Behavioral Attenuation*

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Abstract

We report the results of 30 experiments to study the elasticity of economic decisions with respect to fundamentals. Our experiments cover a broad range of domains, from choice and valuation to belief formation, from strategic games to generic optimization problems, involving investment, savings, effort supply, product demand, taxes, externalities, fairness, beauty contests, search, policy evaluation, forecasting and inference. We identify two general patterns. First, behavioral attenuation: in 93% of our experiments, the elasticity of decisions to variation in fundamentals significantly decreases in subjects' cognitive uncertainty. Second, diminishing sensitivity: the elasticity of decisions decreases in the distance of the fundamental from 'simple points' at which a problem component drops out (such as a wage of zero), and this decrease in elasticities is again mirrored by an increase in cognitive uncertainty. These results suggest that the elasticity of economic decisions is attenuated when people are uncertain about their best decision, and that there is less (or no) uncertainty and attenuation when problems are cognitively easy. We link these results to known decision anomalies, and study the limits of attenuation.

Keywords: Behavioral attenuation, diminishing sensitivity, cognitive uncertainty, experiments

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1 Introduction

In this paper we report the results of over 30 experiments from across economics to study the elasticity of economic decisions with respect to continuous variation in a fundamental that decision-makers attend to. Examples include effort supply as a function of the wage, savings as a function of the interest rate, prosocial giving as a function of efficiency, search as a function of cost, and forecasting as a function of persistence. In each experiment, we measure cognitive uncertainty: people's uncertainty whether the decision they took is actually their best decision, given the preferences and information they have. For example, people may be uncertain what their utility-maximizing labor supply is at a given wage.

Our pre-registered hypothesis is twofold. First, that cognitive uncertainty predicts *behavioral attenuation* – a reduced elasticity of decisions to variation in fundamentals. Second, that cognitive uncertainty predicts *diminishing sensitivity* from "simple points" at which a problem component drops out. Intuitively, identifying one's best decision is easy when the wage is zero, the marginal cost is zero, or the signal diagnosticity is one, such that the sensitivity of decisions should be higher close to these points.

We are interested in the phenomena of attenuation and diminishing sensitivity in part because they concern a core object in economic analysis: the degree to which behavior would differ under counterfactual incentives and fundamentals. Our study is motivated by the idea that a generic cognitive mechanism – that people are often uncertain about what their best decision is – may allow researchers to model, measure or predict the degree to which observed elasticities are attenuated by cognition across various different applications.

Study design. We designed a pre-registered series of online experiments in which we examine an unusually large number of distinct decision tasks (31 experiments in all). At a high level, our experiments cover eight categories from across economics: financial decisions, labor-related decisions, consumer choice, social decisions, strategic decision-making, political decisions, risk and time preference elicitations, as well as tasks related to belief formation and cognition. To help broaden the scope of decision environments considered, a subset of these experiments were designed in consultation with outside experts. In total, our experiments involve 8,200 participants and 89,000 decisions.

Our experiments include both objective and subjective problems. Objective problems are ones that have normatively correct solutions – inference or prediction problems with fully specified data-generating processes or choice experiments with induced values. For example, we study forecasting as a function of the persistence of the process and signal aggregation as a function of the signal sources' relative precisions. Subjective problems, on the other hand, involve decisions in which the optimal choice depends on the decision maker's own preferences or subjective beliefs. For example, we implement experiments on savings, investment, cooperation, fairness, lottery choice, effort supply, beauty contests, information disclosure, policy evaluations and voting.

The thought behind covering such a wide range of experiments is not that all prior behavioral findings in these domains may reflect cognitive uncertainty or attenuation. To take a trivial example, the existence of social motivations such as altruism has arguably nothing to do with cognitive uncertainty. Yet, cognitive uncertainty may matter for how a person's altruism gets translated into a prosocial choice. More generally, our research hypothesis is that cognitive uncertainty-linked attenuation and diminishing sensitivity shape how people's preferences and information get translated into observed decisions.

The common denominator across our collection of tasks is that each task features one main decision-relevant fundamental that (i) people attend to, (ii) can be varied continuously and (iii) has been shown to affect decisions monotonically over some range. In each experiment, we systematically vary the key fundamental across usually eleven experimental rounds. Our primary object of interest is the slope of decisions to variation in these fundamentals (using theory-informed functional forms, when available).

After each decision, we elicit cognitive uncertainty (*CU*): subjects' subjective percentage chance that their decision was not actually their best ex-ante decision, given whichever preferences they have. We think of *CU* as a type of incomplete (cognitive) information. We are agnostic over whether this incomplete information reflects preference uncertainty, uncertainty how to aggregate different problem components, uncertainty how to maximize, lack of knowledge of statistical rules, or something else. All that matters to us is that people may not know which decision is best for them, and the broad swath of experiments we run indeed suggests that there is more than one source of *CU*.

Our experiments are designed to study variation in the elasticity of decisions along two core dimensions: across subjects (some people are more uncertain than others) and across problem fundamentals (some problems are simpler than others). We identify behavioral attenuation and diminishing sensitivity by correlating *CU* with the elasticity of decisions, in both subjective and objective tasks. In objective tasks we can additionally identify behavioral attenuation and diminishing sensitivity simply by comparing observed elasticities to theory-predicted, optimal ones.

Behavioral attenuation. Our *CU* measures strongly suggest that people indeed struggle with mapping economic fundamentals into decisions: in every one of our 31 experiments, the majority of subjects express strictly positive *CU*.

CU is, in turn, strongly predictive of the elasticity of decisions with respect to fundamentals: in 93% of our experiments, higher *CU* is associated with a lower elasticity. These correlations are almost always statistically significant. By contrast, in no task do we find a signficant correlation in the opposite direction. These correlations are economically large: on average, as *CU* – the likelihood subjects attach to the proposition that they failed to take their best decision – increases from 0% to 50%, the elasticity of decisions to fundamentals decreases by an average of 33% across our experiments.

What is perhaps most striking is that we find the same pattern across a wide variety of choice domains, types of preferences and across subjective and objective tasks. The link between *CU* and lower elasticities appears in all of our eight categories of experiments; in both individual decisions and strategic games; in experiments related to preferences, beliefs and cognition; in choices involving risk, intertemporal tradeoffs and social considerations; and in both naturalistic and more abstract designs.

A natural question is to what degree subject-level differences in *CU* (which may be driven by differences in cognitive ability or global attentiveness to the experiment) drive our results. We find that while across-subject heterogeneity in *CU* is almost always a statistically significant predictor of overall attenuation, the quantitative magnitude of attenuation drops by 3/4 in these analyses. This suggests that within-subject variation in *CU* is an important driver of attenuation in our data.

Simple points and diminishing sensitivity. We link *CU* to decision elasticities not just across subjects but also across different values of the fundamentals. To this end, our experiments vary the main fundamental over a wide range, including at or near pre-registered 'simple points'. These are parameter values at which we hypothesized the problem would be cognitively easy, either because a dominant action exists or because a problem component drops out. For instance, determining optimal effort supply may be cognitively difficult in general but it is trivial when the wage is zero. Similarly, determining a firm's optimal output level may be difficult in general, but it is easy both when the marginal cost of production of zero and when the marginal cost equals the output price.

For almost all experiments, we pre-registered 'potential simple points', many of which are points at which a dominant action exists. Across our experiments, the *CU* data strongly suggest that subjects indeed find problems easier to reason about when they involve fundamentals at or close to these pre-registered points. For most tasks median *CU* is zero at simple points, and progressively increases as the fundamental moves away from it. This suggests that decisions are not only cognitively easy at the simple points themselves but are still reasonably easy close to them.

The insight that *CU* varies as a function of the distance to simple points has immediate implications for understanding diminishing sensitivity: the well-known regularity in behavioral economics that decisions are often less sensitive further away from natural boundaries, such as a price of zero, or probabilities of zero and one. The reason is that these natural boundaries are often simple points in the sense that there is little or no cognitive uncertainty at these points. If people's degree of (in)sensitivity is partly driven by the cognitive difficulty of identifying one's best decision, then there *should* be higher sensitivity in the neighborhood of boundaries at which *CU* is low.

To provide evidence for this, we directly connect *CU* and decision elasticities across different problem fundamentals (rather than across subjects). To this effect, we estimate both 'local' *CU* at a specific fundamental and the 'local' elasticity of decisions around that fundamental, on average across all subjects. For example, in our effort supply experiment, we connect average *CU* at a wage of $0 to the average local elasticity of decisions at a wage of $0, and compare these quantities with average *CU* and the average elasticity of decisions at a wage of $0.50. We find that the average local sensitivity of decisions is low at exactly those points at which average *CU* is locally high.

We do not claim that diminishing sensitivity never reflects preferences. Rather, our objective is to document that a part of diminishing sensitivity reflects that the cognitive difficulty of identifying one's best decision increases in the distance from simple points. Because this analysis only leverages variation across problem fundamentals, it nets out across-subject differences in *CU*, which also shows that heterogeneous interpretations of the *CU* elicitation across subjects do not drive the results.

Objective tasks. The research strategy of predicting attenuation and diminishing sensitivity with *CU* is attractive because it can be deployed even in contexts in which the researcher does not know the decision maker's objective function. However, in eight experiments, we do plausibly know subjects' objective function and the normatively-correct decisions. Because we know the 'ground truth' optimal elasticities, we can directly compare them to the estimated elasticities. Again, we find both attenuation (the elasticity of decisions is smaller than optimal) and diminishing sensitivity (people's response functions are more concave than is payoff-maximizing). Thus the results from the objective experiments reinforce the results obtained using the *CU* data.

Behavioral anomalies. Because we implement an unusually large number of experiments, we also cover some domains in which prior research has identified insensitivity-related anomalies, such as attenuation to tax rates, insensitivity of effort supply, insensitivity of valuations to the scope or scale of a good, the attenuation puzzle in stock market investments, probability weighting, and others. The common thread that runs through various anomalies is that they reflect (i) a low elasticity of decisions to relevant parameters and (ii) a higher elasticity at boundary points. Our results suggest that these anomalies may reflect a general pattern that is linked to people's uncertainty about their best decision.

This said, it is worth clarifying that the pervasiveness of *CU*, attenuation and diminishing sensitivity in our data do not suggest that 'non-standard' preferences do not exist. In fact, several of our decision tasks are arguably cognitively difficult precisely *because* subjects have 'non-standard' motivations – for instance, dictator and public goods games would be cognitively trivial if people did not have motivations related to image concerns, altruism or reciprocity. Our objective is not to argue that people have neoclassical utility functions, or that other cognitive mechanisms do not matter. Rather, our objective is to highlight that the cognitive difficulty of identifying one's best decision affects how people's motivations (whatever they are) map to observed behavior, and that these effects share a systematic structure across many different economic domains.

Limit(ation)s. We point out several limitations of our experiments and likely limits of the phenomena we study. First, we document attenuation and diminishing sensitivity in settings in which decisions *should* depend on the fundamental we vary. As such, we have nothing to say about those behavioral economics findings that show that people are often too sensitive to things that are (almost) irrelevant, such as in framing experiments. To study this, we ran an experiment in which the rational elasticity is zero, and we indeed find no attenuation or diminishing sensitivity.

Second, all of our experiments are very low-dimensional, often involving a single scalar fundamental upon which the decision depends. As such, the types of selective attention or memory that may either exacerbate or counteract attenuation are by design ruled out in our study.

Third, our experiments are deliberately designed to induce subjects to consider each decision in isolation. As such, our experiments do not speak to how effects related to comparative thinking or joint evaluations might counteract attenuation, such as in time-series contexts in which people might intuitively compare the current fundamental to the previous one.[1] To tentatively study this, we ran two follow-up experiments with a 'joint evaluation structure' in which subjects are forced to directly compare their decisions across multiple different realizations of the fundamental. We find mixed evidence that this reduces attenuation.

Fourth, while our experiments include many cases in which decision problems are located at or near boundaries (e.g., a wage of zero vs. a strictly positive wage), we do not study cases in which a category discretely changes, which may produce excess sensitivity rather than attenuation.

Finally, like most experiments, we only use modest incentives. This said, we find that a tenfold increase in incentives does not meaningfully affect either attenuation or *CU*.

Contribution and related literature. Our results relate to various strands of the recent literature on the cognitive foundations of economic decision making.[2] One strand of this literature emphasizes the presence of incomplete cognitive information – people may not

[1]Attenuation is also distinct from underreaction to information – attenuation can produce and is consistent with both under- and overreaction (Augenblick et al., 2025; Ba et al., 2022).

[2]More broadly, our paper belongs to a nascent literature that studies and compares a large number of distinct decision tasks within the same experimental framework (e.g., Falk et al., 2018; Dean and Ortoleva, 2019; Enke et al., 2023; Stango and Zinman, 2023).

know their preferences, they may be uncertain how to aggregate or trade off different problem aspects, or they may be unsure how to maximize – and in dealing with this uncertainty people partially anchor on some default or prior (Gabaix, 2019; Woodford, 2020). This literature has focused on decision making under uncertainty and over time, by studying phenomena such as probability weighting, belief updating, and hyperbolic discounting (e.g., Khaw et al., 2021, 2022; Vieider, 2022, 2021; Gabaix and Laibson, 2022; Frydman and Jin, 2021; Enke and Graeber, 2023; Enke et al., 2025; Enke and Shubatt, 2023; Oprea, 2024; Augenblick et al., 2025; Yang, 2023).[3]

We make two contributions to this literature. First, by implementing a large-scale study involving more than 30 experiments, we show that cognitive uncertainty and its link to attenuation appear to be a somewhat general phenomenon that is not restricted to the domains of decision making under uncertainty and over time that this literature has almost exclusively focused on thus far. Moreover, innovating on past research, we show that attenuation is not simply driven by subject-level differences in ability or attention, but also depends on variation in difficulty across problem fundamentals. We demonstrate that this variation has a common structure across a diverse set of choice domains, and so our results both inform and motivate research that models how cognitive difficulty and attenuation vary across decision problems.[4] We view our results as one example of 'cognitive' research that is especially constructive: while one worry may be that 'anything goes' when people are uncertain about their best decision, we show that there is, instead, a fair amount of common structure (attenuation and diminishing sensitivity).

Our second contribution is to connect work on cognitive uncertainty and incomplete information on the one hand to research on diminishing sensitivity from boundaries (e.g., Prelec and Loewenstein, 1991; Ebert and Prelec, 2007) on the other hand. Our results suggest that this diminishing sensitivity is in part driven by a form of heteroscedasticity: decision problems are perceived with substantially lower uncertainty when they are located at or near simple points.

Section 2 presents a formal framework that motivates the link between cognitive uncertainty, attenuation and diminishing sensitivity. Sections 3 presents the experimental design and Sections 4–5 the results. Section 6 concludes.

2 Motivating Framework

Our starting point is twofold. First, the decision maker (DM) may have uncertainty about how to translate a problem fundamental into their best decision, and this uncertainty

[3]This literature builds on earlier work suggesting that people may not know how much they value different options (e.g., Ariely et al., 2003; Butler and Loomes, 2007) and that this can produce insensitivity.

[4]See Shubatt and Yang (2023) for recent work formalizing the idea that choice problems become easier when they are closer to dominance, which in turn increases the sensitivity of decisions to fundamentals.

produces an insensitivity to variation in the fundamental. Second, this uncertainty is lower near simple points at which the best decision is transparent to the DM. These simple points are often natural boundary points of the parameter space. To formalize these broad intuitions, we combine models of constrained-Bayesian responses to uncertainty about the optimal policy function (e.g. Gabaix, 2019; Woodford, 2020; Enke and Graeber, 2023; Ilut and Valchev, 2023) with ideas from the literature on categorization (e.g. Mullainathan, 2002; Bordalo et al., 2025).

Suppose a DM is tasked with making a decision a that depends on a payoff-relevant fundamental θ, where the decision problem is characterized by the objective function $U(a, \theta)$. We assume that for each value of θ, the optimal action $a^*(\theta) \in \text{argmax}_a U(a, \theta)$ is unique, and that the *policy function* $a^*(\theta)$ is differentiable and monotonic. Without loss, we will assume that $a^*(\theta)$ is increasing in θ.

Example 1: Lottery Valuation. A DM is tasked with assessing the certainty equivalent of a lottery that pays off \$18 with some probability p and nothing otherwise, who has expected utility preferences with an increasing and differentiable Bernoulli utility function u. In this setting, we have $\theta = p$, and $a^*(\theta) = u^{-1}(\theta \cdot u(18) + (1-\theta) \cdot u(0))$.

Example 2: Effort Provision. A DM is tasked with choosing a positive level of effort e that yields a piece-rate wage w, but who faces a convex effort cost $c(e) = 1/2\kappa e^2$; preferences are given by $w \cdot e - c(e)$. In this setting, we have $\theta = w$, and $a^*(\theta) = \theta/\kappa$.

Our main assumption is that the DM does not know the mapping $\theta \mapsto a^*(\theta)$. In other words, the DM does not know which decision is best for her, given her preferences and information. We are agnostic over the sources of this uncertainty. For instance, the DM may not know $u(\cdot)$, she may struggle to trade off the costs and benefits implied by different problem dimensions, she may entertain a multiplicity of objective functions, she may not know how to maximize, and others. Following Ilut and Valchev (2023), we model this by assuming that the DM only has access to a noisy mental simulation of the optimal policy function $a^*(\theta)$. As formalized in Appendix E, the DM has uncertainty about a set of decision weights $\{\beta_w\}_{w \in \mathbb{R}}$ that determine $\theta \mapsto a^*(\theta)$.

When the DM deliberates, she generates a noisy *cognitive signal* (or mental simulation) over $a^*(\theta)$. This signal takes the form $s(\theta) \sim N(a^*(\theta), \sigma_a^2(\theta))$, where $\sigma_a(\theta)$ denotes the level of *cognitive noise* in the DM's deliberations. We can think of the level of cognitive noise as being partly determined by the difficulty of the decision problem at θ.

We assume that there is some common *default policy function* that a DM would revert to before they have observed θ. Formally, we model this default as normally distributed priors over β_w (the weights that map fundamentals into the optimal decision), such that the DM's prior over the policy function evaluated at any fundamental is distributed according to $N(a_d, \sigma_0^2)$.

The DM integrates her cognitive signal with her prior, and then takes a decision $a(\theta)$ equal to her Bayesian posterior mean over $a^*(\theta)$. In Appendix E, we show that the average $a(\theta)$ takes the form

$$E[a(\theta)] = \lambda a^*(\theta) + (1-\lambda)a_d$$

where the weight placed on the cognitive signal, $\lambda = \frac{\sigma_0^2}{\sigma_a^2(\theta)+\sigma_0^2}$, is decreasing in the level of cognitive noise $\sigma_a^2(\theta)$ at the fundamental θ. This model can be read with varying degrees of literalness. For instance, a relatively literal read could interpret this model as describing an anchoring-and-adjustment heuristic (Tversky and Kahneman, 1974). However, the model is meant to be an as-if description of a more general intuition that may also apply to other heuristic behaviors.

Proposition 1 (Attenuation). *If $|\sigma_a'(\theta)|$ is sufficiently small:*

(a) Objective attenuation. If $\sigma_a(\theta) > 0$, then $\frac{\partial}{\partial\theta}E[a(\theta)] < \frac{\partial}{\partial\theta}E[a^*(\theta)]$.

(b) Cognitive noise and attenuation. $\frac{\partial}{\partial\theta}E[a(\theta)]$ is decreasing in $\sigma_a(\theta)$.

In words, the first part says that in regions of the parameter space in which the level of cognitive noise does not vary too sharply in the fundamental (i.e., in which the difficulty of identifying one's best decision is relatively similar across fundamentals), the elasticity of decisions will be smaller than the elasticity of the optimal decision. The second part says that more uncertainty in the cognitive signal should be correlated with a more strongly attenuated relationship between the decision and the fundamental.[5]

Prediction 1 describes a setting in which the difficulty of identifying one's best decision does not vary too sharply in the fundamental. In many settings, however, there are some points in the parameter space at which the optimal action is transparent. This occurs at what we call *simple points*. For instance, we might expect the task of assessing the certainty equivalent of a lottery that pays out \$18 with probability θ to contain the simple points $\underline{\theta} = 0$ and $\overline{\theta} = 1$, since at both fundamentals it is clear how to rank the lottery against certain payments due to dominance. Similarly, the task of determining optimal effort supply given a piece-rate wage θ is trivial at the boundary point $\underline{\theta} = 0$.

Formally, we consider a setting where the parameter space may contain a lower and/or upper boundary, denoted $\underline{\theta}$ and $\overline{\theta}$, respectively. Let $\underline{\delta}(\theta) = |\theta - \underline{\theta}|$ and $\overline{\delta}(\theta) = |\overline{\theta} - \theta|$ denote the distance between the fundamental and the lower and upper boundary points, respectively.

[5]Behavioral attenuation is somewhat reminiscent of attenuation bias in econometrics. The main difference is that attenuation bias typically refers to noise in the measurement of an independent variable. Here, the independent variables are economic primitives, θ, that are measured without noise. Instead, the noise arises in the cognitive mapping from independent variables into an optimal decision.

Then, the following proposition states that if cognitive noise is increasing away from a boundary point, decisions will exhibit diminishing sensitivity away from that boundary.[6] More generally, as Prediction 2(a) clarifies, the model predicts that the *local* slope of decisions at any given fundamental decreases in the *local* level of cognitive noise. Unlike Prediction 1, this prediction is one that fundamentally concerns *across-problem-within-person* variation.

Proposition 2 (Diminishing sensitivity from simple points). *Suppose the cognitive default is somewhat intermediate: $a_d > a^*(\theta)$ for θ sufficiently low and $a_d < a^*(\theta)$ for θ sufficiently high. Then, for $|\frac{\partial^2}{\partial\theta^2}a^*(\theta)|$ sufficiently small, we have the following:*

(a) For any $\theta < \theta'$ in a neighborhood around $\underline{\theta}$ with $\frac{\partial}{\partial\underline{\delta}}\sigma_a^2(\theta') \leq \frac{\partial}{\partial\underline{\delta}}\sigma_a^2(\theta)$: if we have $\sigma_a(\theta) < \sigma_a(\theta')$, then $\frac{\partial}{\partial\theta}E[a(\theta)] > \frac{\partial}{\partial\theta}E[a(\theta')]$. An analogous logic applies to $\overline{\theta}$.

(b) If $\frac{\partial}{\partial\underline{\delta}}\sigma_a(\theta) > 0$ and $\frac{\partial^2}{\partial\underline{\delta}^2}\sigma_a^2(\theta) \leq 0$ in a neighborhood around $\underline{\theta}$, then $\frac{\partial}{\partial\theta}E[a(\theta)]$ is decreasing in $\underline{\delta}(\theta)$ in a neighborhood around $\underline{\theta}$. An analogous logic applies to $\overline{\theta}$.

We do not offer a fully articulated theory of what causes a point to be simple. We pre-register simple points in our experiments based on the principle of dominance in combination with other empirical considerations (see Section 3.3).

Empirical Implementation. To empirically test these predictions, we rely on two techniques. First, in many of our tasks, the optimal policy function is *objective*, meaning that we can identify the DM's optimal action, and therefore directly observe both behavioral attenuation and diminishing sensitivity. Second, following the logic of our model, we directly *measure* the uncertainty associated with identifying the optimum. Following Enke and Graeber (2023), we measure the DM's *cognitive uncertainty*: the DM's posterior uncertainty over the optimal action $a^*(\theta)$. Letting $P(a^*(\theta)|S = s(\theta))$ denote the DM's posterior distribution over the optimal action, *CU* is given by

$$CU(\theta) := P(|a^*(\theta) - a(\theta)| > \kappa | S = s(\theta))$$

This quantity is increasing in $\sigma_a(\theta)$, and therefore serves as a measurable proxy for the level of the DM's cognitive noise at θ. Thus, under our model, we can identify the presence of behavioral attenuation by examining the correlation between *CU* and the elasticity of decisions.

By the same logic, we can also leverage *CU* to link cognitive noise and diminishing sensitivity. First, *CU* should increase away from simple boundary points. Second, the local sensitivity of decisions at any given fundamental should decrease in the local *CU* that prevails at that fundamental.

[6] The general idea that heteroscedastic noise can generate diminishing sensitivity is well-known in the literature (e.g. Khaw et al., 2021; Frydman and Jin, 2021).

3 Study Design

3.1 Overview

One of our objectives is to document that *CU*-linked attenuation and diminishing sensitivity appear across different types of decision domains. We thus select a broad range of 31 experiments from across economics. Our tasks can be organized into eight broad topical categories: financial decisions, labor-related decisions, consumer choice, social decision-making, strategic decisions, political decisions, risk and time preference elicitations, and tasks related to beliefs and cognition. In addition to a broad coverage of different economic domains, we also desired our experiments to include some of the dominant paradigms used in the literature.

A subset of the experiments summarized below were designed and selected in consultation with outside experts. This process is described in Appendix F. In total, ten experiments were proposed by experts, ten were selected by us after some expert consultation, and another eleven experiments were designed exclusively by us.

Structure of experiments. Each of our experiments followed the same structure. First, subjects were shown one screen of experimental instructions that followed a standardized logic: (i) outline of task; (ii) explanation of incentives; (iii) screenshot of example decision screen; and (iv) explanation of the *CU* elicitation.

Next, subjects were shown a screen with three comprehension check questions. Prospective participants who did not answer these three questions correctly on their second attempt were immediately routed out of the experiment (19% across all experiments).

Finally, participants completed the actual experiment. Given our research hypothesis, we took care not to overburden participants with a lengthy and repetitive study. Thus almost all experiments consisted of only eleven rounds/decisions across which a key parameter was varied (six rounds in the REC experiment because it consisted of two separate periods). On each decision screen, participants first made a decision and, after they had locked that decision in, stated their *CU* about that decision.

