

**Measurement Error in Discontinuous Online Survey Panels:
Panel Conditioning and Data Quality**

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Abstract: Academics are increasingly relying on online panels as sources of public opinion data to answer research questions. Online panelists represent a new type of respondent, a professional respondent, who takes many surveys in response to requests and rewards. . We consider two separate, but equally problematic measurement concerns that may arise with the use of professional respondents: 1) whether or not panel tenure is related to new opinions, different opinions, or more certain opinions and 2) that the high frequency of surveying the same individuals for extrinsic rewards may reduce the overall quality of respondent data. We find evidence of panel conditioning in the form of decreased survey duration times, increased political sophistication and non-differentiation of responses. Furthermore, we provide evidence that online survey panel respondents are less likely to optimize their responses than respondents in traditional modes that use probability based recruitment methods. We discuss the implications of our research on the quality of data provided by online panels.

Word Count:

“Do you happen to have ties to the University of Michigan Institute for Social Research? Your folksy question wording is very distinctive and very much reminds me of ISR. For the record, I like it.” (Knowledge Network Professional Respondent (304 completed surveys) response to “Thinking about this topic, do you have anything you want to share?”)

While survey researchers are accustomed to thinking about repeated observations of respondents over waves of a particular study as panel respondents, paradigm shifts in survey methodology suggest we need to extend this definition to professional respondents who are members of discontinuous, i.e. unrelated, panels or surveys because online panelists are responding to multiple surveys and multiple clients frequently. Recognizing these survey designs as inherently “discontinuous panels” for the respondent leads us to ask important questions about possible panel effects within these designs including: 1) What is the effect of taking hundreds of discontinuous surveys on the quality of the data produced? 2) Do more experienced online panel members differ in their response patterns from less experienced online panel members? 3) What does it mean to be a professional respondent? 4) What are the implications of using online panels for total survey error?

These questions are central to academic and market research because both parties are increasingly relying on online panel members to provide data to test theories and provide descriptive statistics about populations. In 2014 major news organizations and 538.com embraced online survey panel companies as part of their election outcome estimates. Political Science, in particular, has also embraced this new methodology as shown in the popularity of buy-ins by universities to the Cooperative Congressional Election Study (CCES) and the Cooperative Campaign Analysis Project (CCAP) via

YouGov/Polimetrix, as well as the American National Election Studies (ANES) commission of a GfK (formerly Knowledge Network) panel from 2008-2012, and the opportunities for online panel experiments through Time Sharing Experiments for the Social Sciences (TESS).

Thus, even though the debate about the ability of online survey panels to mitigate coverage and sampling issues is still ongoing (Yeager et al 2011; Ansolabehere and Schaffner 2014), there seems to be a growing consensus in the discipline, based upon usage, that these types of data are increasingly comparable to those collected via RDD telephone designs or other probability based methodologies, especially for population based experiments (Berrens et al 2003; Sanders et al 2008; Borges and Clarke 2008). And, although the American Association of Public Opinion Research (AAPOR) in their report “Research Synthesis: AAPOR Report on Online Panels”, argues that online panels are not acceptable for population inferences, many academics are inferring population parameters from these methodologies (for example, Bafumi & Herron 2010; Dancey & Sheagley 2013; Dolan 2011; Gerber et al. 2012; Goldman 2012; Herrnson et al. 2013; Margalit 2013; Smith & Tolbert 2010).

Yet, there are relatively few published articles critically evaluating the effects of discontinuous panel membership on data quality, especially for the study of political questions (Lupia 2008). In particular, it is important to consider how the advent of professional respondent theoretically alters the survey environment and what the implications are for data quality.

Therefore our study provides one of the first theoretical overviews to understanding panel membership and the implications of that for survey response and the quality of the data produced in these environments. We focus on two concerns that are

not present in traditional probability survey modes: 1) whether or not panel tenure is related to new opinions, different opinions, or more certain opinions (Lazarsfeld 1940; Sturgis, Allum, and Brunton-Smith 2007) presenting us with potentially biased data, not reflective of the true population means; and 2) that the high frequency of surveying the same individuals and a revised incentive structure may increase the difficulty of keeping respondents motivated and engaged; reducing the overall quality of data (Dillman, Smyth, and Christian 2009).

Although Hillygus (2011) recommends that any research using these types of data explicitly discuss the implications of the data source on the substantive conclusions, researchers are only at the beginning stages of empirically assessing the quality of these kinds of data and have failed to consider the potential in these settings for high levels of measurement error including panel conditioning effects.¹ We define panel conditioning broadly as changes in responses due to survey experience as reflected in panel tenure (total number of surveys completed). Effects from panel conditioning could be directly influenced by repeatedly answering the same types of questions or from the effects of incentives used to stimulate survey response. We utilize a publicly available data source to explore whether these two concerns are warranted with online survey panel data.

The Online Survey Respondent Context and Its Implications

¹ Whereas online survey panels are not exactly a panel in the traditional sense of repeatedly surveying the same sample about the same topic over a specified time period, these online panels are “discontinuous panels” (Nancarrow and Cartwright 2007) since the same individuals are surveyed repeatedly over an unspecified period of time.

One implication of this methodological shift to a new type of sampling frame is that the survey experience and motivations for survey engagement for the respondents has drastically changed. Unlike traditional survey methods that rely on social exchange theory (Dillman, Smyth, Christian 2009) to generate respondents, this new methodology uses personal rewards to generate online responses from panel members, creating a new class of respondents with a specific incentive structure for participation. We call these types of respondents professional respondents because they take potentially hundreds of survey and do so under a contract of payment.

In this survey environment panel members take an extraordinary number of surveys. In our study, for example, the range in the number of surveys taken as a panel member is 923, between 2 and 925. This means that many survey takers are professional respondents and very long-term online panel members. Although we have not thought of online respondents as members of panel surveys because the surveys they are taking are not necessarily from the same survey house or part of the same research design. nevertheless these potential respondents are participants in a discontinuous panel. We say discontinuous because participants are repeatedly asked to participate in different types of surveys with different goals. The result is that respondents are likely subject to panel effects from their survey experience.

Online panel members are part of a large sample frame of potential respondents who have agreed to be recruited into individual surveys as needed based upon their demographic characteristics for rewards. The online panel sample frame does not reflect the population under study, but it is used to create a representative sample through matching with a theoretically derived probability sample (Ansolabehere and Shaffner,

2014). Because panel respondents are recruited based upon demographics that reflect the population under study and because the sample panel frame is not reflective of the underlying population some panelists are invited to take more survey than other panelists. In addition, panel respondents enter (and exit) the panel and agree (or not agree) to take surveys at different rates. These factors produce different rates of exposure to surveys that may affect data quality and panel tenure may be correlated with demographic characteristics.

