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Food Insecurity, Cognitive Control, and Risky Choice

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Food Insecurity, Cognitive Control, and Risky Choice

Abstract

Food insecurity affects roughly 18 million people in the United States and 2.3 billion globally. Given its prevalence, this study aims to examine how food insecurity and resulting anxiety affect cognitive control and decision-making. Samples of $n=102$ food-insecure and $n=102$ food-secure individuals were recruited from the Prolific online subject pool to complete an incentivized Stroop Task and a Monetary Risk Taking task. Randomized treatment assignments administered either a High or Low Cognitive Load manipulation prior to decision making by prompting participants to consider a more or less expensive unexpected financial expense. While food insecurity did not impact cognitive control and risky choices as hypothesized, it may indirectly affect outcomes via anxiety. And, exploratory analysis of response times data suggest food insecurity may promote some increased risk taking due to less deliberative decision processing. The role of anxiety and its effect on choice process among the food-insecure likely merits further investigation.

JEL classification

D00, D91, I30

Keywords

food insecurity, cognitive load, anxiety, cognitive control, risky choice

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1 Introduction

According to [U.S. Department of Agriculture, Economic Research Service \(2025\)](#), food insecurity is the household-level economic and social condition of limited or uncertain access to adequate food. As of 2023, 13.5% of households—roughly 18 million people—were food insecure in the United States alone ([U.S. Department of Agriculture, Economic Research Service, 2025](#)). Statistical analysis from the [World Health Organization \(2025\)](#) shows that worldwide, approximately 2.3 billion people in 2024 are facing food insecurity. Because food insecurity is a persistent global issue, its significance remains important, and further research is needed to understand how it may have implications that stretch into the behavioral realm.

Food insecurity is considered a clear subset of poverty ([Haushofer and Fehr, 2014](#)), and its consequences relate to both cognitive development and cognitive control. Cognition and neural development are negatively impacted by poverty, which can have serious implications. Research suggests that poverty, and thus food insecurity, is plausibly correlated to cognition through diminished overall cognitive performance ([Mani et al., 2013](#)), reduction of mental bandwidth ([Mani et al., 2013](#); [de Bruijn and Antonides, 2022](#)), reduction of cognitive flexibility and adaptivity ([Long et al., 2023](#)), and brain network disruptions ([Royer et al., 2021](#)). Such effects likely imply downstream life consequences ([Royer et al., 2021](#)), increased depression rates ([McMichael et al., 2021](#)), and the development and maintenance of poverty traps ([Haushofer and Fehr, 2014](#)).

Findings from observational data and animal experimentation trials on cognitive and behavioral control (i.e., decision-making) are conflicting. Some research has plausibly demonstrated that those experiencing poverty and/or food insecurity may make more impulsive decisions ([Palamarchuk and Vaillancourt, 2021](#); [Mani et al., 2013](#); [Vohs, 2013](#)) while others have found it promotes risk-averse decisions ([de Bruijn and Antonides, 2022](#); [Haushofer and Fehr, 2014](#)). Risk aversion is not, per se, better or worse than risk-seeking preferences, but both imply different choice patterns and subsequent consequences. Despite some conflicted findings, [Mani et al. \(2013\)](#) explain that poverty, as a whole, has been linked to impaired self-control of the sort that is associated with more negative outcomes in meaningful real-life scenarios ([Mani et al., 2013](#); [Vohs, 2013](#)). In short, decrements in cognitive control would predict altered decision-making patterns and processes that can also contribute to negative outcomes or habits such as poverty traps and over-borrowing ([de Bruijn and Antonides, 2022](#); [Vohs, 2013](#)).

Food insecurity levels remain well above pre-COVID-19 pandemic levels ([Organization et al., 2024](#)). Thus, there is a need for further research into the full effects of food insecurity, including the under-appreciated effects it may have on cognition and decision-making. The present study administered an incentivized cognitive control task and a monetary risk-taking task to validated samples of food-secure and food-insecure individuals to help address this gap in the literature.

We summarize our findings as follows. While food insecurity was not found to have a direct affect on key outcome variables, it did impact one’s anxiety response to the key cognitive manipulation. And, some selective evidence found that increased anxiety for a food insecure individual decreased cognitive control and increased monetary risk taking in some version of the decision tasks. Other exploratory analysis found evidence that food insecure individuals have a different choice process than food secure individuals, expecially when choosing risky outcomes.

2 Methodology

Study procedures, sample size targets, and analysis plans were preregistered on the Open Science Framework (OSF) prior to data collection.¹

Ethics approval was given by the Institutional Review Board (IRB) at Appalachian State University, and all participants provided voluntary informed consent. Full instructions for both the screener survey and main decision task survey are given in Appendix B.

2.1 USDA food insecurity screening database

Participants for the study were recruited using the Prolific database (Palan and Schitter, 2018; Peer et al., 2017). A first-stage survey assessed potential participants for their food insecurity levels, and preregistration plans were to recruit those who were the most and least food secure for the main decision study. Participants were U.S. residents aged 18 to 40, where the age restriction was intended to reduce the confounding effects of aging on cognition (Singh-Manoux et al., 2012).

The pre-screen survey administered the USDA 6-Point Food Insecurity instrument (U.S. Department of Agriculture, Economic Research Service, 2024) to a total of 599 participants, and Table 1 shows the food insecurity profile of those who completed our screener survey. The participants' USDA food insecurity scores were used to custom recruit those experiencing high and low levels of food insecurity for the main decision task study, as per our preregistration plans.

Table 1: Preliminary Screener Sample: Food Insecurity Scale

Insecurity Score	Insecurity Level	Number of Participants	% of Participants
0-1	Low Food Insecurity	359	59.93
2-4	Marginal to High Food Insecurity	117	19.53
5-6	Very High Food Security	123	20.53

Notes: The USDA scale is described as a “food security” scale with higher values indicating lower food security (i.e., food insecurity). For clarity, we renamed the categories so that higher scores indicate greater food insecurity (rather than low food security).

In addition to the USDA 6-point questionnaire, the pre-screen survey included a domain-specific risk-taking instrument to provide a baseline measure of one's risk attitude (Blais and Weber, 2006) and a 6-item cognitive reflection task used to assess thinking style (Primi et al., 2016).

2.2 Sample Size Rationale

The researchers preregistered plans to recruit a total of 200 participants (100 participants high and 100 low in food insecurity) for the main decision task study. The desired sample size was assessed with an ex ante power analysis using G*Power 3.1.9.7. Such a sample size has a power of 0.80 to identify medium-sized effects ($d = .52$) for non-parametric differences in mean outcomes at the participant level. These differences are for one-tailed tests of a preregistered hypothesis that focus on food insecure participant treatment effect hypotheses ($d = .58$ for a 2-tailed test). Medium-small effect sizes are detectable if similar hypotheses are tested in a multiple regression model focusing on a

¹https://osf.io/ckedy/overview?view_only=5b81a266c9b242d19d77c8f07d3068a1

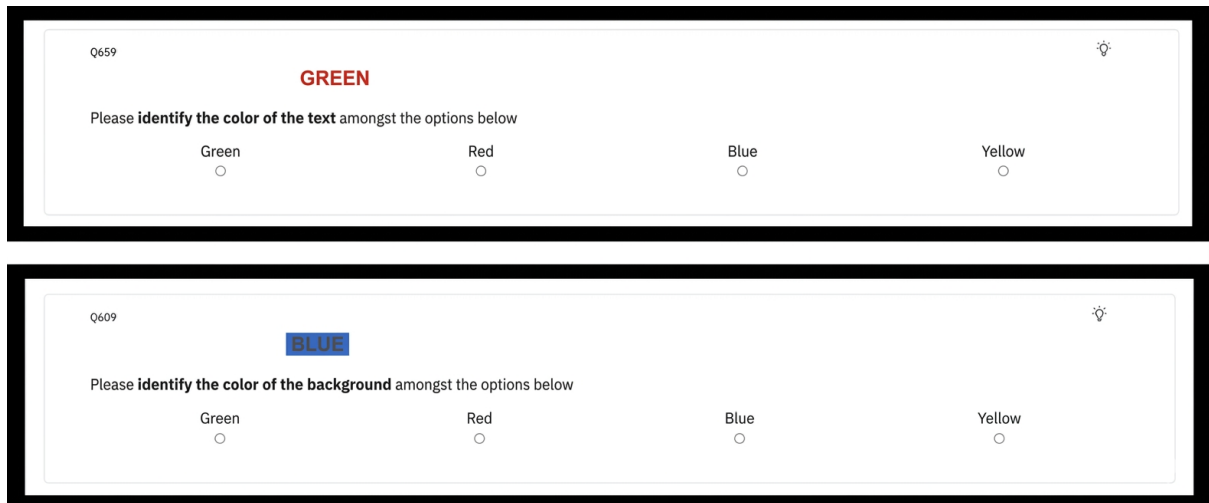
single regression coefficient ($f^2 = .08$). Our sample has power to detect small or near-small effect sizes in similar models when focusing on comparisons between food insecure and insecure participants that utilize a full $n=200$ participant sample. The design is more well-powered to identify small effect sizes in the planned panel data analysis that considers the trial-level observations.

2.3 Main Study Decision Tasks and Key Variables

2.3.1 Stroop Task

An incentivized Stroop task (Stroop, 1935) was administered to examine cognitive control among the participants in the main study. Two blocks of 16 Stroop task trials were administered. One block administered a set of traditional Stroop word/color trials. Here, the word Green, Red, Blue, or Yellow appeared as the target stimulus for the trial, and the color of the font in which the word was written could be any one of those 4 colors. Participants are asked to indicate the color *of the text* for the target stimulus word. The idea is that an incongruence between the color of the text and the word written (e.g., the word “Red” written in yellow font) requires cognitive control to suppress an impulse to select the response corresponding to the word rather than the text color. A second block of trials, called the Background-Stroop, varied this slightly by matching or mismatching the background color on which the word was written (seen in Dickinson (2023)). Figure 1 references an example of an incongruent Stroop task trial (upper panel) and a congruent trial of the Background-Stroop (lower panel). Subjects were informed of a 4-second time limit for each trial; this time limit was based on pilot tests, and the time constraint did not appear binding for most participants. Each correct response earned the participant a 5-cent bonus payment at the end of the study.

Figure 1: Stroop Task Examples



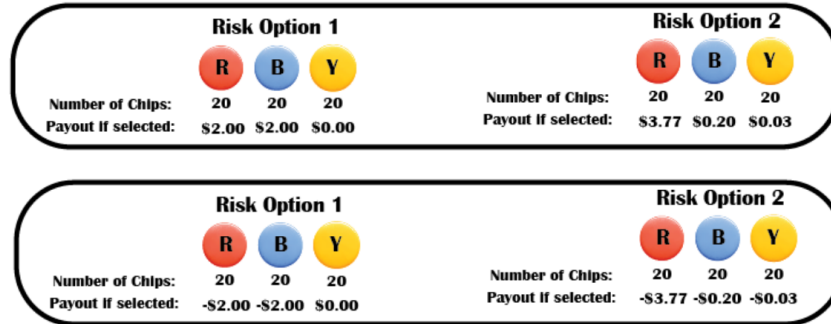
Notes: Example of regular Stroop task trial (top) and the Background-Stroop task trial (bottom). Each 16 trial block included all possible combinations of words and text/background colors of the same set colors (Red, Blue, Green, Yellow). The key outcome measure was accuracy of a given Stroop-trials block (i.e., number correct out of 16 total trials in the block).