3.2 Experiments

Table 1 provides an overview. In each case we list the decision subjects make, the parameter (economic fundamental) that we vary across rounds in the experiment, and the incentive scheme. Moreover, we provide the (potential) simple points, almost all of which are located at the logical boundaries of the parameter space (if they are not, they represent dominance points).

We summarize the most important task features here, highlighting the main elasticity of interest. Appendix A.1 presents more detailed information on each task, including the precise problem configurations, how we translate experimental decisions into regression equations, and the wording of the *CU* elicitation. Screenshots of all experimental instructions, comprehension checks and example decision screens are provided in Appendix G.

Eight of our experiments ("objective tasks") have objectively correct solutions. These are usually forecasting, inference and cognition experiments, or choice experiments in which we induce an objective function for participants. Decisions in the remaining 23 domains ("subjective tasks") depend either on subjects' preferences or on private information about the outside world.

Savings. Participants decide how much of a monetary endowment to receive today and how much to save until six months later at a known interest rate (that varies across rounds). Average savings increase in the interest rate.

Precautionary savings. Participants act as a farmer who allocates a fixed amount of water across two periods to maximize yield. The parameter that varies is the absolute size of a mean-zero shock that hits the farmer in the second period. Average water savings increase in the size of the shock. The participant's bonus is proportional to the farmer's ex post utility (the utility function is given).

Portfolio allocation. Participants allocate money between a riskless savings account and a risky asset (an exchange-traded fund, ETF). The parameter of interest is the participant's subjective return expectation. To generate variation across rounds, the ETF varies and we provide an expert forecast for each ETF. The participant receives the value of their investment one year later. Average allocations to the risky asset increase in expected returns.

Effort supply. Participants decide how many real-effort tasks to complete, as a function of a piece rate. Participants receive their wage and work the chosen number of tasks. Average effort supply increases in the wage.

Search. In a classic induced values setup, the computer randomly draws 'rewards' until a minimum reward is achieved, where each draw is costly. The participant decides which minimum reward value to set, trading off higher expected minimum rewards and higher expected costs. The cost of each draw varies across rounds. The participant receives a bonus if their decision is within a window around the decision that maximizes the expected net payout. Average minimum values set decrease in cost.

Table 1: Overview of experimental tasks

Task and label	Decision	Fundamental	(Pot.) simple	Incentive
Financial decisions				
Savings – SAV	Amount saved	Interest rate	0	Choice
Precaut. savings – PRS	Savings (IV)	Size of shock	0	Choice
Portfolio allocation – POA	Equity share	Return expectat.	n/a	Choice
Forecast stock return – STO	Forecast asset value	Time horizon	0	Hypoth.
Estimate tax burden – TAX	Tax estimate	HH income	0	Accuracy
Newsvendor game – NEW	Production	Marginal cost	0, p	Choice
Labor				
Effort supply – EFF	Tasks completed	Piece rate	0	Choice
Multitasking – MUL	Rel. effort allocation (IV)	Rel. importance	0, 1	Optimality
Search – SEA	Search effort (IV)	Search cost	0	Choice
Consumer choice				
Product demand – PRO	WTP for food item	Quantity of item	0	Hypoth.
Budget allocation – CMA	Rel. product demand (IV)	Rel. prices	n/a	Optimality
Avoid externalities – EXT	WTP to reduce emissions	Size of reduction	0	Choice
Invest to save energy – ENS	WTP fuel-efficient car	Miles driven	n/a	Hypoth.
Social decisions				
Fairness views – FAI	Amount redistributed	P [merit-based]	0, 1	Choice
Dictator game – DIG	Giving	P [donation lost]	0, 1	Choice
Contingent valuation – HEA	Societal WTP	People saved	0	Hypoth.
Public goods game – PGG	Contribution to group	Efficiency	0	Choice
Strategic decisions				
Prisoner's dilemma – PRD	Cooperate / defect	Cooper. payoff	n/a	Choice
Beauty contest – GUE	Guess number	Multiplier	0	Accuracy
Disclosure game – CHT	Reveal / withhold info	True state	0, max	Choice
Political decisions				
Voting – VOT	Vote or not (IV)	# other voters	0	Choice
Policy evaluation – POL	Support for policy	Implied inflation	0	Hypoth.
Risk and time preference elicitations				
Risk pref. elicitation – CEE	Certainty equiv.	P [upside]	0, 1	Choice
Risk pref. elicitation – PRE	Probability equiv.	Payout amount	0, u	Choice
Intertemporal RRR – TID	PV future payment	Time delay	0	Hypoth.
Beliefs and cognition				
Info demand – IND	WTP for info	Info accuracy	0.5, 1	Choice
Belief updating – BEU	Posterior belief	Info accuracy	0.5, 1	Prox. Bayes
Forecasting – FOR	Forecast asset value	Persistence	0, 1	Prox. Bayes
Recall – REC	Recall value	True value	n/a	Accuracy

Table 1: Overview of experimental tasks

Task and label	Decision	Fundamental	(Pot.) simple	Incentive
Signal aggregation – SIA	Aggregate signals	Frac. sources	0, 1	Accuracy
Rational inattention – RIA	Lottery / safe paym.	EV diff.	n/a	Choice

Notes. IV = induced values. Choice = payoff determined by choice. Accuracy (Prox. Bayes) = bonus iff close to truth (to Bayes). Simple points: In NEW, p denotes the sales price of the product the subject's firm produces. In CHT, max denotes the maximum number the receiver can guess. In PRE, u denotes the upside of the lottery against which the safe payments are evaluated.

Budget allocation. In an induced values experiment, participants act as a hypothetical consumer and are endowed with a utility function over two goods. They allocate a fixed monetary budget across expenditure for these two goods, by deciding what fraction of the goods they buy is of either type. Across rounds, the price of one good varies, while the price of the other one is fixed. Participants receive a bonus if their decision is within a window around the decision that maximizes the hypothetical consumer's utility. Average demand for a product decreases in its relative price.

Avoid externalities. Following Pace et al. (2023), in a multiple price list experiment, participants reveal their WTP for reducing CO2 emissions by a certain amount. Across rounds, the magnitude of the reduction in CO2 varies. Depending on their decisions, participants receive money or we purchase carbon offsets on their behalf. Average WTP for the carbon offsets increases in the magnitude of the CO2 reduction.

Invest to save energy. In a series of multiple price lists, participants make hypothetical decisions between a fuel-efficient hybrid car and a less efficient conventional car, revealing their WTP for the more efficient hybrid. Across rounds, the distance that the participant is asked to imagine they would drive varies, such that average WTP for the hybrid increases in miles driven.

Fairness views. Following Cappelen et al. (2022), participants are informed that two previous participants competed in a contest, in which one of them was declared the winner. Participants make consequential decisions about how much of the prize money to redistribute from the declared winner to the declared loser. Across rounds, the probability that the winner was declared based on merit rather than luck varies, such that average redistribution decreases in the probability that the winner was declared based on merit.

Dictator game. Participants decide how much of a monetary endowment to share with another participant. Across rounds, the probability that the money sent is lost varies, such that average giving decreases in this probability. Decisions are consequential for participants' bonuses.

Contingent valuation in health. Participants state a hypothetical societal WTP for a vaccine as a function of the number of sick people prevented. Average WTP increases in the number of sick people.

Prisoner's dilemma. Participants play a binary prisoner's dilemma matrix game. Average cooperation increases in the payoffs to cooperation (which varies across rounds). Participants' bonuses are given by the game payoffs.

Disclosure game. Participants act as sender in a disclosure game, deciding whether or not to reveal the true state to a receiver, being paid to make the receiver guess as high as possible. Across rounds, the realization of the true state changes, and disclosure rates increase in the true state.

Voting. In an induced values setup, participants decide whether or not to cast a costly vote for a policy that increases their payoff. Across rounds, the number of other (computerized) voters varies. Voting probabilities decrease in the number of other voters. Participants receive their game payoff.

Information demand. Participants state their WTP for a binary signal about the outcome of a coin toss. Across rounds, the accuracy of the signal varies, and average WTP increases in accuracy. Bonuses are determined by the accuracy of subjects' guess about the coin toss as well as by whether or not they purchased information.

Belief updating. In a two-states-two-signals belief updating paradigm, participants state their posterior belief after observing a signal. Across rounds, the accuracy of the signal varies, and average updating increases in accuracy. Participants receive a bonus if their posterior is in a window around the Bayesian posterior.

Forecasting. Participants forecast a deterministic process whose innovation is given by a weighted average of the previous innovation and a fixed positive trend. Across rounds, the persistence of the process varies, and the persistence implied by subjects' forecasts increases in true persistence. Participants receive a bonus if their forecast is in a window around the correct forecast.[7]

[7]When we initially ran the FOR experiment, the innovation of the process was given by a weighted average of the previous innovation and a mean-zero shock. However, after we ran the experiment, we discovered an error in the comprehension checks that suggested using a particular incorrect heuristic (to simply ignore the mean-zero shock). We were thus forced to drop the data and re-run the task. When re-running, we replaced the mean-zero shock with a deterministic non-zero trend to avoid the incorrect heuristic our initial faulty comprehension check suggested.

Recall. Participants recall the number of positive and negative news they observed about a hypothetical company. Across rounds, the number of positive and negative news varies. Participants receive a bonus if their estimate is within a window around the truth.

Signal aggregation. Participants estimate a true state based on the reports of two intermediaries. Across rounds, the number of signals that each intermediary receives varies, and the average effective weight participants place on an intermediary increases in the number of signals the intermediary observed. Participants receive a bonus if their estimate is within a window around the truth.

'Special case': Rational inattention. Participants decide whether to accept or reject a binary lottery that has positive expected value. By verifying mathematical equations, they can find out whether the lottery upside or downside will realize. Across rounds, the upside and downside of the lottery are both shifted by a constant. We view this experiment as a special case because in a fully rational model, the elasticity of decisions with respect to the parameter (the payoff shifter) is zero (because under a standard rational model the DM would first solve all mathematical equations and then accept the lottery if and only if the upside realizes, independently of how large it is). We defer a discussion of this experiment to Section 5, where we discuss the limits of behavioral attenuation.

Forecast stock return. Participants forecast the future value of a $100 investment into an ETF, where the parameter that varies is the length of the time horizon. Average forecasts increase in the horizon. This task is not financially incentivized.

Estimate tax burden. Akin to Rees-Jones and Taubinsky (2020), participants are provided with hypothetical federal and state income tax schedules and estimate a hypothetical taxpayer's tax burden. The parameter of interest is the paxpayer's income. The participant receives a bonus if their answer is within a window around the correct response. Estimated tax burdens increase in income.

Newsvendor game. Classic game in management and operations research (Schweitzer and Cachon, 2000). Participants decide how much cola to produce, facing uncertain demand. The varying parameter is the marginal cost of producing cola. The participant's bonus is proportional to the profit of the firm. Average production levels decrease in marginal cost.

Product demand. Participants state their hypothetical willingness-to-pay (WTP) for products such as pasta, where the parameter that varies across rounds is the quantity of the product (e.g., the number of pasta packs). This task is not incentivized. Average WTP for a product package increases in the quantity of its content.

Beauty contest. Following Costa-Gomes and Crawford (2006), subjects participate in a two-player guessing game. Their objective is to guess their target, which is given by the other participant's guess times a multiplier. Across rounds, the multiplier varies and average guesses increase in the multiplier. Participants receive a bonus if their guess is within a window around their target.

Public goods game. Standard three-player PGG in which we vary the efficiency of contributions (the MPCR) varies across rounds. Average contributions increase in efficiency. Decisions are consequential for participants' bonuses.

Multitasking. In an induced values experiment, participants allocate a budget of hours between two tasks (training two different horses), where the tasks' relative importance (the fraction of each horse's prize money that the coach gets) varies across rounds. Participant receives a bonus if their decision is within a window of the profit-maximizing decision. Average time allocation increases in a horse's relative importance.

Policy evaluation. Participants rate their support for a hypothetical policy that increases household incomes. Across rounds, the cost of this policy (an increase in inflation) varies. Support for the policy decreases in anticipated inflation rates.

Risk preference elicitation I: Certainty equivalents. In multiple price lists, participants reveal their certainty equivalents for a binary lottery that pays either $18 or nothing. Across rounds, the payout probability varies, and average certainty equivalents increase in this probability. Participants' bonus is determined by their chosen lottery.

Risk preference elicitation II: Probability equivalents. In multiple price lists, participants reveal their probability equivalents for a safe payment. Across rounds, the safe payment varies, and average probability equivalents increase in the payment. Participants' bonus is determined by their chosen lottery.

Intertemporal required rate of return. In hypothetical price lists, participants reveal their present value equivalent for a delayed payment. Across rounds, the delay varies, and average present values decrease in the delay. No incentives.

Several of the experiments described above involve a second party (e.g. the receiver in the disclosure game). These secondary data points were collected to avoid deception, but we did not analyze these data.

3.3 Pre-Registered Simple Points

An important part of our design is that almost all experiments include parameters at and near pre-registered 'simple points': parameter values at which we hypothesized the problem would be cognitively easy, either because there is a dominant action or because a problem component drops out. For example, in the valuation of lotteries, the payout probabilities included (among others) 0%, 1%, 99% and 100%. In the effort supply task, the piece rates included (among others) \$0 and \$0.01. In the balls-and-urns belief updating task, the signal accuracy/diagnosticity included (among others) 50%, 51%, 99% and 100%. As discussed in Section 2, we hypothesize that *CU* increases in the distance from simple points, and that this increase predicts diminishing sensitivity.

In our pre-registration, we listed *potential* simple points for 25 of our 30 tasks and further identified 14 of these tasks as having dominance points where we thought there was an especially strong ex-ante reason to expect simplicity. Appendix A.1 contains the details for each task. We pre-registered that, in our analyses, we would conclude that a *potential* simple point is an *actual* simple point if *CU* is significantly lower at that point, compared to the five nearest neighboring parameter values.

As summarized in Table 1 and Appendix A.1, almost all pre-registered potential simple points are located at natural boundaries of the parameter space.[8] We do not argue that *any* (potentially artificial or contextual) boundary renders problems cognitively easy – rather, we hypothesize that boundaries render problems simple when they effectively 'switch off' a problem component, removing the need to cognitively aggregate and trade off multiple problem aspects. As such, in a small number of cases our experiments also include simple points that are not located at the logical boundary of a parameter space. For instance, determining a firm's optimal production level may be difficult in general, but it is easier when the marginal cost is either zero (a boundary point) or equal to the sales price of the product (not a boundary but a dominance point). Similarly, stating a probability q that makes one indifferent between receiving \$18 with probability q and a safe payment of s may be difficult in general, but it is arguably trivial when $s = 0$ (a boundary point) or $s = 18$ (a dominance point but not a boundary).

3.4 Cognitive Uncertainty Elicitation

After each decision, we elicited cognitive uncertainty (*CU*). Loosely speaking, our general approach is to ask participants how certain they are that they took their best decision (given whichever preferences and information they have). Obviously, the concept of a best or optimal decision varies widely across decision domains because some are objective (such that an optimal decision is objectively defined), while others are subjective (such that optimal decisions are those that maximize the decision-maker's own unobserved preferences). To the extent possible, we kept the *CU* elicitation constant across domains

[8] These boundaries are 'natural' in the sense that they correspond to organic boundaries of a parameter space. For example, probabilities are between zero and one, prices are typically weakly positive, costs are non-negative, and so on.

that belong to the same category. To illustrate, assuming that a subject took decision Y, we used the following language:

1. Continuous decisions in subjective tasks, illustrated by *Effort supply*: "*How certain are you that completing somewhere between [Y-1] and [Y+1] tasks is actually your best decision, given your preferences?*"
2. Continuous valuations in subjective tasks, illustrated by *Certainty Equivalents*: "*How certain are you that you actually value this lottery ticket somewhere between $[Y-0.5] and $[Y+0.5]?*"
3. Binary decisions in subjective tasks, illustrated by *Prisoner's Dilemma*: "*How certain are you that choosing Y is actually your best decision, given your preferences and the available information?*"
4. Decisions in objective tasks, illustrated by *Multitasking*: "*How certain are you that practicing somewhere between [Y-1] and [Y+1] hours with horse A is actually the best decision?*" Here, the instructions clarify that "best decision" refers to the decision that maximizes the bonus payment.

Subjects dragged a slider between 0% and 100% to indicate their certainty, understood as the percent chance the decision is "best" (in ways that are specific to different types of tasks).[9] Appendix A.1 contains the precise *CU* questions used for each task.

CU can arise from multiple potential channels. First, it may be difficult or costly for people to *access* information on their utility function, producing preference uncertainty. Second, people may struggle when attempting to computationally *combine* their utility function with problem fundamentals. Third, people may find it difficult to negotiate *trade-offs* across different problem components when assessing the optimum. Fourth, in objective problems, people may have trouble formulating the *formal rules* they need to correctly solve a problem. We embrace all of these proximal sources of *CU* (and others). To avoid misinterpretation of the *CU* elicitation as an elicitation of beliefs about uncertainty in the external environment (for example, uncertainty about whether the subject will actually get paid), we include a comprehension check in each of our experiments. The comprehension check verified that subjects' understand that the *CU* question elicits uncertainty about the ability to their best (ex-ante) decision, rather than uncertainty about the external environment, see Appendix G.

[9]The only exception is binary choice tasks, in which the slider only ranged from 50% to 100%. This is because in binary choice the percent chance of making the decision that is actually optimal is presumably at least 50%. For the sake of comparability across experiments, we rescale the resulting uncertainty variable in these binary choice tasks to be in [0%,100%] by multiplying it by two.

3.5 Logistics, Sample Size, Incentives and Pre-Registration

All experiments were conducted in the spring of 2024 on *Prolific*, which Gupta et al. (2021) identify as the best data-collection platform in terms of the tradeoff between response noise and cost. We tailored the fixed participation payment to each experiment to match Prolific's minimum payment rules based on median completion times in our pilots. In those tasks that involved financially incentivized decisions (the great majority of tasks), we selected one decision uniformly at random to be relevant for determining a subject's bonus. As we explained to subjects, they were eligible for a bonus payment with a probability of 1/5. Overall, average earnings across all experiments are $4.40 ($4.90 if we restrict attention to financially incentivized experiments). This includes an average participation fee of $2.80. The median time subjects took for our experiments is 9.8 minutes, for an effective hourly wage of about $27 (much larger than the typical hourly Prolific rate).

To study the role of the stake size for the results, in five of our tasks (CMA, BEU, VOT, SIA, REC) we implemented a high-stakes condition in which the de facto incentives were increased by a factor of ten: every subject was paid out and the maximal bonus (and marginal incentives) were multiplied by two relative to the baseline. Because the results in this experimental treatment are very similar to those in the baseline treatment (see Table 6 below), we pool the data in what follows.

All experiments are pre-registered at AEARCTR-0013308. The pre-registration includes: (i) sample sizes; (ii) problem configurations; (iii) which parameter values constitute simple points; and (iv) regression specifications. Including the follow-up experiments described in Section 5, our experiments involved 8,199 subjects and 88,829 individual decisions. No subject participated in more than one experiment.

Our pre-registration specified sample sizes of 150, 200 or 250 subjects per experiment (in roughly equal proportions). Given the scope of this project, we were not able to run pilots that would enable informative power calculations. As a result, our pre-registered sample sizes were based on intuition about which tasks might be less noisy, and in which we might therefore recruit fewer than 250 subjects without being underpowered (an effort on our part to economize on research funds). Ex post, we determined that this decision caused us to be underpowered in some experiments. We thus elected to increase the sample size uniformly to 250 in all experiments, regardless of whether or not they delivered statistically significant results in the initial data-collection. For full transparency, Appendix C replicates all results using the initial, pre-registered sample. They are quantitatively very similar.

In a minor deviation from the pre-registration, we drop extreme outliers (decisions that are more than five standard deviations away from the median). This only influences 3 out of the 88,829 decisions in the dataset, all in the TAX experiment. The reason extreme outliers occur in this experiment but not in others is that it is a free number-entry task and therefore subject to accidental inclusion of extra digits.

4 Results: Attenuation

The attenuation hypothesis rests on the premise that uncertainty about one's best decision is widespread across economic domains. Our *CU* data strongly suggest that such uncertainty is indeed pervasive. For each of our 30 main experiments, Appendix Figure 11 shows the fraction of decisions that are associated with strictly positive *CU*. In *every single* task, the majority of decisions is associated with strictly positive *CU*. This fraction varies between 59% (in TID) and 95% (in PRS). We find similarly high rates of *CU* in both subjective and objective tasks.

Our data also allow us to study to some degree whether subjects' *CU* is well-calibrated, meaning whether it is correlated with actual optimization failures. In the subset of our tasks in which there is an objectively correct answer, we calculate the correlation between elicited *CU* and the magnitude of mistakes (measured using the log absolute deviation between the subject's decision and the true optimal choice). At the level of individual decisions, *CU* is significantly correlated with objective mistakes in every one of our eight objective tasks, with an average correlation coefficient of $r = 0.31$ ($p < 0.01$).

We also study the link between *CU* and mistakes across different problem configurations (i.e., across different parameters), netting out subject-level variation. Here, we also find that in those problems in which median *CU* is low, objective mistake rates are low too (the average correlation across experiments is $r = 0.68$, $p < 0.01$).

In summary, uncertainty about the ability to identify one's best decision is widespread and – in objective tasks – is predictive of actual optimization failures, both at the level of individual decisions, and at the level of problems that potentially differ in their difficulty.

4.1 Attenuation: A Look at the Raw Data

Figure 1 plots raw data from six of our 30 main experiments, allowing us to preview the main results. Each panel shows the fundamental varied in the experiment on the x-axis and mean decisions on the y-axis. Importantly, we break these data down based on subjects' decision-level *CU*, plotting a separate series for uncertain decisions (i.e. with *CU* greater than the median for a given fundamental) in red, and relatively certain decisions (*CU* lower than the median) in blue. Similar plots are provided for all other experiments in Online Appendix B.1. We make four observations.

First, the left-hand column shows data from three *objective tasks* in which we know subjects' objective function and payoff-maximizing choice, plotted as dashed 45-degree lines. In all of these experiments, subjects are *behaviorally attenuated* over most of the parameter space, particularly away from the boundaries: the elasticity of their decisions is significantly smaller than it would be for an optimizing agent. As we show in Section 4.2, this attenuation is a universal phenomenon in our objective tasks.

Second, in all three of these cases attenuation is significantly stronger among high *CU* decisions. This difference in elasticity produces a canonical "flipping" pattern: high *CU* decisions tend to be higher when canonical economic models predict relatively low decisions, and lower when economic models predict relatively high decisions (a compression effect). As we show in Section 4.2, this linkage between *CU* and objective attenuation is universal in our data.

Third, the exact same patterns occur also in the three *subjective experiments* plotted in the right column of Figure 1. High *CU* decisions in all three tasks are markedly less sensitive to parameter variation in the interior of the parameter space, producing the same flipping pattern as observed in the objective experiments.

Finally, in almost all experiments, the degree of insensitivity increases as fundamentals depart from intuitive (and pre-registered) "simple points," giving rise to *diminishing sensitivity*.[10] As we discuss in more depth in Section 5 below, this pattern is also near-universal in our data.

4.2 Econometric Analysis

In order to extend this analysis to all 30 of our experiments, we first follow our pre-registration by estimating the magnitude of the *interaction* between (i) the fundamental varied in the task and (ii) the subject's *CU* concerning her decision. Our hypothesis is that the sign of this interaction is negative (after normalizing the main effect of the fundamental to be positive).

Importantly, per our pre-analysis plan, we drop from this analysis of attenuation those decision problems that involve parameters that we pre-specified as potential simple points. For instance, the analysis of attenuation does not include a wage of zero, an interest rate of zero or a payout probability of one. We analyze these potential simple points separately in Section 5.2 when we discuss diminishing sensitivity.

Econometric strategy. In each of our experiments, e, we elicit decisions $a^e_{i,j}$ from subject i at parameter values θ^e_j. We also elicit *cognitive uncertainty*, for each decision, $CU^e_{i,j}$. We

[10]For example, in the MUL experiment, subjects allocated time between two projects, as a function of the projects' relative importance. Here, two dominance points exist (a project matters exclusively or not at all). Similarly, in SIA, subjects aggregate two messages as a function of the fraction of signals that either of the two messengers received, such that 0% and 100% are potential simple points (a messenger receives no signals or all of them).

