The Political Consequences of Personality Biases in Online Panel Surveys

Nicholas A. Valentino

Kirill Zhirkov

University of Michigan

D. Sunshine Hillygus

Brian Guay

Duke University

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Abstract

Online surveys, particularly those that draw samples from online panels of experienced respondents, now comprise a large segment of the academic and commercial opinion research markets due to their low cost and flexibility. A growing literature examines the implications of online surveys for data quality, most commonly by comparing demographic and political characteristics of different samples. In this paper, we explore the possibility that personality may differentially influence the likelihood of participation in online and face-to-face surveys. We argue that those high in extraversion and openness to experience will be underrepresented in online panels given the solitary nature of repeated survey-taking. Since openness to experience in particular is associated with liberal policy positions, differences in this trait in online panels may bias estimates of public opinion. Using data from the 2012 and 2016 dual-mode American National Election Studies, we compare political preferences and personality across parallel face-to-face and online samples. Respondents in the online samples were, on average, less open to experience and more politically conservative on a variety of issues compared to their face-to-face counterparts. This was true especially in 2012, when online respondents were drawn from a large panel of experienced survey takers. Our analysis further shows that openness is negatively related to the number of surveys completed by panelists. These results suggest that reliance on professionalized survey respondents, who comprise the vast majority of online survey samples, can bias estimates of many quantities of interest to social scientists.

Survey research has moved online. Global internet access and the ubiquity of mobile devices, coupled with declining survey response rates and increasing costs, has led to the rapid emergence of online surveys. Dozens of commercial market research firms now specialize in measuring public opinion measurement over the internet, and academic research increasingly relies on survey responses from online samples. An estimated $2 billion was spent on online panel surveys in 2009 (Baker et al. 2010), and that number has surely grown since. The shift online has been so recent, and so precipitous, that a great deal of uncertainty remains about sample quality and response biases in online surveys. This uncertainty is further exacerbated by heterogeneity in online survey techniques, both in how samples are drawn and how questionnaires are delivered (for review, see Hillygus and Guay 2018). Nonetheless, even major infrastructure surveys have moved online; for example, the American National Election Study has run parallel samples online and face-to-face since 2012.[1]

A rich literature is emerging on the differences between online surveys and those conducted via other modes (e.g., mail, phone, and face-to-face). Results have been mixed, with some suggesting online surveys, especially ones based on probability samples, are comparable (Ansolabehere and Schaffner 2014; Chang and Krosnick 2009; Yeager et al. 2011), while others find fairly significant differences (Callegaro et al. 2014; De Leeuw and Berzelak 2016). Yet some consistent patterns have emerged. Answering questions online seems to reduce social desirability biases triggered by direct interactions with human interviewers, either in person or over the phone (Atkeson, Adams, and Alvarez 2014; Gooch and Vavreck 2016). On the other hand, online surveys also tend to yield lower response quality, primarily due to satisficing: respondents take surveys less seriously when there is no interviewer to prompt, probe, and follow

[1] The American Community Survey (ACS) is another example of a major survey that has moved online.

up (Heerwegh and Loosveldt 2008). Furthermore, and of particular concern for political surveys, even probability-based online panels may overrepresent politically engaged respondents (Karp and Luehiste 2015). While this literature has largely focused on the demographic characteristics of online samples, other characteristics that may vary across survey modes have received far less attention.[2]

Among the potential non-demographic characteristics of relevance are personality traits, which could have consequences for estimates of political attitudes. Decades of research have established that personality---in particular, the Big Five traits of openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism---can predict a range of attitudes and behaviors. While previous work has shown a link between personality and survey response (e.g., Rogelberg et al. 2003), we consider the possibility that personality-driven forces linked to social interaction, namely openness to experience and extraversion, might lead to differences in cooperation with requests for interviews.

Survey nonresponse has obvious implications for multiple aspects of data quality and representativeness (Groves 2006), and scholars have already learned a lot about the individual, contextual, and design factors that shape the decision to cooperate with a survey request in general (Brick and Williams 2013). For example, women cooperate with higher rates than men (Groves, Calidini, and Couper 1992), and those involved in the community are more likely to accept interview requests of any kind---likely due to perception of survey research as a public good (Groves, Singer, and Corning 2000). Only recently, however, have researchers begun investigating individual differences that may drive participation in one survey mode over another. One study, for example, finds variation in preference for telephone over web surveys

[2] And, by extension, there are debates about the extent to which any differences between the composition of online samples and the general population can be corrected through benchmarking to known population estimates.

along demographic lines, so that allowing everyone to participate in their preferred mode increases compliance (Olson, Smyth, and Wood 2012).

We suspect personality might at least partially undergird the initial decision to participate in a survey, based on the mode in which it is offered. In social and organizational psychology, personality is associated with distinct tastes for social vs. solitary activities (Larson, Rottinghaus, and Borgen 2002). By design, the social nature of the interview process varies by mode (e.g., Frankel and Hillygus 2014). Respondents in face-to-face surveys engage in a detailed conversation with a stranger about everything from the details of their financial circumstances to views on sensitive political issues, while respondents in online surveys answer these questions alone. As such, participation in online surveys may be less attractive to more open and extraverted individuals. This is likely to be especially true for members of online panels, who often participate in dozens or even hundreds of surveys each in return for small amounts of compensation (Hillygus, Jackson, and Young 2014). Critically, one of the Big Five personality traits---openness to experience---has been shown to co-vary with political preferences (Mondak and Halperin 2008), creating the potential for biased estimates in these very popular surveys.

Using data from the 2012 and 2016 American National Election Studies, each of which contained parallel online and face-to-face surveys, we examine how personality traits and political preferences differ across online and face-to-face surveys. These data allow us to make comparisons across two different online samples: one drawn from a probability-based online panel (2012 ANES) and another drawn from a freshly recruited probability cross-section using address-based sampling (2016 ANES). We find as predicted that mean levels of openness to experience and extraversion are higher in the online samples than in the face-to-face surveys. These differences were especially pronounced in 2012, when the online survey was conducted

using a panel survey containing experienced survey respondents. These personality differences corresponded with significant variation in policy preferences, suggesting that samples drawn from online panels may bias estimates political scientists care about. The high cost of recruiting a fresh sample of online respondents, which significantly reduces the bias, means online surveys using experienced respondents are likely here to stay. We therefore think these findings are important for survey researchers to consider as they make inferences with these samples.

Personality, Unit Non-Response, and Survey Mode

Personality is understood as a cluster of relatively stable behavioral, cognitive, and emotional patterns within the individual (Cloninger 2009). Currently, the five-factor model of personality traits, commonly known as the Big Five, represents the dominant paradigm in personality psychology (Digman 1990; McCrae 2009). The Big Five model breaks down personality into five dimensions: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. Table 1 presents short descriptions of the Big Five traits based on a recent version of the revised NEO personality inventory (McCrae, Costa, and Martin 2005).

Table 1. Big Five traits with short descriptions

Trait	Description
Openness to experience	Seeks out new, unconventional, and unfamiliar experiences
Conscientiousness	Prefers order; Values duty and self-discipline; Strives for competence and achievement
Extraversion	Friendly, gregarious, and assertive; Experiences excitement and positive emotions from social activity
Agreeableness	Trusting, straightforward, altruistic, modest, and tender-minded
Neuroticism	Prone to anxiety, anger, and depression; Impulsive and vulnerable

A small literature has examined the relationship between personality and survey participation. Although some research finds no differences in any of the Big Five personality dimensions between survey respondents and non-respondents (e.g., Johnson and Mowrer 2000),

others have found that personality dimensions matter in a variety of ways. For example, unit nonresponse is higher among those low in conscientiousness and high in openness to experience (Cheng, Zamarro, and Orriens 2018).[3] Specifically in relation to online surveys, extraversion and agreeableness are correlated with joining an online panel, while openness to experience and agreeableness are associated with participation in individual survey participation (Brueggen and Dholakia 2010). Item nonresponse, in turn, is greatest among those high in neuroticism, perhaps as a result of sensitivity to making mistakes on challenging questions (Klingler, Hollibaugh, and Ramey 2018). Personality also seems to be related to survey response styles: specifically, openness to experience and conscientiousness increase the proportion of extreme responses and acquiescence bias (Hibbing et al. 2019). Ours is the first paper to explore whether personality traits may *differentially* influence differences in unit non-response from one survey platform to another.

Our analyses focus on the Big Five traits of extraversion and openness to experience---the tendency to embrace new ideas, embrace flexible thinking, and engage in imagination (Goldberg 1990; McCrae and John 1992). Openness is especially important, since we expect it to simultaneously shape survey mode participation and political preferences. Openness to experience is known to be associated with preferences for social interactions: those high in openness are more likely to find artistic, investigative, and socially engaging occupations more attractive (Armstrong and Anthoney 2009; De Fruyt and Mervielde 1997). The impact of openness on preferences for social activities may be comparable to, if not larger than, that of extraversion, which is commonly associated with sociability (McKay and Tokar 2012). In other

[3] On the other hand, greater cooperation among those with higher levels of openness has been found (Dollinger and Leong 1993).

words, those high in openness gravitate toward diverse, interactive, and cognitively demanding tasks rather than routinized activities performed in solitude.

Openness should therefore affect participation based on the social qualities of a given mode: answering questions alone in front of a computer screen should be more attractive to those lower in openness to experience and extroversion. Therefore, we suspect that openness to experience may be negatively associated with completing surveys online---especially in online panels where respondents are expected to engage in these tasks repeatedly. Open and extraverted respondents are likely to have competing opportunities for their time, and are generally less attracted to solitary and socially isolated activities like taking surveys online, so they might quickly tire of that work, even though they are roughly equally likely to agree to join a panel since that is a "new experience."

