



Conspiracist and paranormal beliefs: A typology of non-reductive ideation

Nathan F. Dieckmann^{1,2} and Robert O. Hartman³

¹Oregon Health & Science University, Portland, Oregon, United States of America

²Decision Research, Eugene, Oregon, United States of America

³The MITRE Corporation, McLean, United States of America

Non-reductive ideation is characterized by a tendency to attribute causality to non-physical powers and mysterious forms of intelligent agency such as conspiracist ideation, belief in specific conspiracy theories, and belief in the paranormal. Scholars have identified numerous individual correlates of non-reductive ideation but do not examine shared patterns across multiple predictors to determine subtypes of individuals with different psychological profiles. We address this gap by considering a large set of predictors in a diverse cross-section of the US public (N=792) to uncover latent subtypes of individuals with varying tendencies toward non-reductive ideation. Schizotypal and neurotic tendencies were the strongest predictors of non-reductive ideation, while sociopolitical identity (e.g., political ideology) contributed little explanatory power. We find five distinct latent classes distinguished by: schizotypal and paranoid ideation, alienated skepticism toward people/society, and a negative sense of self. We discuss these results in light of previous findings and suggest directions for future research.

Keywords: science mistrust, conspiracy theories, conspiracist ideation, paranormal, schizotypy, paranoia

According to the Pew Research Center (2015)¹, most people endorse an eclectic mix of naturalistic and non-reductive beliefs. *Naturalistic beliefs* are mostly held by those who report high trust in science and consensus scientific viewpoints, in alignment with materialistic reductionism. *Non-reductive beliefs* are mostly held by those who express greater skepticism about science, who attribute causality to non-physical powers and mysterious forms of intelligent agency (Goode, 2011), and are more likely to identify as believing in: God, the devil, evil spirits, witches, alien abductions, specific religious doctrines, psi phenomena (e.g., telekinesis, precognition), astrology, hexes, and a range of conspiracy theories (Hartman et al., 2017). These two attributional styles (naturalistic beliefs and non-reductive beliefs) tend to be negatively correlated. Well known examples of non-reductive beliefs are conspiracist ideation and paranormal beliefs. These constructs have been shown to be strongly correlated with each other and a range of antecedents and correlates have been identified in the literature. However, few studies have included a large set of candidate predictors in a single study or identified different subtypes of individuals with varying tendencies toward non-reductive ideation.

In this paper, we report results from a large cross-sectional survey from a diverse sample of the US population.

We focus on a broad set of predictors of conspiracist ideation and paranormal beliefs found in previous research and use an automated model-selection approach to identify the most robust predictors across a broad array of candidate models. We then use the strongest predictors to develop a latent class typology to identify clusters of individuals with different psychological profiles and tendencies toward non-reductive ideation.

Non-reductive ideation

Previous research has demonstrated strong correlations among generic conspiracist ideation, beliefs in specific conspiracy theories, and measures of paranormal belief (e.g. Lobato et al., 2014; Drinkwater, 2012; Rizeq, 2020; Swami et al., 2010). The related construct of belief in pseudoscience is also correlated with both conspiracist ideation and paranormal beliefs (Lobato et al., 2014; Fasce, 2019). We, and others (e.g., Rizeq, 2020), suggest that this pattern of correlations reflects a broader explanatory style characterized by a tendency to attribute events to mysterious forms of intelligent agency and/or mystical power that are beyond the ken of reductive naturalism. We use the term *non-reductive ideation* to describe this explanatory style, which entails an openness to non-reductive and agentic forms of causation

Correspondence to: Nathan Dieckmann, Oregon Health & Science University, Portland, Oregon, United States of America
E-mail: dieckman@ohsu.edu

¹The Pew Research Center is a US-based organization describing itself as “a nonpartisan fact tank that informs the public about the issues, attitudes, and trends shaping the world” (<https://www.pewresearch.org/about/>)

and a concomitant skepticism toward the reductive, naturalistic, and impersonal (i.e., “secular”) explanations that are characteristic of mainstream discourse². In this paper, we operationalize non-reductive ideation through the specific measures of generic conspiracist ideation and paranormal beliefs.

Predictors of conspiracist ideation and paranormal beliefs

A rich body of research has identified many different predictors of conspiracist ideation and paranormal beliefs. In general, these proposed causes and correlates can be grouped under three broad conceptual models. First, we have what might be called the *schizotypal trait* model. This model draws support from research showing that both paranormal beliefs and generic conspiracist ideation are correlated with high levels of paranoia and schizotypy (Darwin et al., 2011; Barron, 2018; Denovan, 2020; Dagnall, 2015; Stasielowicz, 2022), having lower need for cognition (Lobato et al., 2014), lower levels of analytic thinking (Swami et al., 2014), seeing agency and intentionality when it is not present (Douglas et al., 2016; although see Dieguez, 2015), and some other general personality traits such as agreeableness and openness (Swami et al., 2010; Rizeq, 2020; although see recent meta-analysis by Goreis (2019) suggesting very small personality effects averaging across studies). From this perspective, paranormal beliefs and conspiracist ideation are just some of the various cognitive byproducts of a schizotypal attributional style (see, e.g., Darwin et al., 2011).