2.3.2 Monetary Risky Taking (Risky Choice) Task

A Risky Choice task was administered after the Stroop task to assess monetary risk taking in both the Gains and Losses domains. The task was split into a 10-trial block

of “Gains” and a 10-trial block of “Losses” trials. The task used the same risky choice structure and trials as in [Mckenna et al. \(2007\)](#). This participant task operationalized the risky choice as if a chip were randomly selected from a bag containing 1/3 Red, 1/3 Blue, and 1/3 Yellow chips (i.e., a 60-chip bag with 20 chips of each color). A dollar value below the color of the chip highlighted the payoff to the participant if that color were drawn for that particular risky option. Importantly, a mean-preserving spread was utilized such that each trial presented risky options that all had the same expected value. The “safer” option (but still risky) was always shown as Risk Option 1, and Risk Option 2 had a higher payoff variance that changed across the 10-trial block. For the GAINS trials block, each risk option involved potential bonus payment earnings, while in the separate 10-trial LOSSES block, all payoff values were negative. Subjects were told that after all decisions had been made, we would randomly select one trial from the GAINS and one trial from the LOSSES trial blocks. Then, the subject would receive as a bonus payment the amount dictated by playing out the lottery represented by their preferred choice in the selected GAINS trial and LOSSES trial. It was made clear to subjects that losses would subtract from their bonus payment earnings (including subtracting from the Stroop task bonus earnings if needed). An example of a risky choice GAINS and LOSSES Trial is shown in Figure 2. As with the Stroop task, the task presented trial-blocks in randomized order for each participant.

Figure 2: Lottery Choice Examples



Notes: Example of a Risky Choice GAINS trial (top) and the comparable Risky Choice LOSSES trial (bottom).

Scoring of the Risky Choice task followed the approach in [Smith et al. \(2002\)](#) and [Mckenna et al. \(2007\)](#) by calculating a *SAFE SCORE* for the GAINS and, separately, the LOSSES trial. The *SAFE SCORE* is defined in equation (1) as simply the number of safer minus riskier options chosen in that block, divided by the total number of trials. Thus, one’s *SAFE SCORE* is contained in the $[-1, +1]$ interval, with positive (negative) values indicating a more risk averse (loving) choice profile.

$$Safe\ Score = \frac{(\# \text{ safe choices}) - (\# \text{ risky choices})}{(\# \text{ total choices})} \quad (1)$$

2.3.3 Cognitive Manipulation: Cognitive Load Variable

The main study randomly assigned participants prior to the decision task to either a High or Low Cognitive Load treatment condition, as in [Mani et al. \(2013\)](#), because the

hypothesized mechanism is that food insecurity increases susceptibility to anxiety and stress due to negative (unexpected) financial shocks (Mani et al., 2013; Haushofer and Fehr, 2014). The Cognitive Load treatment involved presenting the participants with an “unexpected financial expense” scenario, where the dollar value of the unexpected financial expense was higher in the High compared to the Low Cognitive Load conditions. Scenarios were presented prior to a block of decision-making tasks, and the participants were told that they would be asked to briefly tell us how they would deal with the unexpected expense *after* the decision making tasks. Both the Stroop and Risky Choice tasks involved two blocks of tasks, and so each participant saw 4 total scenarios that were with all High or Low Cognitive Load depending on their random treatment assignment, which applied to all applications of the Cognitive Load scenarios for a given participant (see Appendix B). The High Cognitive Load financial expense scenario was intended to trigger additional concern/anxiety among those higher in food insecurity (Mani et al., 2013).

2.3.4 Key Variables

Independent variables measured for this study included the food insecurity level, cognitive reflection, baseline risk-taking behavior, relative emotion state, sleepiness level (recent daytime and current state). We also categorize household income into 13 categories (higher values indicate higher self-reported household income). Also, because financial stress related to income is not merely a function of income level, but also of household expenses, we also included a Likert-scale self-report measure of one’s income sufficiency. Key outcome measures included Stroop Accuracy, risky choice task SAFE SCORES, response times, and self-reported treatment-induced anxiety level changes of each participant.

The USDA Food Security 6-point questionnaire measured the level of food insecurity (U.S. Department of Agriculture, Economic Research Service, 2024). The level of cognitive reflection was measured using a 6-item Cognitive Reflection Task (Primi et al., 2016). One’s default level of risk-taking was measured with the Domain Specific Risk Taking (DOSPERT) scale (Blais and Weber, 2006). Participants’ relative mood states were measured using self-report emotion ratings and were elicited on a 1-7 Likert-scale rating of one’s current level of 10 emotion states.² The Karolinska Sleepiness Measure was used to assess participants’ current sleepiness (Åkerstedt and Gillberg, 1990), and the Epworth Sleepiness Scale was used to assess daytime sleepiness (Johns, 1991). Also, in the Risky Choice task, at the trial-level, the difference in variance of the paired-risky choice options, which had equal expected values, is used as a control measure in the analysis. Regarding key outcome measures, Stroop Task Accuracy and SAFE SCORES for the Risky Choice task were defined in the previous section. We also recorded trial-level response times in the Risky Choice task to be used in exploratory analysis. To assess validity of the Cognitive Load treatment manipulations, we elicited self-reports of how much one’s anxiety level changed (in either direction) due to consideration of the financial expense scenarios presented, and this elicitation was done after each block of tasks. Finally, we also elicited separate 9-point Likert scale responses after both the Stroop and Risky Choice tasks regarding one’s level of motivation, effort, and cognitive fatigue due

²Emotion states elicited included the following positive and negative emotion states: happy, excited, surprised, satisfied, angry, irritated, confused, regret, disgust, anxious.”

to the task just completed.

3 Hypotheses

We preregistered several hypotheses related to the association between food insecurity and poverty, the impact of our cognitive load treatment on anxiety, and task outcomes as a function of food insecurity and cognitive load.³ Other exploratory hypotheses were examined and explicitly identified as such in the analysis section.

Hypothesis 1: Food insecurity will correlate positively with lower household income.

Hypothesis 2: Food-insecure participants will report an increase in anxiety in the HIGH relative to LOW Cognitive Load condition.

These first hypothesis was derived from data showing lower-income individuals are more likely to experience food insecurity ([World Health Organization, 2025](#); [Feeding America, nd](#)). The 2nd hypothesis examines the validity of the Cognitive Load manipulation. Specifically, [Mani et al. \(2013\)](#) argued that low-income individuals, which we associated with food insecurity, will experience a greater increase in anxiety in the HIGH relative to LOW Cognitive Load treatment.

Hypothesis 3: Those higher in food insecurity will have lower Stroop task ACCURACY.

Hypothesis 4: The HIGH Cognitive Load treatment will hurt Stroop task performance for more food insecure individuals.

Hypotheses 3 and 4 were based on past empirical work showing that poor individuals had less cognitive control when faced with a larger unexpected financial expense [Mani et al. \(2013\)](#), and food insecurity hypothesized to associate with lower income.

Hypothesis 5: Higher scores on the financial risk-taking subscale of the DOSPERT scale will predict different choices in the risky choice task.

Hypothesis 6a: The HIGH Cognitive Load condition will change risk-taking choices for those high in food insecurity, but not those low in food insecurity.

Hypothesis 6b: The H6a effect will be due to an increase in risk taking for those higher in the DOSPERT default financial risk subscale, and decreased risk taking for those lower in the DOSPERT risk subscale.

Hypotheses 5 is a test of the validity of the DOSPERT baseline risk taking measure, and Hypotheses 6a and 6b concern the connection between the DOSPERT risk baseline measure and our risk-taking decision task. Regarding H6b, specifically, HIGH Cognitive Load should promote less deliberative thinking due to its hypothesized impact on anxiety, which consumes cognitive resources that would otherwise be used for deliberative thought

³Note: there was a misnumbering of the preregistered hypotheses (two distinct hypotheses were both labeled as Hypothesis 4). Our present listing corrects this duplication in numbering and clarifies terminology in places (HIGH Cognitive Load treatment was referred to as “Hard” treatment in the preregistration).

processes. This hypothesis implicitly assumes a dual-systems framework whereby decisions result from the relative input of automatic (system 1) and deliberative (system 2) thought processes. Thus, whatever type of risk-taking is one's default tendency if should be promoted under HIGH cognitive load ([Speer et al., 2022](#)).

Hypothesis 7: Response times in the risky choice task will be shorter for more food insecure participants in the HIGH Cognitive Load treatment condition.

We base Hypothesis 7 on the assumed dual systems framework, whereby less deliberative (i.e., more automatic) decision-making is expected when one is more anxious, and should be reflected in faster decision response times. Because the Stroop task administered trials with a time limit, this response time hypothesis (H7) is made only for the risky choice task.

4 Results

Table 2 shows control measures summary statistics for our sample of Food Secure and Food Insecure participants, along with balance tests of comparability across samples. The balance/difference tests, as they relate to income measures, also serve to formally test Hypothesis 1.

Table 2: USDA Food Secure vs. Food Insecure Comparison

	USDA Food Secure (n=102)	USDA Food Insecure (n=102)	Difference Test t-stat/z-stat
DOSPERT Total	16.31	17.64	-1.878*
Age (years)	32.67	32.30	0.553
Female (=1)%	42.16%	67.65%	-3.658***
Minority (=1)%	48.04%	45.10%	0.421
Positive Mood Rating $\in [1, 7]$	3.85	3.47	1.833
Negative Mood Rating $\in [1, 7]$	1.43	2.17	-5.458***
Epworth Sleepiness Scale $\in [0, 24]$	14.81	15.45	-1.102
CRT Score $\in [0, 6]$	3.79	2.80	3.418***
Karolinska Sleepiness $\in [1, 9]$	3.24	3.96	-2.647***
Baseline Anxiety $\in [1, 7]$	2.08	2.99	-3.938***
Household Income $\in [1, 13]$	8.98	6.34	5.677***
Income Sufficiency $\in [-4, 4]$	0.79	-1.24	9.094***
Risk Taking–Ethical $\in [6, 42]$	10.68	12.63	-2.468**
Risk Taking–Financial $\in [6, 42]$	16.04	14.23	1.729*
Risk Taking–Health/Safety $\in [6, 42]$	13.92	17.70	-3.818***
Risk Taking–Recreational $\in [6, 42]$	14.45	15.01	-0.515
Risk Taking–Social $\in [6, 42]$	26.48	28.62	-2.361**

Note: Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ for the 2-tailed tests. Female and Minority variables used proportional z-tests. All other variables used t-tests. Positive Mood Rating is the average of: happy, satisfied, excited, and surprised, each measured on a 7-point scale. Negative Mood Rating is the average of: angry, irritated, confused, regret, disgust, and anxious, each measured on a 7-point scale. Epworth Sleepiness Scale is a subjective measure of one’s daytime sleepiness in recent times, combining responses across 8 items. Karolinska sleepiness is one’s subjective self-report of current sleepiness level. Baseline Anxiety is the standardized “anxious” item from the Negative Mood Rating. DOSPERT and CRT are computed from the domain-specific risk-taking questionnaire and the cognitive reflection task. Total household income included all earners on a per-year basis. Level 1 is less than \$10,000, and level 13 is greater than \$150,000 (Shaded cell represent test of preregistered hypothesis). Income sufficiency is a subjective questionnaire assessing participants’ perceptions of income adequacy for household finances. The bottom five rows are each of the total subscale scores for the DOSPERT risk taking scale. Each subscale measures responses on a 7-point scale for each of 6 items in that subscale.

4.1 Hypothesis 1

The Food Secure group had significantly higher income than the Food Insecure group, with self-reported differences that approximately equated to \$26,371.91. The participant’s *Food Insecurity Level* was regressed on participants’ income levels with results reported in Table 3. Simple and multiple regression results indicated a statistically significant association between food insecurity and household income, which is consistent with the income (and income sufficiency) difference test results in Table 2. Additionally, Table 3 also shows that higher food insecurity is predicted by the Female binary indicator, a lower cognitive reflection (CRT) score, and higher DOSPERT baseline risk taking.

Table 3: Food Insecurity and Income

Dependent Var.:	Food Insecurity Level	
Constant	4.947*** (0.418)	2.672* (1.521)
Income	-0.300*** (0.050)	-0.292*** (0.048)
Age		-0.005 (0.036)
Female		0.937*** (0.351)
Minority		-0.030 (0.340)
CRT Score		-0.221*** (0.083)
DOSPRT Total		0.098*** (0.035)
Epworth Sleepiness Scale		0.061 (0.042)
Observations	204	204
R2	0.153	0.259

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ for the 2-tailed test.

Shaded cell represent test of preregistered hypothesis.