Importantly for political surveys, openness to experience is also associated with political preferences. Americans high in openness tend to hold more liberal views on a variety of issues (Gerber et al. 2010). This association has also been found in England, Italy, and Germany: those higher in openness tend to prefer center-left parties and policies (Aidt and Rauh 2018; Caprara, Barbaranelli, and Zimbardo 1999; Schoen and Schumann 2007). If participation in face-to-face and online surveys differs by openness to experience, therefore, estimates of political preferences may also be biased.

This feature of openness to experience---its potential to impact *both* survey participation differently by mode and political preferences---is key to our theoretical expectations in this paper. Other personality traits do not seem to be linked to both variables simultaneously. For example, extraversion impacts social tastes and therefore might differentially influence survey participation face-to-face versus online. However, extraversion is largely politically

inconsequential (Mondak and Halperin 2008), such that differences in this trait across survey mode but should not bias estimates of public opinion. Conscientiousness, in turn, is related to politics but not to social tastes (McKay and Tokar 2012), so while it may influence survey participation, we would not expect it to differentially influence the measurement of policy preferences. Finally, we would predict that agreeableness and neuroticism are not strongly associated with either survey mode preference or political views.[4] We will, of course, test all these assumptions in the following analyses.

In summary, we expect that those high in openness should be less likely to participate in online surveys, especially in online panels that contain respondents who take many surveys. Since personality traits are not explicitly accounted for in standard survey weights, differences in openness to experience between face-to-face and online samples could substantially bias public opinion estimates.

The above logic has two observable implications. First, respondents in online and face-to-face modes should exhibit mean differences in personality traits, with online samples scoring lower on openness to experience and extraversion on average. Second, respondents in the two samples should display dissimilar political preferences on average, with those online being more conservative on a variety of issues.

Data and Measures

The 2012 and 2016 American National Election Studies (ANES) provide a unique opportunity to explore the above conjectures. Unlike previous studies, the 2012 and 2016 ANES were comprised of parallel samples---face-to-face and online---designed to be independently

[4] Note that when we invoke the concept of "mode" it is only to indicate the type of interview platform, not the effect of that platform on individual question asking or answering. While understanding mode effects at the item level is vital, our focus here is on the ways personality influences unit non-response across mode.

representative of the national electorate. For in-person interviews in both 2012 and 2016, the ANES sampled U.S. citizens aged 18 or older living in the 48 contiguous U.S. states or the District of Columbia using a multi-stage, stratified cluster method.

Sampling for the online component differed between 2012 and 2016 in an important way. In 2012, the online sample was drawn from KnowledgePanel, a large pool of regular survey participants maintained by GfK. The KnowledgePanel is recruited via a probability-based random digit dialing and address-based method to build a representative pool of American adults with and without prior internet access. Those without internet access are provided with a computer and free connectivity, while those who are already connected receive small cash payments for participation in surveys. Random samples are then drawn from the panel for each study. In total, 2,054 respondents completed pre-election face-to-face interviews while 3,860 completed the pre-election online survey in 2012. The pre-election wave was administered between September 8 and November 6, 2012, and the post-election wave between November 7, 2012, and January 24, 2013. The response rate (AAPOR RR1) was 38% for the face-to-face component and 2% for the online component.[5] The re-interview rate on the post-election survey in 2012 was 94% for the face-to-face component and 93% for the online component.

In 2016, the online component of the ANES was conducted by Westat Inc. They recruited a fresh representative sample of the U.S. adult population randomly drawn from the U.S. Postal Service's computerized delivery sequence file, which included residential addresses from each of the 50 states and the District of Columbia. Those without internet at home or on a mobile device were encouraged to locate a public library or other location with free access, and a phone number

[5] A detailed description of GfK's sampling methodology can be found here: https://www.gfk.com/fileadmin/user_upload/dyna_content/US/documents/KnowledgePanel_Methodology.pdf

was provided to offer assistance in locating free access.[6] The pre-election sample size in 2016 was 1,181 respondents in the face-to-face sample and 3,090 respondents in the online sample. The pre-election wave was collected between September 7 and November 7, 2016, and the post-election wave administered between November 9 and January 8, 2017. The response rate (AAPOR RR1) was 50% for the face-to-face component and 44% for the online component. The re-interview rate on the post-election survey in 2016 was 90% for the face-to-face component and 84% for the online component.

In both 2012 and 2016, the ANES included the ten-item personality inventory (TIPI; Gosling, Rentfrow, and Swann 2003). The TIPI consists of pairs of items tapping respondents' assessment of their own traits. The battery begins with the following preamble: "We're interested in how you see yourself. Please mark how well the following pair of words describes you, even if one word describes you better than the other." Respondents are then presented with pairs of words (e.g., "extraverted, enthusiastic"), and are asked to choose how well that pair describes them using a 7-point scale from "extremely poorly" to "extremely well." Each item in a pair taps related qualities and there are 2 pairs for each trait (for instance, "critical, quarrelsome" vs. "sympathetic, warm" for agreeableness), which are then used to build the Big Five: openness to experience, conscientiousness, extraversion, agreeableness, and emotional stability.[7] The TIPI has been compared to a more comprehensive 50-item battery, and the shorter scale corresponds closely in terms of both internal reliability and construct validity (Ehrhart et al. 2009). All pairs of the TIPI are presented in Table 2. For the analysis, we calculated mean scores for each trait, preserving the original 7-point scale.

[6] We did not find significant differences in any of the Big Five personality traits between those with and without internet at home among online respondents in 2016 ANES. See Table A1 in the Appendix for the comparisons.
[7] Emotional stability is the neuroticism trait from Table 1 with reversed polarity.

Table 2. Big Five traits with corresponding TIPI qualities

Trait	TIPI qualities	Coding
Openness to experience	Open to new experiences, complex	Original
	Conventional, uncreative	Reversed
Conscientiousness	Dependable, self-disciplined	Original
	Disorganized, careless	Reversed
Extraversion	Extraverted, enthusiastic	Original
	Reserved, quiet	Reversed
Agreeableness	Critical, quarrelsome	Reversed
	Sympathetic, warm	Original
Emotional stability	Anxious, easily upset	Reversed
	Calm, emotionally stable	Original

The TIPI scale is affectively balanced, containing positively and negatively keyed items for each trait. This balance of positive and negative words (e.g., "dependable" vs. "disorganized" for conscientiousness) helps to address acquiescence bias. There are also reasons why another important type of response bias, social desirability, should not dramatically affect reported personality scores in the face-to-face sample. First, validation studies find respondent self-evaluations and observer ratings of personality tend to converge, suggesting that most respondents are sincere on these items (Rohrer et al. 2018). Second, social desirability bias does not negatively affect the relationships between personality self-assessments and some social and organizational outcomes, such as job performance (Ones, Viswesvaran, and Reiss 1996). Finally, the TIPI battery in the face-to-face module was administered using a computer assisted self-interviewing (CASI) system, rendering the measures comparable to the online mode. In sum, the effect of social desirability on the personality trait ratings across the two modes should be negligible compared to personality-driven unit non-response biases. Therefore, the analyses and interpretations to follow are based on the assumption that personality is measured equivalently across the two modes, i.e. online and face-to-face measures of personality are not differentially impacted by measurement error.

To measure political predispositions and policy preferences, we used a wide array of questions available on the ANES. These include partisanship, liberal-conservative ideology, issue self-placements, and several composite indices tapping broader political orientations. To make sure that our comparisons were as broad as possible, we evaluated all issue preference questions that were included in both 2012 and 2016 in similar formats (see Table A2 in Appendix for the list of variables and the corresponding names from the ANES datasets/codebooks). We normalized all variables to the same range, from 0 to 10 with higher scores corresponding to more conservative views, in order to obtain comparable estimates.

Our empirical analysis proceeds in three steps. First, we use simple bivariate comparisons to test whether respondents in the online versus face-to-face samples hold distinct personality traits and political preferences in each year. Second, we use multivariate regression to evaluate the potential for personality to explain differences in policy preferences between modes. Finally, since we discover a significant difference in the effect of mode across the 2012 and 2016 ANES, we investigate its potential sources.

Results

Bivariate Comparisons

We begin by comparing mean levels of the Big Five personality traits in the face-to-face and online components of the 2012 and 2016 ANES. Figure 1 presents bivariate estimates corrected for the survey design (using sampling weights and stratification).[8] Negative coefficients indicate that the online sample returns lower mean levels of a particular trait compared to the face-to-face sample. In 2012, respondents interviewed online were significantly less open to experience and extraverted than those in the face-to-face sample. The differences are about 0.4 on the 7-point

[8] Differences between samples are substantially unchanged when analyzing unweighted data. See Figures A1 and A2 in Appendix for the results.

scale, which is slightly less than half of a standard deviation on each trait. Differences between the two samples in conscientiousness, agreeableness, and emotional stability are smaller and statistically insignificant. Differences across all traits are much smaller in the 2016 survey, but once again the face-to-face sample scored significantly higher on openness to experience compared to online respondents.