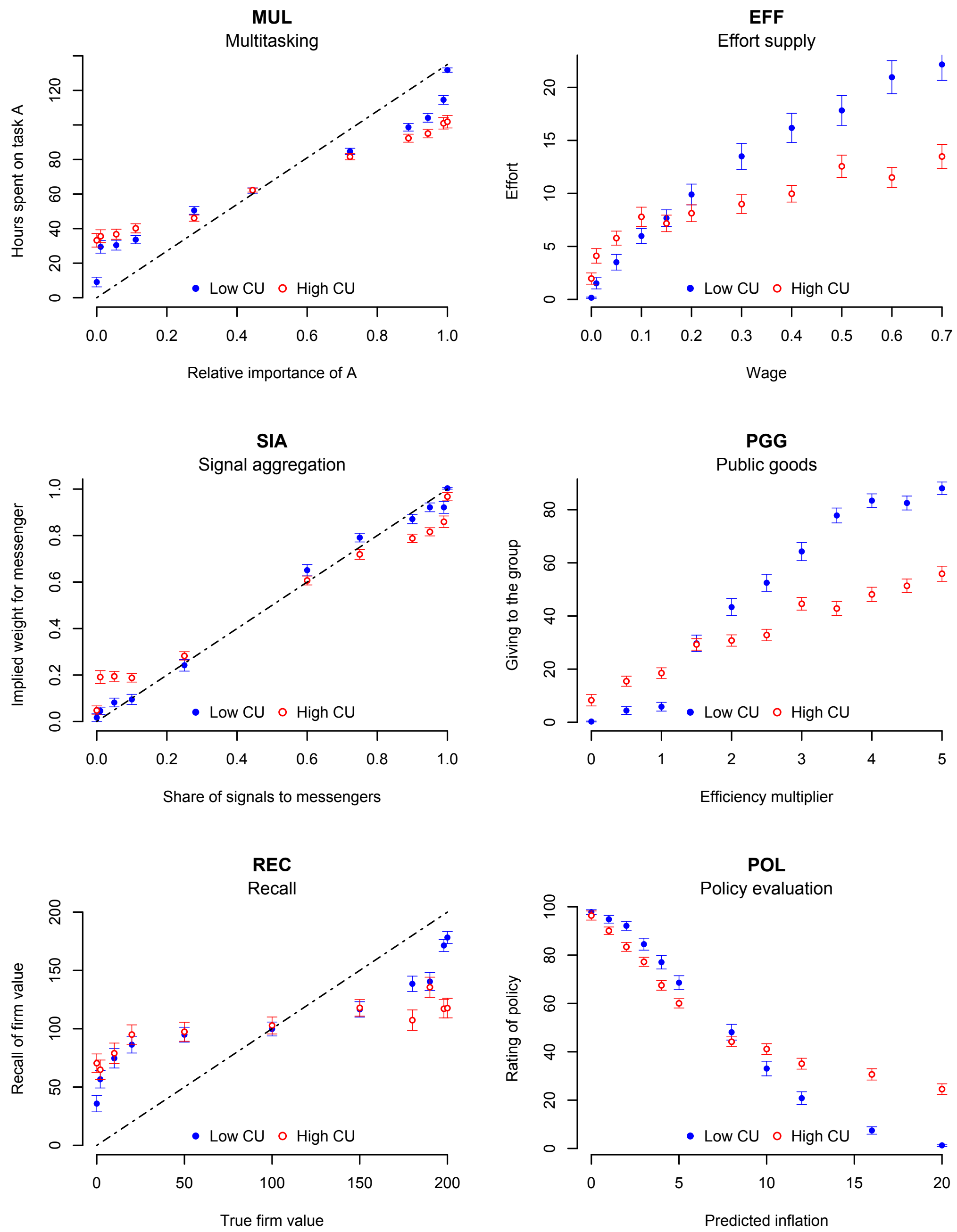


Figure 1: Decisions as a function of fundamentals, with sample split at median *CU* at a given parameter. Top left: Effort allocation to one of two tasks as a function of task's relative importance (MUL). Middle left: Weight placed on message as a function of number of signals observed by messenger (SIA). Bottom left: Recall of firm value as a function of true value (REC). Top right: Effort supply as a function of piece rate (EFF). Middle right: Public goods contributions as a function of efficiency (PGG). Bottom right: Evaluation of hypothetical policy as a function of implied inflation (POL). In the objective tasks, the dashed line shows the rational response.

adopt the labeling convention that the subscript j captures the ordering of parameters, i.e., $\theta_j > \theta_{j-1}$. For each experiment e, we estimate

$$a^e_{i,j} = \alpha^e + \gamma^e \, \theta^e_j + \beta^e \, \theta^e_j \, CU^e_{i,j} + \delta^e \, CU^e_{i,j} + \sum_x \chi^e d^e_x + \epsilon^e_{i,j} \,, \tag{1}$$

where $\epsilon^e_{i,j}$ is a mean-zero error term and d^e_x are controls (fixed effects) that apply in some tasks according to the pre-registration.[11] We always cluster the standard errors at the subject level. The attenuation hypothesis is that β^e is negative (given the normalization that γ^e is positive).

For 12 tasks, theory-inspired functional forms are available that lead us to transform either the raw decisions or the raw fundamental into quantities that directly motivate linear regressions.[12] Appendix A.1 lists the (pre-registered) definitions of $a^e_{i,j}$ and θ^e_j in each experiment.

In principle, testing our hypothesis only requires us to report the estimated β^e, which we do in Appendix Tables 3-5. However, these magnitudes are not very instructive because they are not easily comparable across experiments, given that the decision variables and fundamentals have very different scales.

We therefore visualize our results by plotting two quantities that are comparable across experiments. First, as an overall summary statistic, we calculate the t-statistics associated with the estimated β^e coefficients. Recall that the t-statistic is the coefficient estimate of β^e, divided by its standard error. This measure has the advantages that (i) it is scale-free and (ii) it combines information on both point estimates and associated statistical uncertainty. Our hypothesis is that these t-statistics will tend to be *negative*, indicating a *reduction* in sensitivity when people are more cognitively uncertain.

Second, to visualize the quantitative magnitude of the estimated effects, we calculate a *CU attenuation ratio* that captures by how much the sensitivity of decisions decreases as *CU* increases from 0% to 50% (the 75th percentile of the *CU* distribution across all experiments). Formally:

$$CU \text{ attenuation ratio} = \frac{(\text{Sensitivity at } CU = 0) - (\text{Sensitivity at } CU = 0.5)}{(\text{Sensitivity at } CU = 0)} \tag{2}$$

$$= 1 - \frac{\Delta \mathbb{E}[a^e_{i,j} | CU = 0.5] / \Delta \theta^e_j}{\Delta \mathbb{E}[a^e_{i,j} | CU = 0] / \Delta \theta^e_j} = -\frac{0.5 \hat{\beta}^e}{\hat{\gamma}^e} \equiv \hat{\phi}^e \tag{3}$$

This ratio equals zero if the slope of decisions is uncorrelated with *CU* (i.e., if $\hat{\beta}^e = 0$), and it equals one if the slope of decisions at $CU = 50\%$ is zero (i.e., if there is perfect *CU*-linked attenuation). Our hypothesis implies that this statistic will be positive – evidence

[11]For example, in STO these are fixed effects for the assets whose return the respondent forecasts.

[12]For example, in belief updating, following Grether (1980), the decision $a^e_{i,j}$ is a subject's log posterior odds and the fundamental θ^e_j the log likelihood ratio.

that a reduction in *CU* is associated with an increase in responsiveness to fundamentals.

Results. The top panel of Figure 2 splots the t-statistics for β^e across our 30 experiments. Objective tasks are plotted in dark gray, subjective tasks in light gray. A $N(0,1)$ distribution function with confidence level thresholds is shown in the right margin as a benchmark against which to evaluate the results.

For 28 out of 30 tasks the t-statistics are negative, indicating that, in almost all tasks, behavior becomes *more inelastic* as subjects become less certain in their ability to identify their best decision. 22 of these are statistically significant at the 1% level, two more at the 5% level and two at the 10% level. By contrast, for only two tasks do we find the reverse relationship (PRS and PRD) and these exceptions are small and statistically insignificant (t-statistics of 0.016 and 0.35, respectively).

In Appendix B.2 we report t-statistics adjusted using standard meta-analytic techniques which yield similar conclusions (see the red distribution in the margin of the top panel of Figure 2).

On average, the size of these effects is large. The bottom panel of Figure 2 shows that an increase in *CU* from 0% to 50% is associated with sizable reductions in the sensitivity of decisions. On average, the reduction in sensitivity is equal to 33%, and rises to as high as 87% in effort supply (EFF).

It is worth pausing to emphasize that this link between insensitivity and CU arises in a very similar way in a highly diverse range of decision tasks. This pattern arises in social decisions, decisions that involve risk or intertemporal tradeoffs, elicitations of beliefs and tests of cognition, evaluations of policies, decisions related to effort supply and multitasking, strategic decision making, and more. The similarity in how *CU* predicts behavior across these domains suggests that our results reflect the difficulty of identifying one's best decision rather than (for example) insensitivity-generating preferences that happen to be correlated with *CU*.

Intensive margin of cognitive uncertainty. A potential concern is that expressions of positive *CU* might be due to subjects inattentively or randomly clicking on their screen. In Appendix Figure 15 we replicate the top panel of Figure 2 by restricting attention to observations with $CU_{i,j} > 0$. The results are very similar. What's more, as we will show below, the vast majority of subjects express systematically lower *CU* in tasks at or near simple boundary points, further indicating that *CU* measures subjective uncertainty over one's best decision rather than mere random behavior.

Compression or uncertainty aversion? The framework presented in Section 2 posits that attenuation arises as a result of a compression effect, according to which people's

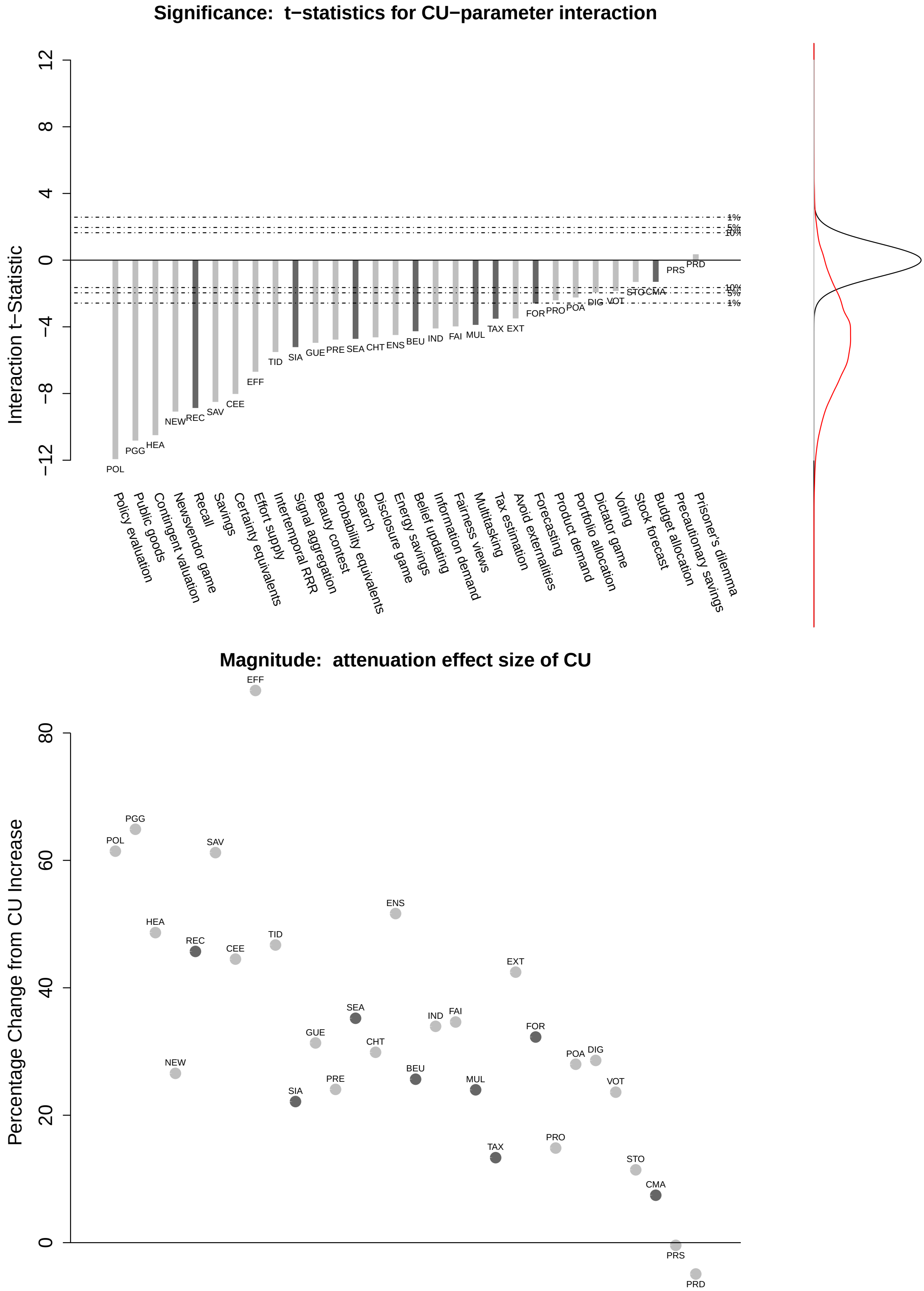


Figure 2: Behavioral attenuation and cognitive uncertainty. The top panel plots the t-statistic associated with $\hat{\beta}^e$ in (1). For comparison, we plot a standard normal distribution in black. The red distribution shows the distribution of adjusted t-statistics from a meta analysis (Bayesian hierarchical regression), see Appendix B.2. The bottom panel plots $\hat{\phi}^e$. Tasks displayed in black have objectively correct solutions, while those displayed in grey are subjective decision problems that involve unknown (to us as researchers) preferences or information sets.

decisions regress towards a common intermediate decision. An alternative possibility is that attenuation is driven by "cognitive uncertainty aversion", by which we mean a type of risk aversion or caution over one's own *CU* (Cerreia-Vioglio et al., 2015, 2022; Chakraborty, 2021; de Clippel et al., 2024). The key behavioral signature that separates a compression effect from *CU* aversion is the "flipping" pattern emphasized earlier in the discussion of Figure 1: if the optimal decision is an increasing function of the fundamental, then compression predicts that high-*CU* decisions are higher than low-*CU* decisions at low fundamental values, but lower at high fundamental values. In contrast, for those of our tasks for which models of caution are currently available, *CU* aversion predicts that high-*CU* decisions exhibits a level shift relative to low-*CU* decisions.[13]

In Figure 1, we reported pronounced flipping patterns in six of our tasks. Formally testing for the same pattern in each of our 30 tasks,[14] we find that 26 tasks exhibit the flipping pattern, including all of the tasks in which attenuation is statistically significant at least at the 5% level. In only one task (VOT) do we find a pattern consistent with *CU*-aversion; the remaining three tasks are inconclusive.

We do not mean to suggest that *CU* aversion is not a plausibly important economic phenomenon – we think it likely is. However, this kind of aversion and the compression effect we formalize in Section 2 are distinct phenomena, and our analyses strongly suggest that attenuation in our data is driven by compression effects.[15]

4.3 Attenuation to Objective Benchmarks

In those eight experiments that have objectively correct solutions, we can directly measure behavioral attenuation by comparing observed with rational elasticities. As described in our pre-analysis plan, we estimate the following equation:[16]

$$a^e_{i,j} = \nu^e + \omega^e \, \theta^e_j + \sum_x \chi^e d^e_x + u^e_{i,j} \, , \tag{4}$$

and then assess attenuation by dividing the observed elasticity $\hat{\omega}^e$ by the elasticity predicted in a rational model, ω^e_R. As above, we cluster standard errors at the subject level.

Figure 3 summarizes the results. For each task, we plot three quantities. First, we plot the ratio $\hat{\omega}^e/\omega^e_R$ as black dots. In every one of our objective tasks we find that this ratio is

[13] To the extent that greater *CU* captures greater preference uncertainty, models of caution assert that it produces lower valuation of actions that yield risky/delayed payoffs or non-pecuniary outcomes relative to actions that yield certain/immediate payoffs or monetary outcomes.

[14] Formally, we define a flipping pattern as being present if above-median-*CU* decisions are higher than below-median-*CU* decisions at the two lowest fundamentals, but lower at the two highest fundamentals.

[15] One potential way to reconcile caution and compression effects is to observe that tending towards intermediate options itself represents cautious behavior, perhaps reflecting a desire to avoid large mistakes.

[16] As above, this analysis is restricted to those fundamental values that (according to the pre-registration) do not constitute potential simple points (such as a piece rate of zero).

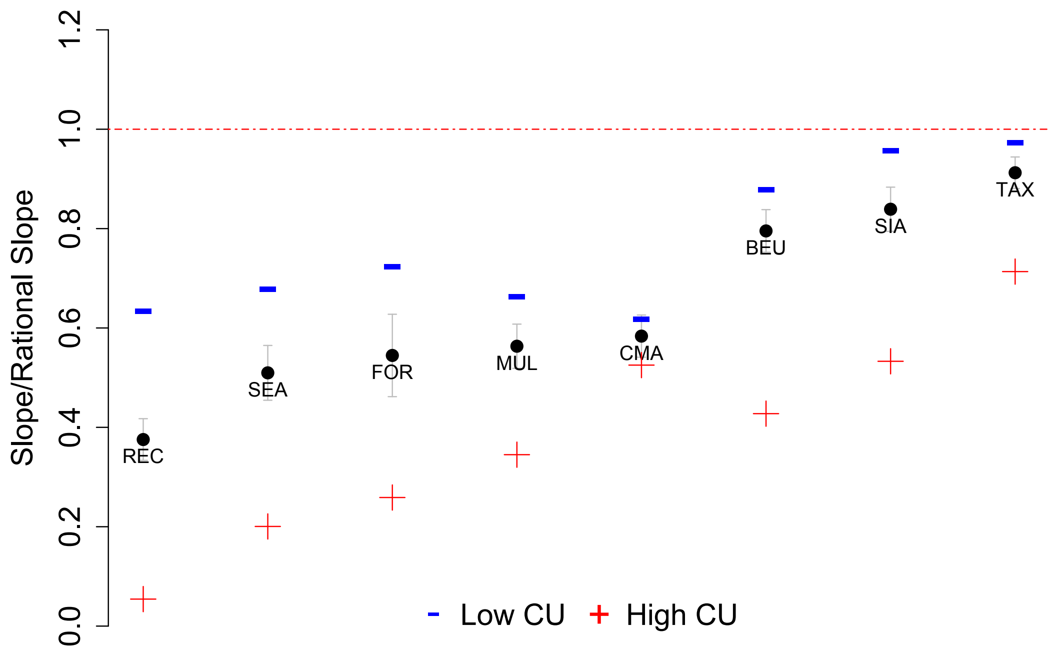


Figure 3: Behavioral attenuation relative to normative benchmarks in objective tasks. For each task, the black dot plots $\hat{\omega}^e/\omega^e_R$ and 95% CIs, see equation (4). The red and blue dots correspond to the fitted values of equation (1) for $CU = 0\%$ (blue) and $CU = 100\%$ (red).

significantly less than one, indicating that subjects are insufficiently elastic to economic fundamentals in the experiment.

Second, we estimate a variation on equation (4) in which we interact θ^e_j with $CU^e_{i,j}$, plotting fitted values for low and high CU decisions. In blue, we plot minus signs ("-") showing the fitted values for decisions with $CU = 0\%$. In red, we plot plus signs ("+") showing the fitted values for decisions with $CU = 100\%$. As already shown in Figure 2, in all of our eight objective tasks we find that *CU* is strongly associated with the degree of objective attenuation.

4.4 Robustness and Limits

In Online Appendix D, we discuss the robustness and bounds of behavioral attenuation. On the *robustness* side, we show that attenuation is unaffected by an order of magnitude increase in incentives (implemented in variations of experiments BEU, CMA, REC, SIA and VOT). We also document some of the demographic (e.g., gender and age) and choice process (e.g., response time) predictors of *CU* and attenuation.

On the *limits* side, we report results from two additional experiments meant to test some hypotheses on the limitations of behavioral attenuation. First, we use the RIA task to study the hypothesis that *CU*-linked attenuation should disappear or even reverse when the fundamental of interest has a very small or even no effect on optimal behavior (in a rational model). Recall that in the RIA experiment, under a fully rational model, decision makers should not respond at all to variation in the key varied fundamental. We find that, as predicted, the link between *CU* and the elasticity of decisions is small and statistically insignificant.

Second, as discussed in the Introduction, attenuation might be weakened or even eliminated when people directly compare decisions under multiple fundamentals simultaneously (as in "joint evaluation" designs in the literature). We tested this using new, pre-registered "Joint" experiments in which we asked subjects in SAV (one of our subjective tasks) and MUL (an objective test) to make initial hypothetical decisions about how to respond to very small or large fundamentals. As detailed in Online Appendix D, we find some evidence (though mixed) that this kind of intervention can reduce behavioral attenuation.

4.5 Within- and Across-Subject Variation

To what extent is attenuation driven by within- versus across-subject variation in *CU*? To study this directly, we re-estimate eq. (1) using each subject's average *CU* rather than the uncertainty associated with a given decision. We then re-compute the implied attenuation effect size $\hat{\phi}^e$. Appendix Figure 12 compares the original estimates with those obtained using the subject-level average *CU* measure. Appendix Figure 13 reports the same exercise for the t-statistics.

The results show that the magnitude of attenuation is always lower (and usually substantially so) when we restrict attention to across-subject variation in average *CU*. The average attenuation effect size $\hat{\phi}^e$ drops from 33.0 to 8.8, and the average t-statistic from -4.8 to -1.39. This is not to say that subject-level differences in underlying cognitive noise/ability are necessarily unimportant drivers of attenuation.[17] Rather, this analysis highlights that beyond within-subject variation in *CU* is also an important driver of the attenuation effect that we document in our pre-registered analysis.[18]

What drives within-subject variation in *CU* and decision elasticities? Some part of this variation is likely idiosyncratic and caused by subject-specific variation in the timing of distracting events, attention allocation, or the order of rounds within the experiment. However, another part is highly systematic: as we analyze in the next section, *CU* strongly increases as the main decision-relevant fundamental departs from the pre-registered (potential) simple points.

[17]For instance, idiosyncratic differences in how subjects interpet the scale of the *CU* question would mechanically weaken the relationship between cognitive noise as measured by *CU* and attenuation.

[18]Indeed, when we re-estimate eq. (1) controlling for subject fixed effects, we continue to find a significant link between *CU* and decision elasticities. Appendix Figure 14 shows the results. 29 out of 30 tasks exhibit a negative t-statistic in this analysis, with 22 of those statistically significant at the 5% level.

5 Diminishing Sensitivity

5.1 Simple Points

Table 1 and Appendix A.1 spell out the simple points. As noted above, we pre-registered two types of simple points. First, parameters that give rise to a dominant action, such as a piece-rate wage of zero in the real effort task. Second, 'potential simple points' that do not produce dominance but nonetheless render the problem cognitively easy, such as a signal diagnosticity of one (a fully informative signal) in the belief updating task.

Figure 5 plots median *CU* in each of our experiments as a function of distance to the pre-registered potential simple points, normalizing the x-axis for comparability by showing the rank distance. As we pre-registered, throughout this section, we restrict the sample to those tasks that have a potential simple point. Moreover, as we pre-registered, we restrict attention the simple parameter and the five nearest parameter values.[19]

First, with few exceptions, median *CU* is zero or close to zero at the potential simple point. Second, *CU* strongly increases as fundamentals become more distant from the simple points. Following our pre-registered procedure, we find that in almost all experiments the 'potential simple points' included in the design are *actually simple* in the sense that they induce significantly lower *CU* than adjacent points.[20]

5.2 Diminishing Sensitivity

Because our simple points are almost always located at the logical boundaries of the parameter space, the insight that decisions become more difficult as fundamentals depart from the simple points has potential implications for understanding diminishing sensitivity. Because *CU* is generally lowest at simple boundary points, uncertainty-linked attenuation *predicts* diminishing sensitivity, a classic pattern previously documented in many decision contexts.

Diminishing sensitivity is indeed pervasive in our data.[21] We denote by $\Delta_j = min\{|\theta_j - \underline{\theta}|; |\overline{\theta} - \theta_j|\}$ the absolute distance between a fundamental and the closest boundary point.

[19]This is necessary because in some of our experiments there are two simple points that occur at opposite extremes of the parameter values (e.g. payout probabilities of 0 and 1 in the lottery valuation task), such that a parameter that is very far from one simple point may be very close to the other. Because our experiments always included eleven different parameter values, restricting attention to the five nearest ones minimizes these problems.

[20]The one exception is FOR, for which we pre-registered potential simple points of 0% (future growth equals a fixed trend of +5) and 100% (future growth exactly equals past growth). The *CU* data suggest that 100% is actually a simple point, while 0% is not.

[21]We exclude the binary choice tasks from this analysis. The reason is that there the idea of diminishing sensitivity cannot realistically apply because, under a standard random choice model, the slope of decisions is much larger over intermediate ranges of the fundamental (close to the decision maker's indifference point). Overall, this leaves us with 22 tasks.

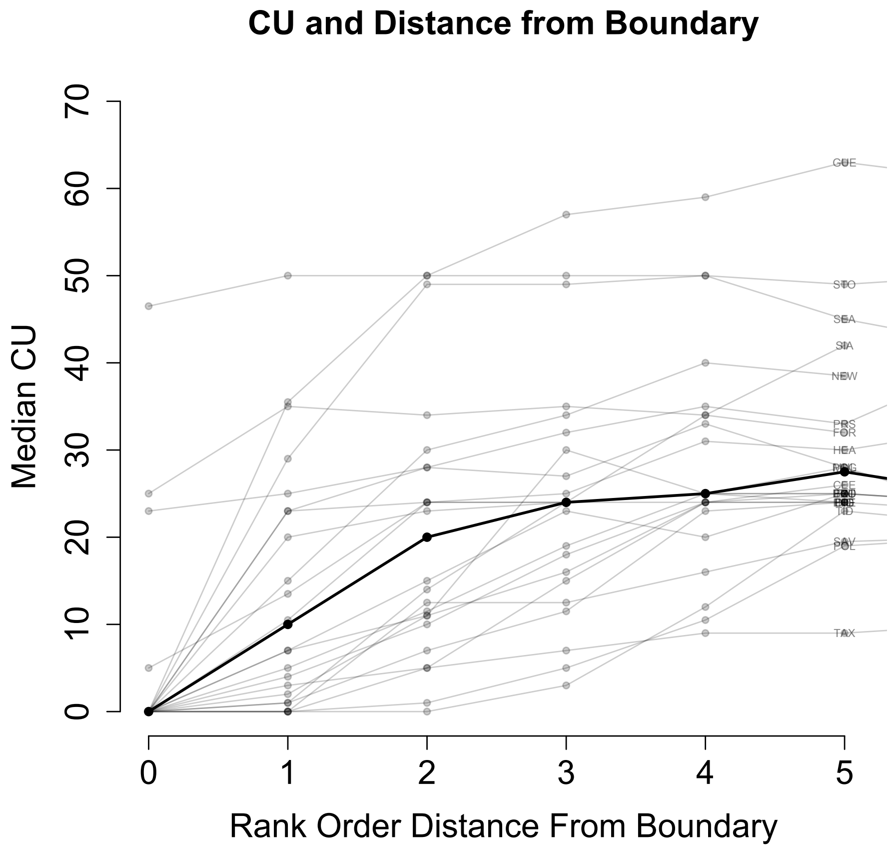


Figure 4: Median cognitive uncertainty as a function of distance to the nearest simple point (measured in ordinal ranks), separately for each experiment. Solid line shows overall median across all experiments. Sample includes those 25 experiments for which we pre-registered at least one potential simple point.