4.2 Hypothesis 2

After each block of decision tasks, participants were asked the following question regarding the financial scenario presented to them *before* the decision task block: “Did being asked to think about the financial problem scenario increase your level of anxiety at all?” This variable, *Anxiety Change*, was a 7-point scale self-report ([1,7] where 1=“No Increase in Anxiety”, 7=“Big Increase in Anxiety”. We recoded the variable as [0,6] for analysis to easily test for any significant increase in anxiety against the benchmark “No Increase in Anxiety” response. Table 4 shows the mean values of this *Anxiety Change* by treatment assignment and a binary indicator of one’s food insecurity level (Food Secure = food insecurity level 0 on the USDA measure, Food Insecure = food insecurity levels 4-6). As is apparent in Table 4, participants reported an increase in anxiety across both treatment levels (the one-sample t-test of the mean difference against *Anxiety Change*=0 is rejected in each instance, $p < .001$). Strictly speaking, Hypothesis 2 tests that Food Insecure participants (top row) will have a higher reported *Anxiety Change* in Cognitive Load HIGH compared to Cognitive Load LOW. The difference test is reported in the far-right column of the second row in Table 4, and we fail to reject the null hypothesis that the reported *Anxiety Change* is different across treatment comparisons for Food Insecure participants. In fact, we also find no difference in reported *Anxiety Change* across treatments among Food Secure participants, although the difference tests reported in the bottom row of Table 4 indicate that Food Insecure participants report a significantly greater increase in anxiety, in both treatment conditions, compared to Food Secure participants in the same treatment condition. Recall also in Table 2 that baseline anxiety levels, which were reported along with other emotion states, were significantly higher among Food Insecure participants. In short, the data fail to support H2, but there is evidence that the Cognitive manipulation successfully increased reported anxiety levels of participants, and this increase was greater among the Food Insecure sample (for both HIGH and LOW Cognitive Load).

Table 4: reported *Anxiety Change* (H2 test)

	LOW Cognitive Load	HIGH Cognitive Load	Treatment Difference Test (t-stat)
Food Secure	1.765	1.909	-0.492
Food Insecure	2.714	3.170	-1.401
Subsample Difference Test (t-stat)	-3.040***	-4.127***	

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ for the 2-tailed test. Two-sample t-tests were used to compare food security levels and treatment levels (high and low). Shaded cell represent test of preregistered hypothesis. One-sample t-tests find all reported levels of *Anxiety Change* are statistically greater than zero ($p < .001$ in each instance).

4.3 STROOP TASK general outcomes

A summary view of Stroop task accuracy can be found in the Appendix in Figure A1, which highlights an overall high degree ($> 90\%$ accuracy) of cognitive control displayed in our time-constrained and incentivized version of the task. Here, we show Stroop accuracy by different levels of food insecurity and by Cognitive Load assignment. Results show that High Cognitive Load nominally lowered cognitive control, as measured by Stroop task accuracy scores, although the decrease appears small (and, as we will see next, statistically insignificant).

4.4 STROOP TASK–Hypothesis 3

Each participant performed similarly in terms of accuracy across the Stroop and Background Stroop Tasks. Two-sample t-tests were conducted on mean-level participant accuracy (i.e., % Correct out of the 16-trial Stroop task block). Here, and for the regressions, percent correct was coded in decimal form (i.e., 93% correct is 0.93). Differences in % Correct by food insecurity status were statistically insignificant for both the Stroop task (Food Insecure mean accuracy = 93.75, Food Secure mean accuracy = 95.34, $t = 1.041$, $p > 0.10$) and the Background Stroop task (food-insecure mean accuracy = 94.49, food-secure mean accuracy = 94.98, $t = 0.263$, $p > 0.10$). Regression estimations show similar results, as seen in Table 5. Thus, the data fail to support H3 regarding food insecurity effects on cognitive control.

The regression results in Table 5 show only a statistically significant association between sleepiness measures and Stroop accuracy. Chronic daytime sleepiness, as measured by the Epworth Sleepiness Scale (ESS), is associated with significantly lower Stroop and Background Stroop task accuracy. In contrast, state-level (Karolinska) sleepiness predicts higher Stroop task accuracy. These results are not entirely unexpected, given that sleep, or lack thereof, can affect cognitive capacities (Dickinson, 2021), though interestingly, the estimation results showed that chronic daytime sleepiness predicted opposite cognitive control effects on Stroop task accuracy compared to state-level “right now” subjective sleepiness.

4.5 STROOP TASK–Hypothesis 4

An interaction variable (*Food Insecurity * Cognitive Load*) was included in the estimations of Table 5 to test the *Cognitive Load* moderation Hypothesis 4. Here, the regression results found no interaction effect, which implies no support for Hypothesis 4 in the data.

Table 5: Stroop Regression Results: Insecurity and Cognitive Load Interaction

Dependent Var.:	Stroop % Correct		Background Stroop % Correct	
Constant	0.963*** (0.015)	1.067*** (0.070)	0.934*** (0.019)	0.977*** (0.086)
Food Insecurity Level	-0.004 (0.004)	-0.006 (0.004)	0.005 (0.005)	0.004 (0.005)
High Cognitive Load	-0.016 (0.021)	-0.027 (0.021)	0.027 (0.026)	0.019 (0.026)
Food Insecurity x Cognitive Load	0.000 (0.006)	0.004 (0.006)	-0.010 (0.007)	-0.007 (0.002)
Age		-0.000 (0.002)		0.002 (0.002)
Female		-0.006 (0.016)		0.002 (0.019)
Minority		-0.014 (0.015)		-0.018 (0.018)
CRT Score		-0.002 (0.004)		0.002 (0.005)
DOSPERT Total		-0.001 (0.002)		-0.002 (0.002)
Epworth Sleepiness Scale		-0.007*** (0.002)		-0.007** (0.002)
Karolinska Sleepiness		0.011*** (0.004)		0.008* (0.005)
Observations	204	204	204	204
R2	0.012	0.117	0.011	0.091

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ for the 2-tailed test. Similar results to columns (1) and (3) are found if estimating a simple binary regression with *Food Insecurity Level* as the only predictor.

4.6 RISKY CHOICE TASK–Hypothesis 5

We next shift focus to the Risky Choice Task, where our outcome measure for assessing risk preferences is the *Safe Scores* measure (defined in Equation 1) in the incentivized Risky Choice Task—this measure is constructed separately for the Gains and the Losses trial blocks. Consistent with prospect theory predictions (Kahneman and Tversky, 1979), participants’ *Safe Scores* were significantly greater than zero, indicating more risk-averse choices in the Gains trials (*Safe Score* Gains mean score = 0.290, $t(203) = 6.846$, $p < 0.001$). In contrast, in the Losses trials *Safe Scores* were significantly less than zero, which implies more risk-seeking behavior in the Losses trials (*Safe Score* Losses mean score = -0.386, $t(203) = -9.185$, $p < 0.001$).

Hypothesis 5 examines the association between the DOSPERT financial risk-taking subscale scores, *Financial Risk-Taking*, on risky choices. Table 6 presents estimation results for Gains and, separately, for Losses trial block. Separate estimations control for Cognitive Load using the binary indicator for *High Cognitive Load* in columns (1) and (2), and we see that the DOSPERT *Financial Risk-Taking* measure does not have a statistically significant association with *Safe Scores*, which fails to support H5. There is some evidence that higher chronic daytime sleepiness increases risk taking in the Gains trials (i.e., lowers *Safe Scores*) and females and minority participants choose risk less frequently in Loss trials compared to other participants.

Table 6: Predictors of Risk-Taking (Safe Scores)

DEPENDENT VARIABLE → INDEPENDENT VARIABLES	Safe Score: Gains Trials (1)	Safe Score: Losses Trials (2)
Food Insecurity Level	0.000 (0.017)	-0.000 (0.016)
Financial Risk-Taking	-0.006 (0.006)	0.006 (0.006)
High Cognitive Load	-0.038 (0.085)	-0.019 (0.084)
Age	0.007 (0.009)	-0.009 (0.009)
Female	-0.063 (0.091)	-0.175** (0.089)
Minority	0.015 (0.086)	0.162* (0.085)
CRT Score	0.029 (0.021)	-0.023 (0.021)
Epworth Sleepiness Scale	-0.020* (0.011)	-0.010 (0.011)
Karolinska Sleepiness	0.001 (0.023)	-0.006 (0.022)
Constant	0.414 (0.381)	0.089 (0.374)
Observations	204	204
R-squared	0.044	0.065

Note. Standard errors in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

4.7 RISKY CHOICE TASK–Hypotheses 6a & 6b

Table 7 presents results that test Hypotheses 6a and 6b. The specifications are similar to those in Table 6, but with separate estimations for the subsamples of food secure and insecure participants to test H6a, and the addition of an interaction term, *High Cognitive Load * Financial Risk-Taking*, to test the H6b moderation hypothesis. The lack of statistical significance on the main effect of *High Cognitive Load* across all subsample columns in Table 7 fails to support H6a, and the lack of statistically significant interaction term implies no support for H6b.

Table 7: Cognitive Load Moderation Effects on *Safe Scores*

DEPENDENT VARIABLE -- >	Safe Score: Gains Trials		Safe Score: Losses Trials	
INDEPENDENT VARIABLES	Food Insecure Participants	Food Secure Participants	Food Insecure Participants	Food Secure Participants
Constant	0.463 (0.570)	0.526 (0.562)	-0.329 (0.540)	0.508 (0.571)
Financial Risk-Taking	-0.001 (0.012)	-0.032** (0.014)	0.006 (0.011)	0.001 (0.014)
High Cognitive Load	-0.107 (0.252)	-0.302 (0.329)	-0.108 (0.239)	-0.095 (0.334)
High Cognitive Load x Financial Risk	0.000 (0.015)	0.019 (0.019)	-0.00 (0.015)	0.009 (0.019)
Age	0.005 (0.015)	0.013 (0.013)	0.003 (0.014)	-0.015 (0.013)
Female	-0.169 (0.143)	0.151 (0.136)	-0.226* (0.135)	-0.148 (0.138)
Minority	-0.006 (0.127)	0.011 (0.125)	0.084 (0.120)	0.255** (0.127)
CRT Score	0.030 (0.032)	0.038 (0.031)	-0.021 (0.030)	-0.030 (0.031)
Epworth Sleepiness Scale	-0.016 (0.015)	-0.023 (0.017)	0.007 (0.014)	-0.028 (0.017)
Karolinska Sleepiness	-0.005 (0.031)	0.002 (0.034)	-0.037 (0.030)	0.021 (0.035)
Observations	102	102	102	102
R2	0.056	0.103	0.094	0.100

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ for the 2-tailed test.

4.8 RISKY CHOICE TASK–Hypothesis 7

Hypothesis 7 relates to the response time (RT) comparison of risky choices in the HARD versus EASY trials among food insecure participants. For this analysis we use the panel data set from risky choices, which includes 20 total trials per participant. Initial means tests show support for H7: among the *Food Insecure* average RT in the High Cognitive Load treatment is significantly faster than in the Low Cognitive Load treatment (mean 5.84 versus 6.99 seconds; two-sample t-test with unequal variance, $p = .027$). In comparison, among the food secure participants, though RT in the High Cognitive Load treatment is nominally faster than in the Low Cognitive Load treatment (mean 5.868 versus 7.55 seconds), the difference is not statistically significant ($p > 0.10$). We can relate this back to our earlier H2 regarding one’s reported *Anxiety Change* resulting from the cognitive manipulation we employ. Though the increase in anxiety among food insecure participants was not statistically significantly greater under High Cognitive Load compared to Low Cognitive Load (see Table 4), the RT data from this specific risky choice task is consistent with a less deliberative decision process than one would expect with increased anxiety.

Though not part of a formal hypothesis, we can further examine the determinants of risky choice response times by estimating regressions that account for the panel nature of the data. We did this for the pooled set of trials, the subset of GAINS-only trials, and the subset of LOSSES-only trials, and results are shown in Table 8. If we consider RT as choice process data that gives insight into the decision-making process in this risky choice task, we find surprisingly few predictors of RT. In the pooled trials and Gains-only trials, *CRT Score* predicts longer RT, but it does not predict any of the variation in RT in LOSSES trials. Rather, in the LOSSES trials column (3) of Table 8, only one’s choice of the riskier gamble explains variation in RT. Specifically, choosing the riskier gamble in a LOSS trial is a significantly faster choice, which points to a less deliberative choice. The exploratory analysis below will examine the micro-determinants of one’s risky choices from the panel data.