Theoretical Implications of Long Term Panel Membership in Online Survey Panels

Even though the issue of panel conditioning in online survey panels has been a concern since their inception (Couper 2000), there are surprisingly few published evaluations of panel conditioning in online survey panels. The concern is that data obtained from seasoned participants in the panel will be biased due to various threats to data validity including learning about the survey process and topics, attitude crystallization, and changes in motivation and engagement (Nancarrow and Cartwright 2007).² Our quote at the beginning of this paper highlights some of the potential issues related to survey experience including respondent learning and sophistication. In this case, the respondent appears to recognize the survey house based upon question style—a clearly professional evaluation. But what are the consequences to data quality of this relatively new way of determining political attitudes and behaviors?

² Furthermore, attrition may also play a part in these types of biases, but we are unable to address this question with the data available to us and therefore it is out of the scope of our study.

Online panels are different from traditional probability samples and the incentives they provide. Because people are recruited for extended periods of time to answer many surveys a month, they receive rewards and gifts in exchange for their participation. Rewards and gifts promote an economic exchange between the survey researcher and the respondent (Dillman, Smyth, and Christian 2009). Traditionally survey researchers have relied on social exchange theory to motivate and engage the respondent to optimize answers to survey questions. However, the economic exchange theory offers a financial or reward incentive in exchange for participation. On the surface economic exchange may not appear to be problematic, but research repeatedly shows that economic incentives do not necessarily increase response rates (Singer, van Hoewyk, and Maher 2000; Curtin, Singer, and Presser 2007) and may have negative effects. Indeed a substantial amount of research in psychology suggests that changing individual motivation from intrinsic to extrinsic often causes a decline in performance. This phenomenon has sometimes been referred to as “The Hidden Cost of Reward” (Lepper and Greene 1978), the “over justification hypothesis” (Lepper, Greene and Nisbett 1973) or the “corruption effect” (Deci 1975).

Motivation is important in survey research because respondents are expected to provide thoughtful and accurate answers about their attitudes and behaviors, which then provides high quality data for research. However, extrinsic motivation (rewards) for a panel member is tied to completing surveys and not necessarily answering questions in an optimal way (Dillman, Smyth and Christian 2009). As the surveys become more frequent and the questions or their style common place any novelty from the survey experience likely wears off leading respondents to shift their effort from optimizing answers to satisficing them (Krosnick 1991).

At the same time panel conditioning may result in some amount of learning on the part of the respondent. Fundamentally presenting similar topics and questions to respondents overtime may draw attention to topics, choices and risks that held little salience before the survey, but led to changes in subsequent attitudes and behaviors (Williams, Block and Fitzsimons 2006; Zwane et al 2011; Zajonc 1968). This happens because the question-answer environment increases the accessibility of beliefs and expands the scope of relevant or salient issues providing opportunities for more active decision-making. In addition, repeated surveys may highlight to respondents mismatches between attitudes and behavior, which may lead to attitude or behavior change to remove any cognitive dissonance. For example, Yalch (1976) found that registered voters interviewed prior to the election were more likely to vote than registered voters interviewed after the election. Many other studies also find a link between survey questions and attitude and behavior change across a variety of domains including volunteerism and altruism (Sherman 1980; Fitzsimons and Williams 2000), voting (Greenwald, Carnot, Beach and Young 1987; Yalch 1976), political knowledge (Sturgis, Allum, and Brunton-Smith 2007), health (Zwane et al 2011) and personal purchases (Morwitz, Johnson and Schmittlein 1993).

Discontinuous Panel Conditioning

The research to date has found little evidence of panel conditioning effects in online survey panels (Dennis 2001; Pineau, Nukulki, and Tang 2005; Nukulki et al 2007; Clinton

2001; Arens and Steiger 2006; and Toepoel, Das, and Van Soest 2008).³ However, the majority of the research atheoretically examines the direction and magnitude of attitude or behavior estimates across different categories of panel tenure (for a review of the problems with this type of approach, see: Sturgis, Allum, and Brunton-Smith 2007), which assumes that panel membership would move individual opinion in a single detectable direction. We are not surprised that this method has produced few results given its atheoretical assumptions and empirically untenable expectations about opinion change.

For example, both Dennis (2001) and Pineau, Nukulij, and Tang (2005) categorize panel tenure and rely on bivariate analysis. Clinton (2001) compares the frequency distributions and weighted response differentials for a set of questions across new panel members and those with earlier recruitment dates. Nukulij et al (2007) utilize a continuous measure of panel tenure to examine its effect upon attitudes about US foreign policy, with the hypothesis that as respondents take more surveys, they will learn about the topic and develop new opinions, but find no effect. Arens and Miller Steiger (2006) also find no evidence of conditioning using a continuous measure, but their tests were bivariate and all of the respondents were relatively new to the panel (the mean number of prior surveys completed in the panel was nine, compared to over 150 in our data). The strongest research design testing conditioning effects actually presents more nuanced results than previous studies (Toepoel, Das, and Van Soest 2008). Comparing responses from a completely fresh online panel with those from an established panel (the mean panel

³ Kruse et al 2009 also look at panel effects with online survey panel data, but their analysis is geared towards traditional panel effects within nine waves instead of effects from participation in discontinuous panels.

duration was 6 years and 8 months), the authors find no differences in the effects of questionnaire design between fresh and trained respondents. They do find preliminary evidence that “trained respondents seem to be more sensitive to satisficing,” (2008: 1003).

To place our research in this backdrop, we begin by testing for panel conditioning effects using the same methodology as in previous studies. We posit that insignificant results in the examination of the direction and magnitude of panel tenure on attitudes and behaviors is not sufficient evidence to conclude that panel conditioning is not present in online survey panels and present further tests to make our case. However, we think it is important to demonstrate that the measures we use show results parallel to what is found in the literature to highlight how this research has relied on weak methods to test for panel conditioning effects. Given previous findings and our criticism of this method, therefore, we expect that we can replicate previous work to accept the null hypothesis:

Hypothesis 1a: The null hypothesis that panel tenure will be a significant factor in explaining political attitudes will not be rejected.

Second we look for indirect evidence of panel conditioning effects that provide support for our argument that survey respondents who take more surveys are inherently different from those who take less surveys. Theoretically panel tenure should not be associated with specific characteristics of panel members and therefore the presence of relationships between demographic characteristics and panel tenure would provide initial evidence of panel conditioning effects.

Hypothesis 1b: Demographic variables will be related to panel tenure.

In addition rewards may play a role in survey retention. In our data set, some panel members were provided with free Internet access in exchange for completing surveys as

well as the standard rewards that apply to all respondents. Given our theoretical framework that extrinsic rewards may not motivate participation we hypothesize that:

Hypothesis 1c: Panel members who receive Internet access for their participation will participate less frequently than panel members who do not receive Internet access..

