Measuring Experimenter Demand: Pre-analysis Plan for Experiment 2

Jonathan de Quidt[*]   Johannes Haushofer[†]   Chris Roth[‡]

July 4, 2016

1   Introduction

Experimenter demand effects pose an important challenge to understand and interpret results from laboratory and field experiments (Rosenthal, 1966; Zizzo, 2010). For example, experimenter demand effects are an important obstacle to interpreting effect sizes and they constitute a threat to the external validity of experiments. Experimenter demand effects also affect the optimal design of experiments; however, little or no empirical evidence exists that studies how design features affect the relevance of experimenter demand effects. Moreover, experimental economists have a very limited understanding of the relative importance of experimenter demand effects for different outcome measures or experimental paradigms.

In this experiment we manipulate subjects' beliefs about the intentions and desires of the experimenters. In particular, we are interested in the extent to which people's behavior in economic games is elastic to experimenter demand. Our estimates in turn provide us with a bound for the importance of experimenter demand effects for experimental economics. In our experiment, we manipulate our subjects' beliefs in two different standard preferences measures: a dictator game and an investment game.

Subjects are randomly assigned to one of three main treatment conditions: in the first one (in the case of the investment game), we induce "positive demand", by telling them that "we expect that participants who are shown these instructions will invest more in the project than they

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[*]Institute for International Economic Studies (IIES); e-mail: jonathan.dequidt@iies.su.se.
[†]Department of Psychology and Public Affairs, Princeton University; e-mail: haushofer@princeton.edu.
[‡]Department of Economics, University of Oxford and CSAE; e-mail: christopher.roth@economics.ox.ac.uk.

normally would". In the second treatment condition, we induce "negative demand" by telling our participants that "we expect that participants who are shown these instructions will invest less in the project than they normally would". In the third condition, we do not induce any demand. Similarly, we induce both positive, negative and no demand in the dictator game. Subjects are randomly assigned to play either of the two different games and we also cross-randomize whether our subjects' choices involve real money or are hypothetical.

This document proceeds as follows: first, we outline the experimental design. Then in section 3, we describe the setting as well as the sample size. Subsequently, we describe the hypotheses. In section 5, we describe the analysis we would like to conduct. Finally, in section 6, we define all of our outcome variables of interest.

2 Experimental Design

At the start our respondents complete a screener (Berinsky et al., 2014) that allows us to examine whether they are paying attention to our instructions. Then, our respondents are randomly assigned to play one of the two following games:[1]

2.1 Dictator Game

We let our respondents play a standard dictator game:

In this task you will allocate $1 between yourself and another randomly chosen participant from MTurk who will be informed that another MTurker had the chance to split money with him or her. You will simply decide how much of the $1 you want to send to the other person. You will get to keep the rest of the money for yourself.

We have three main treatment arms:

- **Positive Demand:** Our subjects receive the following instructions: *We expect that participants who are shown these instructions will give more to the other participant than they normally would.*

- **Negative Demand:** Our participants get the following instructions: *We expect that participants who are shown these instructions will give less to the other participant than they*

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[1] We record our participants' response times to the games.

normally would.

- **No Demand:** We do not induce any demand.

2.2 Investment Game

We let our respondents play an investment game (Gneezy and Potters, 1997):

You are endowed with $1 and you can choose how much of the $1 to keep or invest in a risky project. Money that is not invested in the risky project is yours to keep. The risky project has a 40 percent chance of success (that is a 4 out of 10).

- *If the project is successful, you will receive 3 times the amount you chose to invest.*

- *If the project is unsuccessful, you will receive nothing.*

We have three main treatment arms:

- **Positive Demand:** Our subjects receive the following instructions: *We expect that participants who are shown these instructions will invest more in the project than they normally would.*

- **Negative Demand:** Our participants receive the following instructions: *We expect that participants who are shown these instructions will invest less in the project than they normally would.*

- **No Demand:** We do not induce any demand.

2.3 Hypothetical or incentivized

In addition, we also randomize whether our respondents' choices are hypothetical or real. Depending on our respondents' treatment condition we provide them with the following piece of information before completing the behavioral measure:

- **Incentivized**: *We will now ask you to complete a task which involves real money.*

- **Hypothetical**: *We will now ask you to complete a hypothetical task, i.e. this task does not involve real money.*[2]

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[2]We also prepend the game instructions with "Imagine".

