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# Analytic Thinking Predicts Vaccine Endorsement: Cognitive Style as an Antecedent of Vaccine Attitudes

Daniel A. Anderson  
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## Abstract

Relationships between cognitive style (CS) and affective orientation toward childhood vaccines (AO) were tested in a sample of US adults, controlling for known covariates. Findings suggest an analytic cognitive style predicts greater likelihood of endorsing childhood vaccination (higher AO). Results highlight relationships between individual cognition and cultural influences upon vaccine-beliefs.

## Introduction

### Central variables

**Affective orientation toward childhood vaccines (AO)** refers to a person's overarching feeling toward childhood vaccinations and universal immunization. This latent variable underlies safety attitudes toward childhood vaccination (Kahan, 2014).

**Cognitive style (CS)** is deployment of analytic versus intuitive thinking in daily life. Analytic CS is characterized by rational, objective, and intentional thought, while intuitive CS is characterized by emotional, heuristic, and associative thought. Analytic CS and intuitive CS are independent personality factors and not a singular, unidimensional construct (Epstein, Pacini, Denes-Raj, & Heier, 1996; Epstein, 1994; Epstein, 1998, 2014).

**Conspiracist beliefs (CB)** are assumptions about the world that underlie personal beliefs in specific conspiracy theories (Brotherton, French, & Pickering, 2013).

Belief in conspiracy theories is:

- Highly related to parental resistance toward childhood vaccines (Oliver & Wood, 2014)
- Negatively associated with analytic CS (Swami, Voracek, Stieger, Tran, & Furnham, 2014)
- Positively associated with intuitive CS (Lobato et al., 2014)

### Background

If a person relies on heuristics (intuitive mental shortcuts) when evaluating vaccine-risks, their understanding of vaccine risks will most likely differ from objective risk statistics calculated from data (Jacobson, Targonski, & Poland, 2007; Poland, Jacobson, Opel, Marcuse, & Poland, 2014; Poland & Poland, 2011). Kahan (2014) suggests human evaluations of risks in daily life are rarely based in analytic consideration of data at all, and that affective, intuitive orientation toward vaccination (AO) guides the majority of lay vaccine decision-making. However, conclusive empirical tests of association between both intuitive and analytic thinking with AO are lacking (Browne, Thomson, Rockloff, & Pennycook, 2015). A study was designed to address this gap in the literature. Interactions between intuitive and analytic CS, AO, and CB (noted above) suggested the study should control for the covariate CB in all tested associations.

## Hypotheses

- Higher scores on analytic CS will predict higher AO scores
- Higher scores on intuitive CS will predict lower AO scores
- These associations will be observed independently and in the presence of covariates

## Method

During October-November 2015, a sample of US adults ( $N = 603$ ) was accessed via Mechanical Turk (a paid online service for recruitment and compensation of respondents). Questionnaires were administered that included measures for:

- Affective orientation toward childhood vaccines (Kahan, 2014)
- Analytic cognitive style (Epstein et al., 1996)
- Intuitive cognitive style (Epstein et al., 1996)
- Conspiracist beliefs (Brotherton et al., 2013)

Measures for known covariates of vaccine attitudes (see Boom & Cunningham, 2014) were also administered, including

- Political orientation (5-point scale: Conservative = 1, Liberal = 5. Jost, 2006)
- Demographics (age range, level of education, sex, and parental status)

Out of  $N = 603$  respondents, sixty ( $n = 60$ ) failed to meet inclusion criteria (completion time < 5 min; no proof of completion), leaving  $N = 543$  in the final sample. Observations were weighted by gender according to the 2014 US census to compensate for slight overrepresentation of females. All results were similar with or without exclusions and weighting.

## 1. Results

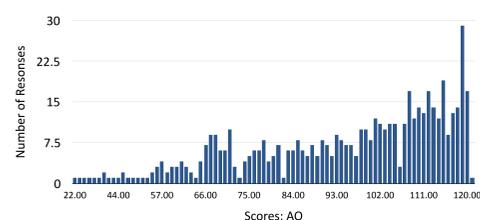


Figure 1. Score Frequencies for affective orientation toward childhood vaccination (AO)

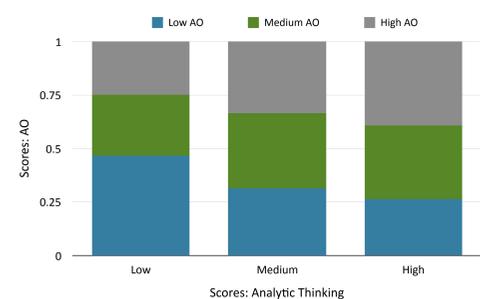


Figure 2. Association between analytic thinking and affective orientation toward childhood vaccination (AO)  
Note: Data are split at 33rd percentiles into low, medium, and high score-groups for ease of presentation