Table 8: Determinants of Risky Choice Response Times

INDEPENDENT VARIABLES	(1) Pooled Trials	(2) GAINS trials	(3) LOSSES trials
Riskier Gamble Chosen (=1)	-0.228 (0.624)	0.363 (0.363)	-1.703* (0.977)
Gamble Variance Difference	-0.084 (0.117)	-0.073 (0.080)	-0.076 (0.192)
Food Insecurity Level	0.001 (0.211)	0.074 (0.180)	-0.064 (0.324)
Financial Risk-Taking	0.003 (0.042)	0.003 (0.038)	-0.000 (0.065)
High Cognitive Load	-1.218 (0.750)	-0.714 (0.672)	-1.712 (1.088)
Anxiety Change	-0.315 (0.249)	-0.107 (0.220)	-0.562 (0.372)
Age	0.024 (0.078)	-0.059 (0.074)	0.114 (0.104)
Female	0.552 (1.052)	-0.187 (0.713)	1.408 (1.764)
Minority	-0.078 (0.843)	0.990 (0.644)	-1.282 (1.380)
CRTscore	0.333*** (0.122)	0.388*** (0.125)	0.300* (0.170)
Epworth	0.188 (0.154)	-0.016 (0.078)	0.396 (0.283)
Ksleepy	-0.326 (0.226)	-0.206 (0.209)	-0.429 (0.325)
Task Effort	-0.769 (0.760)	0.083 (0.391)	-1.621 (1.362)
Task Cognitive Fatigue	0.270 (0.189)	0.061 (0.115)	0.466 (0.332)
Task Motivation	0.628* (0.367)	0.121 (0.242)	1.139* (0.638)
Constant	4.463 (5.217)	5.750 (5.699)	3.715 (5.549)
Observations	4,080	2,040	2,040
Number of subjects	204	204	204
R2 (within)	0.000	0.001	0.000
R2 (between)	0.009	0.021	0.114

Note. Robust standard errors in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

4.9 EXPLORATORY ANALYSIS

The exploratory analysis conducted was twofold. First, we conducted exploratory analysis focused how one’s reported level of anxiety change from the cognitive manipulation predicted Stroop Accuracy and Risky Choice decisions. Then, we conducted panel data analysis of the trial-level determinants of Stroop Accuracy and Risky Choice decisions.

The impact of Anxiety Change on outcomes

First, we considered one’s reported anxiety change as an alternative to using the binary High Cognitive Load manipulation indicator. While our preregistered analysis failed to support most of the preregistered hypotheses related to the effects of the exogenous cognitive load manipulation, we observed variation in how much the cognitive load manipulation increased self-reported anxiety in the participants—recall that previous reported results were that the more food insecure participants reported a significantly greater increase in anxiety for the same cognitive load manipulations as those who were more food-secure. Table 9 shows results of estimations analogous to the Stroop task estimations in Table 5, columns (2) and (4), except with a control for *Anxiety Change* as opposed to the binary indicator for the High Cognitive Load treatment—here, *Anxiety Change* is the average reported increase in anxiety after the two Stroop task cognitive load treatment manipulations. Results in Table 9 show some evidence, in the Background Stroop task, of higher increases in anxiety resulting from the cognitive manipulation harming cognitive control outcomes for food insecure participants.

Results in Table 10 also show some marginally significant support for concluding that a greater reported increase in anxiety affects risky choices only among those who are food insecure—here, *Anxiety Change* is the average reported increase in anxiety after the two Risky task cognitive load treatment manipulations. Specifically, in column (1) of Table 10 for the GAINS trials, the negative coefficient estimate indicates that a reported higher increase in anxiety in the food-insecure participants decreases one’s *Safe Score*, which implies an *increase* in risk seeking choices. Though only marginally statistically significant at the $p < 0.10$ level, together with the exploratory results in the Stroop task outcomes Table 9, these results are at least suggestive that anxiety is particularly important when it comes to key outcomes related to cognitive control and risky choice in food-insecure individuals.

Table 9: Stroop outcomes by reported Anxiety Change

DEPENDENT VARIABLE → INDEPENDENT VARIABLES	Stroop % Correct (1)	Background Stroop % Correct (2)
Anxiety Change	0.001 (0.007)	0.008 (0.009)
Food Insecurity Level	0.001 (0.005)	0.012* (0.006)
Food Insecure * Anxiety Change	-0.010 (0.010)	-0.024** (0.012)
Age	-0.000 (0.002)	0.001 (0.002)
Female	-0.004 (0.016)	0.004 (0.019)
Minority	-0.013 (0.015)	-0.018 (0.019)
CRT Score	-0.003 (0.004)	0.001 (0.005)
DOSPRT Total	-0.001 (0.002)	-0.001 (0.002)
Epworth Sleepiness Scale	-0.007*** (0.002)	-0.008*** (0.002)
Karolinska Sleepiness	0.011*** (0.004)	0.009* (0.005)
Constant	1.052*** (0.069)	1.006*** (0.084)
Observations	204	204
R-squared	0.118	0.109

Note. Standard errors in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 10: Risky Choice outcomes (SAFE SCORE) and reported Anxiety Change

Dependent Variables →	Safe Score: GAINS		Safe Score: LOSSES	
	Food INSECURE	Food SECURE	Food INSECURE	Food SECURE
	participants	participants	participants	participants
	(1)	(2)	(3)	(4)
INDEPENDENT VARIABLES				
Anxiety Change	-0.06*	-0.04	0.05	0.06
	(0.03)	(0.04)	(0.03)	(0.04)
Age	0.00	0.01	0.00	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)
Female	-0.15	0.10	-0.27**	-0.18
	(0.14)	(0.13)	(0.13)	(0.13)
Minority	-0.05	-0.01	0.12	0.27**
	(0.13)	(0.13)	(0.12)	(0.12)
CRTscore	0.02	0.03	-0.01	-0.03
	(0.03)	(0.03)	(0.03)	(0.03)
HighFR	0.05	-0.21	0.00	0.20
	(0.14)	(0.13)	(0.13)	(0.12)
Epworth	-0.02	-0.02	0.01	-0.04**
	(0.01)	(0.02)	(0.01)	(0.02)
Ksleepy	-0.00	0.00	-0.04	0.03
	(0.03)	(0.03)	(0.03)	(0.03)
Constant	0.64	0.35	-0.48	0.44
	(0.54)	(0.53)	(0.51)	(0.52)
Observations	102	102	102	102
R-squared	0.08	0.08	0.10	0.14

Note. Standard errors in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Panel data analysis of task outcomes

Finally, we conducted exploratory analysis of the determinants of Stroop Accuracy and Risky Choices at the trial level. For both tasks, we included a *Trial* variable to capture learning trends in the outcomes, and we also included the participant's self-reported level of *Cognitive Fatigue*, *Motivation*, and *Effort* specific to the task. Because it had somewhat

more explanatory power compared to the binary Cognitive Load treatment indicator, we included *Anxiety Change* as a key control, along with an interaction *Anxiety Change * Trial*. For the Risky Choice task, another key control is the difference in payoff variance between the less-risky versus more-risky gamble, *Gamble Variance Dif*, as this was a defining feature across trials in the Risky Choice task.

These panel data results are shown in Table 11 (Stroop task) and Table 12 (Risky Choice Task). For determinants of Stroop task outcomes, the positive and significant coefficient estimates on the *Trial* variable in Table 11 imply there is a trend of improved accuracy (cognitive control) with experience in the task. Beyond this, task effort is positively related, and task-specific cognitive fatigue is negatively related to cognitive control in the Background Stroop task. Risky Choice task analysis in Table 12 shows a general trend towards making riskier choices with experience. Interestingly, a larger variance between the gamble payoff (i.e., the riskier gamble getting even riskier) only significantly reduces the likelihood of choosing the riskier gamble in the GAINS domain (see column (1) of Table 12). It is also notable that the negative and significant interaction on *Anxiety Change * Trial* in the LOSSES trials indicates a reduction in the tendency across trials to choose the riskier game if one reports a larger increase in anxiety due to the treatment manipulation.

Table 11: Trial-level predictors of Stroop Accuracy

Dependent variable is a binary indicator for a correct response

INDEPENDENT VARIABLES	(1) Stroop	(2) Background Stroop
Trial (1-16)	0.007*** (0.002)	0.004* (0.002)
High Cognitive Load	-0.003 (0.015)	-0.008 (0.016)
Female	-0.022 (0.020)	0.005 (0.019)
Age	0.001 (0.001)	0.002 (0.002)
CRT score	-0.004 (0.005)	0.001 (0.004)
Food Insecurity Level	0.002 (0.004)	-0.001 (0.003)
Anxiety Change	-0.005 (0.011)	0.009 (0.017)
Anxiety Change * Trial	0.000 (0.001)	-0.001 (0.001)
Task Effort	0.023 (0.016)	0.021** (0.010)
Task Motivation	0.003 (0.012)	0.008 (0.008)
Task Cognitive Fatigue	-0.006 (0.005)	-0.008** (0.004)
Constant	0.683*** (0.108)	0.661*** (0.109)
Observations	3,264	3,264
Number of subjects	204	204

Note. Robust standard errors in parentheses, clustered on the participant.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 12: Trial-level predictors of Risky Choice

<i>Dependent variable = 1 if riskier gamble chosen</i>		
INDEPENDENT VARIABLES	(1) GAINS trials	(2) LOSSES trials
Trial (1-10)	0.036** (0.015)	0.038** (0.015)
High Cognitive Load	0.070 (0.114)	0.028 (0.119)
Gamble Variance Dif	-0.152*** (0.025)	-0.023 (0.022)
Female	0.092 (0.127)	0.306** (0.131)
Age	-0.010 (0.013)	0.014 (0.013)
CRT score	-0.027 (0.028)	0.038 (0.030)
DOSPRT financial risk taking	0.008 (0.007)	-0.006 (0.008)
Food insecurity level	-0.003 (0.022)	0.012 (0.024)
Anxiety Change	0.138** (0.059)	0.071 (0.065)
Anxiety Change * Trial	-0.007 (0.005)	-0.010** (0.005)
Task Effort	-0.026 (0.049)	-0.008 (0.055)
Task Motivation	-0.008 (0.045)	0.004 (0.050)
Task Cognitive Fatigue	0.001 (0.025)	-0.016 (0.025)
Constant	-0.215 (0.650)	-0.369 (0.640)
Observations	2,040	2,040
Pseudo R-squared	0.0405	0.0263

Note. Models are non-linear Probit estimations with robust standard errors in parentheses. Standard errors are clustered on the participant. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

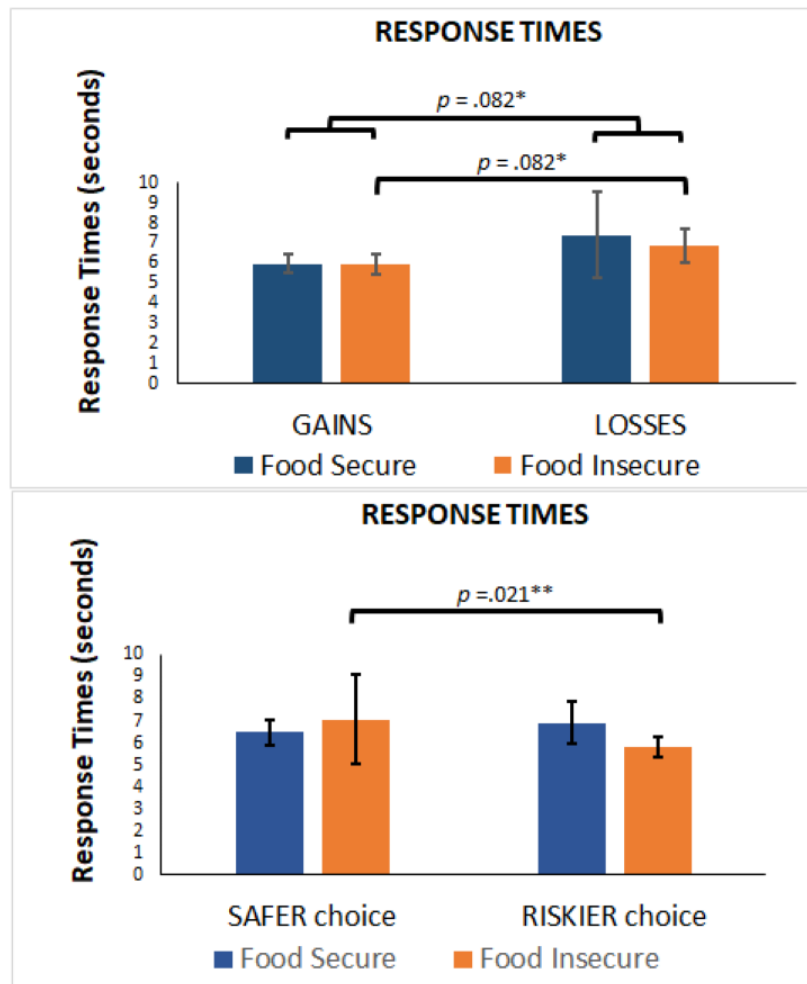
Exploratory Analysis of Risky Choice Response Times