We then test for diminishing sensitivity by estimating, for each experiment e,

$$a^e_{i,j} = \alpha^e_d + \gamma^e_d \; \theta^e_j + \beta^e_d \; \theta^e_j \; \Delta^e_j + \delta^e \; \Delta^e_j + \sum_x \chi^e d^e_x + \nu^e_{i,j} \; , \tag{5}$$

where diminishing sensitivity is indicated by $\hat{\beta}^e_d < 0$.

The top panel of Figure 5 shows the t-statistics associated with $\hat{\beta}^e_d$. The Figure reveals widespread evidence of diminishing sensitivity. Almost all t-statistics are negative and sizable, and most are statistically significantly so.

While we have no *ex-ante* reason to expect a linear response function in every one of our tasks, notice that the pattern of diminishing sensitivity also occurs in objective tasks in which we as researchers know that the optimal policy function is linear, such as in SEA and MUL. Moreover, as we describe in detail below, variation in *CU* across problem fundamentals predicts the diminishing sensitivity in our data.

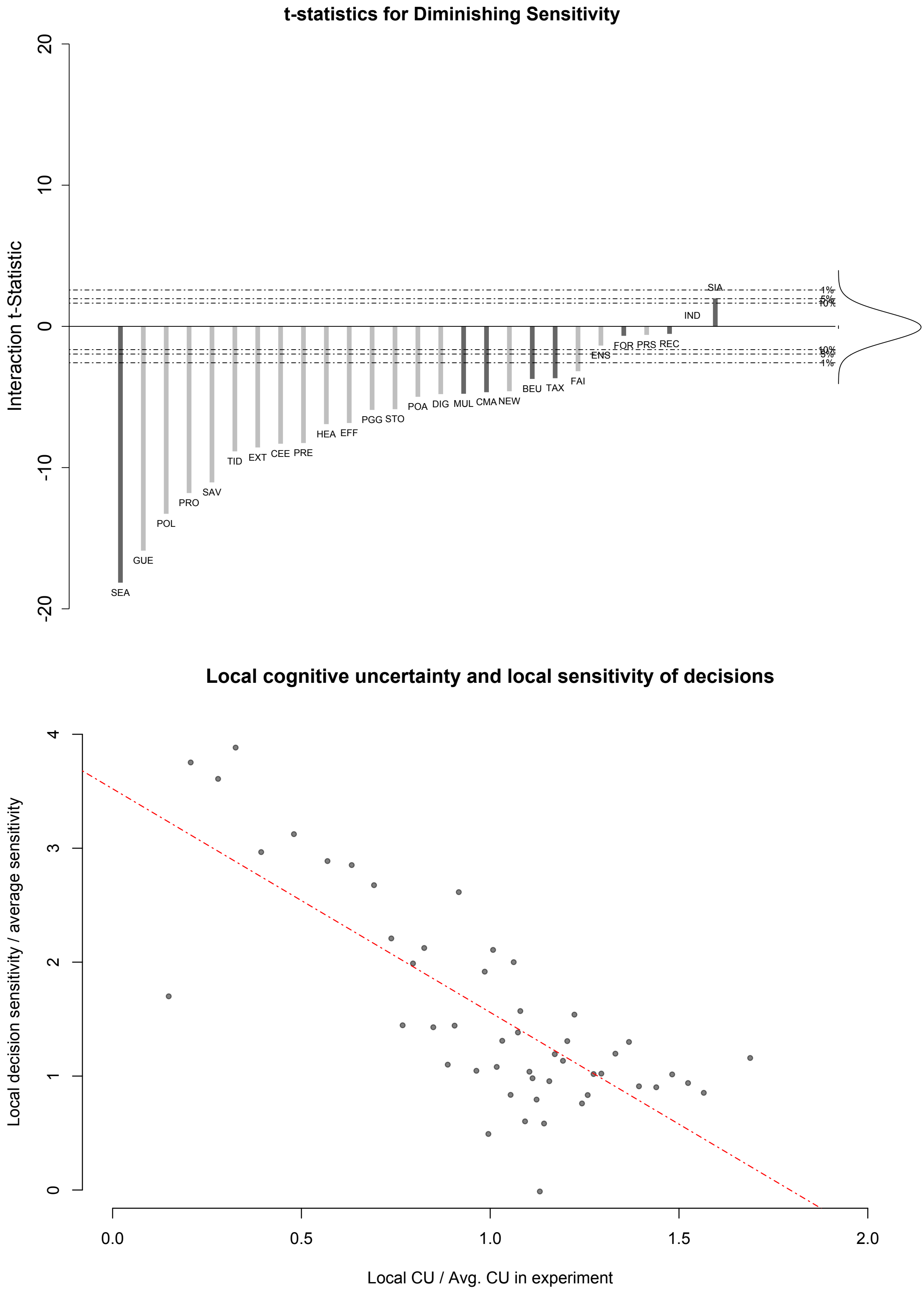


Figure 5: Top panel: Distribution of t-statistics for diminishing sensitivity ($\hat{\beta}_d^e$ in eq. (5)). Bottom panel: Binned scatter plot of the correlation between local *CU* at θ_j (normalized by average *CU* in the experiment) and the local sensitivity of decisions at fundamentals $\{\theta_{j-1}, \theta_j, \theta_{j+1}\}$ (normalized by the average sensitivity in the experiment). In both panels, we restrict attention to experiments that (i) have a simple point and (ii) are not binary choice tasks. In the bottom panel, an observation is a task-fundamental (252 observations), binned into 50 buckets to ease readability.

5.3 Across-Problem Variation in *CU* and Elasticity

Our objective is not to argue that *all* diminishing sensitivity reflects heteroscedastic *CU* or variation in problem difficulty across problem fundamentals. Rather, our objective is merely to document that variation in problem difficulty (or *CU*) is a strong contributor to diminishing sensitivity.

To this effect, we directly link variation in *CU* across fundamentals to variation in elasticity across fundamentals (i.e., diminishing sensitivity). To do this, we conduct an analysis of the sensitivity of decisions and *CU* not across subjects but, instead, across different problem fundamentals (averaged across all subjects). Specifically, we directly link the local sensitivity of decisions around a given fundamental to local *CU* at that fundamental, where both *CU* and local elasticities are calculated averaging across all subjects. For instance, we link the average local slope of decisions at a wage of $\theta = 0$ to average *CU* at $\theta = 0$. According to the model, at those points where *CU* is locally high, the local slope of decisions should be locally low.

We estimate both local decision sensitivities and local *CU* in a way that is comparable across experiments. Intuitively, for each fundamental in a given experiment, we compute the sensitivity of decisions around this fundamental, and normalize it by the average sensitivity across all fundamentals in the experiment.[22] Similarly, for each fundamental, we calculate average *CU* at that fundamental, normalized by average *CU* across all fundamentals in the respective experiment. Given that almost all of our experiments feature 11 distinct fundamental values, this means that we estimate 11 local sensitivities and 11 average *CU* values for a typical experiment.

We emphasize that this analysis only leverages variation in *CU* across different problem configurations and, hence, nets out subject-level differences in cognitive ability, effort, attentiveness, interpretations of the *CU* question, and so on.

The bottom panel of Figure 5 shows the results by providing a binned scatter plot of the relative local decision sensitivities against relative local *CU*. The figure pools observations from all experiments, but controls for experiment fixed effects, such that it only reflects within-experiment across-fundamental variation in local decision sensitivities and local *CU*. In total, the figure is constructed from 252 experiment-parameter

[22]More formally, for each experiment e and fundamental value θ_j^e, we estimate the OLS regression

$$a_{i,j}^e = \alpha_j^e + \xi_j^e \theta_j^e + \sum_x \chi^e d_x^e + \epsilon_{i,j}^e$$

in two different samples. First, we estimate it locally around fundamental θ_j^e, i.e., only including $\{\theta_{j-1}^e, \theta_j^e, \theta_{j+1}^e\}$ (for fundamentals that constitute the minimum or maximum fundamental in our experiments, we estimate the local slope only from two points). Second, we estimate the regression in the full sample of fundamentals in experiment e. To arrive at a measure of the relative local sensitivity, we divide $\hat{\xi}_j^e$ as estimated in the 'local' sample by $\hat{\xi}^e$ as estimated in the full sample. These relative local sensitivities have large outliers, so we winsorize them at the 5th and 95th percentile.

combinations, but we bin those into 50 buckets to ease readability.

The Figure shows that the two quantities are strongly correlated in the predicted direction (partial $r = -0.48$, $p < 0.01$). As local *CU* rises, the local sensitivity of decisions to the fundamental drops sharply. We interpret this evidence as strongly suggesting that a higher problem difficulty (and resulting higher uncertainty about one's best decision) produces greater insensitivity of decisions, in a manner that is orthogonal to across-subject differences.

Taken together, a consistent picture emerges from Figures 4 and 5. At fundamentals at which *CU* is higher, the sensitivity of decisions is lower (bottom panel of Figure 5). Because *CU* increases in distance from simple points (Figure 4), this pattern generates – or contributes to – widespread diminishing sensitivity (top panel of Figure 5). This suggests an interpretation of diminishing sensitivity: it partly reflects that the intensity of attenuation changes as fundamentals move away from simple boundary points.

6 Discussion

In more than two dozen economic contexts, we find consistent evidence of behavioral attenuation and diminishing sensitivity. First, measures of cognitive uncertainty predict a lower elasticity of decisions to fundamentals (attenuation). Second, changes in cognitive uncertainty as a function of the distance to simple boundaries predict diminishing sensitivity. While our results suggest that attenuation and diminishing sensitivity are widespread, we reiterate the limitations emphasized in the Introduction (e.g., low-dimensional problems, no explicit comparisons).

The identification of (i) relatively high insensitivity and (ii) diminishing sensitivity away from boundary points are arguably the central ideas in some of behavioral economists's greatest success stories, such as hyperbolic discounting and prospect theory (see, for example, Prelec and Loewenstein, 1991, for an early discussion highlighting these commonalities). By rooting insensitivity in a generic cognitive mechanism – uncertainty about one's best decision – we show that these classic behavioral economics ideas also extend to other contexts for which they were not initially conceived, such as effort supply, product demand, fairness views, strategic beauty contests and policy evaluation. We view this as one productive contribution of the recent literature on cognitive foundations: it not only provides micro-foundations for known anomalies but also shows that an understanding of cognitive mechanisms helps to see that classical ideas may apply more generally than previously acknowledged.

We now discuss to what extent attenuation *complements* preferences-based explanations and to what extent it *competes* with them. We begin by discussing cases in which they compete, and then highlight cases in which they are complements.

First, attenuation competes with preferences-based explanations in some domains, in particular those domains in which prior research has documented insensitivity-related anomalies. Indeed, various researchers, going back at least to Prelec and Loewenstein (1991), Hilbert (2012) and Hsee et al. (2019), have noted that various behavioral economics anomalies appear to reflect a form of insensitivity to relevant parameters, often coupled with a higher sensitivity at boundary points. Table 2 presents a list of prior findings in the literature that are reproduced in our experiment and that our findings suggest are (at least in part) special cases of behavioral attenuation. For example, prior work has found that effort supply in experiments is often insensitive to variation in the wage (DellaVigna et al., 2022). Researchers typically attribute probability weighting in elicitations of certainty equivalents to non-standard risk preferences, but find inverse probability weighting in elicitations of probability equivalents (e.g., Bouchouicha et al., 2023) – both of which are describable as forms of insensitivity of the elicited quantity to variation in the decision-relevant parameter (see Shubatt and Yang (2023) for a formal derivation of this point).

Our results on the links between cognitive uncertainty and observed elasticities in all of the contexts highlighted in Table 2 suggests to us that behavioral attenuation provides a compelling and parsimonious explanation for these insensitivity-related results. A perennial alternative explanation for insensitities like these is domain-specific preferences. In order to accept a purely preferences-based explantion of our results, one would have to believe that insensitivity-generating preferences happen to coincide with cognitive uncertainty both (i) across subjects and (ii) across parameters. Second, one would have to believe that this pattern of coincidence arises in similar ways across the many decision domains we study: social decisions, intertemporal decisions, decisions under risk, strategic decisions, labor-related decisions, and so on. Finally, these correlations between cognitive uncertainty and insensitivity (both across subjects and across parameters) would have to occur on different bases in objective and subjective tasks since in objective tasks preferences are not available as an explanation. In our opinion, this set of conditions appears implausible and less parsimonious than the interpretation that attenuation reflects the difficulty of identifying one's best decision.

Second, however, in many contexts cognitive uncertainty-linked attenuation *complements* preferences-based explanations. Many of the experiments we rely on were initially developed by other researchers to document the existence of 'non-standard' preferences such as altruism. Cognitive uncertainty-linked attenuation and diminishing sensitivity do not negate the existence of these preferences. Rather, they illustrate how cognition affects the mapping between these preferences and observed decisions. For example, our results do not suggest that people do not have fairness concerns – rather, they show that mapping one's fairness views into redistributive decisions is cognitively challenging, pro-

Table 2: Known insensitivity-related anomalies

Task	Finding in literature	Example reference
CEE	Prob. weighting in certainty equivalent elicitations	Kahneman and Tversky (1979)
PRE	Inverse prob. weighting in probability equivalent elicitations	Bouchouicha et al. (2023)
BEU	Likelihood insensitivity / conservatism	Grether (1980)
TID	Hyperbolic discounting over money	Cohen et al. (2020)
HEA	Scope insensitivity in contingent valuation	Diamond and Hausman (1994)
EFF	Insensitivity of effort supply	DellaVigna et al. (2022)
NEW	Central tendency effect in newsvendor problem	Schweitzer and Cachon (2000)
IND	Insensitive information demand	Ambuehl and Li (2018)
POA	Attenuation puzzle in equity shares	Giglio et al. (2021)
TAX	Schmeduling of tax schedules	Rees-Jones and Taubinsky (2020)
EXT	Concave willingness to mitigate emissions	Pace et al. (2023)
MUL	Bikeshedding effect in multitasking	Parkinson (1957)
SAV	Insensitivity of investment to interest rate	Sharpe and Suarez (2015)
FOR	Insensitivity to autocorrelation parameter	Afrouzi et al. (2023)
FAI	Insensitivity of rewards to luck	Cappelen et al. (2022)

ducing an attenuated link.

In summary, our objective is to highlight that – whichever objectives people have – the cognitive difficulty of identifying one's best decision often predictably distorts the mapping between economic fundamentals and observed behavior. Crucially, these distortions have a systematic structure that applies to a diverse set of decision problems: subjects' perceived inability to optimize generally attenuates the sensitivity of their decisions to economic fundamentals. Moreover, the magnitude of attenuation depends on variation in subjective difficulty across problem fundamentals, and this variation exhibits a consistent pattern that predicts diminishing sensitivity away from simple boundary points. The structure that we document may help other researchers interpret the elasticities observed in empirical analyses, and also motivates and helps inform work modeling how cognitive difficulty and attenuation varies across decision problems.

References

AFROUZI, H., S. Y. KWON, A. LANDIER, Y. MA, AND D. THESMAR (2023): "Overreaction in expectations: Evidence and theory," *The Quarterly Journal of Economics*, 138, 1713–1764.

ARIELY, D., G. LOEWENSTEIN, AND D. PRELEC (2003): ""Coherent arbitrariness": Stable demand curves without stable preferences," *The Quarterly journal of economics*, 118, 73–106.

AUGENBLICK, N., E. LAZARUS, AND M. THALER (2025): "Overinference from Weak Signals and Underinference from Strong Signals," *Quarterly Journal of Economics*.

BA, C., J. A. BOHREN, AND A. IMAS (2022): "Over-and Underreaction to Information," *Available at SSRN*.

BORDALO, P., N. GENNAIOLI, G. LANZANI, AND A. SHLEIFER (2025): "A cognitive theory of reasoning and choice," Tech. rep., National Bureau of Economic Research.

BOUCHOUICHA, R., J. WU, AND F. M. VIEIDER (2023): *Choice Lists and "Standard Patterns" of Risk-taking*, Ghent University, Faculty of Economics and Business Administration.

BUTLER, D. J. AND G. C. LOOMES (2007): "Imprecision as an account of the preference reversal phenomenon," *American Economic Review*, 97, 277–297.

CAPPELEN, A. W., J. MOLLERSTROM, B.-A. REME, AND B. TUNGODDEN (2022): "A meritocratic origin of egalitarian behaviour," *The Economic Journal*, 132, 2101–2117.

CERREIA-VIOGLIO, S., D. DILLENBERGER, AND P. ORTOLEVA (2015): "Cautious expected utility and the certainty effect," *Econometrica*, 83, 693–728.

CERREIA-VIOGLIO, S., D. DILLENBERGER, P. ORTOLEVA, ET AL. (2022): *Caution and Reference Effects*, Penn Institute for Economic Research.

CHAKRABORTY, A. (2021): "Present bias," *Econometrica*, 89, 1921–1961.

COHEN, J., K. M. ERICSON, D. LAIBSON, AND J. M. WHITE (2020): "Measuring time preferences," *Journal of Economic Literature*, 58, 299–347.

COSTA-GOMES, M. A. AND V. P. CRAWFORD (2006): "Cognition and behavior in two-person guessing games: An experimental study," *American economic review*, 96, 1737–1768.

DE CLIPPEL, G., P. MOSCARIELLO, P. ORTOLEVA, AND K. ROZEN (2024): "Caution in the Face of Complexity," Tech. rep., Mimeo.

Dean, M. and P. Ortoleva (2019): “The empirical relationship between nonstandard economic behaviors,” *Proceedings of the National Academy of Sciences*, 116, 16262–16267.

DellaVigna, S., J. A. List, U. Malmendier, and G. Rao (2022): “Estimating social preferences and gift exchange at work,” *American Economic Review*, 112, 1038–1074.

Diamond, P. A. and J. A. Hausman (1994): “Contingent valuation: is some number better than no number?” *Journal of economic perspectives*, 8, 45–64.

Ebert, J. E. and D. Prelec (2007): “The fragility of time: Time-insensitivity and valuation of the near and far future,” *Management science*, 53, 1423–1438.

Enke, B. and T. Graeber (2023): “Cognitive uncertainty,” *The Quarterly Journal of Economics*, 138, 2021–2067.

Enke, B., T. Graeber, and R. Oprea (2023): “Confidence, self-selection, and bias in the aggregate,” *American Economic Review*, 113, 1933–1966.

——— (2025): “Complexity and Time,” *Journal of the European Economic Association*.

Enke, B. and C. Shubatt (2023): “Quantifying Lottery Choice Complexity,” *Working Paper*.

Falk, A., A. Becker, T. Dohmen, B. Enke, D. Huffman, and U. Sunde (2018): “Global evidence on economic preferences,” *The Quarterly Journal of Economics*, 133, 1645–1692.

Frydman, C. and L. Jin (2021): “Efficient Coding and Risky Choice,” *Quarterly Journal of Economics*.

Gabaix, X. (2019): “Behavioral inattention,” in *Handbook of Behavioral Economics-Foundations and Applications 2*, ed. by D. Bernheim, S. DellaVigna, and D. Laibson, Elsevier, 261.

Gabaix, X. and D. Laibson (2022): “Myopia and discounting,” Tech. rep., National bureau of economic research.

Giglio, S., M. Maggiori, J. Stroebel, and S. Utkus (2021): “Five facts about beliefs and portfolios,” *American Economic Review*, 111, 1481–1522.

Grether, D. M. (1980): “Bayes Rule as a Descriptive Model: The Representativeness Heuristic,” *Quarterly Journal of Economics*, 95, 537–557.

Gupta, N., L. Rigott, and A. Wilson (2021): "The Experimenters' Dilemma: Inferential Preferences over Populations," *arXiv preprint arXiv:2107.05064*.

Hilbert, M. (2012): "Toward a synthesis of cognitive biases: how noisy information processing can bias human decision making." *Psychological bulletin*, 138, 211.

Hsee, C. K., G. F. Loewenstein, S. Blount, and M. H. Bazerman (1999): "Preference reversals between joint and separate evaluations of options: A review and theoretical analysis." *Psychological bulletin*, 125, 576.

Hsee, C. K., Y. Yang, and X. Li (2019): "Relevance insensitivity: A new look at some old biases," *Organizational Behavior and Human Decision Processes*, 153, 13–26.

Ilut, C. and R. Valchev (2023): "Economic agents as imperfect problem solvers," *The Quarterly Journal of Economics*, 138, 313–362.

Kahneman, D. and A. Tversky (1979): "Prospect Theory: An Analysis of Decision under Risk," *Econometrica*, 47, 263–292.

Khaw, M. W., Z. Li, and M. Woodford (2021): "Cognitive imprecision and small-stakes risk aversion," *The review of economic studies*, 88, 1979–2013.

——— (2022): "Cognitive Imprecision and Stake-Dependent Risk Attitudes," Tech. rep., National Bureau of Economic Research.

Mullainathan, S. (2002): "Thinking through categories," Tech. rep., Working Paper, Harvard University.

Oprea, R. (2024): "Decisions Under Risk are Decisions Under Complexity," Tech. rep.

Pace, D., T. Imai, P. Schwardmann, and J. van der Weele (2023): "Uncertainty about Carbon Impact and the Willingness to Avoid CO2 Emissions," Tech. rep., Discussion Paper.

Parkinson, C. N. (1957): *Parkinson's law*, Murray.

Prelec, D. and G. Loewenstein (1991): "Decision making over time and under uncertainty: A common approach," *Management science*, 37, 770–786.

Rees-Jones, A. and D. Taubinsky (2020): "Measuring "Schmeduling"," *The Review of Economic Studies*, 87, 2399–2438.

Röver, C. (2020): "Bayesian random-effects meta-analysis using the bayesmeta R package," *Journal of Statistical Software*, 93, 1–51.

SCHUMACHER, H., I. KESTERNICH, M. KOSFELD, AND J. WINTER (2017): "One, two, many-insensitivity to group size in games with concentrated benefits and dispersed costs," *The Review of Economic Studies*, 84, 1346–1377.

SCHWEITZER, M. E. AND G. P. CACHON (2000): "Decision bias in the newsvendor problem with a known demand distribution: Experimental evidence," *Management science*, 46, 404–420.

SHARPE, S. A. AND G. SUAREZ (2015): "Why isn't investment more sensitive to interest rates: Evidence from surveys," *Available at SSRN 2667352*.

SHUBATT, C. AND J. YANG (2023): "Similarity and Comparison Complexity," *Working Paper*.

STANGO, V. AND J. ZINMAN (2023): "We Are All Behavioural, More, or Less: A Taxonomy of Consumer Decision-Making," *The Review of Economic Studies*, 90, 1470–1498.

TVERSKY, A. AND D. KAHNEMAN (1974): "Judgment under uncertainty: Heuristics and biases," *science*, 185, 1124–1131.

VIEIDER, F. M. (2021): "Noisy coding of time and reward discounting," Tech. rep., Ghent University, Faculty of Economics and Business Administration.

——— (2022): "Decisions under Uncertainty as Bayesian Inference on Choice Options," .

WOODFORD, M. (2020): "Modeling imprecision in perception, valuation, and choice," *Annual Review of Economics*, 12, 579–601.

YANG, J. (2023): "On the Decision-Relevance of Subjective Beliefs," *Working Paper*.

ONLINE APPENDIX

A Study Details

A.1 Experimental Tasks, Problem Configurations and *CU* Elicitations

This Appendix summarizes the design of each of our 31 tasks using the following format:

Name of task.

1. The experimental decision subjects take.
2. The problem configurations, in particular the parameter that varies across rounds.
3. Parameters for which a dominance relationship is present (according to our pre-registration) – these points are always classified as "simple".
4. Parameters that according to our pre-registration constitute "potential simple points", and parameters that are actually simple points according to our ex-post analysis of the cognitive uncertainty data. Specifically, a potential simple point is an ex-post simple point if cognitive uncertainty at that parameter is significantly lower than at the five nearest parameters (at the 5% level).
5. How we translate the experimental decisions and parameters into a regression equation.
6. Whether there is an objective / rational regression coefficient, and if so, what it is.
7. Wording of the cognitive uncertainty elicitation.
8. Incentives.

Savings (SAV).

1. Decide how many of 100 points (= \$10) to receive today or save until six months later, at a known interest rate.
2. Interest rates (in %): 0, 1, 5, 7, 10, 15, 20, 25, 30, 40, 50.
3. Dominance points: 0
4. Potential simple points: n/a
5. Dependent variable: Points saved. Independent variable: Interest rate.