Survey Duration

Generally, survey response times have been employed to examine attitude consistency and to diagnose problems with questionnaire designs (Yan and Tourangeau 2008). Importantly, however, response times can be conceptualized as stemming from the cognitive process in question answering which includes: comprehension, retrieval, answer estimate, and then report (Tourangeau, Rips, and Rasinski 2000). The experience from taking previous surveys may decrease the necessary time to go through each of these steps, especially once the respondent has seen a particular question repeatedly or a particular question style, which is often the case with online panels. Research confirms this suspicion with respondents in an online survey panel who had taken fifteen or more surveys (the median in 2003) responding more quickly than those with less experience (Yan and Tourangeau 2008). Finally, Ansolabehere and Schaffner (2014) find that respondents from the YouGov/Polimetrix panel completed the same survey three minutes faster than randomly selected mail respondents who were directed to take the survey online. Although the focus of these three studies is not explicitly panel conditioning, the results provide preliminary empirical evidence of panel conditioning effects. However, no one has tested this relationship with a continuous measure or with such a large range of completed surveys from a discontinuous panel. Therefore, our second hypothesis explicitly tests this proposition:

Hypothesis 2: As panel tenure increases, the time to complete a survey decreases.

Political Sophistication

In addition to decreased survey completion times, we expect panel members to also learn about survey topics. This is partially supported with findings that taking marketing surveys is related to learning about brands (Nancarrow and Cartwright 2007). In addition, Sturgis, Allum, and Brunton-Smith (2007) show that as respondents take political surveys in a biennial political survey panel and become familiar with the subject matter they are stimulated to think more about politics, even if only in a very superficial manner, and consequently have more political knowledge than would be expected on average.⁴

Extending this expectation, we note that prior research resoundingly shows that levels of political knowledge are quite low in the United States (Delli Carpini and Keeter 1996), thus any deliberation about politics by the average respondent should increase political knowledge levels. Therefore, we posit that:

Hypothesis 3: As panel tenure increases we should find evidence of greater levels of political knowledge.

Non-Differentiation and other Data Quality Issues

Theoretically the creation of a new class of professional respondents who are paid to complete surveys on a frequent basis raises the concern that “reward policies that emphasize quantity rather than quality create a situation in which it is in the best interests of respondents to complete surveys quickly and perhaps even to lie about their eligibility for some surveys so that they can be eligible for the rewards connected to them (Dillman, Smyth, and Christian 2009: 348).” If such perverse incentives are driving response then the

⁴ We note that this could also be due to self-selection into the survey topic.

quality of data from these online survey panels may be at risk because the incentives for respondents are to not optimize answers, but instead to complete surveys. One empirical implication of this logic is that respondents in these types of panels will be much more likely to non-differentiate their answers than those surveyed by traditional modes. Non-differentiation is when respondents are presented with the same scale to assess multiple objects and select one point on the scale for their responses to all or most of the questions in the set instead of differentiating across questions. Consequently, those who are satisficing, or not optimizing their answers, display greater levels of non-differentiation. Therefore, we propose that:

Hypothesis 4: Online panel members are more likely to engage in greater levels of non-differentiation than respondents in probability based surveys regardless of survey mode.

Even though there are incentives for greater amounts of non-differentiation in online survey panels, respondents are also learning about the survey process and being stimulated to think about survey subjects, which may reduce the costs for respondents to optimize their answers (Krosnick 1991). Thus, we might expect some increase in crystallization of opinions as survey experience increases. The implication of this argument is that while all panel members have increased incentives to engage in non-differentiation, relative to respondents not participating in an online panel, panel members with more survey experience will likely satisfice less because they are more sophisticated and have increased opinionization. Therefore:

Hypothesis 5: Panel members with less tenure will engage in non-differentiation more than panel members with more tenure.

Data

We utilize all four surveys from the ANES 2010-2012 Evaluations of Government and Social Study (EGSS) to examine our questions about the effect of discontinuous panels on survey response. These surveys were conducted by Knowledge Networks using different samples with questions designed to test instrumentation and gauge public opinion before, during, and after the 2012 election contest, with some questions coming from the public proposal process of the ANES Online Commons.⁵ The Knowledge Networks panel is particularly well suited for this research question because many of the noted pitfalls of Internet surveys are mitigated including the use of probability-based panel recruitment, inclusion of non-Internet households, and panel management (Dennis 2001). Hence, we are confident that these potential confounders do not bias the findings. Furthermore, research shows that Internet survey data collected via methods like those used by Knowledge Networks provides comparable data to telephone surveys for demographic information (Yeager et al. 2011). Unfortunately, only the first of these surveys has been officially released, forcing us to rely on the preliminary data releases of surveys two through four.⁶

⁵ See: http://www.electionstudies.org/studypages/2010_2012EGSS/2010_2012EGSS.htm, accessed August 8, 2012 and DeBelle et al (2011).

⁶ Only the first officially released survey has any detailed methodological information, with a cumulative response rate of 2.3% (for a review of this measure see, Callegaro and DiSogra 2008). The cross-sectional surveys were fielded over a period of 18 months; with the first survey fielded from October 8-19, 2010, the second from May 11-June 1, 2011, the third

We rely on the EGSS data because as far as we are aware they are the only publicly available data from an online panel that includes the total number of surveys taken in the panel by the respondent at the time of the survey, our main independent variables of interest (see below).

We also use the ANES 2008 major panel and the cumulative ANES file to compare whether online survey panelists are less likely to optimize their responses than those in traditional survey modes. Finally, we use data from a mixed-mode probability survey (Internet and mail) and a probability based phone survey of New Mexico voters to test whether any of the observed differences in non-differentiation are due to survey mode.⁷

Main Independent Variable of interest: Panel Tenure

Although a research design might attempt to follow specific panel members over the long term to determine panel conditioning effects, we suggest that the research designs embedded in these types of studies do not avail themselves to this type of panel examination because respondents are experiencing different types of surveys and responding to them at different rates. Because we cannot know the exact nature of any particular respondents former survey experience, we measure panel effects simply with a highly reliable Knowledge Network variable that indicates respondent panel tenure which we define as the total number of surveys taken in the panel by the respondent at the time of the survey.. This allows us to compare respondents who have taken many surveys with respondents who have taken far fewer surveys. Importantly this measure is something

from December 7-13, 2011, and the final survey from February 18-23, 2012 (DeBell et al 2011).