A final exploratory analysis was conducted on choice-level response-times (RTs) to examine if food insecurity affects one's choice process with regard to choices in the risky choice task.⁴ We compared risky choice RTs for Food Secure and Food Insecure partici-

⁴Recall that 4-second timed trials for the Stroop task imply truncated RTs that render them unsuitable for an examination of RT-based choice process.

pants in GAINS versus LOSSES trials, as well as for when the safer versus riskier gamble was chosen in a given trial. Figure 3 highlights the findings by plotting mean RT values with their 95% confidence intervals and showing the results of 2-sample t-tests (only differences that are $p \leq .10$ significant are highlighted in Figure 3). In the top panel, we see that LOSSES trial decisions have marginally significantly longer RTs than GAINS trial decisions, and this difference is only found amongst the Food Insecure participants. In the bottom panel, when the riskier gamble is chosen the decision involves a significantly quicker choice process among Food Insecure participants ($p < .05$), but not among Food Secure participants. This finding is of interest and merits further study, because it suggests Food Insecure individuals may exhibit increased risk taking behaviors due to lack of deliberation, which is a more time-consuming decision process than a more automatic or perhaps emotional choice. In other words, this evidence suggests that food insecurity fundamentally alters one's choice architecture in the domain of financial risk.

Figure 3: Response Times by Frame, Choice, and Participant type



Notes: Mean response times are shown with their 95% confidence interval. Significance p -values are for the 2-sample t-test with unequal variance in each instance.

5 Discussion and Conclusion

Our study aimed to test hypotheses relating food insecurity to household income, to cognitive control and risk taking, and to examine the impact of a randomly assigned cognitive load manipulation on outcomes (Mani et al., 2013). As predicted, self-reported household income (as well as subjective income sufficiency) were both negatively associated with one’s level of food insecurity. One’s level of food insecurity did not, however, predict cognitive control or risky choice outcomes in two incentivized choice tasks. Additionally, randomly assigning participants to ponder a higher (High Cognitive Load) or lower (Low Cognitive Load) level of an unexpected financial expense made all participants self-report an increase in anxiety. While it was hypothesized that the increase in anxiety would be greater in food insecure participants for High versus Low Cognitive load treatments, they experienced similar levels of anxiety increases across both treatments. These increases were higher than reported increases in anxiety among those who were food secure for the same treatments. Given the lack of significant differences in anxiety increase across treatments, it is not surprising that the data failed to support our hypotheses related to the Cognitive Load manipulation.

That being said, exploratory analysis highlighted that differences in self-reported anxiety increase show some evidence that food insecure participants who reported greater increases in anxiety due to our treatment manipulation showed decreased cognitive control (Table 9) and increased risk taking over monetary gains (Table 10). Such results are somewhat in the spirit of our hypotheses that aimed to examine the combined food insecure and cognitive load effects on key outcome measures because the food insecure participants reported significantly greater increases in anxiety, compared to food secure participants, no matter what the cognitive load treatment. It appears that even in the Low Cognitive Load treatment, the level of the monetary expense we chose for the Cognitive Load manipulation scenarios was considered high enough to induce significant increases in anxiety. It is nevertheless important that our findings document a link between an increase in self-reported anxiety, cognitive control, and risky choices.⁵ The importance lies in the fact that increased anxiety is hypothesized to consume cognitive resources. While we do not have data to directly test whether cognitive resources available for task performance were diminished with increased anxiety, our results are consistent with this hypothesis and suggest that anxiety contributes to boundedly rational decision-making. Further research would be beneficial in highlighting the variety of factors that promote boundedly rational decision-making.

Exploratory analysis of choice process data also suggest that food insecurity may fundamentally alter the structure of risky decision-making. The evidence suggested that Food Secure participants display stable levels of deliberation whether choosing a safer or riskier option. This is in contrast to Food Insecure individuals, who displayed faster RTs

⁵As previously stated, study participants’ risky choices were consistent with prospect theory (Kahneman and Tversky, 1979), as the gains-and-losses trial exhibited mean Safe Scores of 0.290 ($p < 0.001$) and -0.386 ($p < 0.001$), indicating risk aversion for gains and risk-loving choices for losses. However, in Table 6, the change in anxiety significantly decreases Safe Scores in the Gains trials and qualitatively increases them in the Losses trials (i.e., the difference is not statistically significant). The trend is therefore toward more risk-neutral choices when evaluating both Gains and Losses domains. Interestingly, these risky choice effects from increased anxiety paralleled the risky choice effects of total sleep deprivation (Mckenna et al., 2007). This might suggest a more general effect of cognitive load from different sources of monetary risk choices.

when a riskier option was chosen. This suggests a reduced amount of deliberation when making riskier financial choices and may provide a clue into the differential choice process that may have downstream effects on other outcomes of importance. We did not preregister plans to examine RT data, but these exploratory findings may be useful in developing *ex ante* hypotheses that can be preregistered in future research.

Of course, limitations to our work must be acknowledged. While our sample has somewhat broad demographic representation by age, sex and minority status, it is yet to be determined how our findings may generalize beyond our sample (e.g., in other cultures outside the U.S.). It is also the case that somewhat loosely defined Food Insecure participants as those with USDA food insecurity score of 4, 5, and 6 on the 6 point scale, though more standard cutoff for significant food insecurity does not include a score of 4 (only 5 and 6). We also captured decisions at a point in time for these participants, but a longitudinal tracking of decisions across time would allow for a better understanding of whether food insecurity effects are entirely linked to one's transitory anxiety fluctuations. Finally, we included but one cognitive control task and one stylized risky choice task, though it is clear that a wider variety of decision domains are of interest in understanding the contributing behavioral factors to poverty traps.

Food insecurity is a global issue with serious consequences and, therefore, deserves further research. This study highlights that food insecurity may place individuals at risk of heightened levels of anxiety that can harm self-control and induce important shifts in risky choice behaviors. Because increased risk-taking can contribute to poverty traps, for example, this highlights that food insecure individuals are at heightened risk of behaviors that can challenge their escape from such traps. These findings relating to self-reported increases in anxiety also imply that future research should consider how anxiety, in general, likely impacts key areas of behavior, given that it is not solely a function of poverty or food insecurity.

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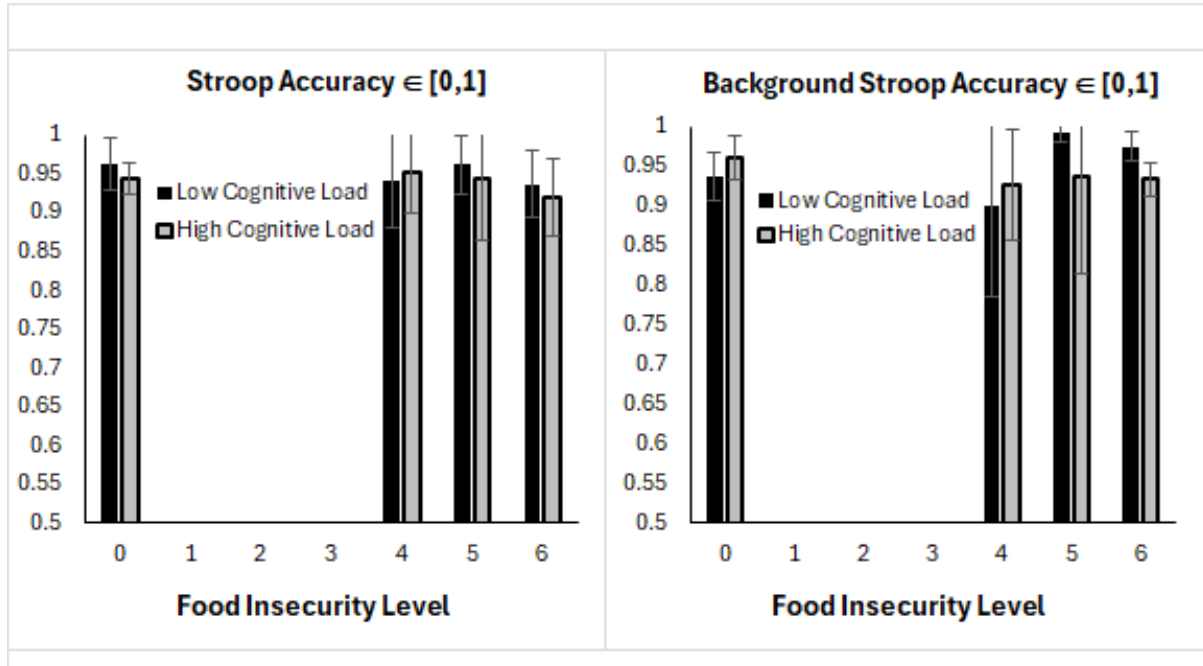
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A Supplemental Appendix: Figures

Figure A1: Effect of Food Security & cognitive load on Stroop Scores (% Correct)



Note: Figure A1 shows means Stroop accuracy by specific level of *Food Insecurity* and by Cognitive Load Treatment. The Left and Right panels show Stroop Accuracy for the Regular and Background Stroop task, respectively. The formal statistical analysis in Table 5 highlights the statistically insignificant differences in both the Stroop and Background Stroop accuracy by *Food Insecurity* and cognitive load treatment condition.

B Supplemental Appendix: Experiment Instructions

APPENDIX B:

Prescreen Survey and Main Decision Task survey (full instructions)

USDA Food Insecurity questionnaire

Note: Commentary for the reader is given below highlighted in square brackets (e.g., [Note:]).

[Note: Spacing condensed between questions in what follows. Researcher identifiers removed for anonymity. Some formatting of original Qualtrics survey was altered when exporting the survey.]

INFORMED CONSENT

This short questionnaire presents you with some assessment questions relating to risk attitude, cognition, and food security. Please be assured that your responses will be kept completely confidential. The study should take you **around 3 minutes to complete, and you will receive \$0.50 for your participation**. Your participation in this research is voluntary. You have the right to withdraw at any point during the study, for any reason, and without any prejudice. An attention check question is included, and failure to accurately complete the attention check will terminate your study participation. **By clicking the button below, you acknowledge that your participation in the study is voluntary, you are 18 years of age, and that you are aware that you may choose to terminate your participation in the study at any time and for any reason.** There are no known risks associated with this study beyond those associated with everyday life. Although this study will not benefit you personally, its results will help our understanding of food security.

Please note that this survey will be best displayed on a laptop or desktop computer. Some features may be less compatible for use on a mobile device.

For additional information related to this questionnaire, contact [REDACTED] at [REDACTED]. [REDACTED] University's Institutional Review Board has determined this study to be exempt from review by the IRB Administration.

- ☐ I consent, begin the study
- ☐ I do not consent, I do not wish to participate

Page Break

Before you start, please switch off phone/ e-mail/ music so that you can focus on this study. Thank you! Please carefully enter your Prolific ID

First, please answer the questions on the next set of pages for us.

Page Break

A bat and a ball cost \$1.10 in total. The bat costs \$1.00 more than the ball. How much does the ball cost?

(please indicate your numeric answer **in cents**)

Page Break

If it takes 5 minutes for 5 machines to make 5 widgets, how long would it take for 100 machines to make 100 widgets?

(please indicate your numeric answer **in minutes**)

Page Break

If 3 elves can wrap 3 toys in 1 hour, how many elves are needed to wrap 6 toys in 2 hours?