2.4 Updated Beliefs

Thereafter our respondents complete a set of questions on their beliefs about the experimenters' intentions and their hypotheses. In particular, we ask the following two questions:

- What do you think is the result that the researchers of this study want to find?

  - They want to find that on average people invest a large share of the $1.

  - They want to find that on average people invest a small share of the $1.

- What do you think was the hypothesis of this research study?

  - The experimenters hypothesized that on average participants would invest a large share of the $1 in the project.

  - The experimenters hypothesized that on average participants would invest a small share of the $1 in the project.

Finally, we examine in how far people completing the task for real money hold different beliefs about whether the task actually involved money or not compared to people completing the hypothetical task. In particular, we ask them:

Which of these options do you think is correct?

- Option A: The choice I made in the game was for real money.

- Option B: The choice I made in the game was for not for real money. It was just for imaginary money.

2.5 Demographics

Finally, we ask participants to complete a questionnaire on demographics, which includes variables on gender, age, education, income etc.

3 Setting, Sample Size and Power

We will run our experiment on Amazon Mechanical Turk, an online platform which is widely used to conduct experiments. We will only recruit participants who currently live in the United States. Moreover, workers must have completed at least 500 HITs, and they must have an overall

rating of more than 95 percent. We pay our participants a show-up fee of $.25. Given that the average duration of the experiment is 2 minutes, this implies an average hourly wage of $7.50 which is above the average pay on mTurk.

We plan to recruit 3000 participants, with 1500 participants randomly assigned to each of the two different games, 1000 participants randomly assigned to each of the three different demand conditions. Also, half of our participants are assigned to complete these tasks for real money.

For our main test of interest, i.e. comparing the behavior of people in the positive and negative demand condition we have a power of .8 to detect standardized effect sizes of 0.125 at $\alpha = 0.05$. To test for heterogeneous treatment effects by incentives and gender we have a power of .8 to detect effect sizes of 0.177 at $\alpha = 0.05$ respectively. Finally, to test for heterogeneous responses to demand for the two different games, we can detect effect sizes of .177 with power .8 at $\alpha = 0.05$.

4   Main Hypotheses

Hypothesis 1 (Positive Demand): We hypothesize that individuals in the "positive demand condition" will donate more money to another mTurker and will invest more in the investment game relative to participants in the control group.

Hypothesis 2 (Negative Demand): We hypothesize that individuals in the "negative demand condition" will donate less money to another mTurker and will invest less in the investment game compared to participants in the control group.

5   Analysis

5.1   Baseline Balance

We will test for baseline balance for the following variables:

- gender

- age

- log income (income is the midpoint of the interval specified by the respondent)

- household size

- ethnicity (dummies for White, Black, Hispanic, and Asian)

- employment status (dummies for unemployed, part-time employed, and employed full-time)

- education (dummy for person with at least bachelor degree)

- experience on MTurk (number of HITs completed on MTurk)

- political orientation (taking value one for Republicans and zero otherwise)

We will regress each of these variables on a treatment indicator to see if there are imbalances. We will account for multiple hypothesis testing by regressing the treatment indicator on all of the variables, and we will conduct a joint F-test, to see if the coefficients are jointly different from zero.

5.2 Main Specifications

5.2.1 Summary of main results

We present our main results by providing the means and standard deviations for each of our main games separately for each of the following conditions:

- Positive Demand with incentives

- Negative Demand with incentives

- No Demand with incentives

- Positive Demand without incentives

- Negative Demand without incentives

- No Demand without incentives

Thus in total, we present 12 means and standard deviations for our treatment arms of interest. We will also present these results graphically by the means of bar charts and by providing conventional 95 percent confidence intervals around the mean. We will also report the equivalent game-level regressions, with standard errors uncorrected for multiple comparisons. We next turn to our main specifications of interest.