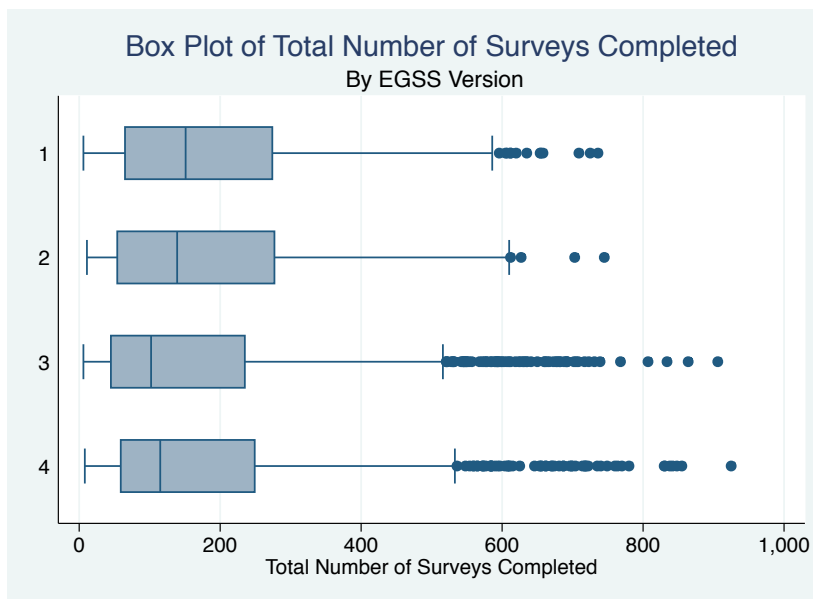
⁷ Identifying information of authors deleted.

that is potentially available to survey researchers to help evaluate these aspects of their data and therefore is a reasonable proxy for understanding discontinuous panel effects that occur in an online panel study. Moreover, this variable is well suited to explore the presence of panel conditioning because it is continuous, which allows us to consider panel conditioning without making any a priori assumptions about how many completed surveys is required for one to be a professional respondent.

Figure 1 displays the box plots of total number of surveys completed by each respondent for each version of the EGSS. It shows that many respondents have taken a large number of surveys. Amazingly, the mean number of respondent surveys for each version is above 150 and the maximum number of surveys taken is over 700 for EGSS versions one and two and over 900 for versions three and four. This means that while the data is uniquely suited to study panel conditioning, the majority of respondents in each EGSS are well-conditioned or professional respondents. For example, over ninety percent of respondents within each version have taken twenty-five or more surveys since joining the panel. We merge the four EGSS surveys together to increase the number of “novice” responders within our data. Specifically, within each version of the EGSS there were no more than 120 respondents with twenty-five or less surveys taken.⁸ By combining the surveys, this provides us with 385 respondents that are less likely to be professional respondents.

Figure 1. Box Plots of Total Number of Surveys Completed by EGSS Versions 1-4

⁸ Version 1 = 108, version 2=93, version 3=120, and version 4=64.



Dependent and Model Control Variables

Although the procedural decision to combine surveys increases the statistical power with which to examine our main independent variable of interest (panel survey experience or the number of surveys completed), we are restricted in the number of variables that we can examine due to the fact that there are only a limited number of questions replicated across surveys. There were only eight political variables in common across the four surveys: ideological self-placement, ideology of partisans (Democrats and Republicans), retrospective and prospective evaluations of the economy, efficacy, approval of President Obama, and support for the Tea Party (see Appendix S.4 for question wording). The ideological variables are 7-point scales from extremely liberal (1) to extremely conservative (7). The economic evaluations are 5-point scales from much worse (1) to much better (5). Approval of President Obama is measured on a 7-point scale from strongly disapprove (1) to strongly approve (7). Tea Party support is also measured on a 7-point scale from oppose a great deal (1) to support a great deal (7). We also use contextual information about survey duration, provided by Knowledge Networks, as a dependent

variable to test hypothesis 2.⁹ All of the multivariate models use the same control variables, which are from previous Knowledge Networks surveys, but are included in the data release. These controls include: age, education, race (dichotomous variable, 1 = white), gender (1 = female), household income, marital status (dichotomous variable, 1 = married), employment status (dichotomous variable, 1 = employed), Internet access (dichotomous variable, 1 = Internet access provided by KN), party identification (7-point scale, 7=strong Democrat), and ideology (7-point scale, 7=very conservative). Additionally, the fixed effects of the different surveys are controlled for with the use of dummy variables for each survey, with the first EGSS used as the reference category.

Method

We use ordered logistic regression to examine whether panel tenure is related to attitudes on the five dependent variables discussed above for hypothesis 1. We use an OLS model to examine the determinants of panel tenure, defined as the total number of completed surveys as a panel member, and to assess survey duration.

In terms of substantive political variables, we examine the relationship between panel tenure and political sophistication (hypothesis 3) with a logistic regression model. Finally, we compare rates of non-differentiation between the online panelists, ANES FTF respondents, and a mixed mode (Internet and mail) and phone survey of New Mexico voters to test hypothesis 4 and 5.

Results

⁹ The analysis presented below drops survey duration times of greater than five hours because these are extreme outliers that are speculated to be from other causes than actually responding to the survey. The omitted respondents represent 5.9% of the sample.

We begin by replicating the analysis strategy of previous research, examining the direction and magnitude of panel tenure coefficients in regression models of political attitudes. Specifically, we examine the relationship between total number of surveys completed and five political attitudes: retrospective and prospective evaluations of the economy, efficacy, President Obama approval, and support for the Tea Party (see supplemental material, Table S.1 for full results). As expected these results provide evidence of no panel conditioning effects due to the insignificant coefficient for panel tenure in each of the five equations. However this test, which is the primary way in which scholars have tested for panel conditioning effects, is not sufficient to determine whether or not participation in online survey panels is associated with panel conditioning effects because it assumes that panel conditioning moves public opinion in a single direction. Yet there is no theoretical justification for why such change would be homogenous. Indeed if a change in attitudes occurs it is more likely to be randomly distributed around the mean, thus averaging out any change across respondents. Thus, we are not surprised by this finding.

Determinants of Panel Tenure

As an initial extension of the research on panel conditioning in online survey panels we first examine indirect evidence that tests whether certain types of people complete surveys on a more frequent basis. If response bias is not a problem then we are unlikely to see differences between newer and older panel members. Table 1 shows the results of an

OLS model regressing panel survey experience on demographic, party and ideology variables.¹⁰

Table 1. OLS Panel Tenure Demographic Model

	b	Standard Error
Age	1.26*	0.18
Education	-16.90*	3.87
White	13.35	7.91
Female	-11.94	6.21
Income	2.89*	0.75
Married	-13.53	7.09
Working	14.83*	6.63
Internet	-57.50*	8.08
Party ID	-0.06	1.74
Ideology	2.09	2.54
EGSS2	-5.93	8.12
EGSS3	-16.55	8.63
EGSS4	0.82	9.30
Constant	135.24*	25.60
R ²	0.05	
F	12.80*	
N	4,902	

Note: * p < 0.05

There are many factors that are significantly related to panel tenure. Older panel members are more likely to have completed more surveys, while more educated panel members are more likely to have completed fewer surveys. Women on average complete about 12 less surveys than men. Household income is positively related to completing more surveys, but married individuals complete fewer surveys. Importantly, panel members who were not provided with Internet access by Knowledge Networks complete on average 58 fewer surveys consistent with our hypothesis regarding the impact of

¹⁰ We use OLS because of its ease of interpretation and the continuous nature of our dependent variable. When we use a negative binomial regression model, the results are the same.