A second conceptual model, which we call the *vulnerability model*, emphasizes the emotional character of non-reductive ideation and the tendency for people to want to feel safe, secure, and in control of their environment (van Prooijen, 2020). Previous research has shown that belief in conspiracy theories is related to feelings of powerlessness (Abalakina-Paap et al., 1999), high levels of anomie (a lack of trust in society; Goertzel, 1994), a lack of faith in other people (Goertzel, 1994), and lower self-esteem (Cichocka, 2016). In each case, non-reductive explanations can provide some feeling of control when faith in the good of society, other people, and the self is low (Douglas et al., 2017).

The third and final model we call the *sociopolitical identity* model of non-reductive ideation, which suggests that paranormal and conspiracy-oriented beliefs are driven by political ideology, “traditional” social-cultural values, religiosity, and other demographic variables (Douglas et al., 2017). From this perspective, non-reductive ideation helps to maintain a positive image and relationship with the self and one’s in-group while assigning blame for negative outcomes to other people or forces. Non-reductive beliefs are more prevalent in demographic groups that may be perceived to have lower societal status such as members of racial and ethnic minority communities (Douglas & Sutton, 2008; Goertzel, 1994), individuals with lower levels of education (Douglas et al., 2016), younger people (Goertzel, 1994), and women (Darwin et al., 2011). Research has also shown that conspiracist ideation is related to both religiosity

(Lobato et al., 2014) and political orientation (Hornsey, 2020; van der Linden, 2020; Uscinski & Parent, 2014; Uscinski, 2020).

Conspiracist ideation, paranormal beliefs, and beliefs about science

Non-reductive ideation, including both conspiracist ideation and paranormal beliefs, has been related to more negative perceptions and beliefs about specific scientific topics and the scientific enterprise in general (Hartman et al. 2017). For example, generic conspiracist ideation has been linked to rejection of climate science (Lewandowsky, Gignac, & Oberauer, 2013; although see Dixon & Jones, 2015 for an alternate interpretation), counter-scientific beliefs about the safety of vaccines (Jolley & Douglas, 2014; Lewandowsky, Gignac, & Oberauer, 2013; Hartman, et al., 2017), and anti-conventional medicine and anti-GMO food beliefs (Hartman, et al., 2017). In addition, specific conspiracy beliefs such as those relating to HIV/AIDS and COVID-19 lead to skepticism about science-based HIV prevention messages and COVID-19 protective behavior messages, respectively (Bird & Bogart, 2005; Freeman, 2020). Generic conspiracist ideation has also been related to more pessimistic views about the causes of scientific disagreements. Individuals higher in conspiracist ideation are more likely to believe that scientific disagreements are caused by incompetent and/or biased scientists as opposed to being part of the normal scientific process (Dieckmann & Johnson, 2019).

Research aims

Based on our review of the literature, most previous studies of conspiracist ideation and paranormal beliefs tend to focus on a relatively narrow set of predictors at any one time making it difficult to understand the relative contributions of different potential predictors or the interplay among them. Our first aim (Aim 1) is to find the strongest predictors of generic conspiracist ideation and paranormal beliefs from a broad set of variables used in previous research. For this we use a robust model selection approach. This method is ideal for narrowing down the set of potential predictors but remains variable-centric and does not reveal shared patterns across multiple predictors. We argue that alternative analytic approaches, such as latent class analysis (LCA), can provide additional insight by revealing latent subgroups of individuals with similar predictor profiles and answering questions such as “What is the psychological profile of individuals who are high in non-reductive ideation?” and “Are there different psychological profiles that result in similar or different levels of non-reductive ideation?”. For example, there may be a class of individuals who endorse conspiracist and paranormal thinking styles because they are consistent with the beliefs of their social in-groups (e.g., political or religious groups), others who endorse these thinking styles because of underlying paranoia and schizotypy, and yet others who may be driven by feelings of hopelessness about society and a lack of faith in other people. These different classes or clusters may represent alternative pathways to similar

² Others have used more tendentious terms such as “contaminated mindware” (see, e.g., Stanovich et al., 2016; Rizeq et al., 2021).

Table 1. Sample Demographics ($N=792$)

	Value
Female	58%
Age [mean (sd)]	51.4 (15.1)
Ethnicity	
Non-Hispanic white	53.7%
African American/Black	21.6%
Latino/Hispanic	7.4%
Asian	5.8%
Native Hawaiian/Pacific Islander	0.5%
American or Alaskan Native	1.1%
Other	9.8%
Education	
≤ high school	25.5%
some college	28.2%
college degree	29.2%
advanced degree	17.2%
Income [median (IQR)]	40,000 (49,925)
US Region	
West	19.3%
Mid-West	24.0%
South	33.2%
North East	22.3%
Non-Contiguous	<1%

outcomes. Our second aim (Aim 2) is to test for the presence of distinct subtypes (latent classes) of individuals with different predictor profiles. We expected to find a latent subtype that was relatively low on all predictors (i.e., psychologically well-adjusted). However, we also expected that there would be other latent subtypes that range in schizotypal thinking, paranoia, alienation, and self-esteem. Our goal is to describe these different latent classes and estimate their relative proportions in the sample. We also estimate the extent to which the observed latent subtypes differ with respect to non-reductive ideation and trust in science.

METHOD

This study was conducted using a cross-sectional survey design. Participants were asked to complete the web-based survey in one sitting. Data collection was approved by the MITRE Institutional Review Board (IRB).

