average comprehension = ~50%

Cause Beliefs

Only in the Climate change condition did political identity influence interpretations, despite the graphs containing the same data

Natural variation $r = -0.46^*$ $r = -0.47^*$ Popular finding $r = -0.35^*$ Secure funding $r = 0.39^*$ Human actions

*Identity is 1 = conservative 7 = liberal

Know grap CONV Point relation

Relat betw

Relat betw relation

Infere draw data

Please contact <u>ngjacobs@usc.edu</u> for further information.

Study 2: Pilot of the LGCM

N = 200 M turk adults33-item LGCM • 5-subscales

Neutral Topic: Restaurant profit

Theory Driven							
Jb-scales	# of Items	α					
vledge of h rentions	7	0.78					
onships	5	0.82					
tionships veen points	10	0.70					
tionships veen onships	4	0.73					
ences n from	7	0.63					
Total	33	0.89					

Study 3: Controversial Gro

- N = 200 Mturk adults will pc 33-item Line Graph Comprehension Measure
- 6-item beliefs about cau
- 1-item partisanship meas



- pertain to a neutral topic, restaurant revenue.
- scientists who are attempting to secure funding.

Anson, I. G. (2018). Partisanship, Political Knowledge, and the Dunning-Kruger Effect. Political Psychology, 39(5), 1173-1192. Hegarty, M. (2011). The Cognitive Science of Visual-Spatial Displays: Implications for Design. Topics in Cognitive Science, 3(3), 446-474.



Methods

aphs,	, Gro	aphic	cacy	, & Pol	itical la	dentity	
articipate							
	•	1-ite	m ide	eology	/ meas	sure	
е	•	1-item self-reported topic					
Jses		knowledge					
sure	•	3-item topic attitudes					
mental Graphics							
erature	e Cha	ange			Тс	opics	

Climate change

Fluoride water treatment

Housing rates

Genetically modified foods

Summary

Across studies individuals had difficulty understanding and interpreting the line graphs. In Study 1, comprehension was approximately 50% for the controversial topics. In Study 2, we used item-response theory to find that the LGCM is best suited for less knowledgeable individuals. Importantly, these results

In Study 1, we found evidence that certain topics are influenced by political identity. Only in the climate change condition did political identity correlate with perceived causes. Those who identified as more liberal were more likely to attribute climate change to human actions, whereas those who identified as more conservative were more likely to attribute climate change to natural variation or attribute it to

The LGCM is promising and demonstrates acceptable internal consistency in total and for each sub-scale. Currently, we are collecting data for Study 3, which builds on the previous studies and broadens the socio-scientific topics of interest.

Reterence . (2004). Informal reasoning regarding socioscientific issues: A critical review of research. Journal of Research in Science Teaching, 41(5), 513-536 Gaines, B. J., Kuklinski, J. H., Quirk, P. J., Peyton, B., & Verkuilen, J. (2007). Same Facts, Different Interpretations- Partisan Motivation and Opinion on Iraq. Journal of Politics, 69(4), 957–974. hacker, I., Sinatra, G. M., Muis, K. R., Danielson, R. W., Pekrun, R., Winne, P. H., & Chevrier, M. (2019). Using persuasive refutation texts to prompt attitudinal and conceptual change. Journal of Educational Psycholog revors, G. J., Muis, K. R., Pekrun, R., Sinatra, G. M., & Winne, P. H. (2016). Identity and epistemic emotions during knowledge revision: A potential account for the backfire effect. Discourse Processes, 53(5-6), 339-3 Friel, S. N., Curcio, F. R., & Bright, G. W. (2001). Making sense of graphs: Critical factors influencing comprehension and instructional implications. Journal for Research in Mathematics Education, 32(2), 124-1