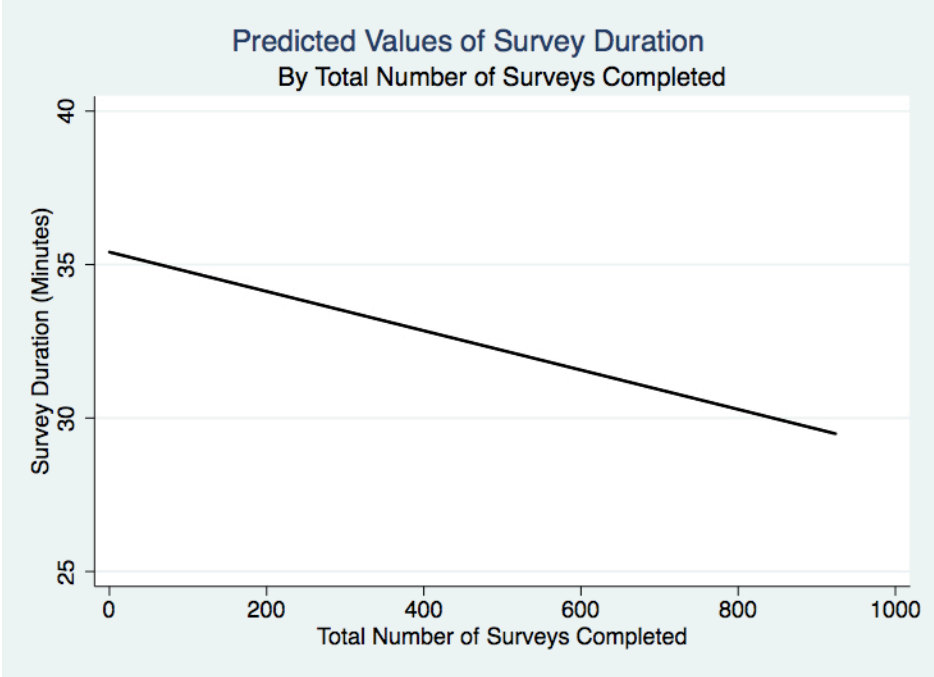
extrinsic rewards on behavior. These respondents get more rewards than other respondents and participate less.

These results suggest that certain types of people are more likely to complete surveys than others, such that all panel members are not created equally and that some engage in the interview process more than others, which may influence survey responses and data quality.

Survey Duration

Figure 2 displays the predicted values from our OLS regression of survey duration (survey completion time) for each value of total number of surveys completed (model results displayed in Table S.1). It is clear that the observed negative relationship provides evidence in favor of our second hypothesis that more professional respondents complete surveys more quickly. We observe a substantial five-minute decline in survey duration from the lowest number of surveys completed (2) in the data (35.24 minutes), to the highest (29.95 minutes). At the 10th (31 surveys completed) and 90th (403 surveys completed) percentiles we still see a considerable decline at 2.14 minutes and between the 25th (63 surveys completed) and 75th (260 surveys completed) percentiles 1.14 minutes. These results show that in fact those who have taken more surveys are behaving differently than those with less experience in the online survey panel. We posit that the implication of this empirical finding is that respondents are learning how to take surveys more efficiently through the experience of responding to repeated questionnaires.

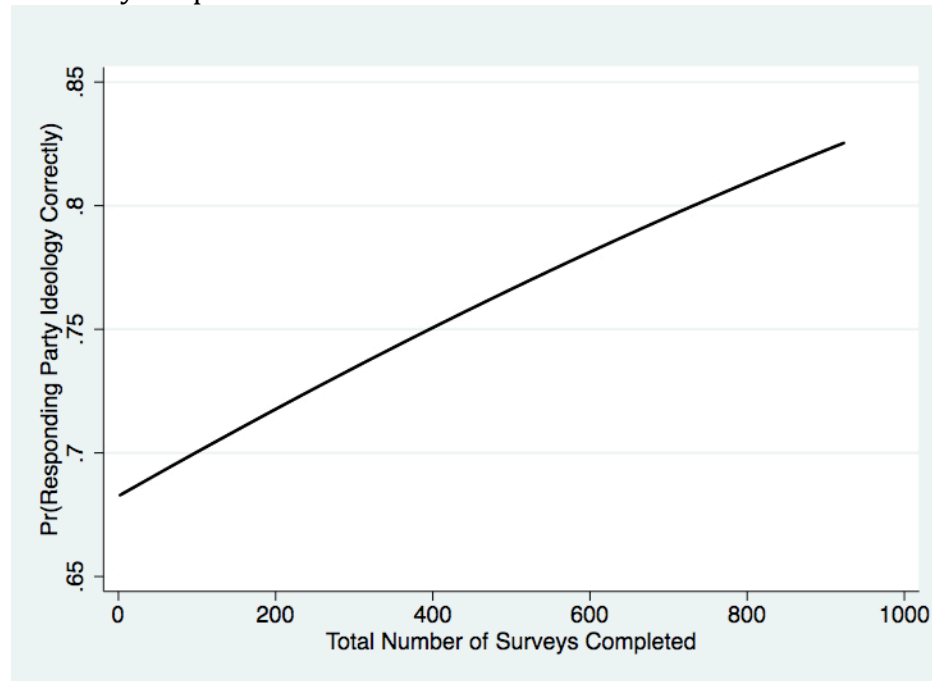
Figure 2: Predicted Survey Duration as Total Number of Surveys Completed Increases



Political Sophistication

We utilize the respondents’ perceptions of Democrats and Republicans ideological placement as a test of panel conditioning on political sophistication in the combined EGSS data. Our measure is a dichotomous variable, with respondents who perceive the relative ideology of the political parties correctly coded as one (e.g., Democrats more liberal than Republicans, and Republicans more conservative than Democrats). Figure 3 presents the results of whether or not the number of surveys completed is related to respondents’ perceptions of ideological differences between the parties. Consistent with our hypothesis that professional respondents are more politically sophisticated we find that as the number of surveys completed increases, the probability that the respondent correctly perceives the relative ideology of the political parties also increases.