Participants and procedure

Members of the Qualtrics panels online opt-in panel who were 18 yrs. or older were recruited in February, 2015 ($N=792$). Participant sampling was quota based to ensure a range of demographic characteristics. Qualtrics recruited at least 25 participants in each crossing of gender (female vs male), education (high school vs college degree vs advanced degree), and race/ethnicity (white vs other). This quota sampling was done to ensure that we would have adequate numbers in each demographic group to test for gender, education, and ethnicity differences. Table 1 shows the sample characteristics.

Measures and scales

The survey comprised a series of measures, listed below. Cronbach's alpha reliability estimates are based on the present sample of participants.

Non-reductive ideation

We used two scales to measure non-reductive ideation: the 15-item General Conspiracist Ideation scale (7-point likert scale; $\alpha = .96$) of Brotherton, French, and Pickering (2013), and a 22-item (7-point likert scale; $\alpha = .94$) Revised Paranormal Belief scale (Tobacyk, 2004). This latter scale originally had 26 items. We removed the four items directly relating to traditional religiosity. Previous research has shown that this scale can be conceptualized as having distinct sub-constructs with traditional religious beliefs (e.g., the existence of the devil, or heaven and hell) being conceptually distinct from the other non-traditionally religious paranormal beliefs (Williams, 2009). We conducted a factor analysis and indeed found a separate factor with strong loadings for the four traditionally religious paranormal beliefs items. Belief in traditional religious concepts was captured in other scales asking about the importance of religion and self-report identity as Christian. Based on this, we decided to remove the traditionally religious items from the Revised Paranormal Beliefs Scale so that it would serve as a measure of generalized paranormal ideation as distinguished from endorsement of traditional Judeo-Christian religious doctrines.

Schizotypal tendencies

To measure schizotypy, we used the SPQ-B (Raine & Benishay, 1995), comprising the three scales Disorganized (6 items; $\alpha = .74$), Interpersonal (8 items; $\alpha = .79$), and Cognitive-Perceptual (8 items; $\alpha = .75$). Each item is rated as either "yes" or "no".

Alienation

To measure alienation, we used the Srole Anomie scale (Srole, 1956) with 5 items (7-point likert scale; $\alpha = .80$), and the 6-item (7-point likert scale; $\alpha = .66$) Rosenberg Faith in people scale (Rosenberg, 1957).

Paranoia

The 18-item ($\alpha = .97$) Paranoia checklist of Freeman et al. (2005) was used to assess paranoia. Each item is rated on a 1 - 5 (Do not believe it - Absolutely believe it) scale.

Beliefs about self/Self-esteem

The 12-item Core Self-Evaluations scale of Judge et al. (2003) was used to measure beliefs about self (5-point likert scale; $\alpha = .88$).

The Big Five of personality

For the Big Five, use was made of the Mini-IPIP, comprising 4-item scales for Extraversion ($\alpha = .74$), Openness ($\alpha = .66$), Neuroticism ($\alpha = .72$), Agreeableness ($\alpha = .64$), and Conscientiousness ($\alpha = .68$) (Donnellan et al., 2006). Each item was rated on a 1 - 7 likert (Very Strongly Disagree - Very Strongly Agree) scale.