5.2.2 Test 1: does demand affect choices?

First, we simply compare the behavior of people in the positive demand group and in the negative demand group with that of people in the control group. We z-score our outcome variables at the paradigm-incentive level, using the mean and s.d. for the no-demand group (Kling et al., 2007). For our main specification we pool together the z-scored outcomes for all three different games. We regress our z-scored outcome variable, ZY_i, on a treatment indicator, POS_i, which takes value one for people who receive the positive demand treatment, and value zero for all the other participants and on a dummy, NEG_i taking value one for people who receive the negative demand treatment, and value zero for all the other participants. Specifically, the equation that we estimate is:

$$ZY_i = \beta_0 + \beta_1 POS_i + \beta_2 NEG_i + \varepsilon_i$$

We conduct three main tests:

- Do people increase their giving, their investment and their patience when exposed to positive demand? $\beta_1 > 0$

- Do people decrease their giving, their investment and their patience when exposed to negative demand? $\beta_2 < 0$

- Is the overall response to demand non-zero? $\beta_1 - \beta_2 = 0$

We correct for multiple hypothesis testing in these three tests by using the "sharpened q-value approach" (Anderson, 2008; Benjamini et al., 2006). In particular, we will adjust our p-values for a false discovery rate of .05.

5.2.3 Test 2: does demand respond to incentives?

In a next step, we test whether incentives affect experimenter demand. To do so, we regress our normalized outcome variables, pooled across games, on the same set of regressors as above as well as an indicator variable, M_i, taking value one when people are in the incentive condition, and the interaction between M_i and the demand treatment indicators, POS_i and NEG_i.

$$ZY_i = \beta_0 + \beta_1 POS_i + \beta_2 NEG_i + \beta_3 M_i \times POS_i + \beta_4 M_i \times NEG_i + \varepsilon_i$$

To test whether incentives affect experimenter demand, we run the following test:

$$\beta_3 - \beta_4 = 0$$

which tests whether the difference between behavior under positive and negative demand, i.e. the magnitude of our demand effect, responds to incentives.

5.2.4 Test 3: Does demand differ between games?

Subsequently, we test whether experimenter demand varies by the type of game that our respondents play. In particular, we interact dummy variables for the different games with our "demand treatment indicators". Specifically, RP_i takes value one for participants randomly assigned to play the investment game and zero otherwise. To identify differential effects across games we estimate the following equation:

$$ZY_i = \beta_0 + \beta_1 POS_i + \beta_2 NEG_i + \beta_3 RP_i \times POS_i + \beta_4 RP_i \times NEG_i + \varepsilon_i$$

We examine whether the effects of demand differ between the dictator game and the investment game by conducting the following test.

$$H_0^{DR} : \beta_3 - \beta_4 = 0, \ H_1^{DR} : \beta_3 - \beta_4 \neq 0$$

5.2.5 Test 4: does demand differ between men and women?

Subsequently, we test whether the elasticity of behavior to experimenter demand differs for men and women. To do so, we interact our demand indicators with a dummy, $Male_i$, taking value one for males. More precisely, we estimate the following equation:

$$ZY_i = \beta_0 + \beta_1 POS_i + \beta_2 NEG_i + \beta_3 MALE_i \times POS_i + \beta_4 MALE_i \times NEG_i + \beta_5 MALE_i + \varepsilon_i$$

To test for gender differences in response to demand we conduct the following test:

$$\beta_3 - \beta_4 \geq 0$$

which tests whether the size of the demand effect (difference in behavior under positive and negative demand) differs by gender.

5.2.6 Test 5: does demand differ by attention?

Finally, we also test whether the elasticity of behavior to experimenter demand differs for attentive vs. inattentive subjects. To do so, we interact our demand indicators with a dummy, $Attention_i$, taking value one for all subjects correctly responding to the attention check. More precisely, we estimate the following equation:

$$ZY_i = \beta_0 + \beta_1 POS_i + \beta_2 NEG_i + \beta_3 Attention_i \times POS_i + \beta_4 Attention_i \times NEG_i$$
$$+ \beta_5 Attention_i + \varepsilon_i$$

To test differences in response to demand by attention we conduct the following test:

$$\beta_3 - \beta_4 \geq 0$$

which tests whether the size of the demand effect (difference in behavior under positive and negative demand) differs by attention.