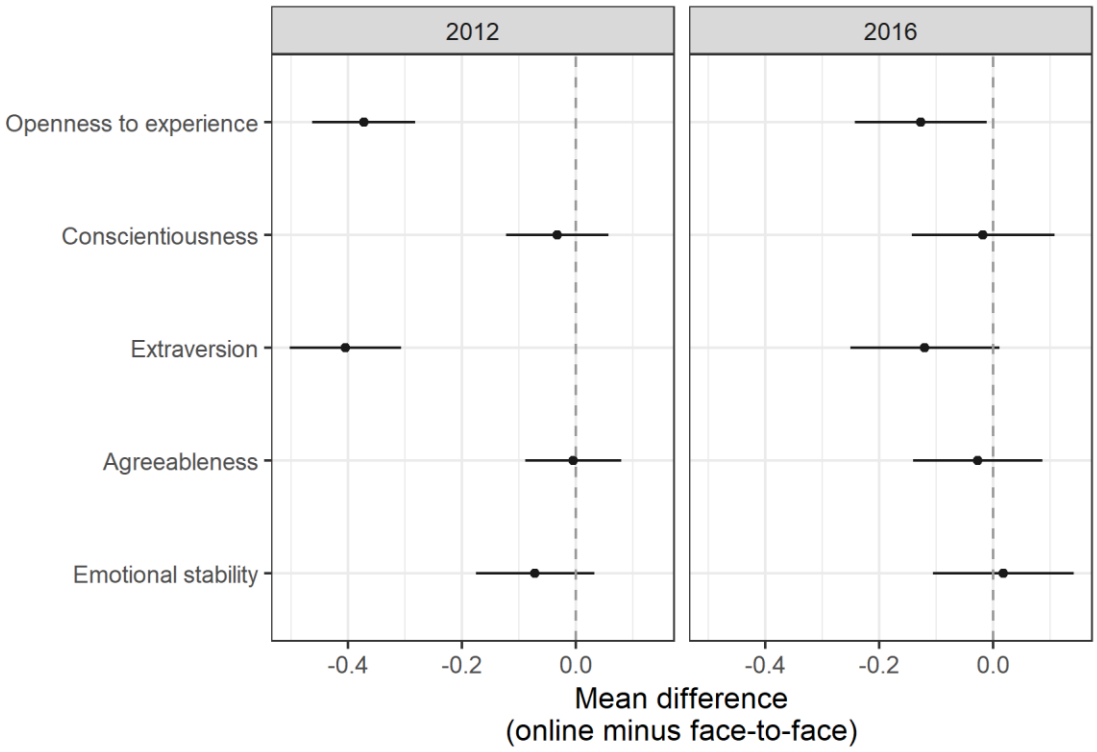

Figure 1. Mode comparisons: personality traits (point estimates and 95% confidence intervals)
Note: Results adjusted for sampling weights and stratification. For mean values by year and sample type, see Appendix Table A3

Next, we examine differences in political preferences between face-to-face and online samples in 2012 and 2016. Results are presented in Figure 2. Again, we subtract the adjusted mean for each variable in the online sample from that in the face-to-face sample, such that positive differences indicate more conservative preferences in the online sample. The results indicate that the 2012 samples are distinct on a host of dimensions, including attitudes about

government services, defense spending, health insurance, aid to blacks, environmental regulation, federal spending, gay rights, sexism, and egalitarianism. Except for spending on defense, all these differences are in the direction predicted by our hypotheses about personality and unit non-response: the online sample, on average, expresses more conservative views, sometimes substantially so. In the 2016 study only differences in preferences for government services and federal spending are statistically significant. In summary, we find that the two samples report substantially different ideological preferences in 2012, whereas in 2016 these differences are much less pronounced. We will analyze these different patterns in more detail later in the paper, but recall that our expectation was for professionalized online samples to exhibit larger biases linked to openness and extraversion, and the pattern is consistent with that expectation.

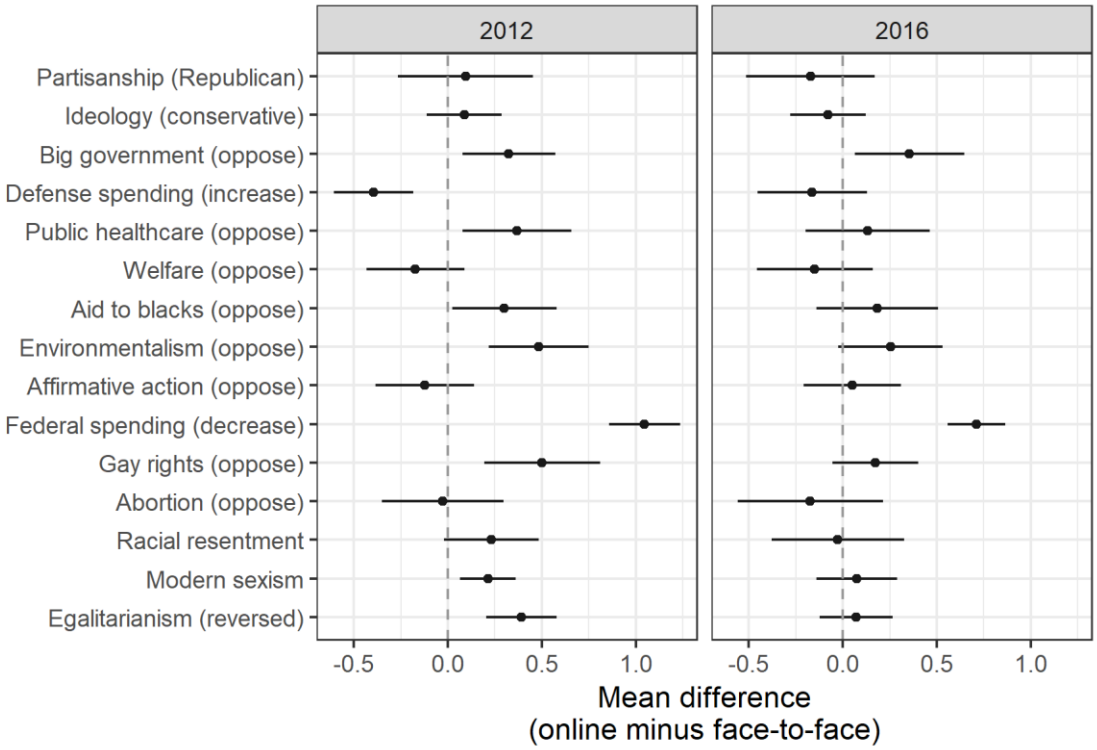

Figure 2. Mode comparisons: political preferences (point estimates and 95% confidence intervals)

Note: Results adjusted for sampling weights and stratification. For mean values by year and mode, see Appendix Table A4

Multivariate Model

Next, we test an integrated multivariate model assuming that survey mode participation (online vs. face-to-face) partially mediates the effect of personality on political preferences. We simultaneously estimate the effects of (a) personality traits on political preferences, (b) personality on survey mode participation, and (c) survey mode participation on political preferences, all controlling for standard sociodemographic variables. In this model, we examine the five political issues and broader orientations that are highly distinct across the face-to-face and online samples in the 2012 data: environmentalism, federal spending, gay rights, modern sexism, and egalitarianism. Our logic in focusing on these specific dependent variables is that they provide a critical test: if there is no difference by mode in political preferences, there is no reason to explore whether mode mediates the effects of personality on preferences. Estimating the effects of interest in a multivariate model allows us to control for the fact that political preferences are not independent: for instance, support for LGBT rights and opposition to sexism are likely positively correlated.

We estimate two identical models using 2012 and 2016 ANES data. Results are presented in Table 3. Cell entries are estimated direct effects of (a) openness to experience on political preferences, (b) openness on mode participation, and (c) mode participation on political preferences. In the 2012 data, openness to experience strongly and significantly predicts both survey mode participation and liberal political preferences. In agreement with bivariate results reported above, open individuals are less likely to appear in the online sample and express greater support for environmental regulation, government spending, gay rights, gender equality,

and egalitarian principles.[9] Survey mode also predicts political preferences, with online respondents consistently more conservative. Altogether, in 2012 openness to experience has both a direct and an indirect effect on political preferences via differential propensities to participate in each mode.

Table 3. Multivariate analysis of openness to experience, survey mode participation, and political preferences

	2012	2016
Openness →		
Environmentalism (oppose)	-0.37***	-0.54***
	(0.06)	(0.06)
Federal spending (decrease)	-0.26***	-0.21***
	(0.04)	(0.03)
Gay rights (oppose)	-0.40***	-0.19***
	(0.07)	(0.05)
Modern sexism	-0.22***	-0.34***
	(0.03)	(0.04)
Egalitarianism (reversed)	-0.28***	-0.43***
	(0.04)	(0.04)
Openness → Mode participation (online)	-0.26***	-0.07
	(0.04)	(0.05)
Mode participation (online) →		
Environmentalism (oppose)	0.38**	0.13
	(0.06)	(0.11)
Federal spending (decrease)	0.92***	0.66***
	(0.09)	(0.08)
Gay rights (oppose)	0.45**	0.17
	(0.16)	(0.10)
Modern sexism	0.19**	0.04
	(0.07)	(0.09)
Egalitarianism (reversed)	0.33**	-0.01
	(0.09)	(0.09)

Note: Control variables (not presented for space considerations): extraversion, agreeableness, conscientiousness, emotional stability, age, gender, race/ethnicity, education, income, home ownership, marital status. Results adjusted for sampling weights and stratification. For the full set of estimates, see Appendix Table A5

* $p < .05$, ** $p < .01$, *** $p < .001$

[9] Extraversion, in turn, is unrelated to all political outcomes included in the multivariate analysis---in agreement with existing literature and our theoretical expectations (see Table A5 in Appendix).

In 2016, personality is not significantly related to survey mode participation, and the differences in political preferences across modes are also sharply reduced. Both the effect of openness to experience on the probability to appear in the online survey mode and the effect of mode on issue positions and ideological orientations dramatically decrease in magnitude compared to 2012. At the same time, the direct effects of openness to experience on political preferences remain large and statistically significant in both samples in 2016.