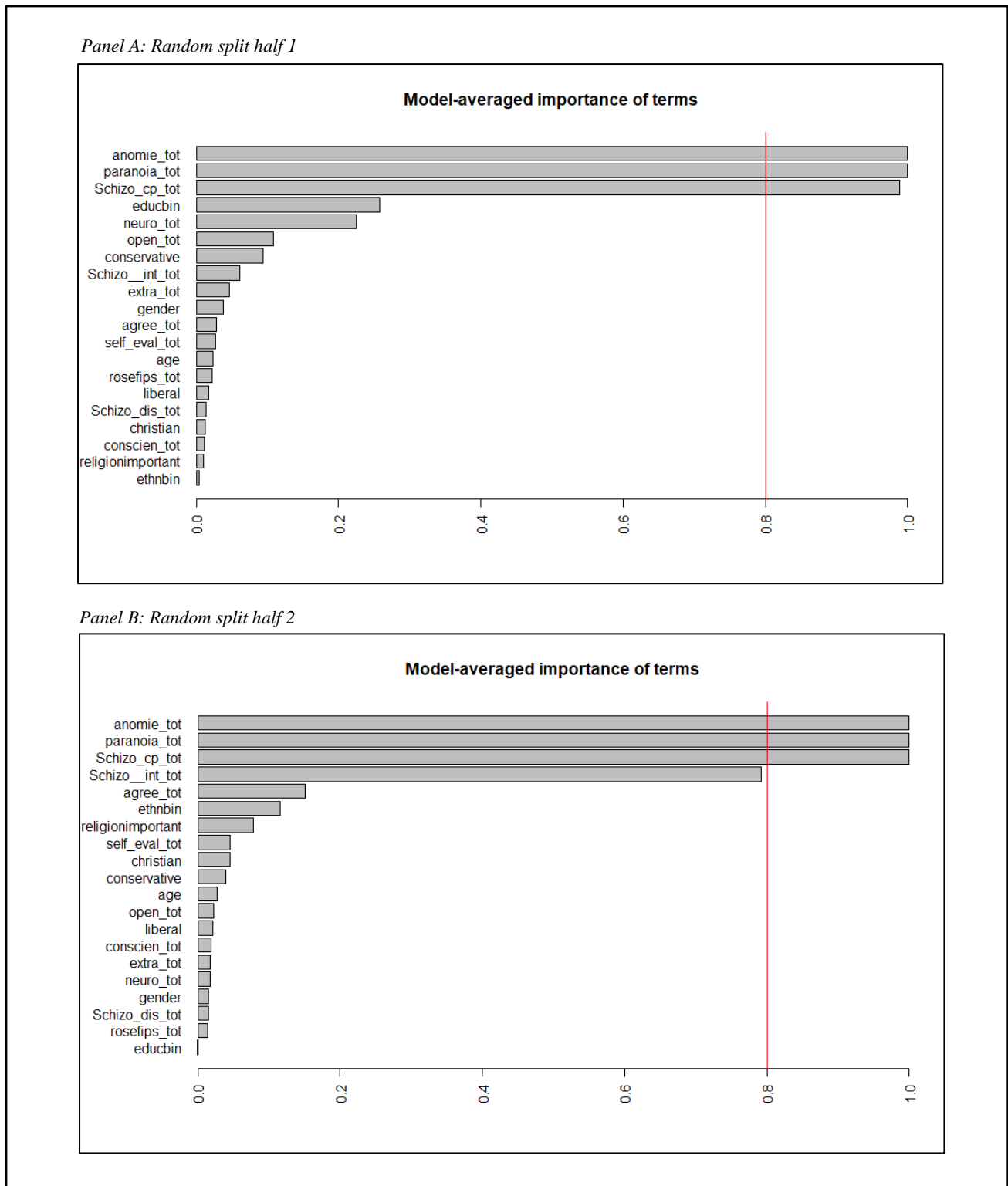


Figure 1. Model-averaged predictor weights for Conspiracist Ideation in each split data half

Science beliefs

To measure science beliefs, we used the six-item (7-point likert scale; alpha = .94) Credibility of Science Scale (CoSS; Hartman et al., 2017).

Worldviews

To measure political and religious worldview orientations,

we used 3 items from Harman et al. (2017). Participants were asked how much they identified with the following labels using a 1 – 5 (Not at All – Extremely) rating scale: Conservative, Liberal, Christian. A final item asked about “the importance of religious faith in your life”, rated on a 1 – 5 (not at all important – extremely important) scale.

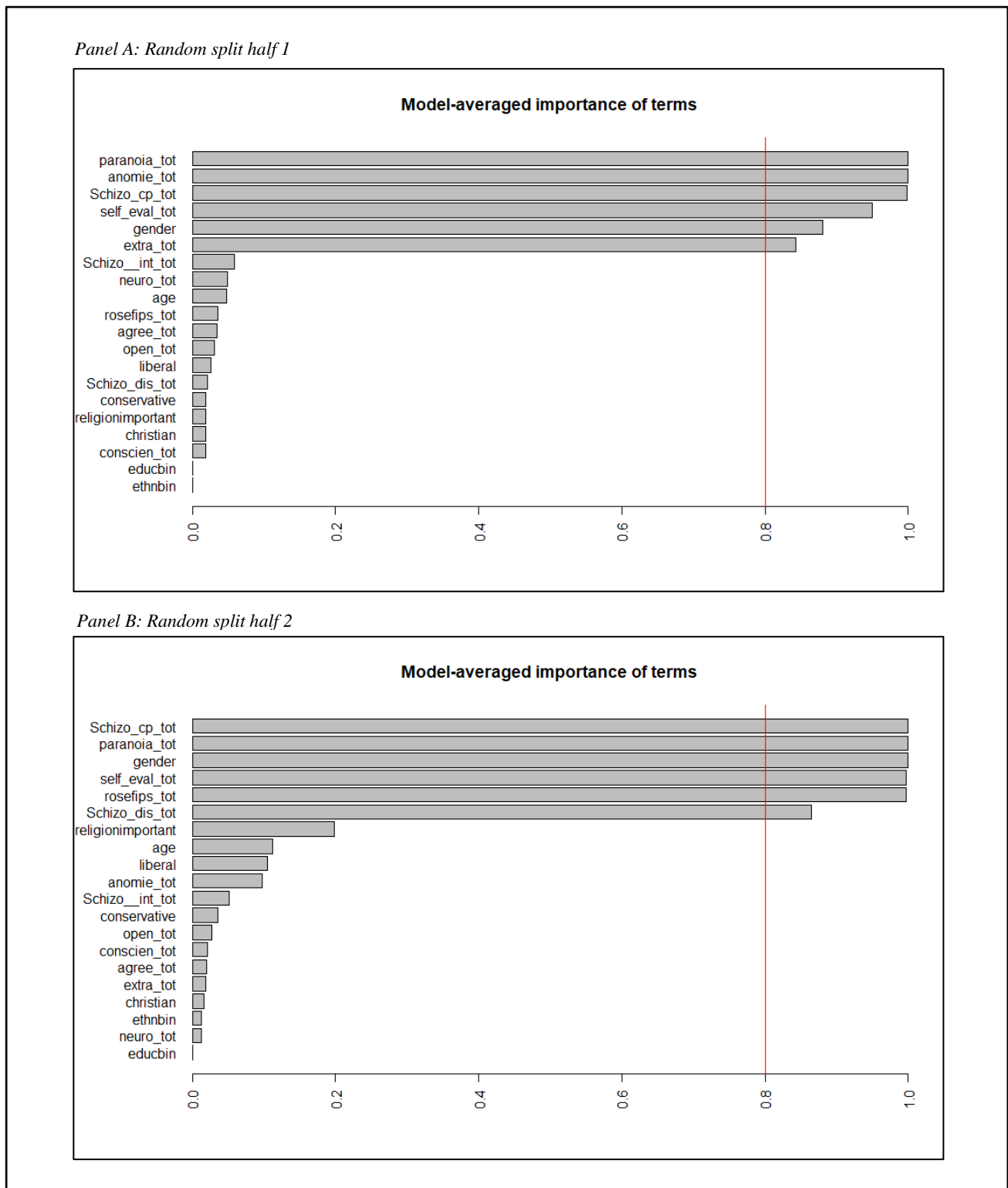


Figure 2. Model-averaged predictor weights for Paranormal Beliefs in each split data half