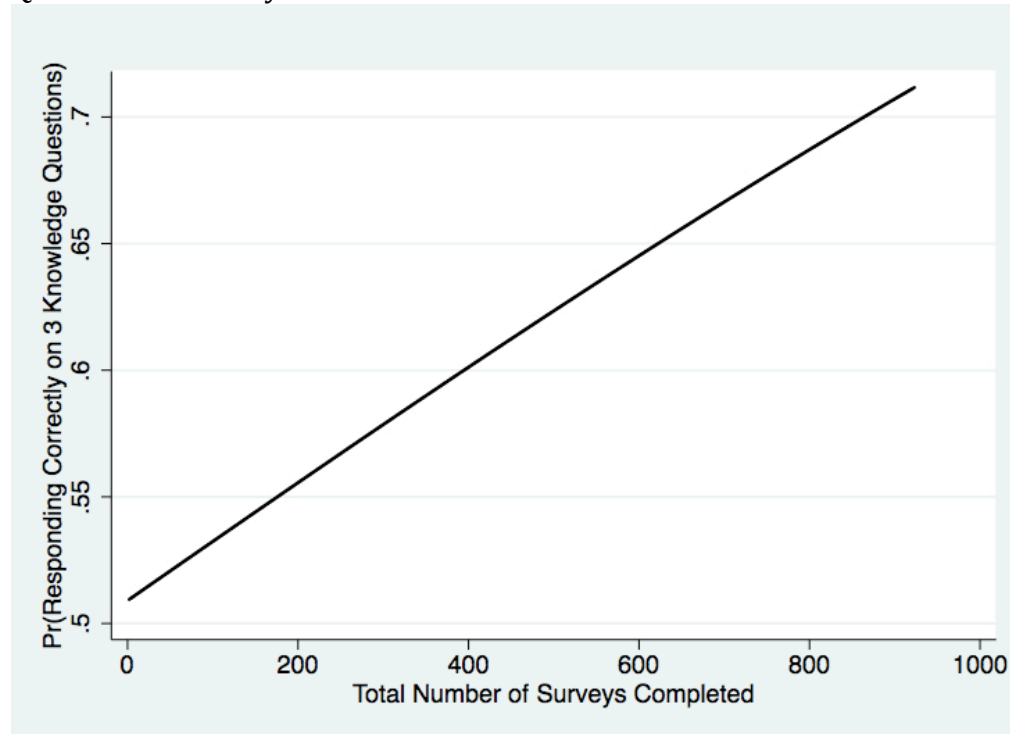
Figure 3. Predicted Probabilities of Correctly Perceiving the Relative Ideology of the Political Parties (e.g., Democrats More Liberal than Republicans) for the Number of Surveys Taken by Respondents



We also explore whether these sophistication effects exist with factual political knowledge questions in the first version of the EGSS. Although all four versions of the EGSS contain factual political knowledge questions, there is limited overlap in the format (open vs. closed ended) and the question wording. We only examine political knowledge questions in the first wave since it is the only one that is not a preliminary release with limited documentation. These questions included which party controlled the House, the Senate, and what was Nancy Pelosi's job, which are combined into a dichotomous variable with respondents correctly identifying all three questions coded as one. This extended measure provides an additional test to determine if those respondents with more survey experience display higher levels of political knowledge. Figure 4 displays the predicted probabilities for answering all three knowledge questions correctly across panel tenure from a logistic regression using the same controls as in the above models. We find that

panel tenure displays a positive and significant relationship with political knowledge. These results provide support for our third hypothesis, evidence of panel conditioning in the data, where respondents are displaying more political sophistication as they gain survey experience.

Figure 4. Predicted Probabilities of Answering All Three Factual Political Knowledge Questions Correctly



Non-Differentiation

We utilize a measure of non-differentiation to explore if the increased frequency of surveying individuals crystallizes their opinions such that they are less likely to satisfice in their responses. We operationalize satisficing with a measure of non-differentiation that is a dichotomous variable, with the value one representing a respondent who perceives their own ideology, the ideology of the Democratic party, and the ideology of the Republican party as identical (e.g., self = very liberal, Democrats = very liberal, and Republicans = very

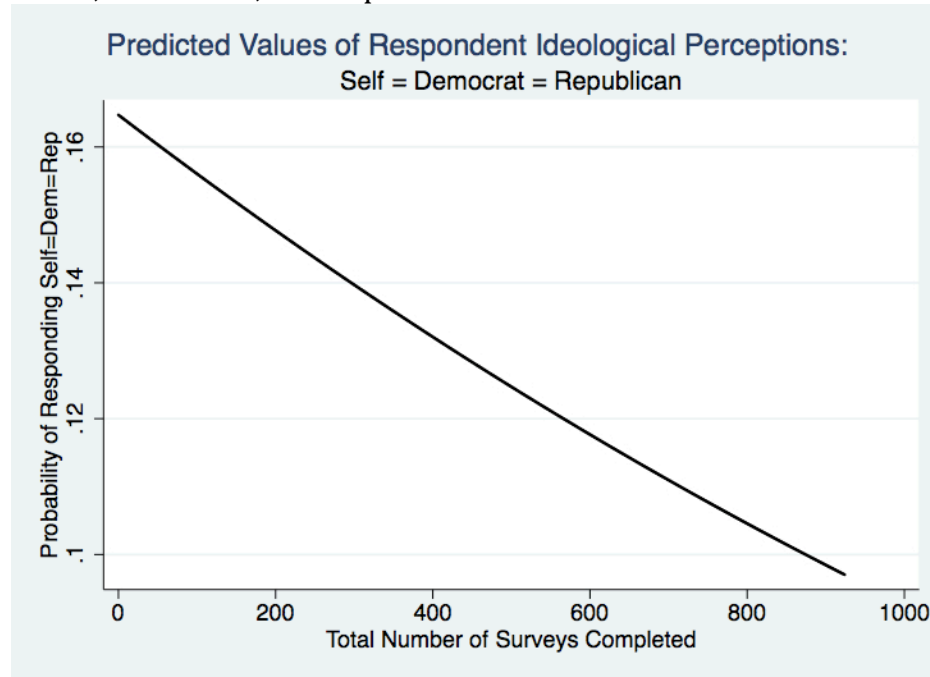
liberal); any respondent scoring one or more variables differently were coded as zero (e.g., self = moderate, Democrats = very liberal, and Republicans = very conservative).¹¹

Figure 5 shows the predicted probabilities of perceiving ideological non-differentiation, which decreases substantially as the number of surveys completed increases. Specifically, there is a decrease of nine and a half percentage points in the probability of responding that self, Democrat, and Republican ideologies are identical when moving from the minimum to the maximum values of total number of surveys completed. Even when considering more common values of total surveys completed this decrease is quite substantial; 4.4 points from the 10th to 90th values, and 2.4 points from the 25th to 75th values. This is further evidence of panel conditioning, where those respondents who have completed more surveys are less likely to perceive the ideologies of self, Democrats, and Republicans as the same.

These results suggest that respondents with lower Knowledge Networks survey experience have not had the time to learn more about their opinions and are more motivated to satisfice than those with longer panel tenure. Repeated survey takers differentiate their opinions more as they take more surveys and consider repeatedly their answers to the same or similar questions over time.

¹¹ Although there is a more complex measure of non-differentiation (see Chang and Krosnick 2009), we use this measure because it is easier to interpret. Nevertheless the conclusions we reach do not change when using the alternative measure.