Figure 3 presents the estimated probabilities of participation in the online mode (vs. the face-to-face mode) across values of openness to experience, which is presented in its original scale from 1 to 7. In 2012, the slope is sharply negative: the chance of appearing in the online mode is 30 percentage points lower for those at the highest compared to the lowest levels of openness. Ceteris paribus, the least open individuals had an almost 85% chance of appearing in the online sample whereas for the most open individuals the corresponding probability was about 55% (compared to a mean value of about 65%, since that is the online share of all completed interviews in 2012). When interpreting these findings, it is necessary to remember that the distribution of openness to experience is skewed: very few people place themselves at the lowest point on the scale. In 2016, the relationship between openness to experience and survey mode, though in the same direction, is much smaller in magnitude and does not reach statistical significance.

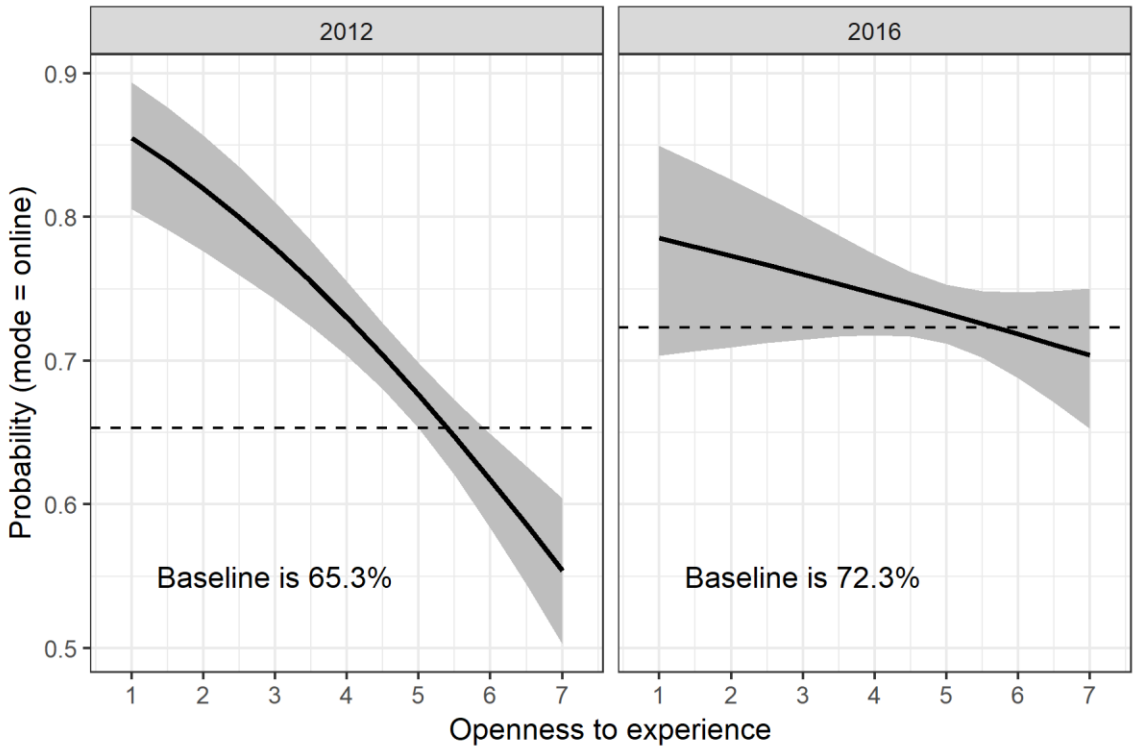

Figure 3. Openness to experience and likelihood of participating in the online mode
Note: Estimates based on multiple logistic regressions. Results adjusted for sampling weights and stratification. For full results, see Appendix Table A6. Dashed lines are the mean shares of all respondents participating online

Changes from 2012 to 2016

Why are personality differences across the two samples so pronounced in the 2012 ANES, only to largely disappear in 2016? We suspect the changes implemented in the sampling strategies for online and face-to-face surveys in the 2016 ANES explain the difference. In the face-to-face sample, a substantial effort has been made to improve the response rate over 2012. In 2012, the response rate in the face-to-face mode was just 38%, whereas in 2016 it increased to 50%. This might have increased recruitment of less open individuals in the face-to-face study.

The recruitment strategy for online respondents was modified even more radically between 2012 and 2016. Instead of using a pre-existing professional panel, the ANES recruited a fresh random sample for the online mode in 2016. This change might have increased the share of

those high in openness in the online sample if open individuals are underrepresented among professional online respondents due to routinized and non-social nature of taking repeated panel surveys.

To determine whether these sampling improvements may have reduced the differences between modes from 2012 to 2016, we perform a straightforward comparison of changes in the Big Five traits between the two ANES studies, independently for each sample type. In doing so, we assume that personality traits should be stable over time. Furthermore, since the two samples are designed to be independently representative of the population, any changes in mean personality traits should have been of about equal size in the face-to-face and online samples.

Results are presented in Figure 4. In the face-to-face sample, none of the means on Big Five traits change significantly between 2012 and 2016. At the same time, significant mean shifts occur in the online samples. The average online respondent in the 2016 data is significantly more extraverted and open to experience compared to the mean online respondent in 2012. This leads us to suspect that the difference is driven almost entirely by unique personality profiles of the professional survey panel. However, it is worth emphasizing that while the switch to the fresh cross-section in the online study for the 2016 survey significantly mitigates this bias, it does not entirely eliminate it. Importantly, these findings also indirectly confirm that personality differences in 2012 should be attributed to sample compositions and not to mode response effects---if the latter were true, these sizable differences should have been unchanged in 2016.

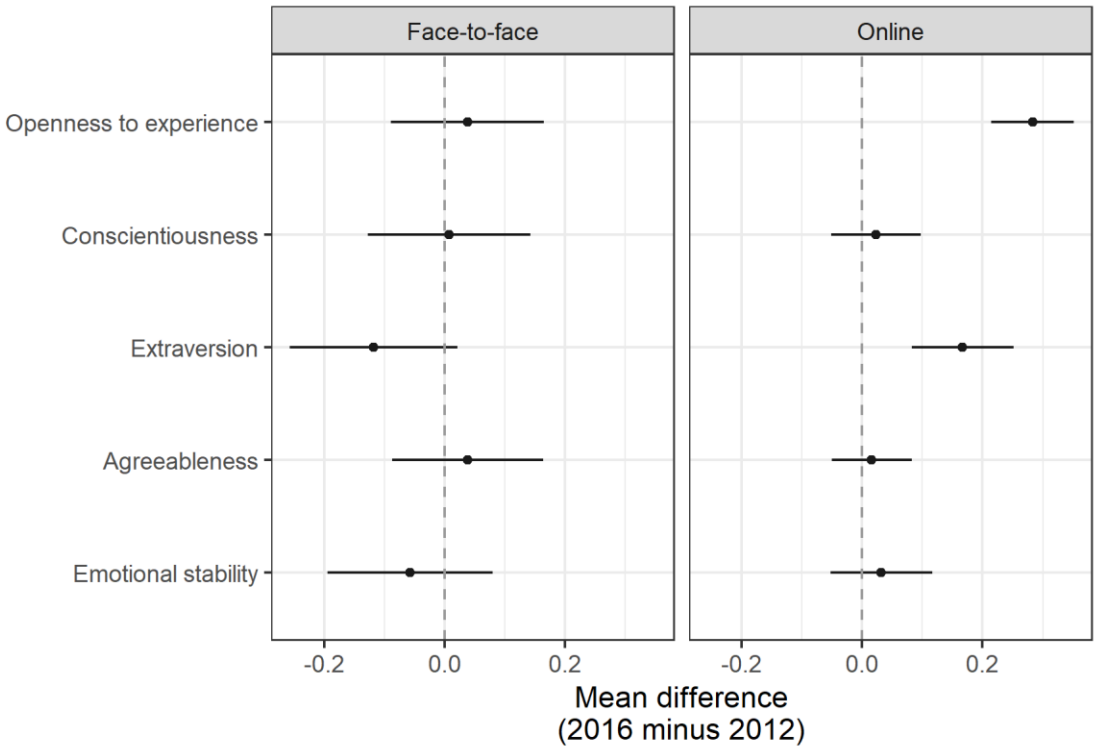

Figure 4. Differences in personality by mode, 2012 to 2016 (point estimates and 95% confidence intervals)
Note: Results adjusted for sampling weights and stratification

To further explore the source of the differences between 2012 and 2016, we display the distributions of openness to experience by year across survey types in Figure 5. For the online samples, the distributions across years are most distinct at the tails. A disproportionate density of cases scoring about 5.5 on openness to experience and below in 2012, with a concomitant hollowing out of high scores on this trait, explain the overall mean shift. For the face-to-face samples, the distributions are nearly identical, and discrepancies at the tails are minimal. Kolmogorov-Smirnov tests confirm non-equality in the distributions for the online samples across years but cannot reject the null of equality in the face-to-face samples.[10]

[10] When interpreting empirical densities and the Kolmogorov--Smirnov tests, it is necessary to bear in mind that the respective estimation procedures do not permit adjustment for sampling weights and/or stratification.