Analysis

We first selected two random data subsets for initial modeling (subset 1) and cross validation (subset 2) to assess reproducibility and decrease the likelihood of false discovery. To address *Aim 1*, we sought to identify the best fitting predictor model for both conspiracist ideation and paranormal

beliefs. With a large set of candidate predictors, a traditional approach might be to use forward or backward stepwise model selection. However, these approaches rely on arbitrary p-value thresholds and will not always result in the same final model depending on the stepwise approach that is used (Venables & Ripley, 1997). As an alternative, we sought a more robust, information-theoretic automated

Table 2. Fit statistics from latent class analyses

Class	AIC	BIC	SABIC	Entropy	Boot LRT test
2	21706.11	21879.07	21761.57	.82	p < .001
3	21189.88	21451.66	21273.83	.83	p < .001
4	21023.77	21374.36	21136.20	.83	p < .001
5	20854.14	21293.55	20995.05	.81	p < .001
6	No convergence				

model selection approach. We used the `glmulti` package for the R statistical computing environment (Cagano & De Mazancourt, 2010; R Development Core Team, 2019) to generate the set of all possible predictor models (i.e., a separate model with every possible combination of predictors) and used the Bayesian information criterion (BIC) to rank those models in a manner that accounts for sample size and incorporates penalties for model complexity (Raftery, 1995). In this way, we could evaluate the importance of each predictor across a range of models with different numbers of competing predictors.

Under this BIC-based automated model selection approach, the “best” model was operationally defined as the one with the smallest BIC, though in practice there often are several plausible models with similar BIC fit values. Accordingly, we used the following heuristic benchmarks to compare the best model to alternative models: BIC diff 0–2 = weak evidence; BIC diff 2–6 = positive evidence; BIC diff 6–10 = strong evidence; and BIC diff >10 = very strong evidence. Further, any alternative model within two BIC units of the best model was considered plausible. Predictor importance was assessed in a multi-model fashion by examining the importance (support) for each predictor across all possible models (Buckland et al., 1997; Cagano & De Mazancourt, 2010). Diagnostic plots for each final model were examined to confirm model adequacy. Models for each outcome were fit on both random data subsets and results were compared to judge the reproducibility of the findings on independent samples.

To address *Aim 2*, the strongest predictors of conspiracist ideation and paranormal beliefs identified above were included in a Latent Class Analysis on the full sample. The goal was to determine whether there were any participant clusters (classes) with unique predictor profiles. All latent class models were based on procedures outlined by Ram and Grimm (2009). The best fitting latent class model was chosen by Bayesian Information Criterion (BIC), convergence (entropy), and the parametric bootstrapped likelihood ratio test (LRT). The LRT assesses the difference in fit between a model with k classes and one with $k-1$ classes. After the final latent class model was selected (i.e., the number of latent classes is determined), each participant was assigned a probability of belonging to each latent class and assigned to the class with the highest probability. We then examined the mean indicator (predictor) values to describe the nature of each latent class. Finally, latent classes were compared with respect to mean levels of conspiracist ideation, paranormal beliefs, and credibility of science. All latent class modeling was conducted in Mplus (version 7).

RESULTS

Predicting generic conspiracist ideation

For the first random subset, the best predictive model of conspiracist ideation included three predictors explaining 42% of the variability: anomie (beta = .45, se = .06, $p < .001$), paranoia (beta = .30, se = .05, $p < .001$), and schizotypal-cognitive perceptual subscale (beta = .10, se = .03, $p < .001$). However, there were two other models that were within 2 BIC units that could be considered as contenders for “best”. The only other predictors included in these models were education and neuroticism. However, these variables had relatively low importance weights across all possible models (see Figure 1, panel A).

For the second random subset, the best predictive model of conspiracist ideation included four predictors explaining 48% of the variability: anomie (beta = .41, se = .05, $p < .001$), paranoia (beta = .33, se = .05, $p < .001$), schizotypal-cognitive perceptual subscale (beta = .15, se = .03, $p < .001$), schizotypal-interpersonal subscale (beta = -.02, se = .02, $p = .35$). However, there were two other models that were within 2 BIC units of this best model. The only other predictor that was included in these models was ethnicity and Schizotypal-interpersonal subscale was excluded in one model, making it equivalent to the best model found in subset 1. However, ethnicity had a relatively low overall importance weight across all models (see Figure 1, panel B).

Predicting Paranormal Beliefs

For the first random subset, the best predictive model of paranormal beliefs included six predictors that explained 38% of the variability: paranoia (beta = .20, se = .04, $p < .001$), anomie (beta = .21, se = .04, $p < .001$), schizotypal-cognitive perceptual subscale (beta = .09, se = .02, $p < .001$), core-self beliefs (beta = -.17, se = .05, $p = .002$), gender (beta = .26, se = .09, $p = .005$), and extraversion (beta = .11, se = .04, $p = .006$). There was one other model that was within 2 BIC units of the best model. This model excluded extraversion as a predictor. However, we retained this variable because extraversion had a strong importance weight across all models (see Figure 2, panel A).