Figure 5. Predicted Probabilities of Whether or Not the Respondent Perceives the Ideology of Self, Democrats, and Republicans to be Identical



Data Quality Compared to Traditional Survey Modes

To examine whether online panelists are responding differently than those respondents in traditional survey modes, who are not part of a long term panel, we calculate non-differentiation in the 2008 ANES and the cumulative ANES file and then compare it to the EGSS. We expect to find that the 2008 ANES variable distribution is very similar to the cumulative file, providing evidence of the measures population reliability and validity, given that these data represent largely face-to-face probability surveys.¹² Table 2

¹² Using the same sponsoring organization helps to mitigate any unobserved differences (e.g., house effects). Furthermore, we use the 2008 ANES because it is the closest in time to the EGSS data that was collected via face-to-face methods and the cumulative file is used to provide evidence that the 2008 estimates are not outliers.

displays the non-differentiation rates on the same ideology questions across the 2008 ANES, cumulative ANES, and the EGSS surveys. Notice that the 2008 ANES results are very close to what we find in the ANES cumulative file validating our assumption about the quality of the ANES probability surveys over time. We see that in both the 2008 ANES and cumulative ANES the percentage of respondents non-differentiating is about 3%, but that in the 2010 EGSS this percentage is 15.5%. This five-fold difference is very strong evidence that online panelists are more frequently satisficing and not optimizing responses.

Table 2. Frequencies of Whether or Not Respondent Places Self, Democrats, and Republicans as the Same on the Liberal-Conservative Scale

	2008 ANES		Cumulative ANES		EGSS	
	Percentage	Count	Percentage	Count	Percentage	Count
Differentiation	96.9	1539	96.8	22,357	84.5	4,098
Non-Differentiation	3.1	49	3.2	751	15.5	753
Total	100.0	1,588	100.0	23,108	100.0	4,852

Note: Using V080102 (Post-Election Weight) for the 2008 NES; VCF0009 (General Weight Variable) for the cumulative ANES; c1_weigh (EGSS1), c2_weigh (EGSS2), c3_weigh (EGSS3), and c4_weigh (EGSS4) for the merged EGSS.

We also computed a variation of this measure of non-differentiation for both a probability based mixed mode (Internet and mail) survey and a probability based telephone survey of 2008 New Mexico voters to test whether any of the observed differences are due to mode effects. Unfortunately, there were no questions about perceived party ideologies, but there were questions about the perceived ideology of the presidential candidates, John McCain and Barack Obama in the New Mexico surveys, which are reasonable replacements in the non-differentiation measure. We find that 1.3% of the mixed-mode survey respondents¹³ and 2.8% of the phone survey respondents rate their own ideology and the ideology of the two presidential candidates as the same. This

¹³ 1.2% of Internet survey respondents recorded that all three were the same.

provides additional evidence that the high rates of non-differentiation in online survey panels are not due to mode because we find that satisficing effects in non panel self-administered surveys were similar to those in interviewer driven surveys.

Taken together these results provide evidence that the EGSS estimates are substantively different from other types of probability samples and especially the ANES benchmarks. Online survey panelists are responding to the survey environment differently. We theorize that professional respondents may be motivated by the desire to complete surveys and hence are more disengaged and less likely to optimize responses. Even when we consider that those respondents with more experience are more likely to optimize their perceived ideology answers, they are still satisficing at a substantially higher rate than those in survey modes where the incentive structure is based upon social exchange and not personal reward.

Conclusion

We extend the research on panel conditioning in online survey panels by examining the relationship between panel survey experience and measures of political attitudes, survey duration, political sophistication, and non-differentiation. We build our case regarding the effects of panel tenure test by test, thus our research design offers a cumulative first look at professional survey respondents and offer a valuable empirical examination based upon panel conditioning theories of how the changing environment of survey recruitment and survey experience influence response patterns. We show that previous research has not been methodologically rigorous or theoretically driven by examining the direction and magnitude of attitudinal variables. Moreover, we find substantial evidence of panel conditioning when examining survey duration, political

sophistication and non-differentiation. Time to complete the survey is negatively associated with panel tenure, while total completed surveys is positively associated with political sophistication and negatively correlated with non-differentiation.

Additionally, when we compare rates of satisficing in the online survey panel to face-to-face interviewing or a mixed mode self-administered survey, we find that panelists are much more likely to non-differentiate. We speculate, but are unable to test that these differences are due to differences in respondent motivation and engagement in online panels. Importantly satisficing can influence the quality of the data. The issue of data quality from frequent satisficing is potentially much more severe because there are techniques for correcting typical panel conditioning effects that arise from attrition (Bartels 1999). However, even if online survey panel samples match demographic population benchmarks, the political attitude and behavior estimates derived from these data sources may produce more survey error because of the lower motivation and engagement of the respondent. Less differentiation means more error in the coefficients and hence weaker models. These results strongly suggest that more consideration of how professional respondents might influence response patterns is needed.

Finally, the fact that panel survey experience is related to political sophistication may be of particular importance. Because political sophistication is such an important mediating and moderating variable in many substantive question of political behavior (see, for example, Zaller 1992) and it is related to panel survey experience, models that do not include survey experience may bias their results.¹⁴ Therefore panel tenure may be an

¹⁴ Political Knowledge is our best measure of the concept political sophistication (Luskin 1987; Delli Carpini and Keeter 1996; Neuman 1986). Therefore, we use the terms political knowledge and political sophistication interchangeably.

important control in models that are interested in estimating the effects of political knowledge variables.

Fundamentally, the implications of this research are substantial. Most disturbingly, non-differentiation was markedly different from a variety of surveys where panel conditioning was not a factor. Importantly, we expect these conditioning effects to be particularly striking in underrepresented sub-groups in the panel. For example, in 2008 only 18% of the UK YouGov panel was aged 55 or older, even though this proportion in a nationally representative sample should have been 36% (Twyman 2008). Accordingly, those panel members aged 55 or older would be called upon more frequently to participate than younger panel members, and thus are at increased risk of conditioning.

In addition, online panel data are often used for experimental survey research. Experimental studies often attempt to balance their respondents to ensure equivalence between experimental groups. One implication of this research is that panel tenure may be a relevant and important factor in balancing along with standard demographics.

In closing, these findings obviously raise new questions about the growing use of these types of data to answer substantive questions in political science. However, all forms of survey research are faced with survey error (Groves 2011). As survey researchers, we constantly make tradeoffs between different aspects of our designs and the amount of error we are willing to tolerate. For us to make those assessments, we must, however, know and understand the types of errors we have and its influence on the quality of the data. Nevertheless, this is just one study that needs to be replicated and extended, but

there is also a more general need for peer-reviewed research of online survey panel methods so that their legitimacy can be further established (Lupia 2008).

Therefore, it is critical for more research to examine the nature and limits of this new and popular data collection method.