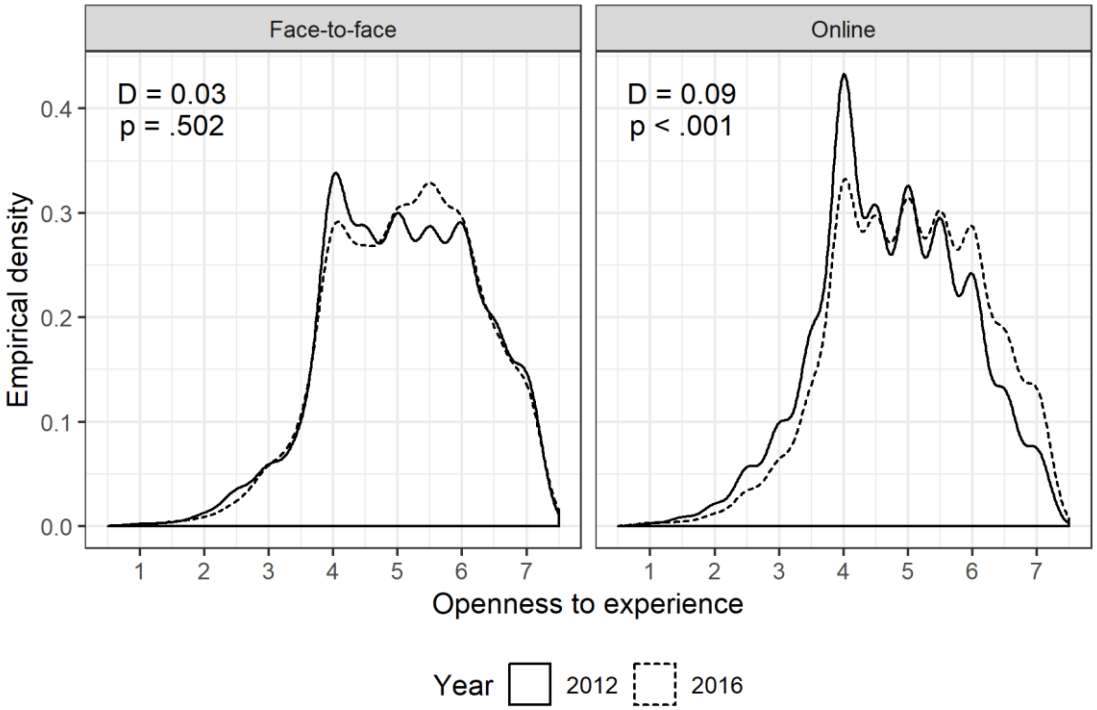

Figure 5. Empirical densities of openness to experience by mode and year
Note: Kolmogorov--Smirnov test statistics and corresponding *p*-values in upper left corners

We further explore the dynamics of the professional online sample by examining the association between personality traits and sample recruitment in 2012. The 2012 ANES provides anonymized administrative information that is helpful in this regard. Specifically, in the online sample, we know many survey respondents have previously completed and the time (in days) they have spent on the panel. In the face-to-face sample, we have information on how many contact attempts were made before each respondent agreed to be interviewed.[11] Open individuals might be less willing to join online panels in the first place, more likely to drop out of the online panel, or easier to contact in the face-to-face study. We can examine the relationships between these three variables and openness to experience in order to test our conjecture that the professional online sample is uniquely biased by openness.

[11] This information was not included in the public release of the 2012 ANES time series dataset, but we were able to obtain it by request from the ANES.

Results are presented in Figure 6. Since the dependent variables---surveys taken, days in panel, and contact attempts---are count data, we log-transform them. We find that openness to experience is negatively and significantly related only to the number of surveys previously taken. In other words, highly open individuals are less likely to take part in online surveys even when they agree to participate in professional panels, compared to those low in openness. The number of online surveys taken is also negatively related to extraversion (confirming results presented above) and positively related to emotional stability. Neither openness to experience nor other personality traits are related to time as an online panel member, suggesting that open individuals will agree to join panels, but they will simply fail to take as many surveys once enrolled. Finally, openness is unrelated to the number of contacts necessary to arrange an interview with a respondent. This suggests that mean differences in personality are likely driven by the professionalized online sample rather than, say, an increased cooperation rate among highly open individuals in the face-to-face studies.

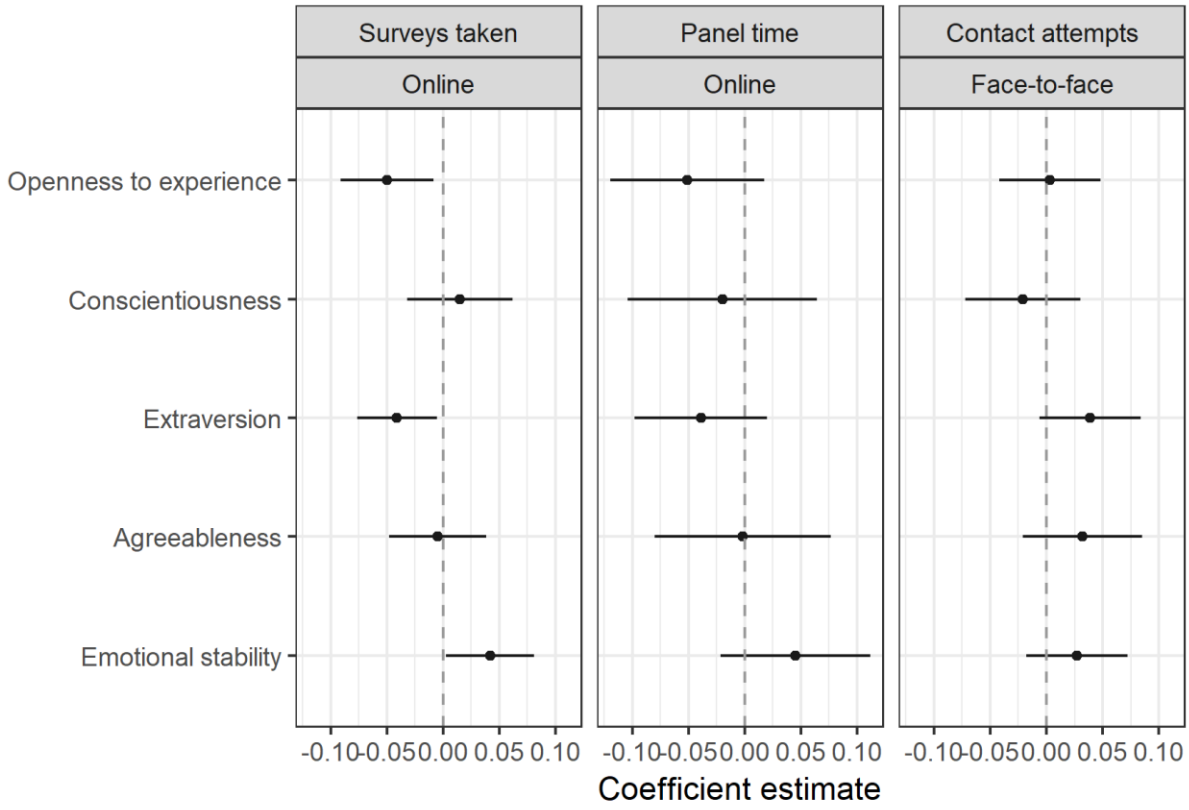

Figure 6. The impact of personality traits on survey engagement in online and face-to-face samples, ANES 2012
Note: Entries are point estimates with 95% confidence intervals. Control variables (not presented for space considerations): age, gender, race/ethnicity, education, income, home ownership, marital status. Results adjusted for sampling weights and stratification. See Appendix table A7 for full models

Figure 7 plots the marginal effect of openness to experience on the number of surveys taken in the online panel. To ease interpretation, the dependent variable is transformed back to its original count scale. Moving from the lowest to the highest score on openness reduces the number of surveys taken by almost 40, which is a nearly 25% reduction in the overall mean number of surveys taken. These results identify the mechanism linking openness to experience and survey mode participation: open individuals are less likely to be active participants in online professionalized survey panels. Even once enrolled, those high in openness tend to take fewer surveys than those who are less open. At the same time, openness to experience does not lead

respondents to drop out of the panels, since open individuals, on average, spend the same amount of time in the panel. This is an important finding, suggesting that simply recruiting higher numbers of open individuals into professional online panels does not eliminate the bias. Instead, active efforts are required to ensure that individuals who are high on openness actually participate in online surveys.