For the second random subset, the best predictive model of paranormal beliefs included six predictors explaining 38% of the variance: paranoia (beta = .22, se = .04, $p < .001$), schizotypal-cognitive perceptual subscale (beta = .21, se = .03, $p < .001$), schizotypal-disorganized subscale (beta =

Table 3. Non-reductive Ideation and Science Trust by latent class ($n = 792$)

	High-Adjustment (C1; $n=192$)		Moderate-Adjustment (C2; $n=187$)		Introverted-Alienated (C3; $n=194$)		Moderately-Schizotypal (C4; $n=150$)		Paranoid-Schizotypal (C5; $n=69$)	
	M (sd)	M (sd)	Cohen's d^a	M (sd)	Cohen's d^a	M (sd)	Cohen's d^a	M (sd)	Cohen's d^a	
Conspiracist Ideation	2.68 (1.38)	3.58 (1.02)	0.74	3.57 (1.06)	0.72	4.47 (1.37)	1.30	5.00 (1.26)	1.72	
Paranormal Beliefs	2.82 (1.11)	3.34 (0.82)	0.53	3.29 (0.92)	0.46	3.88 (1.20)	0.92	4.43 (1.08)	1.46	
Mistrust science (CoSS)	3.55 (1.69)	4.03 (1.29)	0.32	4.21 (1.23)	0.45	4.22 (1.48)	0.42	4.75 (1.49)	0.73	

Note: M=Mean; a Cohen's d effect size (small=.20, medium=.50, large=.80) as compared to high-adjustment group (C1)

-.06, $se = .03$, $p=.07$), faith in people ($\beta = .24$, $se = .06$, $p<.001$), core-self beliefs ($\beta = -.20$, $se = .05$, $p<.001$), and gender ($\beta = .47$, $se = .09$, $p<.001$). There were five other models that were within 2 BIC units that could be considered as contenders for "best". These models included a mix of additional predictors including the importance of religion, age, political ideology (liberal item), and anomie. However, none of these additional predictors had a strong importance weight across all models (see Figure 2, panel B).

Latent class analysis

Several latent class models were fit using the predictors that appeared in the best fitting prediction models described above (see Figures 1 and 2). The best fitting latent class model consisted of 5 latent classes (Entropy = .81, ΔBIC versus 4 class model = -80.81, bootstrap LRT $p<.001$; see Table 2). Figure 3 shows the mean predictor values for each latent class. The first two classes account for 48% of participants, and we refer to them as high- and moderate-adjustment classes, respectively. In particular, the high-adjustment class is notably low in schizotypy, anomie, and paranoia and notably high in core self-evaluation, extraversion, and faith in people. Moderate-adjustment participants also present as relatively high functioning, but with slightly higher scores on anomie, paranoia, and schizotypal variables.

A third class, which we call introverted-alienated, accounts for 24% of participants. Relative to the high- and moderate-adjustment classes, the introverted-alienated group is characterized by much higher interpersonal schizotypy and lower extraversion. Introverted-alienated participants also are relatively high on anomie, with average anomie item ratings in the "agree" range.

We refer to the fourth and fifth classes as moderately-schizotypal and paranoid-schizotypal, respectively. Both of these groups score notably worse than the other three across a range of predictors. The moderately-schizotypal class (19% of participants), is highly mistrustful with average anomie item ratings in the "strongly agree" range, average paranoia items ratings in the "believe it somewhat" to "believe it a lot" range, and average faith in people ratings in the "disagree" range. This class is also relatively high in schizotypy agreeing, on average, to more than 50% of schizotypal-cognitive-perceptual and schizotypal-interpersonal items, but

with core-self beliefs at about the same level as moderate-adjustment and introverted-alienated classes. Finally, compared to all other classes, the paranoid-schizotypal group (9% of participants) shows the highest schizotypy, paranoia, and anomie, along with the lowest self-belief, faith in people, and extraversion. This class agrees, on average, to a majority of the schizotypal items on all subscales, rates the paranoia items in the "believe it a lot" range, "agrees" to "strongly agrees" with the anomie items, "disagrees" with the faith in people items, and rates in the "disagree" range for core-self-evaluation and extraversion.

Latent class comparisons

Table 3 shows the mean (standard deviation) for conspiracist ideation, paranormal beliefs, and credibility of science for each of the 5 latent classes. Since the classes are defined by the strongest predictors of conspiracist ideation and paranormal beliefs found in the previous analyses, we expected that the classes would show differences on these measures. However, this comparison provides a clearer picture of exactly how much of a difference in conspiracist ideation and paranormal beliefs we might expect between people with different predictor profiles. The high-adjustment class rated, on average, between "strongly disagree" and "disagree", while the moderate-adjustment and introverted-alienated classes rated between "disagree" and "neither agree nor disagree" on the conspiracist ideation and paranormal beliefs scale items. These three groups did not differ much with respect to the average number of scale items to which they rated "agree" or higher either. On average, participants rated "agree" to between 2.28 and 3.86 items on the conspiracist ideation scale (15 total items), and between 4.09 and 4.29 items on the paranormal beliefs scale (22 total items). Consistent with US polling data, a large percentage of the US population hold at least some non-reductive beliefs and we see the same pattern in these higher adjustment classes.