6. Rational regression coefficient: n/a
7. "*How certain are you that saving somewhere between $Y-1$ and $Y+1$ points is actually your best decision, given your preferences?*"
8. Receive money at chosen times.

Precautionary savings (PRS).

1. Act as a hypothetical farmer whose utility from his output is given by $U = \sqrt{w_1} + 0.9\sqrt{w_2}$, where w_i is water available in period i. In each round, decide how many out of 100 barrels of water to save for the second period, knowing that in the second period a weather shock hits that either depletes or adds a fixed amount of water with 50-50 chance.
2. Absolute size of shock (in gallons): 0, 1, 2, 5, 8, 10, 15, 20, 25, 30, 40.
3. Dominance points: n/a
4. Potential simple points: 0; Ex-post simple points: 0
5. Dependent variable: Amount saved. Independent variable: Absolute size of shock.
6. Rational regression coefficient: n/a
7. "*How certain are you that allocating somewhere between $Y-1$ and $Y+1$ barrels to Spring is actually your best decision, given your preferences and the available information?*"
8. Bonus = Farmer's realized utility divided by two.

Portfolio allocation (POA).

1. Decide how to allocate $1000 between a riskless savings account (2% return) and a risky ETF (with uncertain return). Subjects receive information about the one-year return of the ETF (computed over a period of five years), then state their subjective return expectations for the ETF, and allocate their $1000.
2. Historical returns (ETF Ticker): RSPG, RSPH, RSPS, RSPU, RSPN, RSPM, RSPD, RSPR, IBB, PPA, RSPF.
3. Dominance points: n/a
4. Potential simple points: n/a

5. Dependent variable: Amount invested in ETF. Independent variable: Subjective return expectation. Controls: ETF fixed effects.

6. Rational regression coefficient: n/a

7. "*How certain are you that investing somewhere between* $\$Y - 20$ *and* $\$Y + 20$ *in the Stock Account is actually your best decision, given your preferences and the available information?*"

8. Receive value of portfolio in one year, divided by 100.

Forecast stock return (STO).

1. Forecast value of $100 investment into one of several ETFs at some point in the future.

2. Time horizon: 0 hours, 1 day, 1 week, 1 month, 6 months, 1 year, 2 years, 3 years, 4 years, 5 years, 7 years.

3. Dominance points: n/a

4. Potential simple points: 0 hours; Ex-post simple points: 0 hours

5. Dependent variable: Forecast. Independent variable: Time horizon. Controls: ETF fixed effects.

6. Rational regression coefficient: n/a

7. "*How certain are you that the best possible forecast is actually somewhere between* $\$Y - 1$ *and* $\$Y + 1$*, given the information you have?*"

8. None.

Estimate tax burden (TAX).

1. Participants are presented with hypothetical federal and state income tax schedules. A hypothetical taxpayer makes his entire income through labor income. Estimate total tax burden based on income.

2. Income (in $): 0, 10,000, 15,000, 25,000, 35,000, 45,000, 60,000, 75,000, 90,000, 115,000, 150,000.

3. Dominance points: n/a

4. Potential simple points: 0; Ex-post simple points: 0

5. Dependent variable: Estimate. Independent variable: Income.

6. Rational regression coefficient: 0.3442633

7. *"How certain are you that the correct answer is actually somewhere between* $\$Y-300$ *and* $\$Y+300$*?"*

8. Receive bonus of $10 if estimate is within +/- $300 of correct answer.

Newsvendor game (NEW).

1. Act as hypothetical cola producer who can sell cola at a market price of $12. Demand is unknown and uniformly distributed between 0 and 100. Cola that is produced but not sold goes to waste. Producing cola is associated with a constant marginal cost.

2. Cost (in $): 0, 0.1, 1, 2, 4 , 6, 8, 10, 11, 11.9, 12.

3. Dominance points: 0, 12

4. Potential simple points: n/a

5. Dependent variable: Production. Independent variable: Cost.

6. Rational regression coefficient: n/a

7. "How certain are you that producing somewhere between $Y-1$ and $Y+1$ gallons is actually your best decision, given your preferences and the available information?"

8. Bonus (in $) = 6 + 1/200 * Firm profit (or loss)

Effort supply (EFF).

1. Decide how many real-effort tasks to complete at a given piece rate. Effort task is to count number of ones in an 8x8 table.

2. Piece rate (in $): 0, 0.01, 0.05, 0.10, 0.15, 0.20, 0.30, 0.40, 0.50, 0.60, 0.70.

3. Dominance points: 0

4. Potential simple points: n/a

5. Dependent variable: Number of tasks. Independent variable: Piece rate.

6. Rational regression coefficient: n/a

7. "*How certain are you that completing somewhere between $Y-1$ and $Y+1$ tasks is actually your best decision, given your preferences?*"

8. Receive earnings and work required amount.

Multitasking (MUL).

1. In an induced values experiment, allocate time budget of 135 hours between practicing with two horses (A and B), and receive a fraction of each horse's prize money, where the two fractions always sum up to 90%. Prize money of each horse is concave (linear-quadratic) in practice time, such that the optimal effort allocation for horse A is 135 × Absolute Profit share A/90.

2. Absolute Profit share for A (in %): 0, 1, 5, 10, 25, 40, 65, 80, 85, 89, 90.

3. Dominance points: 0, 90

4. Potential simple points: n/a

5. Dependent variable: Practice time with A. Independent variable: Relative Profit share for A.

6. Rational regression coefficient: 135

7. "*How certain are you that practicing somewhere between $Y-1$ and $Y+1$ hours with Horse A is actually the best decision?*"

8. Receive bonus of $10 if estimate is within +/- 1 hours of the optimal answer.

Search (SEA).

1. There's a bag with 100 chips labeled 1-100. The computer draws at random until it gets a number that is at least as high than the minimum value specified by the participant. Each draw is costly, with a cost that varies across rounds. Earnings are highest number drawn minus cost of drawing.

2. Cost per draw: 0, 0.1, 0.5, 1, 2.5, 5, 10, 15, 20, 30, 50.

3. Dominance points: 0

4. Potential simple points: n/a

5. Dependent variable: Minimum value set. Independent variable: Cost per draw.

6. Rational regression coefficient: -1.949051

7. "*How certain are you that setting the minimum value somewhere between* $Y-1$ *and* $Y+1$ *points is actually the best decision?*"

8. Receive bonus of $10 if estimate is within +/- 1 points of the optimal answer.

Product demand (GPT).

1. Across rounds, a participant is exposed to three different types of products: pasta, rice and coffee. Each product comes in a certain quantity (for example, three packages of pasta). Participants state their hypothetical WTP for a given product-quantity.

2. Quantity: 0, 1, 2, 3, 4, 5, 6, 7, 8, 10, 12.

3. Dominance points: 0

4. Potential simple points: n/a

5. Dependent variable: WTP. Independent variable: Quantity. Controls: Product fixed effects.

6. Rational regression coefficient: n/a

7. "*How certain are you that you actually value this product somewhere between* $\$Y-1$ *and* $\$Y+1$*?*"

8. None.

Budget allocation (CMA).

1. In an induced values setup, participants are endowed with a utility function over two goods, bottles of milk (x_1) and bottles of juice (x_1). The utility function is $U=\sqrt{x_1}+\sqrt{x_2}$. The price of good x_2 is normalized to one, and the price of x_1 varies across rounds. Participants decide what fraction of the total number of bottles they buy should be milk or juice. Once participants enter a fraction, the decision interface automatically and instantly displays the absolute number of bottles of either type and the corresponding expenditure. Subjects can revise their decisions before they get locked in.

2. Price of milk: 0.1, 0.3, 0.5, 0.7, 1.3, 1.7, 2, 2.5, 3, 5, 10.

3. Dominance points: n/a

4. Potential simple points: n/a

5. Dependent variable: Fraction of all bottles that are milk. Independent variable: Price of milk.

6. Rational regression coefficient: -9.977986

7. "*How certain are you that the best decision is actually somewhere between $Y-1$ and $Y+1$ percent?*"

8. Receive bonus of $10 if estimate is within +/- 1% of optimal answer.

Avoid externalities (EXT).

1. In a multiple price list experiment, participants make binary decisions between money for themselves and reducing CO2 emissions by a certain amount, which varies across rounds. Reductions in CO2 are implemented by us purchasing carbon offsets. From each price list, we extract the participant's WTP for reducing emissions by a certain amount as the midpoint of the participant's switching interval in the list.

2. Amount of CO2 emissions (in metric tons): 0, 0.25, 0.5, 0.75, 1, 1.5, 2, 2.5, 3, 4, 5.

3. Dominance points: 0

4. Potential simple points: n/a

5. Dependent variable: WTP. Independent variable: Amount of emissions.

6. Rational regression coefficient: n/a

7. "*How certain are you that you actually value a reduction of CO2 emissions of X metric tons as much as a monetary gain somewhere between $\$Y-1$ and $\$Y+1$?*"

8. One randomly-selected binary choice is implemented, such that either the participant receives money or we purchase carbon offsets.

Invest to save energy (ENS).

1. Participants are exposed to a hypothetical scenario in which they need to lease one of two cars for the next two years, a Toyota Camry and a Toyota Camry Hybrid. The Hybrid is more fuel-efficient but the lease is more expensive. The scenario describes the number of miles the customer expects to drive. In a multiple price list experiment, participants make binary decisions between leasing the Camry at a certain price and the Camry Hybrid at a certain price. From each list, we extract the participant's WTP for the Camry Hybrid (i.e., the additional money the participant

is willing to pay to get the Camry Hybrid rather than the Camry), as the midpoint of the switching interval. Across rounds (lists), the scenario about how many miles the customer expects to drive varies.

2. Expected miles driven: 2,000, 3,000, 4,000, 5,000, 6,000, 8,000, 10,000, 11,000, 12,000, 13,000, 14,000.
3. Dominance points: n/a
4. Potential simple points: n/a
5. Dependent variable: WTP. Independent variable: Expected miles driven.
6. Rational regression coefficient: n/a
7. "*How certain are you that you are actually willing to pay somewhere between* $\$Y-50$ *and* $\$Y+50$ *more annually to lease the Camry Hybrid as opposed to the Camry?*"
8. None.

Fairness views (FAI).

1. In a spectator design, participants are informed that two previous participants competed in a contest (a letter transcription task). The winner of the contest is declared either based on performance or based on a 50-50 coin toss. The declared winner receives $10. The participant decides how much of this amount to redistribute to the declared loser. The participant does not know whether the winner was declared based on performance or luck, but knows the probability that the winner was declared based on performance. This probability varies across rounds.
2. Probability winner declared based on performance (in %): 0, 1, 5, 10, 25, 40, 75, 90, 95, 99, 100.
3. Dominance points: n/a
4. Potential simple points: 0, 100; Ex-post simple points: 0, 100
5. Dependent variable: Amount redistributed. Independent variable: Probability winner declared based on performance.
6. Rational regression coefficient: n/a
7. "*How certain are you that transferring somewhere between* $Y-1$ *and* $Y+1$ *points is actually your best decision, given your preferences and the available information?*"
8. Participant's own payoff is unaffected by their decision, but the payoffs of the other participants are implemented accordingly.

Dictator game (DIG).

1. Participants decide how much out of an endowment of $10 to send to a receiver. The amount sent gets doubled. However, there's a known percent chance that the receiver never gets the money but it gets burned instead.

2. Probability amount sent is lost (in %): 0, 1, 5, 10, 25, 50, 75, 90, 95, 99, 100.

3. Dominance points: n/a

4. Potential simple points: 0, 100; Ex-post simple points: 0, 100

5. Dependent variable: Amount sent. Independent variable: Probability amount sent is lost.

6. Rational regression coefficient: n/a

7. "*How certain are you that sending somewhere between* $Y - 1$ *and* $Y + 1$ *points is actually your best decision, given your preferences and the available information?*"

8. Participants and receivers are paid according to the dictator's decisions.

Contingent valuation (HEA).

1. Participants are presented with a hypothetical scenario about a disease that get a number of people very sick. The participants states a Dollar value to indicate how much they think the government should at most be willing to pay to cure the disease.

2. Number of people affected: 0, 1, 10, 100, 500, 1,000, 5,000, 10,000, 25,000, 75,000, 100,000.

3. Dominance points: 0

4. Potential simple points: n/a

5. Dependent variable: WTP. Independent variable: People affected.

6. Rational regression coefficient: n/a

7. "*How certain are you that spending somewhere between* $\$Y - 2500$ *and* $\$Y + 2500$ *is actually your best decision, given your preferences and the available information?*"

8. None.

Prisoner's dilemma (PRD).

1. Standard two-player matrix game with a prisoner's dilemma structure. Participants decide to cooperate or defect. Payoffs are given by $\pi(C,C) = (X,X)$, $\pi(C,D) = (1,7)$ and $\pi(D,D) = (2,2)$ Across rounds, the payoff to cooperation X varies.

2. Payoff to cooperation X (in $): 2.2, 2.5, 2.7, 3, 3.5, 3.7, 4, 4.5, 4.7, 5, 5.2.

3. Dominance points: n/a

4. Potential simple points: n/a

5. Dependent variable: 1 if cooperate. Independent variable: Cooperation payoff X.

6. Rational regression coefficient: n/a

7. "*How certain are you that choosing Top/Bottom is actually your best decision, given your preferences and the available information?*"

8. Game payoff.

Beauty contest (GUE).

1. In a two-player guessing game, participants guess a number between 0 and 100. Their target is the other player's guess times a multiplier. The other participant's target is the participant's guess.

2. Multiplier: 0, 0.01, 0.1, 0.2, 0.5, 0.7, 1.3, 2, 3, 4, 5.

3. Dominance points: n/a

4. Potential simple points: 0; Ex-post simple points: 0

5. Dependent variable: Guess. Independent variable: Multiplier.

6. Rational regression coefficient: n/a

7. "*How certain are you that the best possible guess is actually somewhere between $Y-1$ and $Y+1$, given the information you have?*"

8. Bonus (in $) = 10 - 1/50 * |Guess-target|

Public Goods Game (PGG).

1. In a three-player public goods game, participants choose how much out of an endowment of 100 points to contribute to a shared account. Points in the shared account are multiplied by a number and redistributed equally to all players.

2. Multiplier: 0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5.

3. Dominance points: 0

4. Potential simple points: n/a

5. Dependent variable: Points contributed. Independent variable: Multiplier.

6. Rational regression coefficient: n/a

7. "*How certain are you that transferring somewhere between* $Y-1$ *and* $Y+1$ *is actually your best decision, given your preferences?*"

8. Game payoff (10 cents for each point).

Disclosure game (CHT).

1. Participants act as sender in a disclosure game. They observe the true state (which ranges from 0 to 20) and are incentivized to make the receiver make a guess about the true state that is as high as possible. Participants decide whether or not to reveal the true state before the receiver makes their guess.

2. True state: 0, 1, 3, 5, 7, 10, 13, 15, 17, 19, 20.

3. Dominance points: n/a

4. Potential simple points: 0, 20; Ex-post simple points: 0, 20

5. Dependent variable: 1 if revealed. Independent variable: True state.

6. Rational regression coefficient: n/a

7. "*How certain are you that choosing Revealing/Hiding is actually your best decision, given your personal preferences and the available information?*"

8. Bonus (in \$) $= 10 - 0.0025 * (20 - \text{receiver's guess})^2$

Voting (VOT).

1. Decide whether or not to vote for policy A when both A and B are on the ballot. When B receives a weak majority of the votes, the participant loses \$8 of their \$10 endowment, while if A receives a strict majority, the participant can keep their endowment. Voting costs \$1. The other voters in the election are a certain number of computers who vote uniformly randomly.

2. Number of other voters: 0, 2, 6, 10, 20, 30, 40, 50, 60, 80, 100.

3. Dominance points: 0

4. Potential simple points: n/a

5. Dependent variable: 1 if voted. Independent variable: Number of other voters.

6. Rational regression coefficient: n/a

7. "*How certain are you that choosing to vote/not vote is actually your best decision, given your preferences and the available information?*"

8. Game payoff.

Policy evaluation (POL).

1. Decide on a Likert scale (from 0 to 100) how strongly to support a policy. The policy would increase each household's next year by \$10,000 but it would also produce an increase in inflation.

2. Inflation (in %): 0, 1, 2, 3, 4, 5, 8, 10, 12, 16, 20.

3. Dominance points: 0

4. Potential simple points: n/a

5. Dependent variable: Support for policy. Independent variable: Inflation.

6. Rational regression coefficient: n/a

7. "*How certain are you that rating the policy somewhere between $Y-1$ and $Y+1$ is actually your best decision, given my personal preferences and the available information?*"

8. None.

Rational inattention (RIA).

1. Decide whether to accept or reject a binary 50-50 lottery that results in a gain of \$X or a loss of \$(X-10). The participant has a budget of \$10. The participant can acquire information about whether the upside or downside will realize – the decision screen contains 60 mathematical equations, of which 35 are correct when the upside realizes and 25 when the downside realizes.

2. Payoff shifter X (in points): 40, 45, 50, 55, 60, 70, 75, 80, 85, 90, 95.

3. Dominance points: n/a

4. Potential simple points: n/a

5. Dependent variable: 1 if accept lottery. Independent variable: Payoff shifter X.

6. Rational regression coefficient: n/a

7. "*How certain are you that Accepting/Rejecting the lottery is actually your best decision, given your preferences and the available information?*"

8. Endowment plus / minus outcome of choice.

Risk preference elicitation – certainty equivalents (CEE).

1. In a multiple price list experiment, participants make binary decisions between varying safe payments and a binary lottery that pays \$18 with probability p. The payout probability varies across rounds. From each price list, we extract the participant's normalized certainty equivalent of the lottery as the midpoint of the participant's switching interval in the list, divided by 18.

2. Payout probability (in %): 0, 1, 5, 10, 25, 50, 75, 90, 95, 99, 100.

3. Dominance points: 0, 100

4. Potential simple points: n/a

5. Dependent variable: Normalized certainty equivalent. Independent variable: Payout probability.

6. Rational regression coefficient: n/a

7. "*How certain are you that you actually value this lottery ticket somewhere between* $\$Y-1$ *and* $\$Y+1$*?*"

8. One randomly selected binary choice.

Risk preference elicitation – probability equivalents (PRE).

1. In a multiple price list experiment, participants make binary decisions between a safe payment and a varying binary lottery that pays \$18 with probability p. The safe payment varies across rounds. From each price list, we extract the participant's probability equivalent of the safe payment as the midpoint of the participant's switching interval in the list.

2. Safe payment (in \$): 0, 0.2, 1, 2, 4.5, 9, 13.5, 16, 17, 17.8, 18.

3. Dominance points: 0, 18

4. Potential simple points: n/a

5. Dependent variable: Probability equivalent. Independent variable: Safe payment.

6. Rational regression coefficient: n/a

7. "*How certain are you that you actually value the safe payment of X as much as \$18 received with a percentage chance somewhere between* $Y - 5\%$ *and* $Y + 5\%$*?*"

8. One randomly selected binary choice.

Intertemporal RRR (TID).

1. In a hypothetical multiple price list experiment, participants make binary decisions between varying payments today and a fixed delayed payment of \$18. The delayed payment varies across rounds. From each price list, we extract the participant's normalized present value of the delayed payment as the midpoint of the participant's switching interval in the list, divided by 100.

2. Delay: 0 days, 1 day, 1 week, 1 month, 6 months, 1 year, 2 years, 3 years, 4 years, 5 years, 7 years.

3. Dominance points: 0 days

4. Potential simple points: n/a

5. Dependent variable: Ln (Normalized present value). Independent variable: delay in days. This log specification is directly motivated by the exponential discounting model.

6. Rational regression coefficient: n/a

7. "*How certain are you that you actually value \$100 somewhere between* $\$Y - 5$ *and* $\$Y + 5$ *received now?*"

8. None.

Information demand (IND).

1. Participants are incentivized to accurately guess the outcome of a fair coin toss. Prior to making their binary guess, they can purchase an informative binary signal that has accuracy (in %) of $P(report = H|truth = H) = q \geq 50$. Participants have a budget of $5 and state their WTP for the signal using a BDM mechanism.

2. Accuracy q (in %): 50, 51, 55, 60, 65, 75, 85, 90, 95, 99, 100.

3. Dominance points: 50, 100

4. Potential simple points: n/a

5. Dependent variable: Willingness to pay. Independent variable: Value of hint [(Accuracy-0.5)*5].

6. Rational regression coefficient: n/a

7. "*How certain are you that you actually value this hint somewhere between* $\$Y - 1$ *and* $\$Y + 1$*?*"

8. Bonus (in $) = Budget of $5 + $5 if guessed correctly - price paid for signal (if any).

Belief updating (BEU).

1. In a standard binary balls-and-urns belief updating experiment, participants know the prior is 50% and receive a binary signal with accuracy $P(report = H|truth = H) = q \geq 50$. They state a posterior probability.

2. Accuracy q (in %): 50, 51, 55, 60, 65, 75, 85, 90, 95, 99, 100.

3. Dominance points: n/a

4. Potential simple points: 50, 100; Ex-post simple points: 50, 100

5. Dependent variable: Log posterior odds. Independent variable: Log accuracy odds. This transformation is directly motivated by the Grether (1980) decomposition. Control: signal FE.

6. Rational regression coefficient: 1

7. "*How certain are you that the statistically correct likelihood that Bag R was selected is actually somewhere between $Y - 1$ and $Y + 1$ percent?*"

8. Get $10 if posterior is within +/-1 percentage points of Bayesian posterior.

Forecasting (FOR).

1. Forecast the 2024 earnings of a fictional firm based on the firm's earnings in 2022 and 2023. Participants are told that the change in earnings between 2023 and 2024 is given by a linear combination of (1) the change in earnings between 2022 and 2022; and (2) an earnings drift of +5 annually. Participants observe past earnings and the persistence parameter (the weight of (1)) and then forecast 2024 earnings. The persistence of the earnings trend varies across rounds.

2. Persistence parameter: 0, 0.01, 0.05, 0.10, 0.25, 0.50, 0.75, 0.90, 0.95, 0.99, 1.

3. Dominance points: n/a

4. Potential simple points: 0,1; Ex-post simple points: 1

5. Dependent variable: Implied predictability = (response - earnings 2023 - 5) / (earnings 2023 - earnings 2022 - 5). Independent variable: predictability.

6. Rational regression coefficient: 1

7. "*How certain are you that the correct forecast of the firm's 2024 earnings is actually somewhere \$$Y - 1$ and \$$Y + 1$?*"

8. Receive $10 if answer is within +/-1$ of correct answer.

Recall (REC).

1. Participants estimate the value of a hypothetical firm, which is given by 100 plus the net number of positive (vs. negative) news. In a first period, participants observe 100 news through memorable images and estimate the company value based on counting or estimating the number of positive and negative news. In a second period a few minutes later (the period of interest in the experiment), subjects are surprised with a recall task and are asked to estimate the value of the company again, without having access to the news again. The total number of news is always 100, but the composition (positive / negative) varies across rounds.

2. Number of positive news: 0, 1, 5, 10, 25, 50, 75, 90, 95, 99, 100.

3. Dominance points: n/a

4. Potential simple points: n/a
5. Dependent variable: Estimate of company value. Independent variable: True value.
6. Rational regression coefficient: 1
7. "*How certain are you that the stock price is actually somewhere between* $\$Y - 1$ *and* $\$Y + 1$*?*"
8. Receive \$10 if answer is within +/-1\$ of correct answer.

Signal aggregation (SIA).

1. Participants estimate the weight of a hypothetical bucket based on other people's estimates. There are two so-called Communicators (A and B) and 100 so-called Estimator. Each Estimator gives an independent unbiased estimate of the bucket's weight and transmits it to one of the Communicators. The Communicators compute the average of the estimates they observe and communicate those averages to the participant. The true weight is given by the average estimate of the Estimators. Across rounds, the number of Estimators that transmits to either Communicator varies.
2. Number of Estimators who report to Communicator A: 0, 1, 5, 10, 25, 60, 75, 90, 95, 99, 100.
3. Dominance points: n/a
4. Potential simple points: 0, 100; Ex-post simple points: 0, 100
5. Dependent variable: Implied weight on A = (response - weight reported from B)/(weight reported from A - weight reported from B). Independent variable: Correct weight on A (number of Estimators who report to A).
6. Rational regression coefficient: 1
7. "*How certain are you that the weight of the bucket is actually somewhere between* $Y - 1$ *and* $Y + 1$ *pounds?*"
8. Receive \$10 if answer is within +/-1 pounds of Bayesian answer.