(please give your numeric answer in **# of elves**)

Page Break

Jerry received both the 15th highest and the 15th lowest mark in the class. How many students are there in the class?

(please give your numeric answer in **# of students**)

Page Break

In an athletics team, tall members are **three** times more likely to win a medal than short members. This year the team has won 60 medals so far. How many of these have been won by short athletes?

(please give your numeric answer in **# of medals**)

Page Break

In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover **half** of the lake?

(please indicate your numeric answer **in days**)

Page Break

FOOD SECURITY QUESTIONS In this next set of questions **you will be asked are about the food eaten in your household in the last 12 months** (i.e., since September of last year), and whether you were able to afford the food you need. If others (besides just you) are in your

household, respond considering everyone in your household unless the question specifically asks only about you.

Page Break

The following two statements have been made by people about their food situation. For each of these statements, please tell me whether the statement was **often true**, **sometimes true**, or **never true** for (you/your household) in the last 12 months—that is, since September 2024.

Statement: **“The food that (I/we) bought just didn’t last, and (I/we) didn’t have money to get more.”** Was that often, sometimes, or never true for (you/your household) in the last 12 months?

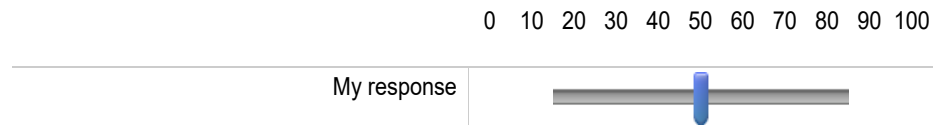
- ☐ Often True
 - ☐ Sometimes True
 - ☐ Never True
 - ☐ Don't Know or Rather not say
-

Statement: **“(I/we) couldn’t afford to eat balanced meals.”** Was that often, sometimes, or never true for (you/your household) in the last 12 months?

- ☐ Often True
- ☐ Sometimes True
- ☐ Never True
- ☐ Don't Know or Rather not say

Page Break

As described earlier, we are interested in factors that influence the decisions you might make. In order for the results of this survey to be valid, **it is essential that you read all the instructions and questions carefully**. So we know that you have read these instructions, please place the slider below on the answer to $(33+12)=?$ Thank you for taking the time to read these instructions.



[NOTE: Incorrect responses then prompted participant to review the same question once more, but a second incorrect response to this attention check question lead to an immediate end to their study participation (participants progress was stopped and they were asked to return the study on Prolific)

Page Break

Here are a few more questions about the food in your household in the last 12 months

In the last 12 months, since last September, did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food?

- ☐ Yes, almost every month
- ☐ Yes, some months but not every month
- ☐ Yes, only 1 or 2 months
- ☐ No

In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?

- ☐ Yes
- ☐ No
- ☐ Don't Know

In the last 12 months, were you ever hungry but didn't eat because there wasn't enough money for food?

- ☐ Yes
- ☐ No
- ☐ Don't Know

Page Break

Finally, for each of the statements below (each row is its own statement) and continued on the next several pages, **please indicate the likelihood that you would engage in the described activity or behavior** if you were to find yourself in that situation. Provide a rating from

Extremely Unlikely to Extremely Likely for each statement below: **How likely am I to engage in each activity or behavior listed below if I were to find myself in that situation?**

	Extremel y Unlikely	Moderatel y Unlikely	Somewh at Unlikely	Not Sur e	Somewh at Likely	Moderatel y Likely	Extremel y Likely
Admitting that your tastes are different from those of a friend.	☐	☐	☐	☐	☐	☐	☐
Going camping in the wilderness.	☐	☐	☐	☐	☐	☐	☐
Betting a day's income at the horse races.	☐	☐	☐	☐	☐	☐	☐
Investing 10% of your annual income in a moderate growth mutual fund.	☐	☐	☐	☐	☐	☐	☐
Drinking heavily at a social function.	☐	☐	☐	☐	☐	☐	☐
Taking some questionable deductions on your income tax return.	☐	☐	☐	☐	☐	☐	☐

Page Break

How likely am I to engage in each activity or behavior listed below if I were to find myself in that situation?

	Extremel y Unlikely	Moderatel y Unlikely	Somewh at Unlikely	Not Sur e	Somewh at Likely	Moderatel y Likely	Extremel y Likely
Disagreein g with an authority figure on a major issue.	☐	☐	☐	☐	☐	☐	☐
Betting a day's income at a high-stake poker game.	☐	☐	☐	☐	☐	☐	☐
Having an affair with a married man/woma n.	☐	☐	☐	☐	☐	☐	☐
Passing off somebody else's work as a your own.	☐	☐	☐	☐	☐	☐	☐
Going down a ski run that is a beyond your ability.	☐	☐	☐	☐	☐	☐	☐
Investing 5% of your annual income in a very speculative stock.	☐	☐	☐	☐	☐	☐	☐

Page Break

How likely am I to engage in each activity or behavior listed below if I were to find myself in that situation?

	Extremel y Unlikely	Moderatel y Unlikely	Somewh at Unlikely	Not Sur e	Somewh at Likely	Moderatel y Likely	Extremel y Likely
Going whitewater rafting at high water in the spring.	☐	☐	☐	☒	☐	☐	☐
Betting a day's income on the outcome of a sporting event.	☐	☐	☐	☒	☐	☐	☐
Engaging in unprotected sex.	☐	☐	☐	☒	☐	☐	☐
Revealing a friend's secret to someone else.	☐	☐	☐	☒	☐	☐	☐
Driving a car without wearing a seat belt.	☐	☐	☐	☒	☐	☐	☐
Investing 10% of your annual income in a new business venture.	☐	☐	☐	☒	☐	☐	☐

Page Break

How likely am I to engage in each activity or behavior listed below if I were to find myself in that situation?

	Extremel y Unlikely	Moderatel y Unlikely	Somewha t Unlikely	Not Sur e	Somewha t Likely	Moderatel y Likely	Extremel y Likely
Taking a skydiving class.	☐	☐	☐	☐	☐	☐	☐
Riding a motorcycle without a helmet.	☐	☐	☐	☐	☐	☐	☐
Choosing a career that you truly enjoy over a more secure one.	☐	☐	☐	☐	☐	☐	☐
Speaking your mind about an unpopular issue in a meeting at work.	☐	☐	☐	☐	☐	☐	☐
Sunbathin g without sunscreen	☐	☐	☐	☐	☐	☐	☐
Bungee jumping off a tall bridge.	☐	☐	☐	☐	☐	☐	☐

Page Break

How likely am I to engage in each activity or behavior listed below if I were to find myself in that situation?

	Extremel y Unlikely	Moderatel y Unlikely	Somewha t Unlikely	Not Sur e	Somewha t Likely	Moderatel y Likely	Extremel y Likely
Piloting a small plane.	☐	☐	☐	☐	☐	☐	☐
Walking home alone at night in an unsafe area of town.	☐	☐	☐	☐	☐	☐	☐
Moving to a city far away from your extende d family.	☐	☐	☐	☐	☐	☐	☐
Starting a new career in your mid- thirties.	☐	☐	☐	☐	☐	☐	☐
Leaving your young children alone at home while running an errand.	☐	☐	☐	☐	☐	☐	☐
Not returning a wallet you found that contains \$200.	☐	☐	☐	☐	☐	☐	☐

Page Break

To finalize this survey, **please click "FINISH SURVEY"** below and advance the page (otherwise, Prolific completion code may not register properly).

☐ FINISH SURVEY

Main Decision Task Study

Note: Commentary for the reader is given below highlighted in square brackets (e.g., **[Note:]**).

[Note: High versus Low Cognitive Load treatment differences highlighted below where appropriate. Spacing condensed between questions in what follows. Researcher identifiers removed for anonymity. Some formatting of original Qualtrics survey was altered when exporting the survey.]

Informed Consent: You are being asked to complete this online survey that includes some demographic and mood/emotion questions, a cognitive task, and a risky choice task. Participation in this online survey is completely voluntary, your responses to this survey will remain completely confidential, the data will be securely stored, your name will not be recorded anywhere on this survey. The only identifier we will record will be your Prolific ID, which we as researchers cannot link to personally identifiable data of yours. This survey is estimated to take 14 minutes to complete and your payment for successful survey completion will be \$2.50. Additionally, **the cognitive and risky choice tasks present the opportunity to earn an additional bonus payment between \$0.00 and \$5.60 (the average bonus payment will be closer to \$1.50).** There is an attention-check question within the survey to ensure that you are being attentive and reading each question prior to responding. Successful survey completion requires passing the attention check question. **Failure to answer the attention-check question correctly may jeopardize receiving your payment** for this Prolific study. There are no known risks associated with this study beyond those associated with everyday life. Although this study will not benefit you personally, its results will help our understanding of how people make decisions. Please note that **this survey will be best displayed on a laptop or desktop computer.** Some features may be less compatible for use on a mobile device. For additional information related to this questionnaire, contact [REDACTED]. [REDACTED] University's Institutional Review Board has determined this study to be exempt from review by the IRB Administration.

- ☐ **I Consent** and wish to continue with this study
- ☐ **I do not consent** to participating and **do not wish to continue**

Page Break

Before you start, please switch off phone/ e-mail/ music so that you can focus on this study. Thank you! Please carefully enter your Prolific ID (or double check if it has auto-filled)

Page Break

What is **your current age** (in years)?

18 26 34 43 51 59 67 75 84 92 100

Years of age	
--------------	--

What is your sex?

(i.e., what sex were you assigned at birth, such as on an original birth certificate)?

☐ Female

☐ Male

What is **your ethnicity**?

☐ Hispanic or Latino

☐ Not Hispanic or Latino

What is **your racial category**?

☐ American Indian/Alaska Native

☐ Asian

☐ Native Hawaiian or Other Pacific Islander

☐ Black or African American

☐ White (Caucasian)

☐ Mixed

Page Break

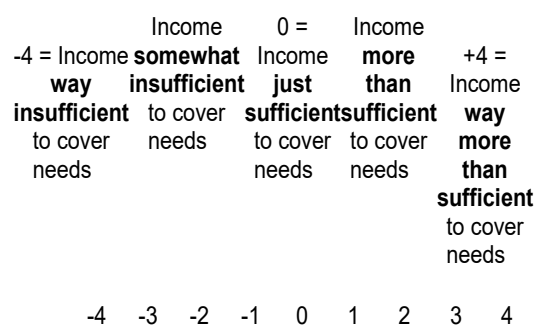
What is your **total household income per year**, including **all earners** in your household (after tax) in USD?

- ☐ < \$10,000 per year
 - ☐ \$10,000-\$15,999
 - ☐ \$16,000-\$19,999
 - ☐ \$20,000-\$29,999
 - ☐ \$30,000-\$39,999
 - ☐ \$40,000-\$49,999
 - ☐ \$50,000-\$59,999
 - ☐ \$60,000-\$69,999
 - ☐ \$70,000-\$79,999
 - ☐ \$80,000-\$89,999
 - ☐ \$90,000-\$99,999
 - ☐ \$100,000-\$149,999
 - ☐ More than \$150,000 per year
-

The previous question asked about total "household" income. **How many individuals are in your "household" (including yourself)?**

- ☐ One individual (just me)
- ☐ 2 individuals
- ☐ 3 Individuals
- ☐ 4 Individuals
- ☐ 5 Individuals
- ☐ 6 Individuals
- ☐ 7 Individuals
- ☐ 8 Individuals
- ☐ 9 Individuals
- ☐ 10 Individuals
- ☐ > 10 Individuals in my household

On the following scale, please indicate **how much you feel your current household income is or is not adequate** to cover your household financial needs. (-4 = way insufficient, 0 = Just sufficient, +4 = way more than sufficient)



Income sufficiency	
--------------------	--

What is the highest level of education you have completed?

- ☐ Some high school or less
- ☐ High school diploma or GED
- ☐ Some college, but no degree
- ☐ Associates or technical degree
- ☐ Bachelor's degree
- ☐ Graduate or professional degree (MA, MS, MBA, PhD, JD, MD, DDS etc.)

Page Break

Here's a few short questions about sleep and sleepiness.

Please mark the number that best corresponds to how sleepy you feel **right now**. You may mark any number, but mark only one number.