5.2.7 Test 6: Beliefs about experimental hypotheses

To check whether the demand treatments affected people's beliefs about what the researchers want to find and hypothesized, we estimate the following equation:

$$\text{Belief}_i = \alpha_0 + \alpha_1 POS_i + \alpha_2 NEG_i + \varepsilon_i$$

As before, we conduct three main tests:

- Are people more likely to believe we wanted/hypothesized a "high" action when exposed to positive demand? $\alpha_1 > 0$

- Are people more likely to believe we wanted/hypothesized a "low" action when exposed to positive demand? $\alpha_2 < 0$

- Is there an overall effect effect of demand on beliefs? $\alpha_1 - \alpha_2 = 0$

As above, we account for multiple hypothesis adjustment by adjusting the p-values for these six tests (three per beliefs question, two questions) for a false discovery rate of .05 (Anderson, 2008).

5.2.8 Test 7: Beliefs about additional bonuses

To check whether the incentive treatment affected people's beliefs about whether they will be paid for their choice in the task we estimate the following equation:

$$\text{Beliefbonus}_i = \beta_0 + \beta_1 incentive_i + \varepsilon_i$$

Beliefbonus$_i$ takes value one if people think that they completed the task for real money. We conduct one test: Are people more likely to believe that the task involved real money when doing the task for real money? $\beta_1 > 0$

5.3 Testing for differences in social and cognitive demand

We will use data from a previous experiment in which we tested in how far behavior is elastic to demand to examine whether our estimates of experimenter demand differ for different experimental instructions. In the first experiment, we induced quite strong social demand by telling our participants that they will do us a favor if they behave in a particular way[3]. In experiment 2 outlined in this pre-analysis plan we manipulated our subjects' beliefs about the experimenter's expectations (and hypotheses).

We pool our data from the previous experiment (Experiment 1) together with our data from the experiment, we-prespecified in this PAP (Experiment 2). Then, we run three different regressions. First we pool all observations from the dictator[4] and investment game[5] together, then we estimate the baseline specification separately for the dictator and investment game. We include a dummy indicator taking value 1 for observations from experiment 1, $Experiment1_i$ and interact this indicator with the demand treatment indicators. In particular, we estimate the following three specifications:

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[3]The pre-analysis plan for this first experiment with experimental instructions can be found here: `https://www.socialscienceregistry.org/trials/1248`

[4]ZY_i^{DT} refers to the normalized outcomes from the dictator game. The superscript DT refers to the dictator game.

[5]ZY_i^{RP} refers to the normalized outcomes from the investment game. The superscript RP refers to the investment game.

$$ZY_i = \gamma_0 + \gamma_1 POS_i + \gamma_2 NEG_i + \gamma_3 POS_i \times Experiment1_i$$
$$+ \gamma_4 NEG_i \times Experiment1_i + \gamma_5 Experiment1_i + \varepsilon_i$$

$$ZY_i^{DT} = \gamma_0^{DT} + \gamma_1^{DT} POS_i + \gamma_2^{DT} NEG_i + \gamma_3^{DT} POS_i \times Experiment1_i$$
$$+ \gamma_4^{DT} NEG_i \times Experiment1_i + \gamma_5^{DT} Experiment1_i + \varepsilon_i$$

$$ZY_i^{RP} = \gamma_0^{RP} + \gamma_1^{RP} POS_i + \gamma_2^{RP} NEG_i + \gamma_3^{RP} POS_i \times Experiment1_i$$
$$+ \gamma_4^{RP} NEG_i \times Experiment1_i + \gamma_5^{RP} Experiment1_i + \varepsilon_i$$

We test the following three hypotheses:

- Is demand in experiment 1 equal to demand in experiment 2? $\gamma_3 - \gamma_4 \neq 0$

- Is demand in experiment 1 equal to demand in experiment 2 in the dictator game?
  $\gamma_3^{DT} - \gamma_4^{DT} \neq 0$

- Is demand in experiment 1 equal to demand in experiment 2 in the investment game?
  $\gamma_3^{RP} - \gamma_4^{RP} \neq 0$

As above, we account for multiple hypothesis adjustment by adjusting the p-values for three tests for a false discovery rate of .05 (Anderson, 2008).

5.4 Dealing with Imbalances

If there are imbalances between the treatment group and the control group, we will also estimate the above equations with a set of controls. We will choose as controls all of the variables for which there are imbalances.

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5.5 Differential Attrition

We will test whether attrition is related to the treatment by estimating the following equation:

$$A_i = \pi_0 + \pi_1 Treatment_i + \Pi^T X_i + \varepsilon_i$$

where A_i indicates if a participant did finish our experiment, $Treatment_i$, and where X_i is a vector of pre-determined characteristics. We will use the same set of pre-determined characteristics as for the baseline balance test.