B Additional Analyses for Main Experiments

B.1 Taskwise Raw Data

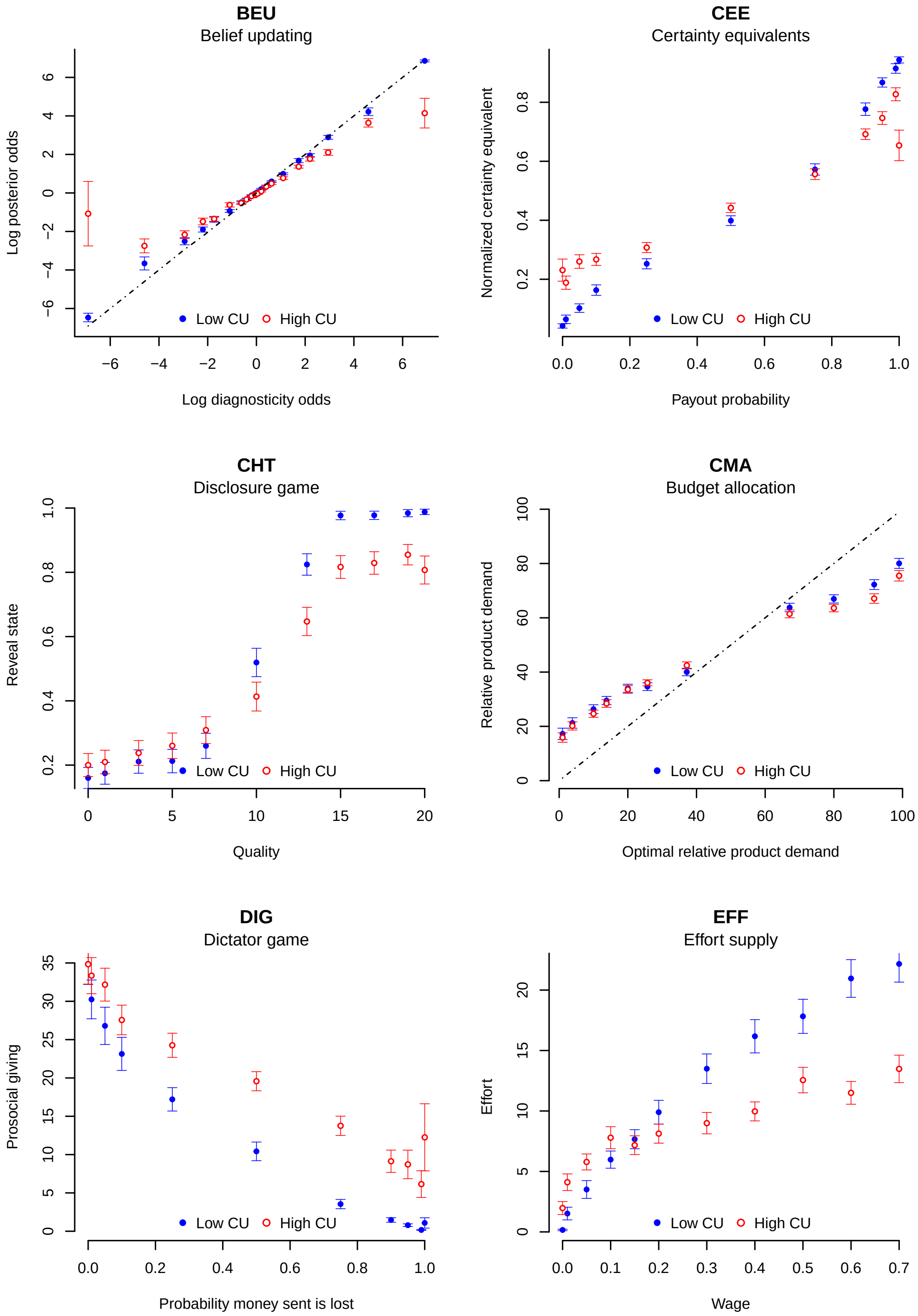


Figure 6: Decisions as a function of parameters.

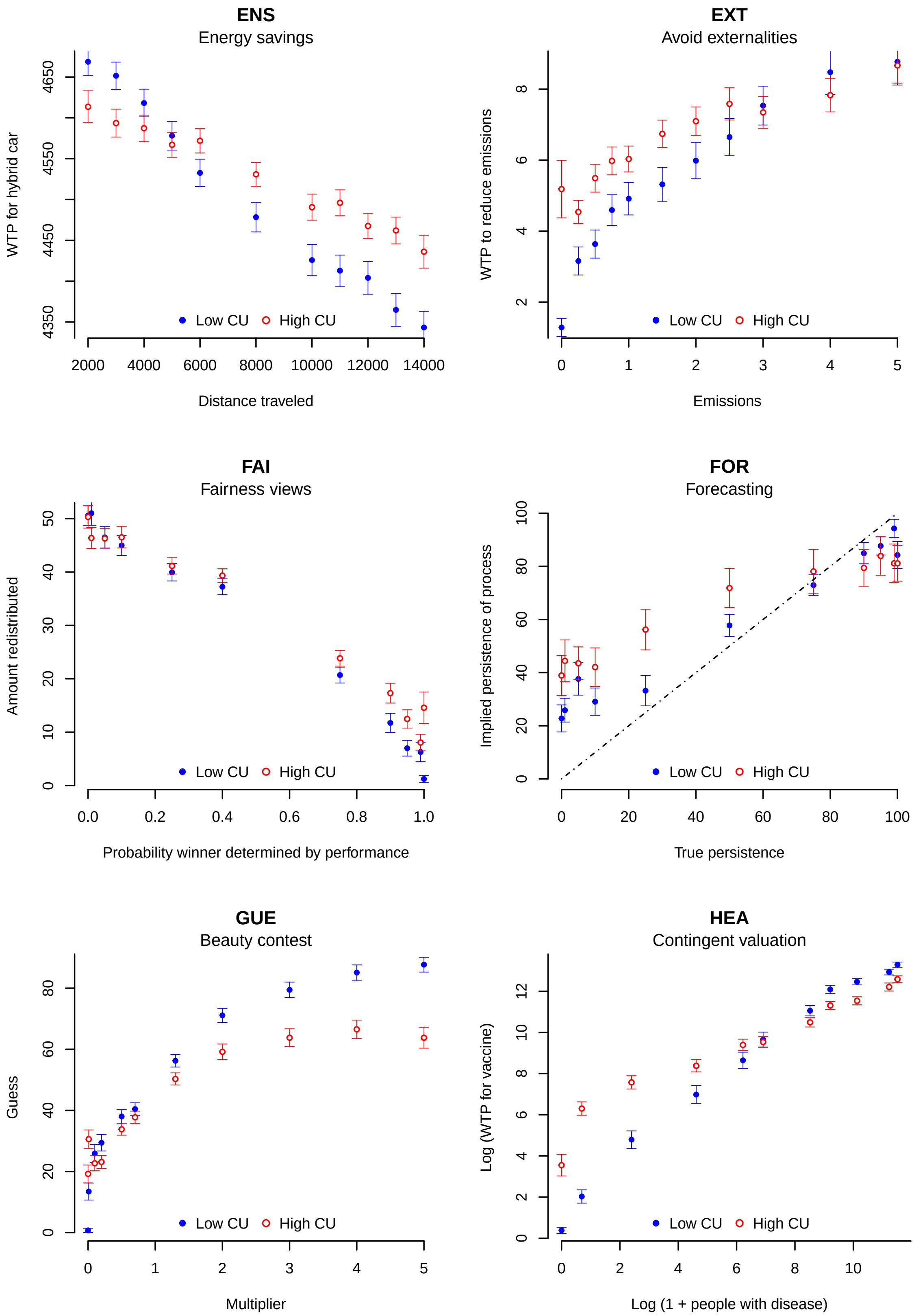


Figure 7: Decisions as a function of parameters.

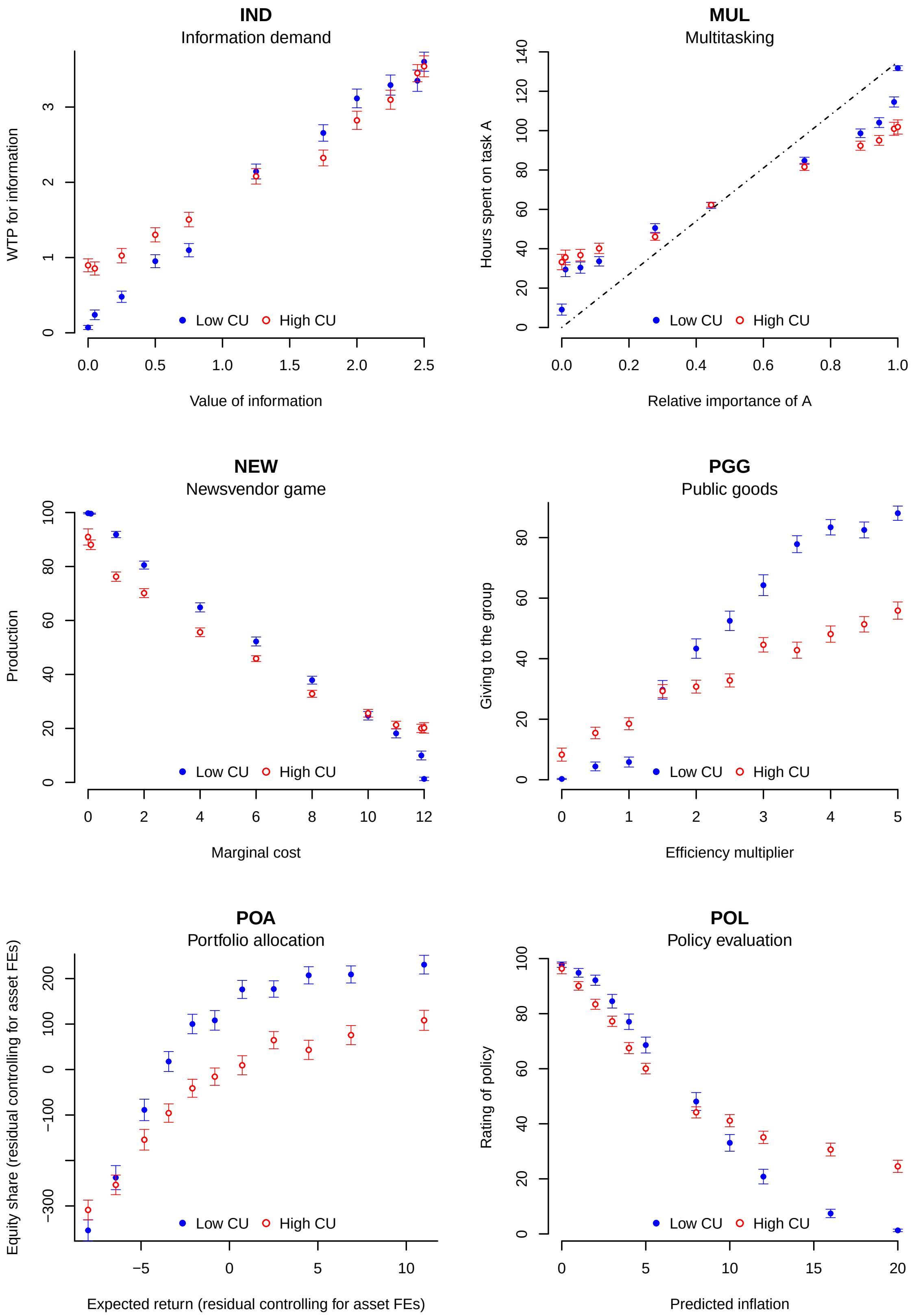


Figure 8: Decisions as a function of parameters.

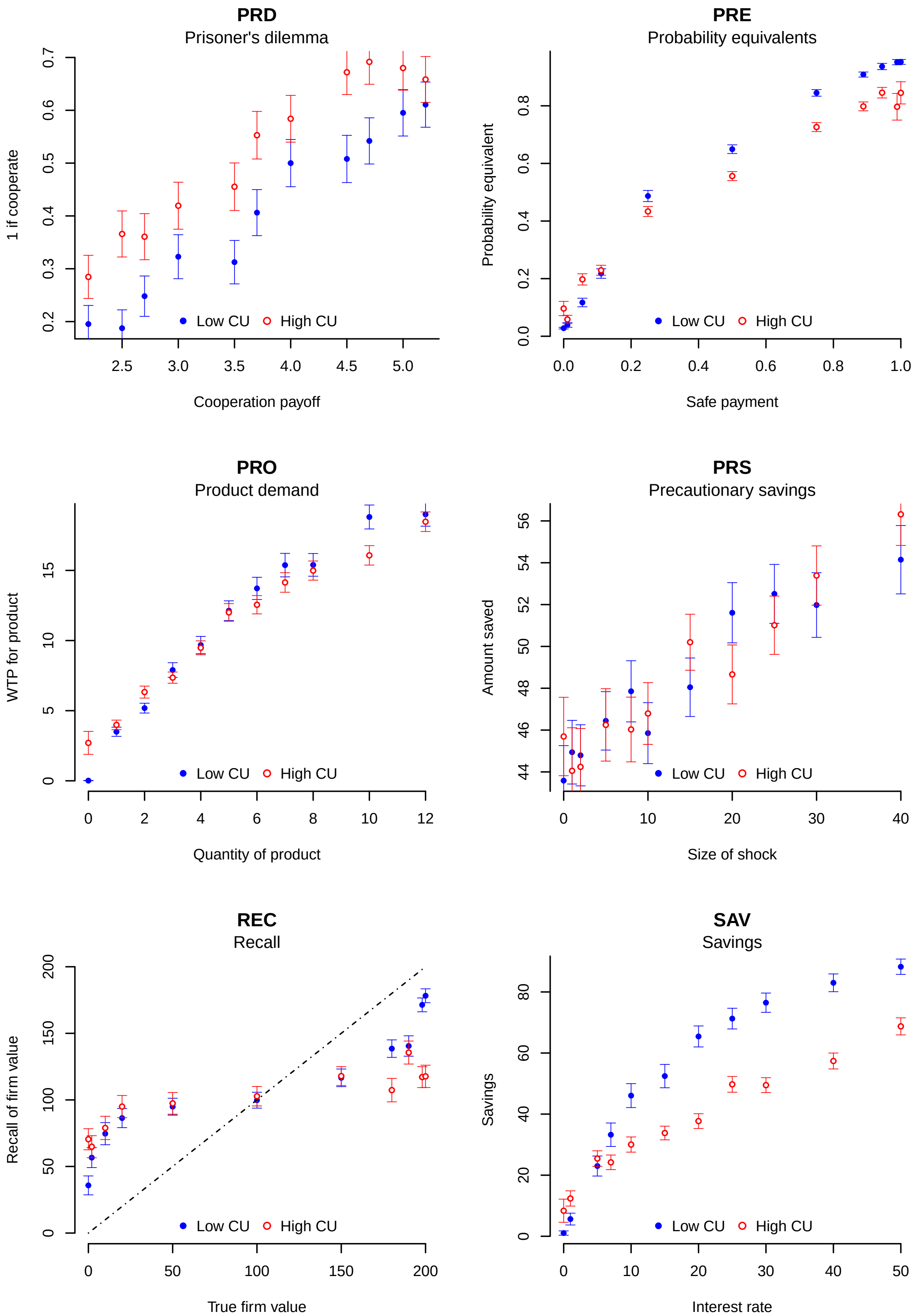


Figure 9: Decisions as a function of parameters.

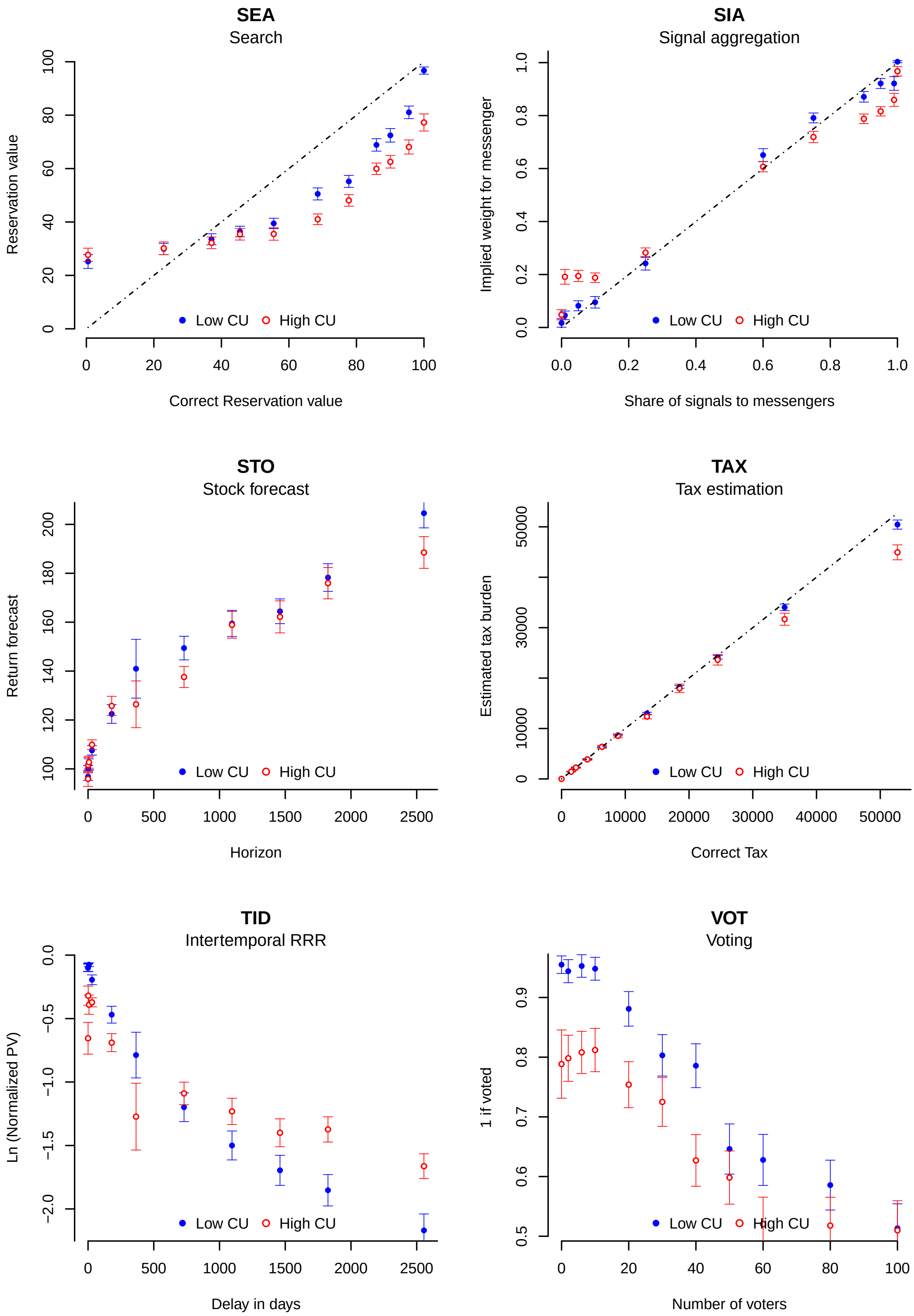


Figure 10: Decisions as a function of parameters.

B.2 Bayesian Meta-Analysis

The main hypothesis behind our paper is that there is an overarching structure behind the many experiments we run, which is a lower sensitivity to parameters when people are less sure they understand what is optimal. We, hence, additionally report t-statistics adjusted using standard meta-analytic techniques, i.e., using Bayesian hierarchical regressions. These adjustments effectively amount to a Bayesian shrinkage that pulls each t-statistic towards the sample mean across experiments. Appendix B.2 describes these estimations in detail.

Our meta-analyses are implemented as follows. Recall that applying standard meta-analytic formulas requires a vector of point estimates and associated standard errors. First, to adjust the t-statistics, we treat the t-statistics as 'point estimates' and assign them the same standard error of one. Second, to adjust the attenuation magnitude, we collect the estimated ϕ^e and their estimated standard errors, which are calculated using the delta method.

All meta-analyses are done using a normal-normal hierarchical model (NNHM). This model features two levels. The first level links the point estimate $\hat{x}_e$ of task e to its "true" effect x_e. The second level links the "true" effects $x_1, x_2, ...$ across tasks $e = 1, 2, ...$ to a common effect x_0. In our case, $\hat{x}_e$ is a t-statistic or a ϕ^e estimate, x_e is the true value of those variables net of sampling error, and x_0 is the underlying attenuation behavior shared across tasks. For a given task, our certainty about how close $\hat{x}_e$ is to the task's "true" effect x_e is measured by the associated standard error σ_e. We assume $\hat{x}_e$ is normally distributed around the true value x_e:

$$\hat{x}_e | x_e, \sigma_e \sim \mathcal{N}(x_e, \sigma_e^2) \tag{6}$$

where the variability of the $\hat{x}_e$ point-estimate is due to the sampling error, whose magnitude is given by the standard error σ_e. All tasks e measure the same attenuation effect x_0, but there is some "true" between-study heterogeneity that introduces variance to task-specific effects x_e. The second level of the NNHM assumes that task-specific effects x_e are distributed normally around common effect x_0:

$$x_e | x_0, \tau \sim \mathcal{N}(x_0, \tau^2) \tag{7}$$

where the "true" heterogeneity between tasks is captured by parameter τ. The NNHM can be rewritten as a single draw from a Normal distribution centered at common effect x_0 via the law of total variance:

$$\hat{x}_e \mid x_0, \sigma_e, \tau \sim \mathcal{N}(x_0, \sigma_e^2 + \tau^2) \tag{8}$$

Estimating this model requires empirical estimates of $\hat{x}_e$ with associated standard errors σ_e and assumptions on the prior distribution of x_0 and τ. For all meta-analyses, we assume x_0 is distributed uniformly over the real line and that τ is drawn from a half-normal distribution with scale 1. These choices are commonly used as non-informative priors. We estimate the NNHM model using the bayesmeta R package (Röver, 2020).

The red distribution in the margin of the top panel of Figure 2 shows the results. The meta-analytic distribution of t-statistics is very different from the null hypothesis $N(0,1)$ distribution, with a mean adjusted t-statistic of -4.7. This corroborates our main finding of widespread and quantitatively meaningful attenuation.

B.3 Additional Figures

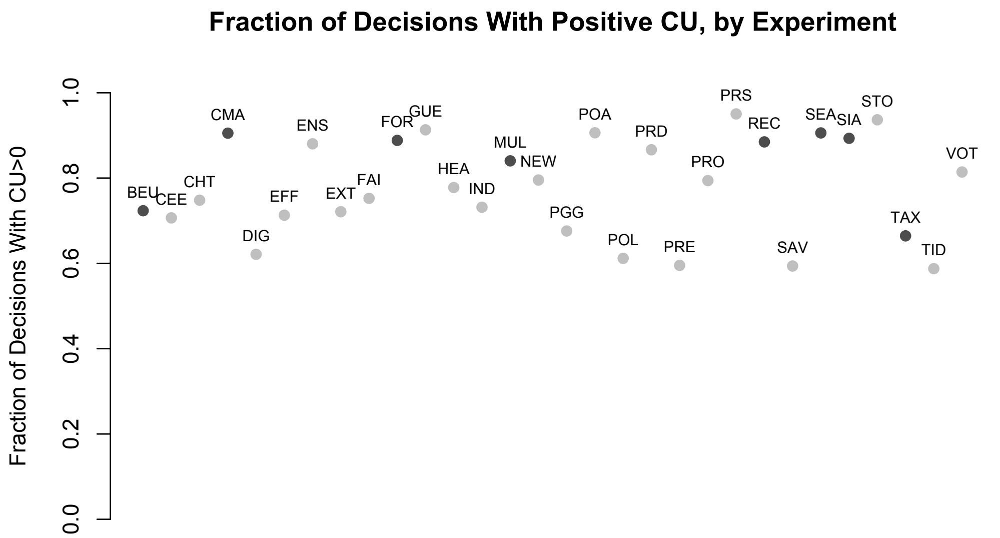


Figure 11: Fraction of decisions associated with strictly positive CU, by experiment. Tasks displayed in black have objectively correct solutions, while those displayed in grey are subjective decision problems that involve unknown (to us as researchers) preferences or information sets.

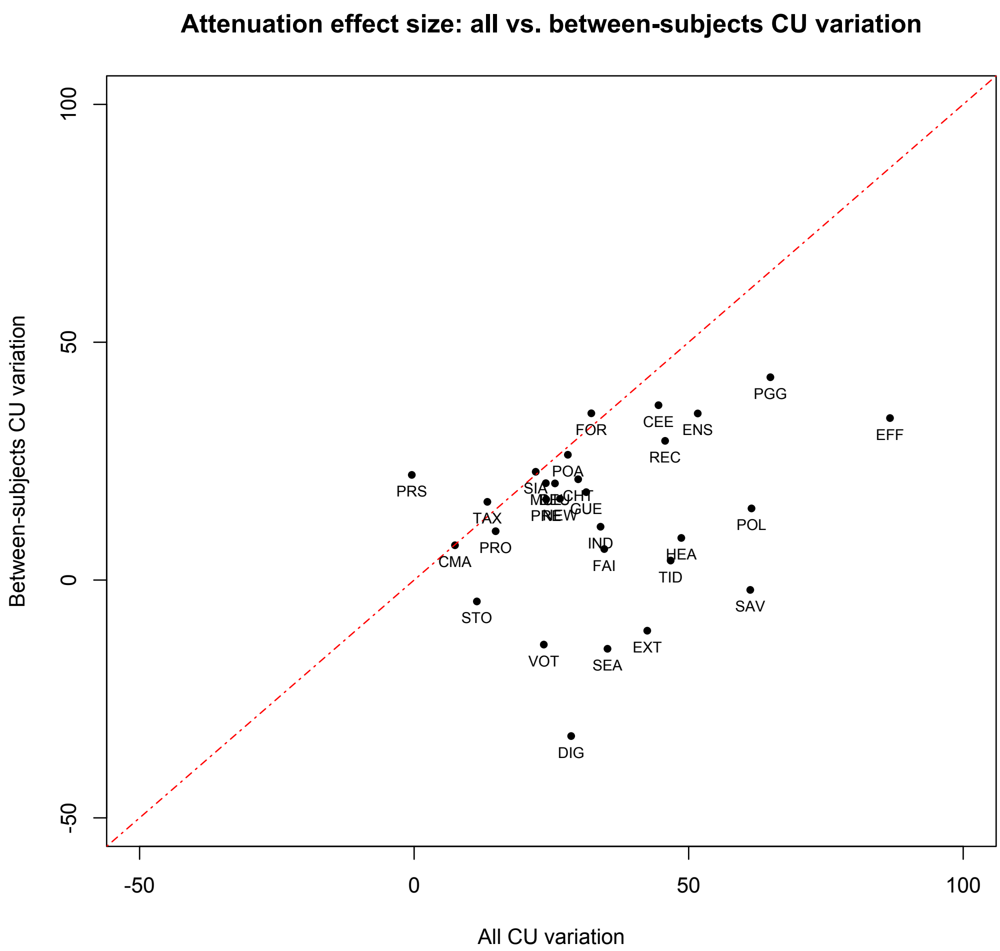


Figure 12: Behavioral attenuation with decision-level and subject-level *CU*. The x-axis shows $\hat{\phi}^e$, calculated by estimating eq. (1) using decision-level cognitive uncertainty, and the y-axis shows $\hat{\phi}^e$, calculated by estimating eq. (1) using subject-level average cognitive uncertainty.