- ☐ 1. Extremely alert
- ☐ 2.
- ☐ 3. Alert
- ☐ 4.
- ☐ 5. Neither alert nor sleepy
- ☐ 6.
- ☐ 7. Sleepy--but no difficulty remaining awake
- ☐ 8.
- ☐ 9. Extremely sleepy--fighting sleep

Over the last 7 nights, what is the average amount of sleep you obtained each night?

0 1 2 3 4 5 6 7 8 9 10 11 12

Average nightly sleep over the LAST WEEK



What do you consider **the optimal amount of nightly sleep for you personally?** (optimal in terms of performance, alertness, and mood).

0 1 2 3 4 5 6 7 8 9 10 11 12

Nightly hours of sleep I personally need
for optimal performance, alertness, and mood.



Page Break

How likely are you to doze off or fall asleep in the following situations, in contrast to just feeling tired? This refers to your usual way of life in recent times. Even if you have not done some of these things recently, try to work out how they would have affected you.

	would NEVER doze or fall asleep	SLIGHT chance of dozing or falling asleep	MODERATE chance of dozing or falling asleep	HIGH chance of dozing or falling asleep
Sitting and reading	☐	☐	☐	☐
Watching TV	☐	☐	☐	☐
Sitting, inactive in a public place (e.g., a theater or a meeting)	☐	☐	☐	☐
As a passenger in a car for an hour	☐	☐	☐	☐
Lying down to rest in the afternoon when circumstances permit	☐	☐	☐	☐
Sitting and talking to someone	☐	☐	☐	☐
Sitting quietly after lunch without alcohol	☐	☐	☐	☐
In a car, while stopped for a few minutes in traffic	☐	☐	☐	☐

Page Break

Now, we'd like to get your baseline ratings on some mood/emotion states. Please rate how strongly you feel each of these emotions *right now*.

Right now I feel.....

	Zero level of this emotion (1)	(2)	(3)	Mid- Range level of this emotion (4)	(5)	(6)	Maximum level of this emotion (7)
Happy	☐	☐	☐	☐	☐	☐	☐
Excited	☐	☐	☐	☐	☐	☐	☐
Surprised	☐	☐	☐	☐	☐	☐	☐
Satisfied	☐	☐	☐	☐	☐	☐	☐
Angry	☐	☐	☐	☐	☐	☐	☐
Irritated	☐	☐	☐	☐	☐	☐	☐
Confused	☐	☐	☐	☐	☐	☐	☐
Regret	☐	☐	☐	☐	☐	☐	☐
Disgust	☐	☐	☐	☐	☐	☐	☐
Anxious	☐	☐	☐	☐	☐	☐	☐

Page Break

As described earlier, we are interested in factors that influence the decisions you might make. In order for the results of this survey to be valid, **it is essential that you read all the instructions and questions carefully**. So we know that you have read these instructions, please place the slider below on the answer to $(33+12)=?$ Thank you for taking the time to read these

instructions.

0 10 20 30 40 50 60 70 80 90 100

My response	
-------------	--

[NOTE: Incorrect responses then prompted participant to review the same question once more, but a second incorrect response to this attention check question lead to an immediate end to their study participation (participants progress was stopped and they were asked to return the study on Prolific]

Page Break

OUTCOMES ON THIS TASK WILL AFFECT YOUR PROLIFIC BONUS PAYMENT FOR THIS STUDY (so, please read the instructions carefully)

This next task asks you to provide a response in each of several trials. There is an incentive to be **as accurate as possible** on this task. A bonus payment of 5 cents can be earned for each correct response in the task, and there are a total of 32 trials on this task--a total bonus payment potential of \$1.60 from this task. This bonus payment would be *in addition to* your \$2.50 fixed payment for completing the study. It is important to also note that the trials are timed in this task. Specifically, **you will have a maximum of 4 seconds to input your response on any given trial**. There will be a timer on each page, and the page will auto-advance after 4 seconds and move to the next trial. Any trials where you do not input a response (i.e., the timer hits zero and the page auto-advances to the next trial) will be counted as incorrect in terms of bonus payment earnings. So, you do need to be attentive and timely in your response to make sure that you make your choice within each trial's designated 4-second time limit. The next page will describe the task in more detail

Page Break

One version of the task asks you to identify the **color of the text**, and not the word itself. There will be a total of **16 trials of this version** and some trials may be more challenging than others. Here's a few examples of how these trials will look:

(Your answers to these practice trials do not count towards your calculating a bonus payment, and so we tell you the correct answer so that you clearly understand what the objective of the task is).

The examples below are not timed, but remember that **in the real trials you will have 4 seconds to input your answer** before the survey auto-advances to the next trial of this task.

Example #1

Orange

Please **identify the color of the text** amongst the options below

*(answer: in this version, **you should select the option "purple"** below because the text is written in purple color)*

☐ Yellow

☐ Orange

☐ Purple

Example #2

Purple

Please **identify the color of the text** amongst the options below

*(answer: in this version, **you should select the option "yellow"** below because the text is written in yellow color)*

☐ Yellow

☐ Orange

☐ Purple

Example #3

Orange

Please **identify the color of the text** amongst the options below

*(answer: in this version, **you should select the option "orange"** below because the text is written in orange color)*

☐ Yellow

☐ Orange

☐ Purple

Page Break

Another version of the task asks you to identify the **color of the background** behind the text, and not the word written on the background. There will be a total of 16 trials of this version and some trials may be more challenging than others. Here's a few examples of how these trials will

look:

(Again, your answers to these practice trials do not count towards your calculating a bonus payment, and so we tell you the correct answer so that you clearly understand what the objective of the task is).

The examples below are not timed, but remember that **in the real trials you will have 4 seconds to input your answer** before the survey auto-advances to the next trial of this task.

Example #1

Yellow

Please **identify the color of the background** amongst the options below

(answer: in this version, you should select the option "purple" below because the background color is purple)

☐ Yellow

☐ Orange

☐ Purple

Example #2

Orange

Please **identify the color of the background** amongst the options below

(answer: in this version, you should select the option "orange" below because the background color is orange) **[Note: orange background not available in Word for reproduction]**

☐ Yellow

☐ Orange

☐ Purple

Example #3

Orange

Please **identify the color of the background** amongst the options below

(answer: in this version, you should select the option "yellow" below because the background color is yellow)

☐ Yellow

☐ Orange

☐ Purple

Page Break

Now you are ready for the main trials of this task (16 trials of each version of the task). Each trial will be shown on a separate screen. Trials for each version of the task will all be grouped together, but it is randomly determined which version you see first. You will see the 4-seconds timer on each screen that represents the seconds you have left to input your response before the screen auto-advances to the next trial.

Please click below when you are ready, and remember that you will earn a 5 cents bonus payment for each correct response on this task.

☐ Ready to start the task

Page Break

One thing before this set of trials on this decision task. We'd like you to please take a moment to **carefully read and think about the scenario below.** It is important to us that you consider your response to this scenario because we are interested in how different participants would deal with such a scenario. **After the set of timed decision task trials that you will complete next, you will be asked to tell us how you would handle this scenario below.**

[Note: Example reflect HIGH COGNITIVE LOAD treatment. LOW COGNITIVE LOAD replaces 15% cut with "5% cut"]

Scenario

The economy is going through difficult times; suppose your employer needs to make substantial budget cuts. Imagine a scenario in which you received **a 15% cut in your salary.** Given your situation, would you be able to maintain roughly your same lifestyle under those new circumstances? If not, what changes would you need to make? Would it impact your leisure, housing, or travel plans?

☐ I have read and thought about the scenario, I know I will be asked how I would deal with that scenario after a set of timed decision task trials, and I am ready to start the decision

trials now. (the next page will immediately start the 4-second timed trials for the decision task)

Page Break

GREEN

Please **identify the color of the text** amongst the options below

- ☐ Green
- ☐ Red
- ☐ Blue
- ☐ Yellow

Page Break

YELLOW

Please **identify the color of the text** amongst the options below

- ☐ Green
- ☐ Red
- ☐ Blue
- ☐ Yellow

[**Note:** 14 additional trials follow, to complete all combinations of the words Red, Blue, Yellow, Green in all possible text colors. Trials were available for response for a total of 4 seconds per trial.]

Page Break

[**Note:** This below is presented after completion of the Stroop block of 16 trials]

Before this set of tasks completed, you were asked to consider the following scenario:

Scenario

The economy is going through difficult times; suppose your employer needs to make substantial budget cuts. Imagine a scenario in which you received a **15% cut in your salary**. Given your situation, would you be able to maintain roughly your same lifestyle under those new circumstances? If not, what changes would you need to make? Would it impact your leisure,

housing, or travel plans? Please indicate in the text box below how you would handle that scenario

[Note: Text box is presented for response entry here]

Did being asked to think about the financial problem scenario increase your level of anxiety at all?

	No increase in anxiety		Some increase in anxiety		Big increase in anxiety		
	1	2	3	4	5	6	7
My increase in anxiety							

Page Break

One thing before this set of trials on this decision task. We'd like you to please take a moment to **carefully read and think about the scenario below**. It is important to us that you consider your response to this scenario because we are interested in how different participants would deal with such a scenario. **After the set of timed decision task trials that you will complete next, you will be asked to tell us how you would handle this scenario below.**

[Note: Example reflect HIGH COGNITIVE LOAD treatment. LOW COGNITIVE LOAD replaces \$2,000 expense with "\$200 expense"]

Scenario

Imagine that **an unforeseen event requires of you an immediate \$2,000 expense**. Are there ways in which you may be able to come up with that amount of money on a very short notice? How would you go about it? Would it cause you long-lasting financial hardship? Would it require you to make sacrifices that have long-term consequences? If so, what kind of sacrifices?

- ☐ I have read and thought about the scenario, I know I will be asked how I would deal with that scenario after a set of timed decision task trials, and I am ready to start the decision trials now. **(the next page will immediately start the 4-second timed trials for the decision task)**

Page Break

BLUE

Please **identify the color of the background** amongst the options below

- ☐ Green
- ☐ Red
- ☐ Blue
- ☐ Yellow

Page Break

GREEN

Please **identify the color of the background** amongst the options below

- ☐ Green
- ☐ Red
- ☐ Blue
- ☐ Yellow

Page Break

[**Note:** 14 additional trials follow, to complete all combinations of the words Red, Blue, Yellow, Green in all possible background colors. Trials were available for response for a total of 4 seconds per trial.]

Page Break

[**Note:** This below is presented after completion of the Background-Stroop block of 16 trials]

Before this set of tasks you completed, you were asked to consider the following scenario:

Scenario

Imagine that an **unforeseen event requires of you an immediate \$2,000 expense**. Are there ways in which you may be able to come up with that amount of money on a very short notice? How would you go about it? Would it cause you long-lasting financial hardship? Would it require you to make sacrifices that have long-term consequences? If so, what kind of sacrifices? Please indicate in the text box below how you would handle that scenario

[**Note:** Text box is presented for response entry here]

Did being asked to think about the financial problem scenario increase your level of anxiety at all?

	No increase in anxiety	Some increase in anxiety	Big increase in anxiety
	1	2	3
My increase in anxiety			

How motivated were you on the word/color task you just completed?

	Not at all Motivated!	Mid-range amount of Motivation	Highest level of Motivation!
	1	2	3
Level of Motivation on word/color task			

How much effort did you put forth on the word/color task you just completed?

	No effort at all!	Mid-range amount of effort	Highest possible level of effort!
	1	2	3
Level of effort on word/color task			

How cognitively (or "mentally") fatigued are you after having just completed the word/color task?

	Not at all Cognitively Fatigued!		Mid-range amount of Cognitive Fatigue		Totally Cognitively Fatigued!				
	1	2	3	4	5	6	7	8	9
Perceived Cognitive Fatigue level after word/color task									

Page Break

The next task is composed of two sets of trials involving risky monetary choices. Please read carefully below so that you understand how your bonus payment will be affected by outcomes in this task. Your decision on a randomly chosen trial from one set (i.e., the "risky choice-gains" trials) will determine an amount *added* to your bonus payment for this study, but your decision on a randomly chosen trial from the other set (i.e., the "risky choice-losses" trials) will determine an amount *subtracted* from your bonus payment. The order of the two sets of trials is randomly determined, and so you may see either the set of "risky choice-losses" trials first, followed by the set of "risky choice-gains" trials, or vice-versa. **In the event the bonus payment loss you earn in the "risky choice-losses" trials is greater than the bonus payment you earn in the "risky choice-gains" trials**, then the additional loss will subtract from the bonus payment you earn from the first decision task in this study. No matter what the outcomes, **you are still guaranteed the fixed study compensation of \$2.25 for completing this study** (i.e., outcomes from the decision tasks only affect the size of the bonus payment you will receive afterwards).