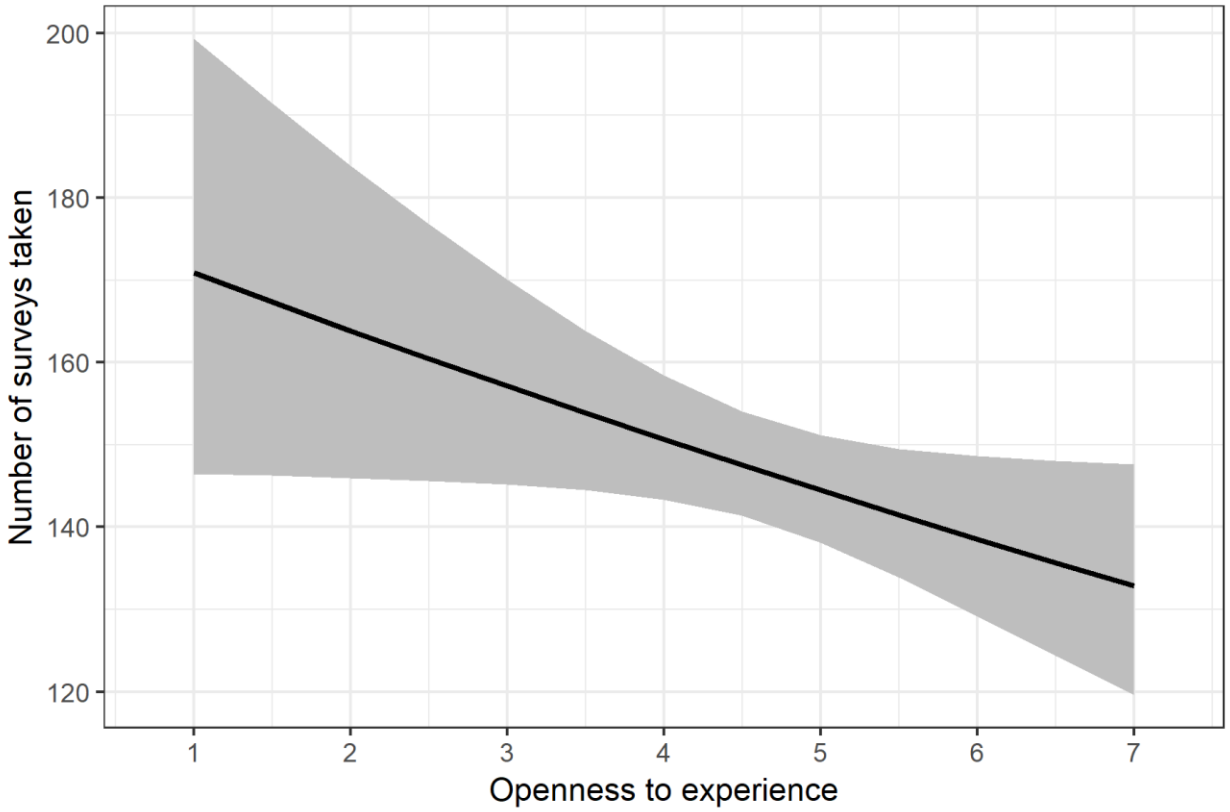

Figure 7. Openness to experience and number of surveys taken in the online panel, 2012 ANES
Note: Estimated based on a multiple regression. Results adjusted for sampling weights and stratification. For full results, see Model 1 in Table A7 in Appendix

Discussion and Conclusion

Surveys remain the most important data generation tool for understanding public opinion formation, changes in mass preferences over time, and links between mass preferences and political behavior. Survey researchers contact people via a wide variety of modes and platforms

to ask them where they stand on a nearly infinite set of topics. Methodologists have thought deeply about the effects of survey mode on item and unit nonresponse, but little is known about how personality traits might shape individuals' willingness to engage in particular survey modes. As we show, personality traits may affect who agrees to accept a survey interview, not just based on the topic but also on the type of social interaction being demanded. Since personality is not neutral with respect to political preferences, differences in relative likelihood of survey mode participation by personality traits are consequential for the ideological profile of the "average voter" obtained from surveys.

The online and face-to-face samples in the 2012 ANES feature especially large differences in personality. Why so? We suspect they are primarily the result of relatively low levels of openness to experience in professional online samples, in which panelists can take up to hundreds of surveys in solitude. A definitive test of this conjecture would require tracing panel members for an extended period of time, monitoring their panel activity and estimating its relationship with personality traits and other factors. For the moment we can simply observe whether personality traits differ significantly in samples drawn from professionalized panels compared to fresh cross-sections in ways that could bias estimates of public opinion. Given that the contemporary online survey marketplace is largely dominated by professionalized online panels, this may have critical implications for the practice of survey research.

Do these discrepancies also have implications for non-political outcomes that social researchers are interested in and might measure using surveys? To answer this question, we reviewed several existing meta-analytic studies that explore the relationships between the Big Five personality traits and some socially relevant individual-level variables, from subjective well-being to physical activity (see Table A8 in Appendix for the full list). The overall pattern

suggests that for social, psychological, and health outcomes extraversion is more consequential than openness to experience. If professionalized online samples are lower in extraversion, estimates for these non-political domains might deviate significantly from the population means. Addressing the nature and extent of such biases would require further study.

Our results cannot definitively say whether the online or face-to-face sample more closely matches the population distribution of personality traits since there exist no population benchmarks of these traits. Indeed, the ANES is often viewed as the gold standard for estimating means on these psychological, non-demographic characteristics in the United States. If personality impacts individuals' propensity to participate in surveys, any survey-based population estimate of personality can be biased. Still, our results lean heavily toward the conclusion that professional online samples are the outlier. We find that, out of the four analyzed samples, only the 2012 online data based on the professionalized survey respondents stands out in terms of lower levels of openness to experience. This suggests that samples based on fresh cross-sections, both face-to-face and online, yield better population estimates for personality than professionalized panels. Again, this conjecture merits further investigation.

To be sure, there are limitations to this study. The largest concerns the observational nature of the results. We find support for the proposed theoretical model using the ANES, one of the most trusted public opinion surveys across the globe. However, the design does not allow us to prove a unidirectional causal effect of openness to experience on survey mode participation, and other factors could have contributed to the differences observed here. For instance, online survey technologies evolve relatively quickly, so some change we are unaware of might have altered the nature of online survey participation and completion between 2012 and 2016. While it is of course impossible to manipulate and randomly assign personality traits, it is possible to

randomly assign survey modes after collecting information about personality and other potential causes of compliance. One fruitful direction of further study would be to collect a host of potential predictors of compliance, including personality traits, prior to randomly assigning respondents to mode. This would definitively determine if personality or its correlates influence unit non-response differently for different types of surveys.

If we are right, how can the problem of potential sampling bias via personality traits be mitigated? Unfortunately, we cannot propose a simple remedy for this problem since, as we have discussed above, personality distributions of the general population are unknown. It is thus challenging to design survey weights that would correct for underrepresentation or overrepresentation of different personality types in a given survey. If we trust the ANES face-to-face sample as a benchmark measure of personality, we might be able to use weights from that study to improve estimates from online professional surveys taken at around the same time. For now, however, it is important that scholars recognize the potential caveats of public opinion estimates, particularly those related to personality, that rely exclusively on professional online samples.

We would note that the fresh cross-section recruited for the online study in 2016 was much improved over 2012, but far more expensive. The additional cost threatens one of the most powerful advantages of the move to online survey data collection. In the end, we would encourage scholars of public opinion and political behavior to consider these challenges as they move forward in the collection of single surveys and especially in time-series studies to examine public opinion dynamics. Our results suggest that discrepancies in public opinion estimates driven by personality-related differences between fresh cross-sections and professionalized survey panels may be significant and have the potential to bias estimates of public opinion.

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Appendix

Table A1. Comparison of respondents with and without internet at home in terms of the Big Five personality traits, 2016 ANES, online mode

	With internet	Without internet	Difference
Openness to experience	3.91	3.89	-0.01
			(0.10)
Conscientiousness	4.14	4.25	0.11
			(0.11)
Extraversion	3.63	3.53	-0.09
			(0.11)
Agreeableness	3.92	3.90	-0.02
			(0.09)
Emotional stability	3.42	3.40	-0.02
			(0.11)
N	312	2762	

Note: Standard errors and significance levels shown only for difference estimates. Results adjusted for sampling weights and stratification

* $p < .05$, ** $p < .01$, *** $p < .001$

Table A2. Variables used in the study with their ANES names

Variable	ANES names	
	2012	2016
Partisanship	pid_x	V161158x
Ideology	libcpre_self	V161126
Big government	spsrvpr_ssself	V161178
Defense spending	defsppr_self	V161181
Public healthcare	inspre_self	V161184
Welfare	guarpr_self	V161189
Aid to blacks	aidblack_self	V161198
Environmentalism	envjob_self	V161201
Affirmative action	aa_uni_x	V161204x
	aapost_hire_x	V162238x
Federal spending	fedspend_ss	V161205
	fedspend_schools	V161206
	fedspend_scitech	V161207
	fedspend_crime	V161208
	fedspend_welfare	V161209
	fedspend_child	V161210
	fedspend_poor	V161211
	fedspend_enviro	V161212
Gay rights	gayrt_discrev_x gayrt_discstd_x	V161229x
	gayrt_adopt	V161230
	gayrt_marry	V161231
Abortion	abortpre_4point	V161232
Racial resentment	resent_workway	V162211
	resent_slavery	V162212
	resent_deserve	V162213
	resent_try	V162214
Modern sexism	modsex_media_x	V162231x
	modsex_special	V162232
	modsex_prob	V162233
Egalitarianism	egal_equal	V162243
	egal_worryless	V162244
	egal_notbigprob	V162245
	egal_fewerprobs	V162246

Table A3. Mode comparisons: personality traits

	Face-to-face	Online	Difference
Openness to experience			
2012	5.06	4.69	-0.37***
			(0.05)
2016	5.10	4.97	-0.13*
			(0.06)
Conscientiousness			
2012	5.64	5.61	-0.03
			(0.05)
2016	5.65	5.63	-0.02
			(0.06)
Extraversion			
2012	4.40	3.99	-0.40***
			(0.05)
2016	4.28	4.16	-0.12
			(0.07)
Agreeableness			
2012	5.12	5.11	-0.00
			(0.04)
2016	5.15	5.13	-0.03
			(0.06)
Emotional stability			
2012	4.95	4.87	-0.07
			(0.05)
2016	4.89	4.91	0.02
			(0.06)

Note: Standard errors and significance levels shown only for difference estimates. Results adjusted for sampling weights and stratification