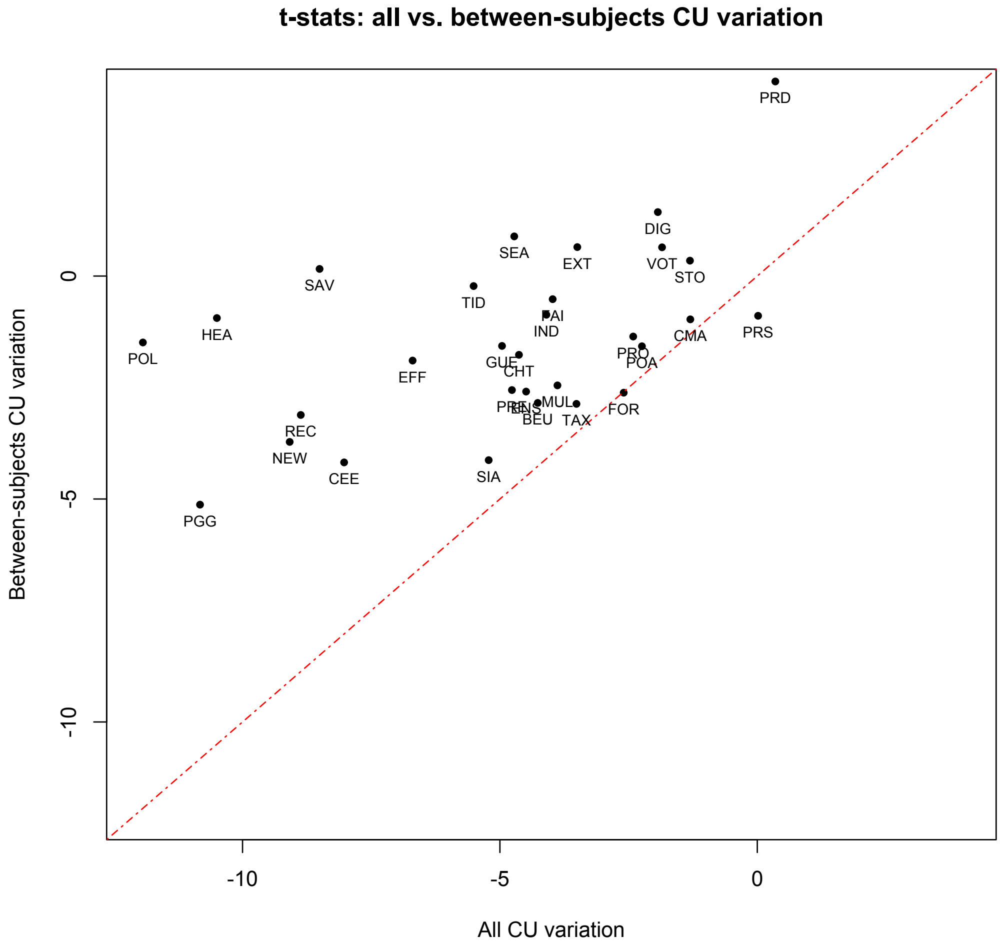


Figure 13: Behavioral attenuation with decision-level and subject-level *CU*. The x-axis shows the t-statistic associated with $\hat{\beta}^e$ in (1) when using decision-level cognitive uncertainty, and the y-axis shows the same object when using subject-level average cognitive uncertainty.

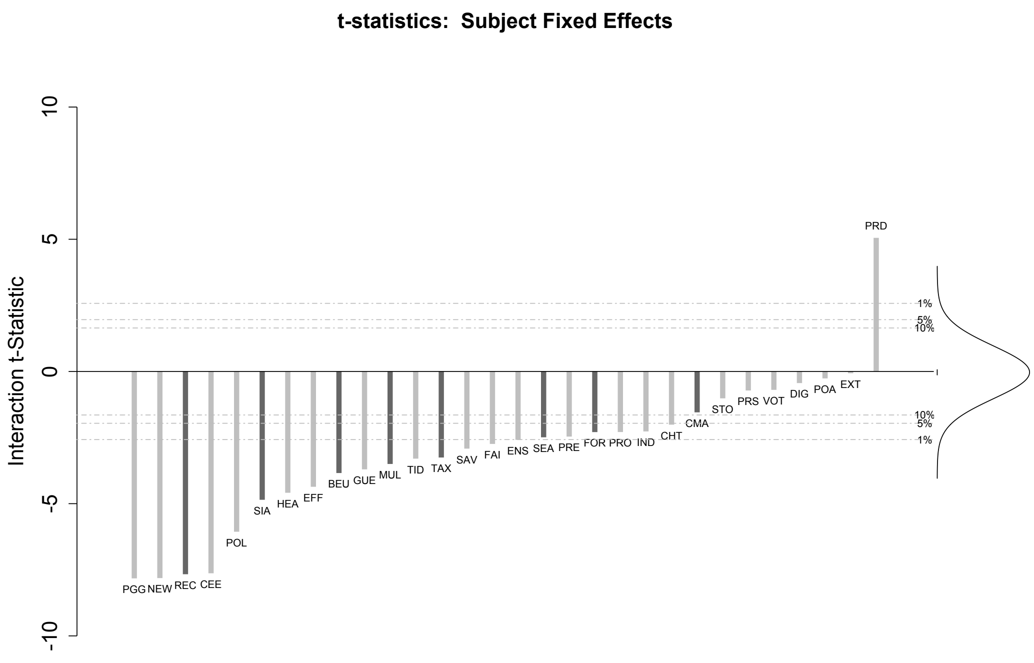


Figure 14: Sensitivity to parameters and cognitive uncertainty within subjects. The figure plots the t-statistic associated with $\hat{\beta}^e$, when estimating (1) controlling for subject fixed effects.

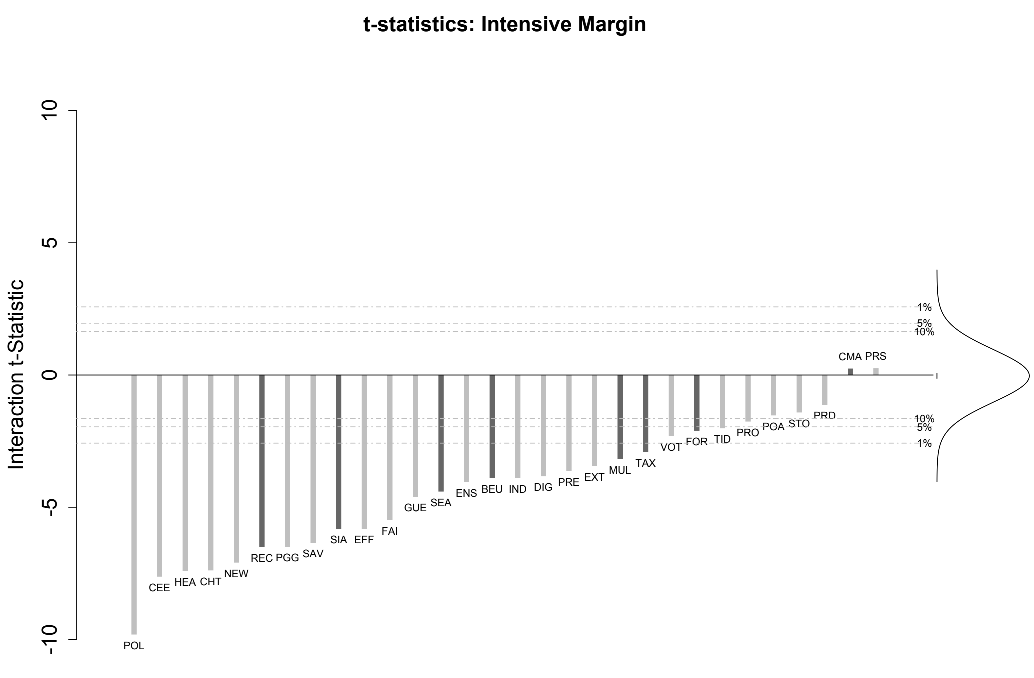


Figure 15: Sensitivity to parameters and cognitive uncertainty within subjects. The figure plots the t-statistic associated with $\hat{\beta}^e$, when estimating (1), restricting only to subjects with $CU > 0$.

B.4 Additional Tables

	BEU	CEE	CHT	CMA	DIG	EFF	ENS	EXT	FAI	FOR
Intercept	-0.00	0.06^{***}	0.04	18.79^{***}	-27.51^{***}	2.96^{***}	-4724.98^{***}	3.72^{***}	-51.85^{***}	23.15^{***}
	(0.08)	(0.01)	(0.04)	(2.11)	(2.04)	(0.70)	(23.63)	(0.43)	(1.92)	(5.45)
Par.	0.88^{***}	0.83^{***}	0.06^{***}	0.62^{***}	28.52^{***}	29.97^{***}	0.03^{***}	1.26^{***}	46.73^{***}	0.72^{***}
	(0.03)	(0.02)	(0.00)	(0.04)	(2.24)	(2.28)	(0.00)	(0.12)	(2.42)	(0.06)
CU	-0.24^{*}	0.27^{***}	0.30	2.05	-7.23	7.24^{***}	150.86^{**}	2.21^{**}	8.46^{*}	27.94^{*}
	(0.14)	(0.05)	(0.20)	(3.61)	(5.96)	(1.96)	(64.46)	(1.08)	(5.03)	(15.79)
Par. × CU	-0.45^{***}	-0.74^{***}	-0.07^{***}	-0.09	-16.32^{*}	-51.95^{***}	-0.03^{***}	-1.07^{***}	-32.37^{***}	-0.46^{***}
	(0.11)	(0.09)	(0.01)	(0.07)	(8.44)	(7.76)	(0.01)	(0.31)	(8.14)	(0.17)
FE	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO
R^2	0.72	0.65	0.37	0.56	0.27	0.19	0.18	0.08	0.41	0.09
Num. obs.	2340	2259	2250	2871	2268	2530	2783	2500	2277	2250

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.
Robust standard errors, clustered on subject-level.

Table 3: Separate estimates of equation (1) from the body of the paper for each of ten experiments. The dependent variable is the decision subjects take, while "'Par." is the main decision-relevant parameter in the experiment. See A.1 for the details for each task.

	GUE	HEA	IND	MUL	NEW	PGG	POA	POL	PRD	PRE
Intercept	26.23^{***}	1.89^{***}	0.17^{**}	24.27^{***}	-99.98^{***}	0.54	419.05^{***}	-98.44^{***}	-0.16^{***}	0.13^{***}
	(3.03)	(0.44)	(0.07)	(2.95)	(1.03)	(2.30)	(34.08)	(2.02)	(0.06)	(0.01)
Par.	15.85^{***}	1.05^{***}	1.39^{***}	89.52^{***}	7.58^{***}	19.03^{***}	27.77^{***}	5.32^{***}	0.14^{***}	0.88^{***}
	(1.12)	(0.04)	(0.05)	(4.70)	(0.17)	(0.69)	(2.55)	(0.11)	(0.02)	(0.01)
CU	7.68^{*}	8.32^{***}	1.27^{***}	15.22^{**}	37.64^{***}	31.66^{***}	-111.48	67.83^{***}	0.44	0.07^{**}
	(4.29)	(0.98)	(0.22)	(6.61)	(4.23)	(6.59)	(77.88)	(8.40)	(0.29)	(0.03)
Par. × CU	-9.94^{***}	-1.02^{***}	-0.95^{***}	-42.95^{***}	-4.03^{***}	-24.70^{***}	-15.55^{**}	-6.54^{***}	0.03	-0.42^{***}
	(2.00)	(0.10)	(0.23)	(11.06)	(0.44)	(2.28)	(6.94)	(0.55)	(0.08)	(0.09)
FE	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
R^2	0.32	0.46	0.44	0.52	0.74	0.40	0.28	0.54	0.10	0.76
Num. obs.	2500	2520	2277	2250	2268	2530	2750	2520	2761	2268

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.
Robust standard errors, clustered on subject-level.

Table 4: Separate estimates of equation (1) from the body of the paper for each of ten experiments. The dependent variable is the decision subjects take, while "'Par." is the main decision-relevant parameter in the experiment. See A.1 for the details for each task.

	PRO	PRS	REC	SAV	SEA	SIA	STO	TAX	TID	VOT
Intercept	0.45	43.19***	46.27***	22.29***	14.06***	0.02	96.93***	85.42	0.23***	−1.01***
	(0.48)	(1.81)	(5.42)	(2.67)	(3.67)	(0.02)	(3.26)	(124.29)	(0.03)	(0.02)
Par.	1.55***	0.26***	0.63***	1.54***	0.68***	0.96***	0.04***	0.97***	0.00***	0.00***
	(0.07)	(0.06)	(0.04)	(0.06)	(0.05)	(0.03)	(0.00)	(0.02)	(0.00)	(0.00)
CU	1.60	3.67	45.68***	−3.05	10.74*	0.23***	−1.04	2117.90**	1.02***	0.66***
	(1.26)	(5.05)	(9.42)	(6.59)	(6.44)	(0.04)	(5.93)	(934.56)	(0.17)	(0.11)
Par. × CU	−0.46**	0.00	−0.58***	−1.89***	−0.48***	−0.42***	−0.01	−0.26***	−0.00***	−0.00*
	(0.19)	(0.14)	(0.07)	(0.22)	(0.10)	(0.08)	(0.01)	(0.07)	(0.00)	(0.00)
FE	YES	NO	NO	NO	NO	NO	YES	NO	NO	NO
R^2	0.39	0.04	0.22	0.31	0.28	0.64	0.30	0.82	0.29	0.12
Num. obs.	2570	2510	1632	2520	2500	2421	2510	2517	2500	2520

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.
Robust standard errors, clustered on subject-level.

Table 5: Separate estimates of equation (1) from the body of the paper for each of ten experiments. The dependent variable is the decision subjects take, while "'Par." is the main decision-relevant parameter in the experiment. See A.1 for the details for each task.

C Replication of Results with Pre-Registered Sample

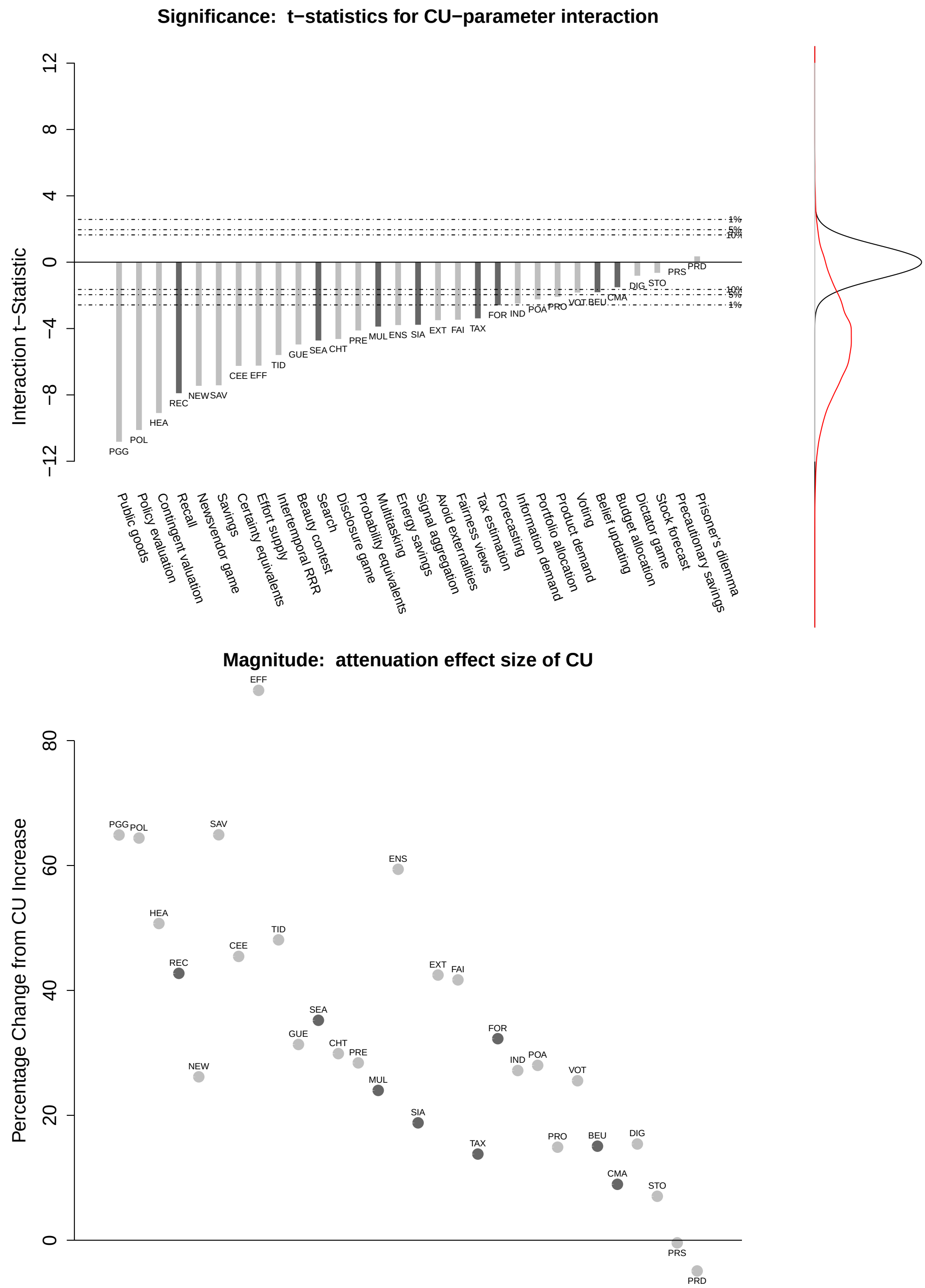


Figure 16: Replication with pre-registered sample. Behavioral attenuation and cognitive uncertainty. The top panel plots the t-statistic associated with $\hat{\beta}^e$ in (1). For comparison, we plot a standard normal distribution in black. The red distribution shows the distribution of adjusted t-statistics from a meta analysis (Bayesian hierarchical regression). The bottom panel plots $\hat{\phi}^e$. Tasks displayed in black have objectively correct solutions, while those displayed in grey are subjective decision problems that involve unknown (to us as researchers) preferences or information sets.

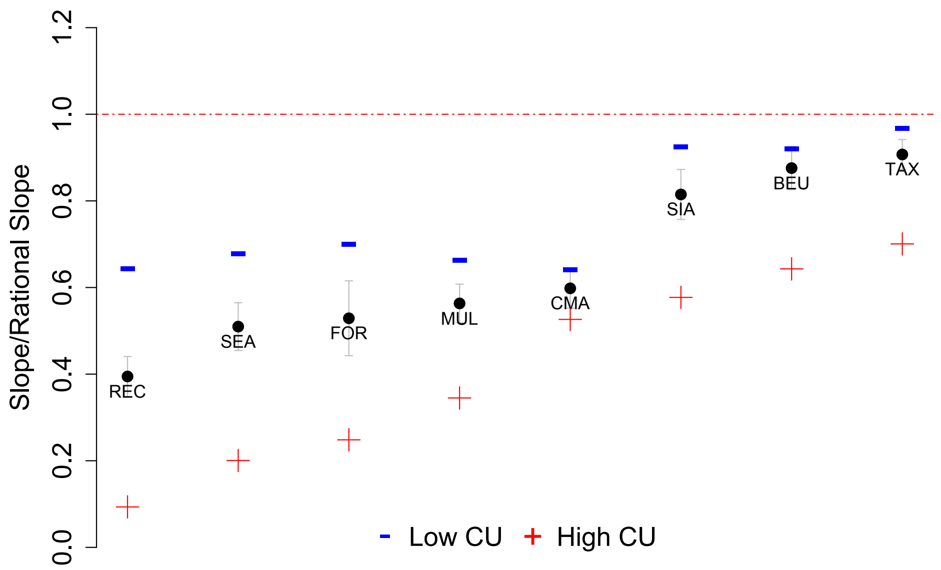


Figure 17: Replication with pre-registered sample. Behavioral attenuation relative to normative benchmarks in objective tasks. For each task, the black dot plots $\hat{\omega}^e/\omega_R^e$ and 95% CIs, see equation (4). The red and blue dots correspond to the fitted values of equation (1) for $CU = 0\%$ (blue) and $CU = 100\%$ (red).

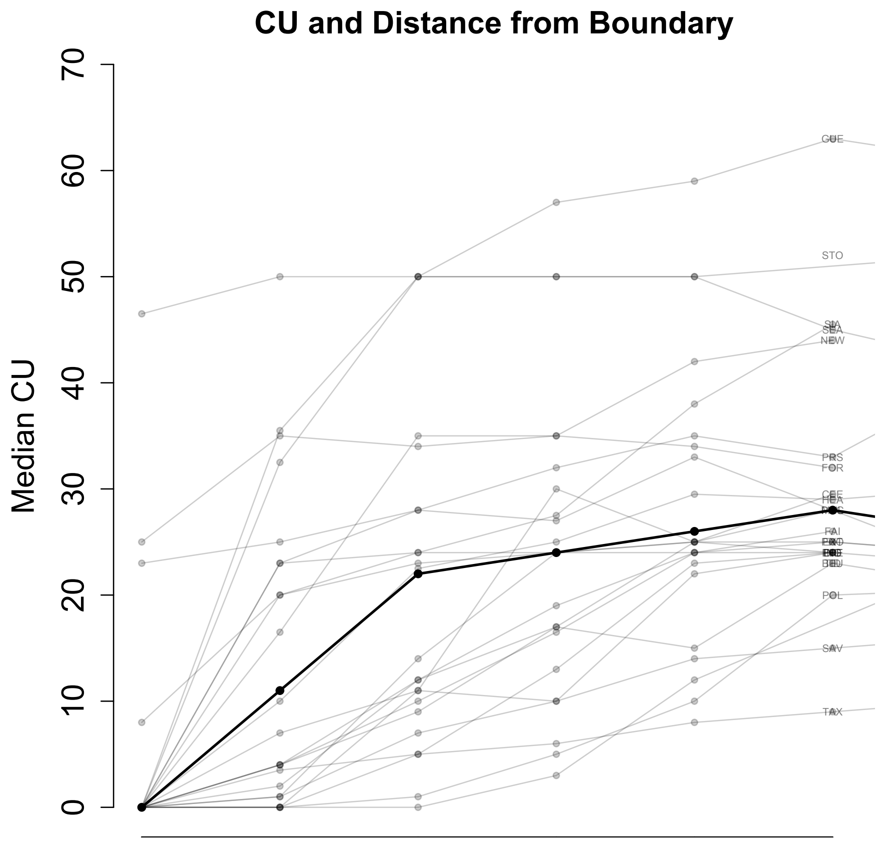


Figure 18: Replication with pre-registered sample. Median cognitive uncertainty as a function of distance to the nearest boundary point (measured in ordinal ranks), separately for each experiment. Solid line shows overall median across all experiments. Sample includes those 25 experiments for which we pre-registered at least one potential simple point at the boundary of the parameter space.