If the coefficient π_1 on the treatment indicator is significant at the 5 percent level, we will use Lee bounds for the statistical analysis. This will allow us to bound our estimates. If the coefficient π_1 is not significant at the 5 percent level, we will conduct the statistical analysis without adjusting for attrition.

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Experimental Instructions

A   Screener

When a big news story breaks people often go online to get up-to-the-minute details on what is going on in the world. We want to know which websites people trust to get this information. We also want to know if people are paying attention to the question. To show that you've read this much, please ignore the question and select ABC News and The Drudge Report as your two answers.

When there is a big news story, which is the one news website would you visit first? (Please only choose one)

B   Instructions: Dictator Game

B.1   Control (Incentives)

We will now ask you to complete a task which involves real money. In this task you will allocate $1 between yourself and another randomly chosen participant from MTurk who will be informed that another MTurker had the chance to split money with him or her.

You will simply decide how much of the $1 you want to send to the other person. You will get to keep the rest of the money for yourself. What amount would you like to give to the other MTurk participant?

B.2   Positive Demand (Incentives)

We will now ask you to complete a task which involves real money. In this task you will allocate $1 between yourself and another randomly chosen participant from MTurk who will be informed that another MTurker had the chance to split money with him or her.

You will simply decide how much of the $1 you want to send to the other person. You will get to keep the rest of the money for yourself.

We expect that participants who are shown these instructions will give more to the other participant than they normally would.

What amount would you like to give to the other MTurk participant?

B.3   Negative Demand (Incentives)

We will now ask you to complete a task which involves real money. In this task you will allocate $1 between yourself and another randomly chosen participant from MTurk who will be informed that another MTurker had the chance to split money with him or her.

You will simply decide how much of the $1 you want to send to the other person. You will get to keep the rest of the money for yourself.

We expect that participants who are shown these instructions will give less to the other participant than they normally would.

What amount would you like to give to the other MTurk participant?

B.4   Control (No Incentives)

We will now ask you to complete a hypothetical task, i.e. this task does not involve real money. Imagine that you allocate $1 between yourself and another randomly chosen participant from MTurk who will be informed that another MTurker had the chance to split money with him or her.

You will simply decide how much of the $1 you want to send to the other person. You will get to keep the rest of the money for yourself. What amount would you like to give to the other MTurk participant?

B.5   Positive Demand (No Incentives)

We will now ask you to complete a hypothetical task, i.e. this task does not involve real money. Imagine that you allocate $1 between yourself and another randomly chosen participant from MTurk who will be informed that another MTurker had the chance to split money with him or her.

You will simply decide how much of the $1 you want to send to the other person. You will get to keep the rest of the money for yourself.

What amount would you like to give to the other MTurk participant?

B.6 Negative Demand (No Incentives)

We will now ask you to complete a hypothetical task, i.e. this task does not involve real money. Imagine that you allocate $1 between yourself and another randomly chosen participant from MTurk who will be informed that another MTurker had the chance to split money with him or her.

You will simply decide how much of the $1 you want to send to the other person. You will get to keep the rest of the money for yourself.

What amount would you like to give to the other MTurk participant?

B.7 Beliefs

What do you think is the result that the researchers of this study want to find?

- They want to find that on average people give a large share of the $1 to the other person.

- They want to find that on average people give a small share of the $1 to the other person.

What do you think was the hypothesis of this research study?

- The experimenters hypothesized that on average participants would send a large share of the $1 to the other person.

- The experimenters hypothesized that on average participants would send a small share of the $1 to the other person.

C   Instructions: Investment Game

C.1   Control (Incentives)

We will now ask you to complete a task which involves real money.

You are endowed with $1 and you can choose how much of the $1 to keep or invest in a risky project. Money that is not invested in the risky project is yours to keep. The risky project has a 40 percent chance of success (that is a 4 out of 10).

- If the project is successful, you will receive 3 times the amount you chose to invest.

- If the project is unsuccessful, you will receive nothing.

What amount would you like to invest in the risky project?

C.2   Positive Demand (Incentives)

We will now ask you to complete a task which involves real money.