### Preliminary analyses

- Concurring with previous research (Kahan, 2014; Funk & Rainie, 2015), scores for AO were highly positively skewed (Figure 1), indicating a high level of vaccine endorsement in the sample
- In support of the hypothesis, analytic CS showed a weak but significant positive association with AO,  $r_s = .15$ ,  $p < .001$  (Figure 2)
- Contrary to the hypothesis, intuitive CS showed no association with AO,  $r_s = -.03$ ,  $p = .552$

### Central findings

**Results from ordinal regression models (All models shown in Table 1)**

- In every model that included analytic CS (models 1-3, 5-6), this variable emerged as a significant positive predictor of AO ( $p < .05$ )

**Table 1. Ordinal regression models predicting affective orientation toward childhood vaccination (AO)**

Measures	Model											
	1		2		3		4		5		6	
	OR	95% CI										
Analytic thinking	<b>1.473</b>	1.218, 1.782	<b>1.475</b>	1.220, 1.784	<b>1.401</b>	1.148, 1.709			<b>1.365</b>	1.124, 1.658	<b>1.336</b>	1.089, 1.640
Intuitive thinking			0.945	0.795, 1.146	<b>1.226</b>	1.007, 1.492			1.070	0.879, 1.301	<b>1.331</b>	1.076, 1.646
Conspiracist belief					<b>0.931</b>	0.919, 0.944					<b>0.928</b>	0.914, 0.941
Political orientation							<b>0.625</b>	0.540, 0.724	<b>0.637</b>	0.549, 0.739	<b>0.610</b>	0.522, 0.713
Age							0.973	0.908, 1.042	0.972	0.907, 1.042	0.977	0.908, 1.051
Education							<b>1.096</b>	1.008, 1.192	1.090	1.000, 1.187	0.978	0.892, 1.074
Parental status							1.090	0.768, 1.545	1.135	0.798, 1.616	1.209	0.834, 1.752
Sex							1.175	0.846, 1.632	1.161	0.830, 1.625	1.233	0.865, 1.757

Note. OR = Odds Ratio; CI = Confidence Interval  
 $p$ -values < .05 shown in bold.

## 2. Results

### Central findings (cont.)

- Intuitive CS did not to predict AO, both alongside analytic CS (model 2) and upon inclusions of political/demographic covariates (model 5;  $p > .05$ )
- However, In every model that included CB and CS variables, intuitive CS emerged as a significant predictor of higher AO (models 3, 6;  $p < .05$ )

## Discussion

**Summary.** The hypotheses were partially supported. Holding covariates constant in several regression models, analytic cognitive style predicted vaccine endorsement in a national sample. Intuitive cognitive style, unexpectedly, also predicted vaccine endorsement, but only upon inclusion of a measure of conspiracist beliefs in the model. The presence of this interaction was not hypothesized, and without more detailed testing the relationship between intuitive cognitive style and affective orientation toward childhood vaccines remains unclear.

**Interpretation.** Local sociocultural norms of vaccine endorsement and/or resistance significantly influence individual vaccine decisions (Streefland, Chowdhury, & Ramos-Jimenez, 1999). However, the present findings suggest individual psychological factors might influence the *kind* of culture an individual identifies with in the first place: highly analytic individuals might more comfortably enculturate among groups where acceptance of the scientific paradigm dominates popular opinion, in that they are better able to approach and understand the complex, counterintuitive concepts that underly science and math (see Leron & Hazzan, 2009). They might come to feel a sense of familiarity with scientific-medical consensus, and this feeling of familiarity might resonate in judgements about childhood vaccination (which is endorsed by most American scientists, see Funk & Rainie, 2015). Likewise, less analytic individuals might be less likely to internalize (and so would feel less comfortable with) scientific culture, due to having comparatively less exposure scientific ideas and concepts. Because of this lower feeling of familiarity with scientific-medical consensus, they might be more likely to endorse alternative views on vaccine safety instead of medical recommendations.

**Future directions.** Future work should examine relationships between an explicit trust in scientific consensus and CS; AO, considering education in the sciences and cultural norms of science-acceptance for respondents. Beliefs and sentiments of "local vaccine cultures" (Streefland, Chowdhury, & Ramos-Jimenez, 1999: p. 1707) should also be examined in relation to CS as possible influences upon vaccine attitudes.

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