* $p < .05$, ** $p < .01$, *** $p < .001$

Table A4. Mode comparisons: political preferences

	Face-to-face	Online	Difference
Partisanship (Republican)			
2012	4.61	4.71	0.09
			(0.18)
2016	4.79	4.62	-0.17
			(0.17)
Ideology (conservative)			
2012	5.32	5.41	0.09
			(0.10)
2016	5.25	5.17	-0.08
			(0.10)
Government services (oppose)			
2012	5.24	5.56	0.32*
			(0.13)
2016	4.80	5.15	0.36*
			(0.15)
Defense spending (increase)			
2012	5.45	5.06	-0.39***
			(0.11)
2016	5.97	5.81	-0.16
			(0.15)
Health insurance (private)			
2012	5.06	5.43	0.37*
			(0.15)
2016	4.91	5.04	0.13
			(0.17)
Welfare (oppose)			
2012	5.65	5.48	-0.17
			(0.13)
2016	5.48	5.33	-0.15
			(0.16)
Aid to blacks (oppose)			
2012	6.48	6.78	0.30*
			(0.14)
2016	5.52	5.71	0.18
			(0.16)
Environmentalism (oppose)			
2012	3.49	3.97	0.48***
			(0.14)
2016	3.40	3.65	0.25
			(0.14)

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Table A4. Mode comparisons: political preferences (continued)

	Face-to-face	Online	Difference
Affirmative action (oppose)			
2012	7.25	7.13	-0.12
			(0.13)
2016	6.53	6.59	0.05
			(0.13)
Federal spending (decrease)			
2012	3.11	4.16	1.05***
			(0.10)
2016	2.60	3.31	0.71***
			(0.08)
Gay rights (oppose)			
2012	3.29	3.79	0.50**
			(0.16)
2016	4.39	4.56	0.17
			(0.12)
Abortion (oppose)			
2012	3.61	3.58	-0.03
			(0.16)
2016	3.79	3.62	-0.17
			(0.20)
Racial resentment			
2012	6.16	6.39	0.23
			(0.13)
2016	5.50	5.47	-0.03
			(0.18)
Modern sexism			
2012	3.54	3.76	0.21**
			(0.08)
2016	3.30	3.37	0.08
			(0.11)
Egalitarianism (reversed)			
2012	3.59	3.99	0.39***
			(0.10)
2016	3.41	3.48	0.07
			(0.10)

Note: Standard errors and significance levels shown only for difference estimates. Results adjusted for sampling weights and stratification

* $p < .05$, ** $p < .01$, *** $p < .001$

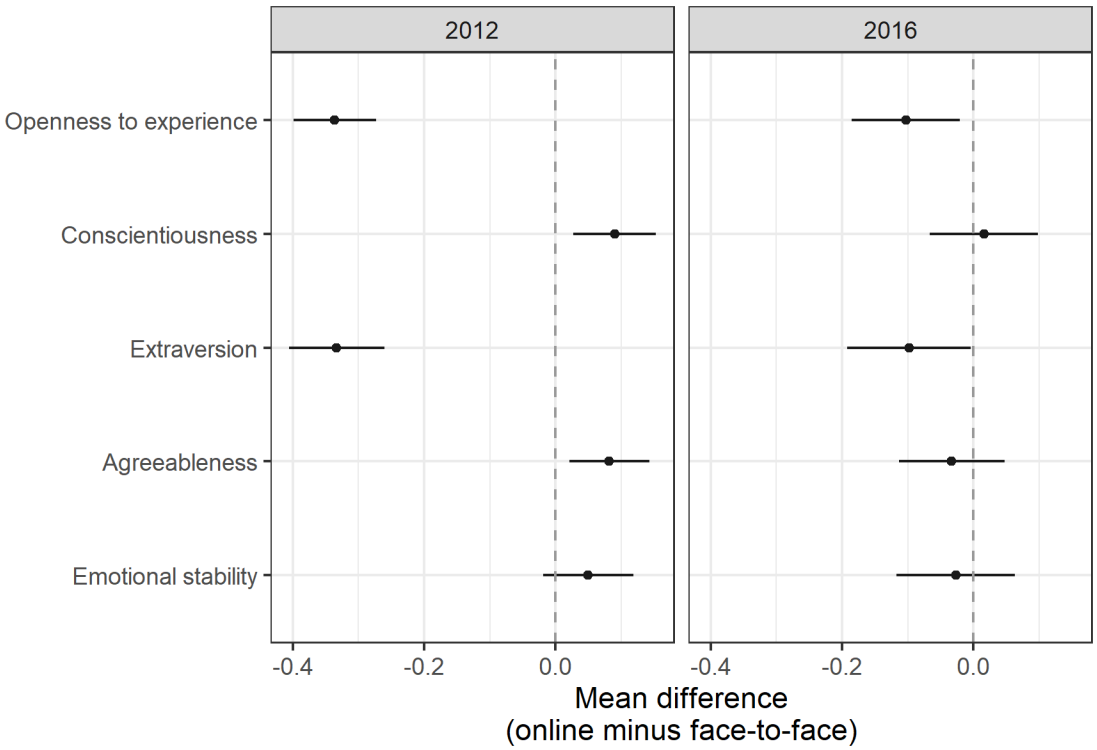

Figure A1. Mode comparisons: personality traits; no correction for survey design

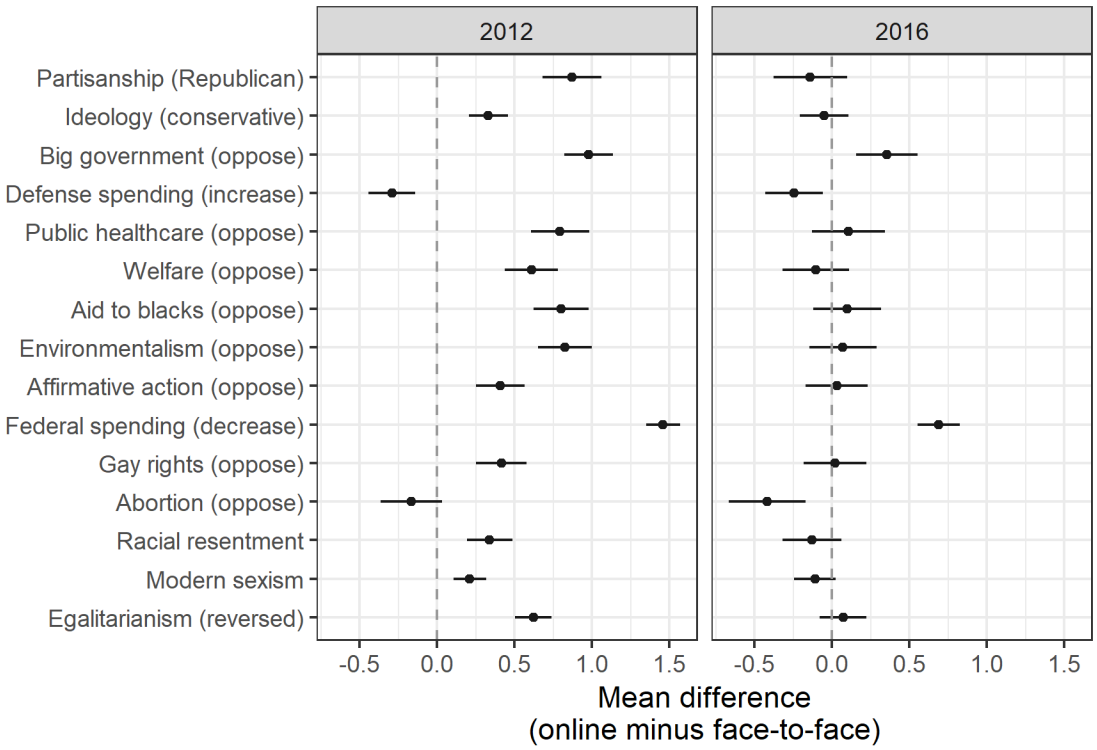

Figure A2. Mode comparisons: political preferences; no correction for survey design

Table A5. Multivariate analysis of openness, survey mode participation, and political preferences

	2012	2016
Mode (online) ←		
Openness to experience	-0.26***	-0.07
	(0.04)	(0.05)
Conscientiousness	0.02	0.01
	(0.05)	(0.05)
Extraversion	-0.20***	-0.05
	(0.04)	(0.04)
Agreeableness	0.05	-0.00
	(0.04)	(0.05)
Emotional stability	0.02	0.02
	(0.04)	(0.04)
Age	-0.00	-0.02
	(0.03)	(0.04)
Black	0.10	-0.11
	(0.21)	(0.17)
Education	-0.00	-0.03
	(0.02)	(0.02)
Female	-0.08	0.02
	(0.09)	(0.10)
Home owner	0.07	-0.02
	(0.12)	(0.14)
Income	-0.01	0.01
	(0.01)	(0.01)
Married	-0.04	-0.02
	(0.09)	(0.03)
Constant	2.52***	1.78**
	(0.42)	(0.58)

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Table A5. Multivariate analysis of openness, survey mode participation, and political preferences (continued)

	2012	2016
Environmentalism (oppose) ←		
Mode (online)	0.37**	0.13
	(0.13)	(0.11)
Openness to experience	-0.35***	-0.51***
	(0.06)	(0.06)
Conscientiousness	0.19***	0.10
	(0.06)	(0.07)
Extraversion	0.03	0.15**
	(0.05)	(0.05)
Agreeableness	-0.17**	-0.05
	(0.06)	(0.06)
Emotional stability	0.02	0.15*
	(0.05)	(0.06)
Age	0.14***	0.03
	(0.04)	(0.05)
Black	-0.97***	-0.56*
	(0.20)	(0.27)
Education	-0.08**	-0.08*
	(0.03)	(0.03)
Female	-0.18	-0.46**
	(0.12)	(0.14)
Home owner	0.13	-0.36*
	(0.15)	(0.17)
Income	0.00	-0.01
	(0.01)	(0.01)
Married	0.59***	-0.13***
	(0.13)	(0.04)
Constant	4.75***	6.17***
	(0.47)	(0.66)