You are endowed with $1 and you can choose how much of the $1 to keep or invest in a risky project. Money that is not invested in the risky project is yours to keep. The risky project has a 40 percent chance of success (that is a 4 out of 10).

- If the project is successful, you will receive 3 times the amount you chose to invest.

- If the project is unsuccessful, you will receive nothing.

We expect that participants who are shown these instructions will invest more in the project than they normally would.

What amount would you like to invest in the risky project?

C.3   Negative Demand (Incentives)

We will now ask you to complete a task which involves real money.

You are endowed with $1 and you can choose how much of the $1 to keep or invest in a risky project. Money that is not invested in the risky project is yours to keep. The risky project has a 40 percent chance of success (that is a 4 out of 10).

- If the project is successful, you will receive 3 times the amount you chose to invest.

- If the project is unsuccessful, you will receive nothing.

We expect that participants who are shown these instructions will invest less in the project than they normally would.

What amount would you like to invest in the risky project?

C.4   Control (No Incentives)

We will now ask you to complete a hypothetical task, i.e. this task does not involve real money. Imagine you are endowed with $1 and you can choose how much of the $1 to keep or invest in a risky project.

Money that is not invested in the risky project is yours to keep. The risky project has a 40 percent chance of success (that is a 4 out of 10).

- If the project is successful, you will receive 3 times the amount you chose to invest.

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What amount would you like to invest in the risky project?

C.5   Positive Demand (No Incentives)

We will now ask you to complete a hypothetical task, i.e. this task does not involve real money. Imagine you are endowed with $1 and you can choose how much of the $1 to keep or invest in a risky project.

Money that is not invested in the risky project is yours to keep. The risky project has a 40 percent chance of success (that is a 4 out of 10).

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- If the project is unsuccessful, you will receive nothing.

We expect that participants who are shown these instructions will invest more in the project than they normally would.

What amount would you like to invest in the risky project?

C.6 Negative Demand (No Incentives)

We will now ask you to complete a hypothetical task, i.e. this task does not involve real money. Imagine you are endowed with $1 and you can choose how much of the $1 to keep or invest in a risky project.

Money that is not invested in the risky project is yours to keep. The risky project has a 40 percent chance of success (that is a 4 out of 10).

- If the project is successful, you will receive 3 times the amount you chose to invest.

- If the project is unsuccessful, you will receive nothing.

We expect that participants who are shown these instructions will invest less in the project than they normally would.

What amount would you like to invest in the risky project?

C.7 Beliefs

What do you think is the result that the researchers of this study want to find?

- They want to find that on average people invest a large share of the $1.

- They want to find that on average people invest a small share of the $1.

What do you think was the hypothesis of this research study?

- The experimenters hypothesized that on average participants would invest a large share of the $1 in the project.

- The experimenters hypothesized that on average participants would invest a small share of the $1 in the project.

Which of these options do you think is correct?

- Option A: The choice I made in the game was for real money.

- Option B: The choice I made in the game was for not for real money. It was just for imaginary money.

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D Demographics

The main part of the survey is now over. We will now just ask you some general questions about yourself.

Which of these describes you more accurately? [Male, Female]

What year were you born?

In which state do you currently reside?

How many people are there in your household including yourself?

What was your annual household income (before taxes) in 2015? [Less than $10,000, Between $10,000 and $19,999, Between $20,000 and $29,999, Between $30,000 and $39,999, Between $40,000 and $49,999, Between $50,000 and $59,999, Between $60,000 and $69,999, Between $70,000 and $79,999, Between $80,000 and $99,999, More than $100,000]

What is the highest level of education you have completed? [12th grade or less; Graduated high school or equivalent; Some college, no degree; Associate degree; Bachelor's degree; Post-graduate degree]

What is your religion? [Christianity, Judaism, Islam, Hinduism, None, Other]

What is your ethnicity? [White, Black, Hispanic, Asian, Other]
What category would best describe your political orientation? [Democrat; Republican; Other]
Pick the category that describes you best: [Mechanical Turk is my main source of income. I work on Mechanical Turk to supplement my income. I work on Mechanical Turk as a hobby. Other]
Which of these describes your current situation most accurately? [Employed full-time, Employed part-time, Unemployed and looking for a job, Unemployed but not looking for a job, Retired, Other]
How many HITs have you already completed on Amazon Mechanical Turk? [dropdown menu]