It is only in the latter two classes that we see, on average, ratings approaching "agree" across the conspiracist ideation and paranormal belief items. These differences in non-reductive ideation are large as compared to the high-adjustment group (see Cohen's d values in Table 3). Thus, approximately 28% of the survey participants (classes 4 and 5) would broadly "agree" to conspiracist ideation and paranor-

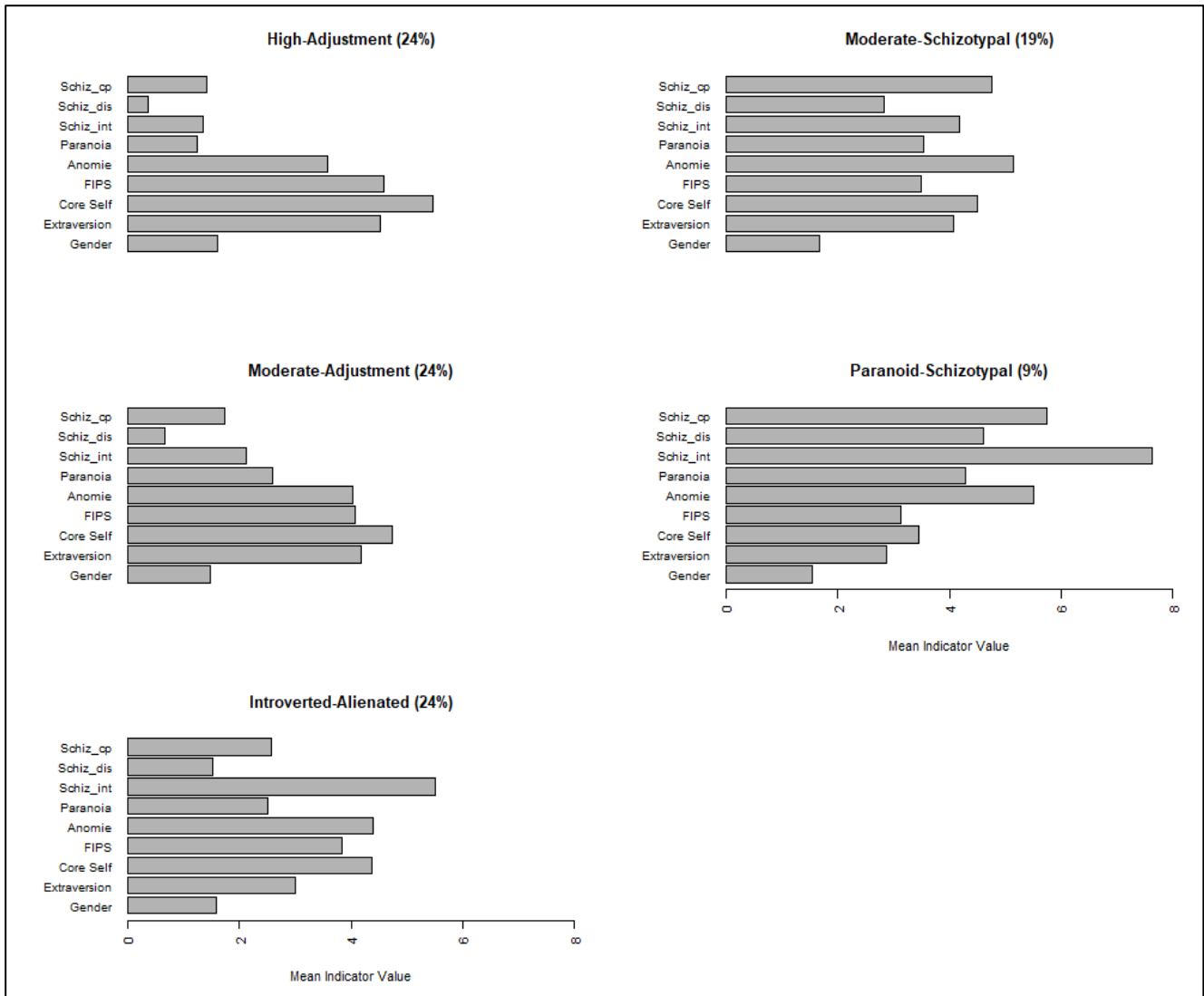


Figure 3. Mean predictor values for each latent class

mal beliefs items and this level of agreement is substantially higher than the ratings of the majority of participants in the sample. With respect to average agreement with individual scale items, participants rated “agree” or higher to 7.73 and 9.59 items on the conspiracist ideation scale (15 total items), and 8.19 and 10.60 items on the paranormal beliefs scale (22 total items), on average, in classes 4 and 5, respectively. With respect to science beliefs, we see the expected increases in science mistrust as we move from the higher-adjustment to the more schizotypal classes. However, only in the most extreme schizotypal-paranoid class do we see average ratings approaching “agree” for the general credibility (mistrust) scale.

DISCUSSION

Our results from *Aim 1* add to previous literature exploring key drivers of non-reductive ideation. We find an overlapping set of primary predictors for both conspiracist ideation and paranormal beliefs, supporting the notion that these two

non-reductive belief systems have shared roots. Specifically, schizotypal and neurotic-alienated-vulnerable traits were the strongest predictors of both forms of non-reductive ideation that we tested. For generic conspiracist ideation, the strongest predictors were very clearly schizotypal tendencies, paranoia, and anomie. For paranormal beliefs, these same three predictors consistently appeared in the best models although there was a slightly wider set of key drivers, including self-esteem and personality traits related to positive affect (extraversion), as well as a gender effect such that women are more likely to hold paranormal beliefs holding other variables constant.