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Table A5. Multivariate analysis of openness, survey mode participation, and political preferences (continued)

	2012	2016
Federal spending (oppose) ←		
Mode (online)	0.91***	0.67***
	(0.09)	(0.08)
Openness to experience	-0.27***	-0.22***
	(0.04)	(0.03)
Conscientiousness	0.12**	0.05
	(0.04)	(0.04)
Extraversion	0.01	0.01
	(0.03)	(0.03)
Agreeableness	-0.12**	-0.09*
	(0.04)	(0.04)
Emotional stability	0.12***	0.12***
	(0.03)	(0.03)
Age	-0.02	-0.05*
	(0.02)	(0.02)
Black	-1.27***	-0.94***
	(0.11)	(0.11)
Education	0.06**	0.02
	(0.02)	(0.02)
Female	-0.33***	-0.22**
	(0.08)	(0.08)
Home owner	0.33***	-0.20*
	(0.09)	(0.10)
Income	0.02***	0.01
	(0.01)	(0.01)
Married	0.25**	-0.08***
	(0.08)	(0.02)
Constant	2.90***	3.66***
	(0.33)	(0.39)

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Table A5. Multivariate analysis of openness, survey mode participation, and political preferences (continued)

	2012	2016
Gay rights (oppose) ←		
Mode (online)	0.45**	0.18
	(0.16)	(0.10)
Openness to experience	-0.37***	-0.16**
	(0.07)	(0.05)
Conscientiousness	0.23***	0.02
	(0.06)	(0.05)
Extraversion	0.03	0.01
	(0.05)	(0.03)
Agreeableness	-0.14*	0.08
	(0.07)	(0.05)
Emotional stability	0.13*	0.09*
	(0.06)	(0.04)
Age	0.19***	0.16***
	(0.04)	(0.03)
Black	0.28	0.65***
	(0.19)	(0.16)
Education	-0.17***	-0.06*
	(0.03)	(0.02)
Female	-0.64***	-0.15
	(0.14)	(0.10)
Home owner	0.18	-0.03
	(0.16)	(0.12)
Income	-0.04***	-0.02**
	(0.01)	(0.01)
Married	0.85***	-0.05*
	(0.14)	(0.03)
Constant	4.80***	4.58***
	(0.54)	(0.43)

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Table A5. Multivariate analysis of openness, survey mode participation, and political preferences (continued)

	2012	2016
Modern sexism ←		
Mode (online)	0.19**	0.04
	(0.07)	(0.09)
Openness to experience	-0.22***	-0.36***
	(0.04)	(0.04)
Conscientiousness	0.05	-0.04
	(0.03)	(0.04)
Extraversion	0.05	0.05
	(0.03)	(0.03)
Agreeableness	-0.10**	-0.14**
	(0.04)	(0.04)
Emotional stability	-0.04	0.03
	(0.03)	(0.05)
Age	-0.03	-0.09***
	(0.02)	(0.03)
Black	-0.60***	-0.53***
	(0.11)	(0.14)
Education	-0.08***	-0.12***
	(0.02)	(0.02)
Female	-0.35***	-0.35***
	(0.07)	(0.09)
Home owner	-0.01	0.04
	(0.09)	(0.11)
Income	-0.00	-0.02*
	(0.01)	(0.01)
Married	0.18*	-0.05*
	(0.07)	(0.02)
Constant	5.97***	8.08***
	(0.29)	(0.41)

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Table A5. Multivariate analysis of openness, survey mode participation, and political preferences (continued)

	2012	2016
Egalitarianism (reversed) ←		
Mode (online)	0.33***	-0.01
	(0.10)	(0.09)
Openness to experience	-0.28***	-0.43***
	(0.04)	(0.04)
Conscientiousness	0.04	-0.01
	(0.04)	(0.04)
Extraversion	0.06	0.07
	(0.03)	(0.03)
Agreeableness	-0.18***	-0.14**
	(0.04)	(0.05)
Emotional stability	0.12**	0.08*
	(0.04)	(0.04)
Age	-0.03	-0.02
	(0.02)	(0.02)
Black	-1.18***	-1.00***
	(0.11)	(0.14)
Education	-0.00	-0.05*
	(0.02)	(0.02)
Female	-0.11	-0.35***
	(0.08)	(0.10)
Home owner	0.12	-0.03
	(0.09)	(0.09)
Income	0.01	-0.01
	(0.01)	(0.01)
Married	0.33***	-0.12***
	(0.09)	(0.02)
Constant	4.84***	7.21***
	(0.32)	(0.40)

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Table A5. Multivariate analysis of openness, survey mode participation, and political preferences (continued)

	2012	2016
Variances		
Environmentalism (oppose)	7.82***	8.24***
	(0.19)	(0.24)
Federal spending (oppose)	3.66***	3.47***
	(0.10)	(0.11)
Gay rights (oppose)	11.00***	4.59***
	(0.23)	(0.16)
Modern sexism	2.94***	3.95***
	(0.10)	(0.13)
Egalitarianism (reversed)	3.99***	3.99***
	(0.11)	(0.12)
Covariances		
Environmentalism (oppose), Federal spending (oppose)	2.36***	2.48***
	(0.11)	(0.14)
Environmentalism (oppose), Gay rights (oppose)	2.95***	0.92***
	(0.19)	(0.18)
Environmentalism (oppose), Modern sexism	1.42***	1.77***
	(0.11)	(0.15)
Environmentalism (oppose), Egalitarianism (reversed)	2.11***	1.94***
	(0.12)	(0.15)
Federal spending (oppose), Gay rights (oppose)	1.89***	0.51***
	(0.13)	(0.09)
Federal spending (oppose), Modern sexism	1.08***	1.18***
	(0.07)	(0.09)
Federal spending (oppose), Egalitarianism (reversed)	1.64***	1.46***
	(0.09)	(0.09)
Gay rights (oppose), Modern sexism	1.70***	0.62***
	(0.13)	(0.09)
Gay rights (oppose), Egalitarianism (reversed)	1.71***	0.55***
	(0.13)	(0.09)
Modern sexism, Egalitarianism (reversed)	1.37***	1.71***
	(0.08)	(0.09)

Note: Standard errors in parentheses. Results adjusted for sampling weights and stratification
* $p < .05$, ** $p < .01$, *** $p < .001$

Table A6. Logistic regressions of online mode participation, 2012 and 2016

	2012	2016
Openness to experience	-0.26***	-0.07
	(0.04)	(0.05)
Conscientiousness	0.02	0.01
	(0.05)	(0.05)
Extraversion	-0.20***	-0.05
	(0.04)	(0.04)
Agreeableness	0.05	-0.00
	(0.04)	(0.05)
Emotional stability	0.02	0.02
	(0.04)	(0.04)
Age	-0.00	-0.02
	(0.03)	(0.04)
Black	0.10	-0.11
	(0.21)	(0.17)
Education	-0.00	-0.03
	(0.02)	(0.02)
Female	-0.08	0.02
	(0.09)	(0.10)
Home owner	0.07	-0.02
	(0.12)	(0.14)
Income	-0.01	0.01
	(0.01)	(0.01)
Married	-0.04	-0.02
	(0.09)	(0.03)
Constant	2.52***	1.78**
	(0.42)	(0.58)

Note: Standard errors in parentheses. Results adjusted for sampling weights and stratification
* $p < .05$, ** $p < .01$, *** $p < .001$

Table A7. Regressions of survey engagement in online and face-to-face sample, ANES 2012

	Surveys taken (Online)	Panel time (Online)	Contact attempts (Face-to-face)
Openness to experience	-0.04*	-0.03	-0.01
	(0.02)	(0.04)	(0.02)
Conscientiousness	0.01	-0.04	-0.02
	(0.02)	(0.04)	(0.02)
Extraversion	-0.04*	-0.04	0.04
	(0.02)	(0.03)	(0.02)
Agreeableness	-0.01	-0.02	0.04
	(0.02)	(0.04)	(0.03)
Emotional stability	0.04	0.03	0.03
	(0.02)	(0.03)	(0.02)
Age	0.05***	0.12***	-0.06***
	(0.01)	(0.02)	(0.01)
Black	0.05	0.15	-0.05
	(0.08)	(0.12)	(0.07)
Education	-0.01	0.00	0.01
	(0.01)	(0.02)	(0.01)
Female	-0.20***	-0.17*	-0.01
	(0.05)	(0.08)	(0.05)
Home owner	0.18**	0.31**	-0.02
	(0.06)	(0.10)	(0.06)
Income	-0.00	-0.01	0.01*
	(0.00)	(0.01)	(0.00)
Married	-0.11*	-0.02	0.03
	(0.05)	(0.08)	(0.05)
Constant	5.06***	6.01***	0.87***
	(0.20)	(0.33)	(0.21)

Note: Standard errors in parentheses. Results adjusted for sampling weights and stratification
* $p < .05$, ** $p < .01$, *** $p < .001$

Table A8. Meta-analytic correlations between openness to experience, extraversion, and some non-political outcomes

Outcome	Openness	Extraversion	Reference
Subjective well-being	.11	.17	DeNeve and Cooper (1998)
Job satisfaction	.01	.19	Judge, Heller, and Mount (2002)
Anxiety and depression	-.09	-.24	Kotov et al. (2010)
Alcohol involvement	-.01	.03	Malouff et al. (2007)
Relationship satisfaction	.03	.06	Malouff et al. (2010)
Smoking status	n.s.	.19	Munafo, Zetteler, and Clark (2007)
Academic performance	.10	-.01	Poropat (2009)
Physical activity	.08	.23	Rhodes and Smith (2006)

Note: n.s. = not significant

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