Page Break

Risky Choices (GAINS) trials

Outcomes from a randomly chosen trial from this set of trials will impact your Prolific bonus payment for this study, so please read these instructions carefully

Instructions

For this set of decision trials you will be presented with a series of risky monetary choices that can add money to your Prolific bonus payment for this study.

Imagine a container filled with 60 colored chips: 20 Red, 20 Blue, and 20 Yellow chips. Next imagine that one chip is drawn at random from this container. **An equal number of each color of chip means there is an *equally likely chance* the color of the chip drawn at random**

could be red, or blue, or yellow. The color of the chip drawn will dictate your payoff from that Choice, and the image presented will show the payoff from each outcome below that color of chip. Each decision trial will present two risky choice options and you will be asked to indicate which of the two risk options you prefer. For example, consider the risky choice below:

In this example, if you were to select Risk Option 1 as your preference, then if a chip drawn at random is red or blue, you would earn \$2.00, whereas if a yellow chip is drawn you would earn \$0.00. On the other hand, if you select Risk Option 2 as your preference, you can see that the payoffs would be different for each color of chip that might be drawn (e.g., \$3.77 if red, \$0.20 if blue, and \$0.03 if yellow)

The next pages will present you with 10 different choice trials of this sort, and you must indicate a preference in each instance. At the end of the study, we will draw one of the 10 trials at random, and a chip color will be drawn at random, and **your bonus payment will be the payoff associated with that chip color for your preferred Risk Option in that trial.** Because each trial has an equally likely chance of being the one that counts for your payoff on this task, please make each decision carefully (because your choice on any given trial may be the one that counts for your bonus payment). **Please advance the page when you are ready to start these decision trials.**

Page Break

[Note: Example reflect HIGH COGNITIVE LOAD treatment. LOW COGNITIVE LOAD replaces \$1,500 service with "\$150 service"]

One thing before this set of trials on this decision task. We'd like you to please take a moment to **carefully read and think about the scenario below.** It is important to us that you consider your response to this scenario because we are interested in how different participants would deal with such a scenario. **After the set of risky choice trials that you will complete next, you will be asked to tell us how you would handle this scenario below.**

Scenario

Imagine that **your car is having some trouble, and requires a \$1,500 service.** Unfortunately, your auto insurance will cover only 10% of this cost. You now need to decide the following: (1) Pay the full amount in cash. Would this require liquidating savings? How would you go about it? (2) Take out a loan, which you can pay back in monthly installments. A typical such loan may require monthly payments of roughly \$150 a month for 12 months, which would amount to about \$1800 total. (3) Take a chance, forego the service, and hope that the car lasts for a while longer. Of course, this leaves open the possibility of breakdown, or even greater expenses in the long run.

☐ I have read and thought about the scenario, I know I will be asked how I would deal with that scenario after a set of risky choice decision trials, and I am ready to start the decision

trials now. (the next page will immediately start the set of risky choice-Gains trials for the decision task)

Page Break

Choose your Preferred Risk Option from this set of two options

Risk Option 1				Risk Option 2			
	R	B	Y		R	B	Y
Number of Chips:	20	20	20	Number of Chips:	20	20	20
Payout If selected:	\$2.00	\$2.00	\$0.00	Payout If selected:	\$0.20	\$3.40	\$0.40

☐ I Prefer RISK OPTION 1

☐ I Prefer RISK OPTION 2

Page Break

Choose your Preferred Risk Option from these two options

Risk Option 1				Risk Option 2			
	R	B	Y		R	B	Y
Number of Chips:	20	20	20	Number of Chips:	20	20	20
Payout If selected:	\$2.00	\$2.00	\$0.00	Payout If selected:	\$3.00	\$0.60	\$0.40

☐ I Prefer RISK OPTION 1

☐ I Prefer RISK OPTION 2

[Note: 8 additional Risky GAINS trials follow, for a total of 10 trials in the block. Choice response times were recorded on each trial.]

Page Break

[Note: This below is presented after completion of the 10 Risky GAINS trials]

Before this set of risky choice trials you just completed, you were asked to consider the following scenario:

Scenario

Imagine that **your car is having some trouble, and requires a \$1,500 service**. Unfortunately, your auto insurance will cover only 10% of this cost. Please indicate in the text box below how you would handle that scenario

[Note: Text box is presented for response entry here]

Did being asked to think about the financial problem scenario increase your level of anxiety at all?

	No increase in anxiety		Some increase in anxiety		Big increase in anxiety		
	1	2	3	4	5	6	7
My increase in anxiety							

Page Break

Risky Choices (LOSSES) trials

Outcomes from a randomly chosen trial from this set of trials will impact your Prolific bonus payment for this study, so please read these instructions carefully

Instructions

For this set of decision trials you will be presented with a series of risky monetary choices that can subtract money from your Prolific bonus payment for this study (this will not impact your fixed study compensation, just the bonus payment).

Imagine a container filled with 60 colored chips: 20 Red, 20 Blue, and 20 Yellow chips. Next imagine that one chip is drawn at random from this container. **An equal number of each color of chip means there is an equally likely chance the color of the chip drawn at random could be red, or blue, or yellow.** The color of the chip drawn will dictate your payoff from that Choice, and the image presented will show the payoff from each outcome below that color of chip--the negative sign with each payoff implies that **your bonus payment will decrease by the amount indicated** based on the color of chip drawn at random. Each decision trial will present two risky choice options and you will be asked to indicate which of the two risk options you prefer. For example, consider the risky choice below:

In this example, if you were to select Risk Option 1 as your preference, then if a chip drawn at random is red or blue, you would *lose* \$2.00 from your bonus payment, whereas if a yellow chip is drawn you would lose nothing (\$0.00). On the other hand, if you select Risk Option 2 as your preference, you can see that the amount you lose from your bonus payment would be different for each color of chip that might be drawn (e.g., -\$3.77 if red, -\$0.20 if blue, and -\$0.03 if

yellow)

The next pages will present you with 10 different choice trials of this sort, and you must indicate a preference in each instance. At the end of the study, we will draw one of the 10 trials at random, and a chip color will be drawn at random, and **your bonus payment from this study will be reduced by the amount indicated for that chip color for your preferred Risk Option in that trial**. Because each trial has an equally likely chance of being the one that counts for your payoff on this task, please make each decision carefully (because your choice on any given trial may be the one that counts for subtracting from your bonus payment). **Please advance the page when you are ready to start these decision trials.**

Page Break

[**Note:** Example reflect HIGH COGNITIVE LOAD treatment. LOW COGNITIVE LOAD replaces "will cost you \$999.....\$100 each.....a total of \$1200" with "will cost you \$399...a total cost of \$480"]

One thing before this set of trials on this decision task. We'd like you to please take a moment to **carefully read and think about the scenario below**. It is important to us that you consider your response to this scenario because we are interested in how different participants would deal with such a scenario. **After the set of risky choice trials that you will complete next, you will be asked to tell us how you would handle this scenario below.**

Scenario

Suppose you have reached the point where **you must replace your old refrigerator**. The model you plan to buy offers two alternative financing options:

- (1) You can pay the full amount in cash, which **will cost you \$999**.
- (2) You can pay in 12 monthly payments, of **\$100 each**, which would amount to a **total of \$1200**.

Which financing option would you opt for? Would you have the necessary cash on hand? Would the interest be worth paying in this case?

- ☐ I have read and thought about the scenario, I know I will be asked how I would deal with that scenario after a set of risky choice decision trials, and I am ready to start the decision trials now. **(the next page will immediately start the set of risky choice-losses trials for the decision task)**

Choose your Preferred Risk Option from these two options

Risk Option 1				Risk Option 2			
							
Number of Chips:	20	20	20	Number of Chips:	20	20	20
Payout If selected:	-\$2.00	-\$2.00	\$0.00	Payout If selected:	-\$0.40	-\$3.40	-\$0.20

☐ I Prefer RISK OPTION 1

☐ I Prefer RISK OPTION 2

Page Break

Choose your Preferred Risk Option from these two options

Risk Option 1				Risk Option 2			
							
Number of Chips:	20	20	20	Number of Chips:	20	20	20
Payout If selected:	-\$2.00	-\$2.00	\$0.00	Payout If selected:	-\$3.00	-\$0.60	-\$0.40

☐ I Prefer RISK OPTION 1

☐ I Prefer RISK OPTION 2

Page Break

[Note: 8 additional Risky LOSSES trials follow, for a total of 10 trials in the block. Choice response times were recorded on each trial.]

Page Break

[Note: This below is presented after completion of the 10 Risky LOSSES trials]

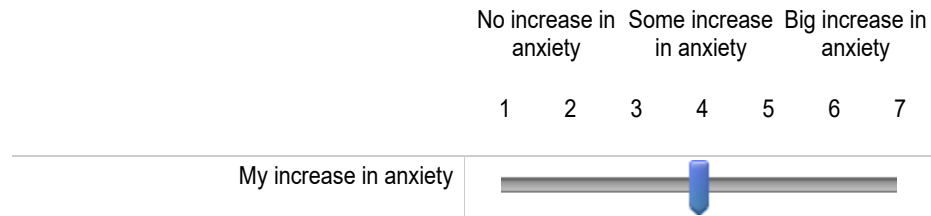
Before this set of risky choice trials you just completed, you were asked to consider the following scenario:

Scenario

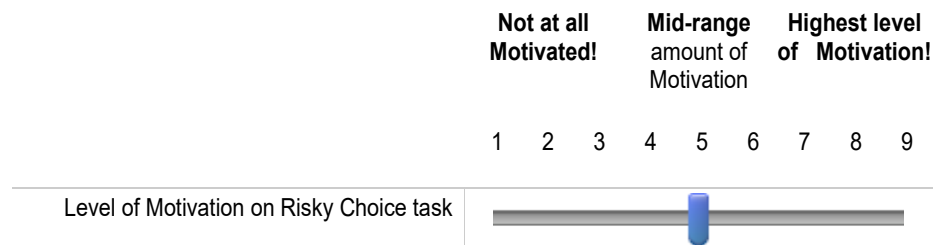
Suppose you have reached the point where **you must replace your old refrigerator**. The \$999 model you plan to buy offers cash and financing options: Please indicate in the text box below how you would handle that scenario

[Note: Text box is presented for response entry here]

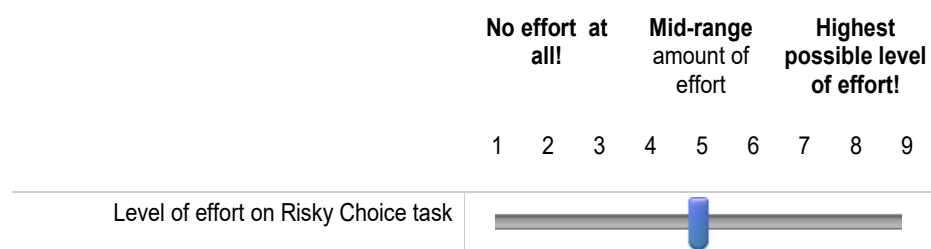
Did being asked to think about the financial problem scenario increase your level of anxiety at all?



How motivated were you on the risky choice task you just completed?



How much effort did you put forth on the risky choice task you just completed?



How cognitively (or "mentally") fatigued are you after having just completed the risky choice task?

	Not at all Cognitively Fatigued!		Mid-range amount of Cognitive Fatigue		Totally Cognitively Fatigued!				
	1	2	3	4	5	6	7	8	9
Perceived Cognitive Fatigue level after Risky Choice task									

Page Break

To finalize this survey, **please click "FINISH SURVEY"** below and advance the page (otherwise, Prolific completion code may not register properly).

☐ **FINISH SURVEY**