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Supplemental Material to be Made Available Online

Table S.1. Estimates for the Five Common Questions Across the Four EGSS Surveys

	Retrospective Economic Evaluation	Prospective Economic Evaluation	Efficacy	Obama Approval	Support for the Tea Party
	Ordered Logit b/se	Ordered Logit b/se	Ordered Logit b/se	OLS b/se	OLS b/se
Panel Tenure	-0.003 (0.002)	-0.003 (0.002)	-0.001 (0.002)	-0.003 (0.001)	0.000005 (0.001)
Age	0.001 (0.002)	0.007* (0.002)	0.01* (0.002)	0.001 (0.001)	-0.004* (0.001)
Education	0.2* (0.04)	0.2* (0.04)	0.2* (0.04)	0.2* (0.03)	-0.1* (0.03)
White	-0.1 (0.08)	-0.2* (0.09)	-0.7* (0.09)	-0.7* (0.07)	-0.1 (0.06)
Female	-0.1* (0.07)	-0.02 (0.07)	-0.03 (0.07)	0.1 (0.06)	-0.005 (0.05)
HH Income	0.03* (0.01)	0.03* (0.01)	-0.002 (0.01)	-0.004 (0.01)	-0.01* (0.006)
Married	-0.1 (0.07)	-0.1 (0.08)	-0.03 (0.07)	-0.1 (0.06)	0.1 (0.06)
Employed	0.1* (0.08)	0.1 (0.08)	0.1 (0.08)	0.1 (0.06)	-0.03 (0.05)
Internet	0.1 (0.09)	0.1 (0.09)	0.1 (0.09)	-0.1 (0.08)	-0.1 (0.07)
Party ID 7-Pnt	0.3* (0.02)	0.2* (0.02)	0.02 (0.02)	0.5* (0.02)	-0.3* (0.02)
Ideology 7-Pnt	-0.2* (0.03)	-0.1* (0.03)	0.03 (0.03)	-0.3* (0.03)	0.4* (0.02)
EGSS 2	0.4* (0.09)	-0.2 (0.09)	-0.2 (0.09)	0.2* (0.07)	-0.2* (0.07)
EGSS 3	0.2 (0.09)	-0.2* (0.09)	-0.3* (0.09)	0.1 (0.07)	-0.2* (0.07)
EGSS 4	1.0* (0.10)	0.4* (0.10)	-0.3* (0.10)	0.2* (0.08)	-0.2* (0.07)
Cut 1/Constant	-0.1 (0.27)	-0.8* (0.28)	-0.8* (0.28)	2.6* (0.24)	4.7* (0.21)
Cut 2	1.1* (0.27)	0.4 (0.27)	0.9* (0.28)		
Cut 3	3.0* (0.27)	2.4* (0.27)	2.3* (0.28)		
Cut 4	5.8* (0.30)	4.8* (0.29)	3.6* (0.29)		
Adjusted R ²				0.472	0.379
n	4,879	4,878	4,887	4,881	4,880

Note: * p < 0.05

Table S.2 OLS Regression Results for Survey Duration (Minutes): Full Results for Figure 2.

	Survey Duration
	b/(se)
Panel Tenure	-0.01* (0.003)
Age	0.22* (0.04)
Education	-0.40 (0.62)
White	-5.42* (1.60)
Female	-0.89 (1.11)
HH Income	-0.13 (0.17)
Married	-1.01 (1.24)
Employed	0.42 (1.30)
Internet	-9.36* (1.64)
Party ID 7-Pnt	0.12 (0.30)
Ideology 7-Pnt	-0.16 (0.47)
EGSS 2	9.13* (1.52)
EGSS 3	3.13* (1.41)
EGSS 4	11.55* (1.55)
Constant	33.71* (4.40)
Adjusted R ²	0.065
n	4,652

Note: * p < 0.05

Table S.3 Regression Estimates for Perceived Ideology (Ordered Logistic), Political Knowledge (Logistic), and Non-Differentiation (Logistic): Full Results From Figures 3 - 5

	Figure 3: Perceived Ideology Ordered Logit b/se	Figure 4: Political Knowledge Logistic b/se	Figure 5: Nondifferentiation Logistic b/se
Panel Tenure	0.001* (0.0002)	0.001* (0.0006)	-0.0008* (0.0004)
Age	0.02* (0.002)	0.03* (0.01)	-0.03* (0.004)
Education	0.76* (0.05)	0.44* (0.09)	-0.64* (0.06)
White	0.17 (0.11)	0.07 (0.19)	0.13 (0.14)
Female	-0.37* (0.09)	-0.77* (0.16)	0.44* (0.11)
HH Income	0.17* (0.01)	0.10* (0.02)	-0.08* (0.02)
Married	-0.17 (0.10)	-0.05 (0.18)	0.31* (0.12)
Employed	-0.04 (0.10)	-0.14 (0.17)	-0.16 (0.13)
Internet	0.49* (0.11)	0.33 (0.21)	-0.41* (0.14)
Party ID 7-Pnt	-0.12* (0.03)	-0.06 (0.05)	0.04 (0.03)
Ideology 7-Pnt	-0.03 (0.04)	0.15* (0.03)	0.02 (0.05)
EGSS 2	-0.21 (0.13)		0.16 (0.16)
EGSS 3	-0.36* (0.13)		0.53* (0.16)
EGSS 4	-0.21 (0.13)		0.31 (0.16)
Constant	-2.22* (0.36)	-3.86* (0.53)	1.67* (0.41)
n	4,848	1,240	4,862

Note: * p < 0.05

Table S.4. Question Wording for Dependent Variables Used in the Analysis

Self Ideology:

When it comes to politics, would you describe yourself as liberal, conservative, or neither liberal nor conservative?

Would you call yourself very liberal or somewhat liberal?

Would you call yourself very conservative or somewhat conservative?

Do you think of yourself as closer to liberals, or conservatives, or neither of these?

Democrats Ideology:

When it comes to politics, would you describe Democrats as liberal, conservative, or neither liberal nor conservative?

Would you call Democrats very liberal or somewhat liberal?

Would you call Democrats very conservative or somewhat conservative?

Do you think of Democrats as closer to liberals, or conservatives, or neither of these?

Republicans Ideology:

When it comes to politics, would you describe Republicans as liberal, conservative, or neither liberal nor conservative?

Would you call Republicans very liberal or somewhat liberal?

Would you call Republicans very conservative or somewhat conservative?

Do you think of Republicans as closer to liberals, or conservatives, or neither of these?

Retrospective Evaluations of the Economy:

Now thinking about the economy in the country as a whole, would you say that as compared to one year ago, the nation's economy is now better, about the same, or worse?

If better, would you say much better or somewhat better?

If worse, would you say much worse or somewhat worse?

Prospective Evaluations of the Economy:

What about 12 months from now? Do you think the economy, in the country as a whole, will be better, about the same, or worse in 12 months?

If better, would you say much better or somewhat better?

If worse, would you say much worse or somewhat worse?

Efficacy:

How much can people like you affect what the government does?

(A Great Deal, A Lot, A Moderate Amount, A Little, or Not at All?)

Approval of President Obama:

Do you approve, disapprove, or neither approve nor disapprove of the way Barack Obama is handling his job as president?

Do you [approve/disapprove] (extremely strongly, moderately strongly, or slightly strongly / slightly strongly, moderately strongly, or extremely strongly)?

Support for the Tea Party:

Do you support, oppose, or neither support nor oppose the Tea Party movement?

(Oppose a Great Deal, Oppose a Moderate Amount, Oppose a Little, Neither Support nor Oppose, Support a Little, Support a Moderate Amount, or Support a Great Deal)