Notably, after controlling for these core schizotypal and neurotic traits, we find little evidence that non-reductive ideation is driven by sociopolitical identity factors, such as demographic variables, religiosity, or political ideology. This is inconsistent with some previous studies that have found stable relations between non-reductive ideation and ethnicity, age, religiosity, other personality variables, and political ideology. We speculate that these findings would likely have been attenuated or disappeared when competing

against a broader set of more fundamental predictors. It is possible, however, that our relatively simple measures of religiosity and political orientation did not give these variables a fighting chance in our predictive models. For instance, more nuanced worldview variables such as those from Cultural Cognition Theory may have had more of an impact (Douglas & Wildavsky, 1982). It is also important to note that we examine non-reductive ideation with generic conspiracist ideation and paranormal beliefs in this paper and not belief in specific conspiracy theories that might be more strongly related to sociopolitical identity (e.g., that fraudulent voting was the deciding factor in the 2020 US presidential election). Several recent papers have suggested that there can be different sets of predictors for belief in specific conspiracy theories as compared to the more general tendency toward a non-reductive attributional style (Hartman et al., 2021; Imhoff et al., 2022).

There are also several variables found in previous research that we did not include, such as analytic thinking, need to explain events, tendency to see agency when it is not present, and need for cognition. The inclusion of these variables may have changed our results, particularly because many of these variables may act as mediators. For example, schizotypy and paranoia may lead one to see agency when it does not exist, which in turn then leads to more non-reductive beliefs. Separating fundamental predictors, mediators and outcomes is another important task for future research.

For *Aim 2* we used latent class analysis to uncover underlying subtypes of individuals with similar non-reductive ideation predictor profiles. These analyses revealed 5 classes, or subtypes, of individuals who were primarily distinguished by tendencies toward schizotypal and paranoid ideation, alienated skepticism toward people and society in the abstract, and a negative sense of self. It was only the two most extreme classes (28% of the sample) that showed strong non-reductive ideation (i.e., high average scores on conspiracist ideation and paranormal beliefs). In addition, it is only the most extreme schizotypal-paranoid class that showed strong anti-science beliefs, although the general monotonic pattern of more mistrust in science being related to less well-adjusted psychological profiles was apparent. These results suggest that holding some non-reductive beliefs is common, even in the most highly adjusted classes, but it is a relatively small subgroup of individuals (~1 in 10) who have psychological profiles conducive to more extreme non-reductive ideation and anti-science beliefs.

There may be some error in these estimates of the proportions of the US population in these different latent classes, since our sample was not a true nationally representative probability sample. Nevertheless, through our quota sampling approach, we were able to construct a large and highly diverse sample with respect to educational attainment, race/ethnicity, and U.S. geographic region. Notably, this sample was more highly educated than the general population and, if anything, may *under*-represent individuals with extreme psychological profiles due to such participants being less likely to be part of an online survey panel (e.g., individuals with high levels of paranoia probably do not trust or participate in online surveys). Thus, our estimate that 9% of the population falls into the most extreme paranoid-schizotypal subclass might be an underestimate.

These results are also broadly consistent with the notion that non-reductive ideation is in some sense opposed to a more naturalistic-reductive worldview characterized by scientific thinking. This is not to say that a non-reductive attributional style is necessarily “bad” since it has been the dominant view of reality worldwide throughout human history and one that continues to command considerable allegiance today (see, e.g., Goode, 2011; Hood, Hill, & Spilka, 2018). In this sample, we do see the expected relations between non-reductive ideation and more mistrust of science, but these effects are not large. This is likely because non-reductive ideation is not necessarily the only, or even the biggest, predictor of science mistrust. Much research has shown that sociocultural identity factors, both political and religious, are strongly related to general mistrust and specific science beliefs (Hartman et al., 2017). Our goal here was not to find the strongest predictors of science mistrust but to further characterize the observed latent classes with respect to science belief.

Our methods and results also suggest some directions for future research. First, given the relatively large set of inter-related predictors that are often of interest in this and similar domains, we see automated model selection methods as a beneficial tool for keying in on the most robust predictors without falling into the inferential pitfalls of earlier approaches (e.g., stepwise regression). Cross-validation (or replication) of modeling results is another critical model refinement tool, particularly in cross-sectional research like ours. For example, although we found generally consistent predictor importance weights in the cross-validation subsets, there were individual variables that appeared important in only a single random subset (e.g., extraversion as a predictor of paranormal beliefs). Cross-validation allowed us to distinguish these anomalies from the more robust trends. This work also demonstrates the usefulness of latent class analysis as a means of theory-refinement that moves us beyond simple bivariate statements of the “predictor X relates to outcome Y” variety (see Denovan, et al. 2018 as well). To that end, we welcome replication and expansion of the work we report in this paper. For instance, these latent classes could be further validated by examining criterion variables such as perceptions of COVID-19 risk, protective behaviors, and vaccination. Further refinement of this typology and/or further exploration of mediating pathways could help in the design of messaging to open constructive dialogue about important societal issues that affect us all.

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Conflict of interest statement

The authors have no conflicts of interest to report.

Data availability statement

The analysis plan for this study was not preregistered. All data reported in this article are publicly available on the Open Science Framework: https://osf.io/9ybvvn/?view_only=b5ad11f1e56b4b2b84e4484e15b07fad

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