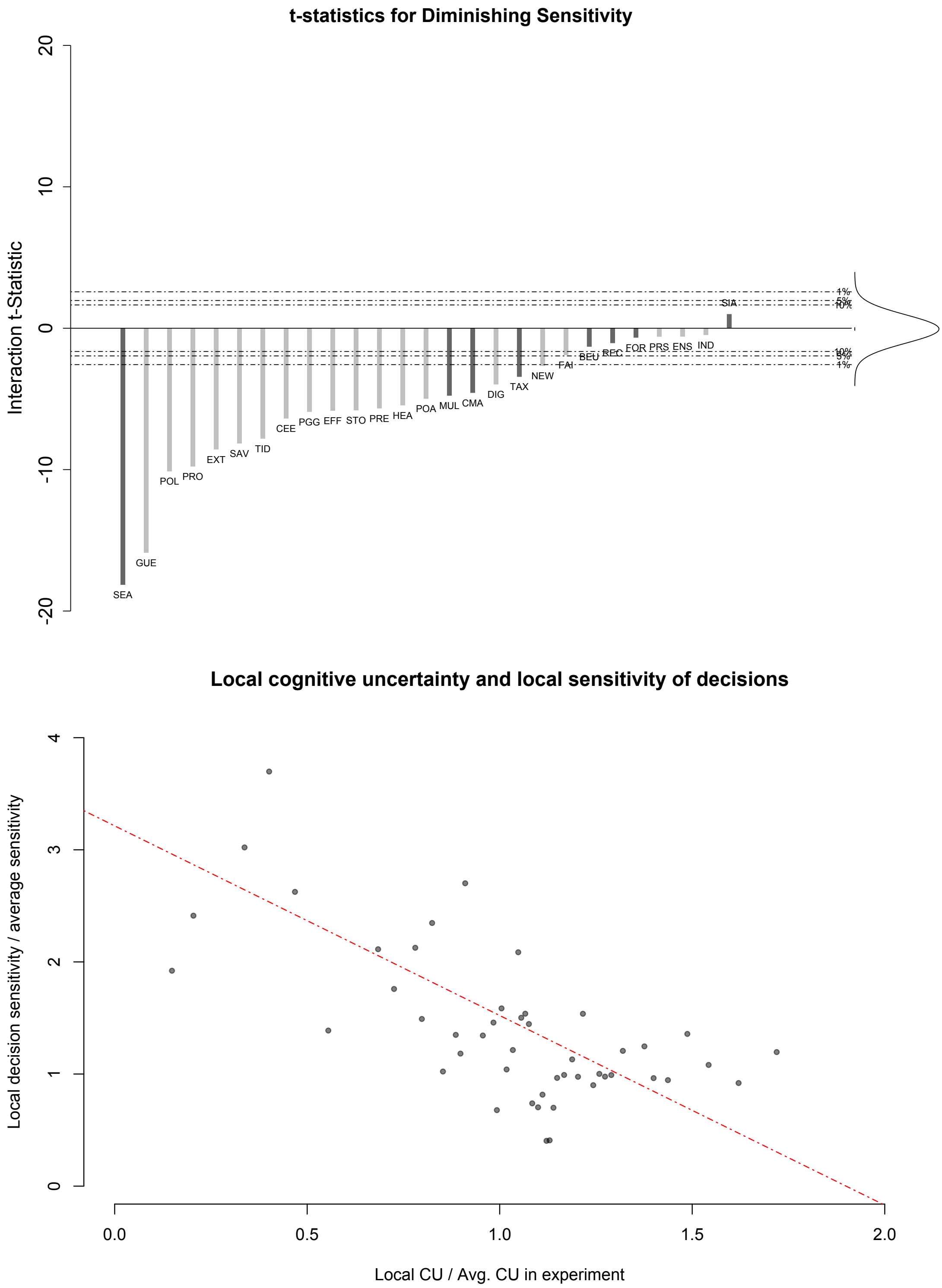


Figure 19: Replication with pre-registered sample. Top panel: Distribution of t-statistics for diminishing sensitivity ($\hat{\beta}_d^e$ in eq. (5)). Bottom panel: Binned scatter plot of the correlation between local *CU* at θ_j (normalized by average *CU* in the experiment) and the local sensitivity of decisions at parameters $\{\theta_{j-1}, \theta_j, \theta_{j+1}\}$ (normalized by the average sensitivity in the experiment). In both panels, we restrict attention to experiments that (i) have a simple boundary point and (ii) are not binary choice tasks. In the bottom panel, an observation is a task-parameter (252 observations), binned into 50 buckets to ease readability.

D The Bounds of Attenuation

In this Section we discuss several findings and diagnostic treatments that point to the robustness and limits of behavioral attenuation.

Stake size, cognitive effort and demographics. To what degree does attenuation reflect low stakes, low cognitive effort or demographics – three common sources of explanation for deviations from standard predictions? To study this, Table 6 presents OLS regressions in which the dependent variable is the subject-level slope (sensitivity) of decisions, computed in a standardized way across experiments.[23] Recall that a lower slope means more attenuation.

Column (1) shows that a tenfold increase in incentives – implemented in experiments BEU, CMA, REC, SIA and VOT – does not significantly affect attenuation. We take this as tentative evidence for the robustness of the attenuation phenomenon, but we do not wish to suggest that we believe attenuation will always be independent of the stake size.

Column (2) documents that longer completion times in the experiment are associated with *more* attenuation – a finding that is seemingly at odds with the idea that attenuation merely reflects laziness. Rather, this correlation suggests that subjects who have greater difficulty thinking through a problem take longer to think, yet still exhibit attenuation. Column (3) controls for demographics, showing that older people and women exhibit stronger attenuation.

Given the explanatory power of *CU* for attenuation, researchers may be interested in which variables correlate with or predict it. Columns (4)–(7) of Table 6 present OLS regressions in which the dependent variable is decision-level *CU*, normalized by average *CU* in the experiment for comparability. First, again, the increase in incentives did not affect *CU*. Second, a longer response time in a given decision is associated with higher *CU*, while a longer completion time in the study as a whole is associated with lower *CU*. A potential interpretation of this is that subjects who exert higher cognitive effort as a whole exhibit lower uncertainty, yet whenever they find a particular decision difficult, they both take longer and exhibit higher uncertainty.

Bound #1: Rational elasticity of zero. Intuitively, behavioral attenuation arises because people often know the sign but not the magnitude of comparative statics. For ex-

[23]Specifically, for each subject i, we estimate

$$a^e_{i,j} = \nu^e_i + \omega^e_i\,\theta^e_j + \sum_x \chi^e d^e_x + u^e_{i,j}\,, \tag{9}$$

and then divide the estimate $\hat{\omega}^e_i$ by $\hat{\omega}^e$ (the estimate obtained in the full sample of subjects). As always when we look at attenuation (rather than diminishing sensitivity), this analysis excludes the pre-registered potential simple points.

Table 6: Correlates and predictors of attenuation and *CU*

	Subject-level decision slope			Decision-level *CU*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1 if (incentives x 10)	0.059	0.061	0.059	−0.028	−0.019	−0.003	0.016
	(0.041)	(0.041)	(0.041)	(0.037)	(0.038)	(0.038)	(0.048)
Log [Completion time experiment] (std.)		−0.030***	−0.026***		−0.067***	−0.062***	−0.061***
		(0.008)	(0.008)		(0.009)	(0.009)	(0.010)
Age			−0.002***			−0.003***	−0.003***
			(0.001)			(0.001)	(0.001)
1 if female			−0.052***			0.133***	0.134***
			(0.016)			(0.016)	(0.018)
Log [Response time decision] (std.)					0.117***	0.116***	0.112***
					(0.006)	(0.006)	(0.006)
Distance from boundary (rank, 0-11)							0.064***
							(0.002)
Experiment fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.005	0.007	0.009	0.000	0.013	0.019	0.047
Num. obs.	7604	7604	7572	82281	80903	80567	69152

Notes. OLS estimates, robust standard errors in parentheses (columns (4)–(7) clustered at subject level). Observations include data from all experiments. In columns (1)–(3), the dependent variable is $\hat{\omega}_i$, divided by the overall (across-subject) $\hat{\omega}$ in the respective experiment, and then winsorized at the 5th and 95th percentile. In columns (4)–(7), the dependent variable is decision-level *CU*, divided by average *CU* (across all decisions and subjects) in the respective experiment. Time variables are standardized into z-scores within each experiment. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

ample, even without intensive information processing, people know that they will want to invest more when expected returns are higher, but determining how much more exactly is difficult. This intuition suggests that there may be situations in which the opposite of behavioral attenuation will be present: when the utility-maximizing elasticity of decisions to fundamentals is tiny or even zero. In these cases, people don't know how much to respond, and because the normative change is small, they may be excessively sensitive.

Because of this, we deliberately requested proposals from our experts in which there was an expected strong monotonic relationship between parameter and response. However, the experiment proposed by one of our experts, Sandro Ambuehl, was explicitly designed to illuminate this limit of behavioral attenuation. As discussed in Section 3.2, the main feature of the RIA experiment is that – under a fully rational model without information-processing costs – the elasticity of the decision (accept or reject a positive expected-value lottery) to variation in the fundamental (the expected value of the lottery) is zero because the DM can determine whether the lottery upside or downside will realize by verifying a few mathematical equations. Because of the illustrative potential of this task we included it in our design even though it is structurally different from all other tasks; we did this with the explicit intention (shared with Ambuehl ahead of time) to include it as a test of the limits of the phenomenon, rather than as a baseline task.

In this experiment, we find, as expected, that decisions that are associated with higher *CU* are slightly more sensitive to variation in the problem parameter, though this relationship is not statistically significant.[24] Note that we used a smaller sample size than

[24]Formally, the regression coefficient $\hat{\beta}^e$ in equation (1) is positive, with $p = 0.32$.

the experiment that motivated our study setup. It is thus conceivable that we would have found a statistically significant positive interaction coefficient had we opted for a larger sample.

Bound #2: Joint evaluations. Following the literature on joint vs. separate evaluations (Hsee et al., 1999), we hypothesized that people may become less attenuated to economic fundamentals when they are prodded to directly compare different circumstances, i.e., when they are asked to reason through their responses to counterfactual values of the decision-relevant parameter. For instance, people's savings decisions may become less attenuated to the interest rate when they not only ask themselves "How much do I save when the interest rate is 3%?", but also "How much would I save if the interest rate was 1% or 5%?"

Building on this intuition, we ran a pre-registered variant ("*Joint*") of two of our experiments: savings as a function of the interest rate (SAV, a subjective task) and allocation between two tasks in a multitasking environment (MUL, an objective task). In both experiments, subjects received the same instructions as in the corresponding baseline treatments. However, before they made their decisions, they encountered an additional screen on which they were asked to indicate which (hypothetical) decision they would take if the relevant problem parameter was either very small or very large. Later, on their actual decision screens, subjects were reminded of their answers to this hypothetical question, inducing a direct joint evaluation of the different problems. This is similar to the design in Yang (2023), who documents that people's investment decisions become substantially less attenuated to their return expectations after they are asked to indicate their hypothetical investment behavior for a large set of different potential return expectations.

We ran each of these pre-registered treatments along with a replication of our baseline experiments (randomized within experimental sessions) with 100 subjects each, for a total of 400 subjects.[25] Figure 20 shows the results. We find that the slope of decisions with respect to fundamentals is significantly higher in the *Joint* treatment in the MUL experiment ($p < 0.05$) but not in the SAV experiment. We view this as providing tentative evidence that behavioral attenuation can be corrected by external parties via framing, at least in some circumstances. Alternative implementations of this intervention might lead to more consistent results, but our findings suggest that behavioral attenuation may be more robust than we originally hypothesized.

[25]The 100 subjects in the baseline condition of SAV are part of our main dataset because they were collected after the initial pre-registered data collection. The *Joint* treatments were run simultaneously with the additional data collection for the baseline experiments.

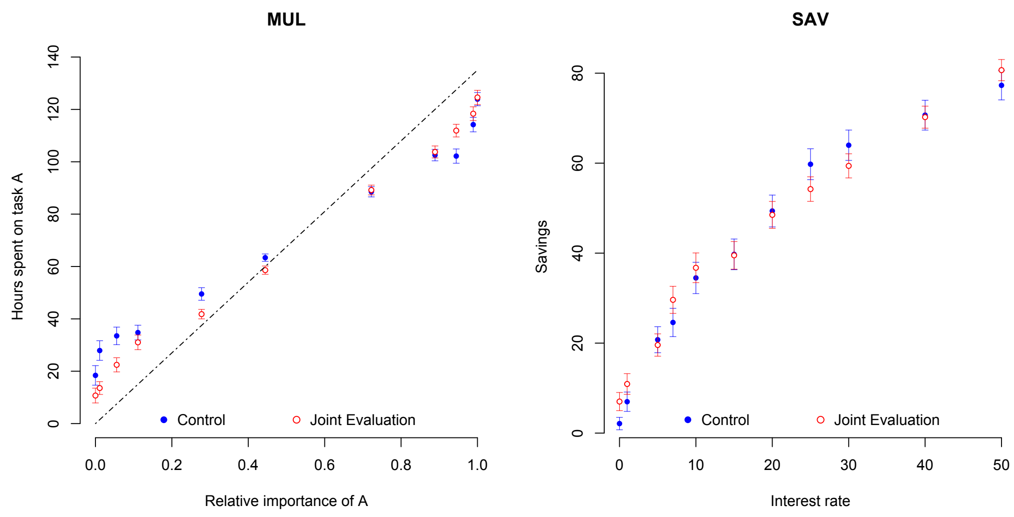


Figure 20: Raw data for the *Joint* treatment in tasks MUL and SAV.

E Derivations for Theoretical Framework

In our formal framework, we follow Ilut and Valchev (2023) who model policy function uncertainty using Gaussian processes. Given a known parameter value θ, the DM faces a decision problem $\max_a U(a,\theta)$, where the optimal action $a^*(\theta) \in \operatorname{argmax}_a U(a,\theta)$ is unique, and the *policy function* $a^*(\theta)$ is differentiable and monotonically increasing.

Note that $a^*(\theta)$ can be expressed as a projection of a complete set of Gaussian basis functions:

$$a^*(\theta) = \int \beta_w \phi_w(\theta)\, dw$$
$$\phi_w(\theta) = \exp(-\psi(\theta - w))$$

The weights of this projection $\{\beta_w\}_{w\in\mathbb{R}}$ are unknown to the DM, reflecting uncertainty over the policy function. In particular, the DM's priors over β_w are independent and Gaussian-distributed with mean $\overline{\beta}_w$ and constant variance. Letting

$$a_d(\theta) \equiv \int \overline{\beta}_w \exp(-\psi(\theta - w))\, dw$$

denote the DM's *default policy function*, we make the restriction that the prior means of the basis weights $\overline{\beta}_w$ are such that $a_d(\theta)$ is weakly increasing in θ — again, the idea is that the DM correctly understands that her action should be increasing in the parameter. Given this structure, Lemma 1 of Illut and Valchev (2023) implies that for any parameter

θ, the DM's prior distribution over $a^*(\theta)$ is given by

$$a^*(\theta) \sim N(a_d(\theta), \sigma_0^2)$$

for some $\sigma_0^2 > 0$. Given this fact, the rest of the analysis is routine. The DM has access to a cognitive signal over the her optimal action at the parameter value θ:

$$s(\theta) \sim N(a^*(\theta), \sigma_a^2(\theta))$$

where $\sigma_a^*(\theta)$ denotes the level of *cognitive noise* in the DM's deliberation process. The DM then takes the decision $a(\theta)$ equal to her Bayesian posterior mean over $a^*(\theta)$, given her prior and the signal realization $s(\theta)$.

Given the Gaussian prior and signal, a routine derivation shows that the DM's posterior distribution over $a^*(\theta)$ given the signal realization $s(\theta)$ is given by

$$\begin{aligned} a^*(\theta)|s(\theta) &\sim N(a(\theta), \tilde{\sigma}_a^2(\theta)), \text{ where} \\ a(\theta) &= \lambda s(\theta) + (1-\lambda)a_d(\theta) \\ \tilde{\sigma}_a^2(\theta) &= \lambda \sigma_a^2(\theta) \\ \lambda &= \frac{\sigma_0^2}{\sigma_a^2(\theta) + \sigma_0^2} \end{aligned}$$

We now state and prove two generalizations of the predictions in the main text, which allow for the default policy function $a_d(\theta)$ to be non-constant. The following proposition corresponds to Prediction 1 in the main text.

Proposition 3. *(Cognitive Noise and Attenuation). Suppose $\frac{\partial}{\partial\theta}a^*(\theta) > \frac{\partial}{\partial\theta}a_d(\theta)$. If $|\sigma_a'(\theta)|$ is sufficiently small, then $\frac{\partial}{\partial\theta}E[a(\theta)]$ is decreasing in $\sigma_a(\theta)$.*

Proof. Consider the case where $\sigma_a'(\theta) = 0$. We have

$$\frac{\partial}{\partial\theta}E[a(\theta)] = \lambda\frac{\partial}{\partial\theta}a^*(\theta) + (1-\lambda)\frac{\partial}{\partial\theta}a_d(\theta)$$

which in turn implies

$$\begin{aligned} \frac{\partial}{\partial\sigma_a(\theta)}\frac{\partial}{\partial\theta}E[a(\theta)] &= -\frac{\sigma_0^2}{(\sigma_a^2(\theta)+\sigma_0^2)^2}\left[\frac{\partial}{\partial\theta}a^*(\theta) - \frac{\partial}{\partial\theta}a_d(\theta)\right] \\ &< 0 \end{aligned}$$

since $\frac{\partial}{\partial\theta}a^*(\theta) > \frac{\partial}{\partial\theta}a_d(\theta)$. By continuity, there exists $\epsilon > 0$ such that for $|\sigma_a'(\theta)| < \epsilon$, we maintain $\frac{\partial}{\partial\sigma_a(\theta)}\frac{\partial}{\partial\theta}E[a(\theta)] < 0$. □

We now turn to Prediction 2 in the main text. Say that $a_d(\theta)$ is *interior* if for θ large enough, we have $a_d(\theta) < a^*(\theta)$ and for θ small enough, we have $a_d(\theta) > a^*(\theta)$.

Proposition 4. *(Cognitive Noise and Diminishing Sensitivity). Suppose $\frac{\partial}{\partial\theta}a^*(\theta) > \frac{\partial}{\partial\theta}a_d(\theta)$, and that $a_d(\theta)$ is interior. For $|\frac{\partial^2}{\partial\theta^2}a^*(\theta)|$ and $|\frac{\partial^2}{\partial\theta^2}a_d(\theta)|$ sufficiently small, we have the following:*

(a) Suppose $\underline{\theta}$ exists. There exists a neighborhood around $\underline{\theta}$ such that for any $\theta < \theta'$ in that neighborhood with $0 < \frac{\partial}{\partial\underline{\delta}}\sigma_a^2(\theta') \leq \frac{\partial}{\partial\underline{\delta}}\sigma_a^2(\theta)$: if $\sigma_a(\theta) < \sigma_a(\theta')$ then $\frac{\partial}{\partial\theta}E[a(\theta)] > \frac{\partial}{\partial\theta}E[a(\theta')]$.

Suppose $\overline{\theta}$ exists. There exists a neighborhood around $\overline{\theta}$ such that for any $\theta > \theta'$ in that neighborhood with $0 < \frac{\partial}{\partial\overline{\delta}}\sigma_a^2(\theta') \leq \frac{\partial}{\partial\overline{\delta}}\sigma_a^2(\theta)$: if $\sigma_a(\theta) < \sigma_a(\theta')$ then $\frac{\partial}{\partial\theta}E[a(\theta)] > \frac{\partial}{\partial\theta}E[a(\theta')]$.

(b) Suppose $\underline{\theta}$ exists. If $\frac{\partial}{\partial\underline{\delta}}\sigma_a(\theta) > 0$ and $\frac{\partial^2}{\partial\underline{\delta}^2}\sigma_a^2(\theta) \leq 0$ in a neighborhood around $\underline{\theta}$, then $\frac{\partial}{\partial\theta}E[a(\theta)]$ is decreasing in $\underline{\delta}(\theta)$ in a neighborhood around $\underline{\theta}$.

Suppose $\overline{\theta}$ exists. If $\frac{\partial}{\partial\overline{\delta}}\sigma_a(\theta) > 0$ and $\frac{\partial^2}{\partial\overline{\delta}^2}\sigma_a^2(\theta) \leq 0$ in a neighborhood around $\overline{\theta}$, then $\frac{\partial}{\partial\theta}E[a(\theta)]$ is decreasing in $\overline{\delta}(\theta)$ in a neighborhood around $\overline{\theta}$.

Proof. Begin by proving the first statement of part a) of the proposition. Consider the case where $\frac{\partial^2}{\partial\theta^2}a^*(\theta) = \frac{\partial^2}{\partial\theta^2}a_d(\theta) = 0$, and let $\gamma = \frac{\partial}{\partial\theta}a^*(\theta)$. Let $N(\underline{\theta})$ denote the neighborhood around $\underline{\theta}$ such that for any $\theta \in N(\underline{\theta})$, $a^*(\theta) < a_d(\theta)$; this neighborhood is guaranteed to be non-empty since $a_d(\theta)$ is intermediate.

Now take any $\theta, \theta' \in N(\underline{\theta})$ with $\theta < \theta'$, $\frac{\partial}{\partial\underline{\delta}}\sigma_a^2(\theta') \leq \frac{\partial}{\partial\underline{\delta}}\sigma_a^2(\theta)$, and $\sigma_a(\theta) < \sigma_a(\theta')$. Note that

$$\frac{\partial}{\partial\theta}E[a(\theta)] = \frac{\partial}{\partial\theta}\lambda(\theta)(a^*(\theta) - a_d(\theta)) + \lambda(\theta)\gamma$$
$$\frac{\partial}{\partial\theta}E[a(\theta')] = \frac{\partial}{\partial\theta}\lambda(\theta')(a^*(\theta') - a_d(\theta')) + \lambda(\theta')\gamma$$

We want to show that $\frac{\partial}{\partial\theta}E[a(\theta')] < \frac{\partial}{\partial\theta}E[a(\theta)]$. Since $\sigma_a(\theta) < \sigma_a(\theta') \implies \lambda(\theta') < \lambda(\theta)$, it suffices to show that $\frac{\partial}{\partial\theta}\lambda(\theta')(a^*(\theta') - a_d(\theta')) < \frac{\partial}{\partial\theta}\lambda(\theta)(a^*(\theta) - a_d(\theta))$. To see this, note that $a^*(\theta) - a_d(\theta) < a^*(\theta') - a_d(\theta') < 0$ since $\theta, \theta' \in N(\underline{\theta})$ and $\frac{\partial}{\partial\theta}a^*(\theta) >$

$\frac{\partial}{\partial\theta}a_d(\theta)$. In addition, we have

$$\begin{aligned}\frac{\partial}{\partial\theta}\lambda(\theta) &= -\frac{\sigma_0^2}{(\sigma_0^2+\sigma_a^2(\theta))^2}\frac{\partial}{\partial\theta}\sigma_a^2(\theta)\\ &\leq -\frac{\sigma_0^2}{(\sigma_0^2+\sigma_a^2(\theta'))^2}\frac{\partial}{\partial\theta}\sigma_a^2(\theta')\\ &= \frac{\partial}{\partial\theta}\lambda(\theta')\end{aligned}$$

since by assumption we have $\sigma_a(\theta) < \sigma_a^2(\theta')$ and $\frac{\partial}{\partial\underline{\delta}}\sigma_a^2(\theta') < \frac{\partial}{\partial\underline{\delta}}\sigma_a^2(\theta) \implies \frac{\partial}{\partial\theta}\sigma_a^2(\theta') < \frac{\partial}{\partial\theta}\sigma_a^2(\theta)$, and so the desired inequality obtains; for any $\theta, \theta' \in N(\underline{\theta})$ with $\theta < \theta'$, $\frac{\partial}{\partial\underline{\delta}}\sigma_a^2(\theta') \leq \frac{\partial}{\partial\underline{\delta}}\sigma_a^2(\theta)$, and $\sigma_a(\theta) < \sigma_a(\theta')$, we have $\frac{\partial}{\partial\theta}E[a(\theta')] < \frac{\partial}{\partial\theta}E[a(\theta)]$. By continuity, we can conclude that there exists some $\epsilon > 0$ such that when $|\frac{\partial^2}{\partial\theta^2}a^*(\theta)| < \epsilon$ and $|\frac{\partial^2}{\partial\theta^2}a_d(\theta)| < \epsilon$ such that the above statement continues to hold. The proof of the second statement of part a) follows from an analogous argument.

We now prove the first statement of part b) of the proposition. Consider the case where $\frac{\partial^2}{\partial\theta^2}a^*(\theta) = \frac{\partial^2}{\partial\theta^2}a_d(\theta) = 0$. Suppose $\frac{\partial}{\partial\underline{\delta}}\sigma_a(\theta) > 0$ and $\frac{\partial^2}{\partial\underline{\delta}^2}\sigma_a^2(\theta) \leq 0$ in a neighborhood around $\underline{\theta}$. Since $a_d(\theta)$ is interior, there exists a neighborhood around $\underline{\theta}$ for which $\frac{\partial}{\partial\underline{\delta}}\sigma_a(\theta) > 0$, $\frac{\partial^2}{\partial\underline{\delta}^2}\sigma_a^2(\theta) \leq 0$, and $a_d(\theta) > a^*(\theta)$. Note that for θ in this neighborhood, we have

$$\begin{aligned}\frac{\partial}{\partial\underline{\delta}}\frac{\partial}{\partial\theta}E[a(\theta)] &= \frac{\partial^2}{\partial\theta^2}E[a(\theta)]\\ &= \left(\frac{\partial^2}{\partial\theta^2}\lambda\right)[a^*(\theta)-a_d(\theta)] + 2\left(\frac{\partial}{\partial\theta}\lambda\right)\left[\frac{\partial}{\partial\theta}a^*(\theta) - \frac{\partial}{\partial\theta}a_d(\theta)\right]\end{aligned}$$

To see that the second term is strictly negative, note that by assumption $\frac{\partial}{\partial\theta}a^*(\theta) - \frac{\partial}{\partial\theta}a_d(\theta) > 0$ and

$$\frac{\partial}{\partial\theta}\lambda = -\frac{\sigma_0^2}{(\sigma_a^2(\theta)+\sigma_0^2)^2}\frac{\partial}{\partial\theta}\sigma_a^2(\theta) < 0$$

since by assumption $\frac{\partial}{\partial\theta}\sigma_a^2(\theta) = \frac{\partial}{\partial\underline{\delta}}\sigma_a^2(\theta) > 0$. To see that the first term is strictly negative, note that by assumption $a^*(\theta) - a_d(\theta) < 0$ and

$$\begin{aligned}\frac{\partial^2}{\partial\theta^2}\lambda &= -\frac{\sigma_0^2}{(\sigma_a^2(\theta)-\sigma_0^2)^2}\cdot\frac{\partial}{\partial\theta^2}\sigma_a^2(\theta) + 2\frac{\sigma_0^2}{(\sigma_a^2(\theta)-\sigma_0^2)^3}\cdot\left(\frac{\partial}{\partial\theta}\sigma_a^2(\theta)\right)^2\\ &= -\frac{\sigma_0^2}{(\sigma_a^2(\theta)-\sigma_0^2)^2}\cdot\frac{\partial}{\partial\underline{\delta}^2}\sigma_a^2(\theta) + 2\frac{\sigma_0^2}{(\sigma_a^2(\theta)-\sigma_0^2)^3}\cdot\left(\frac{\partial}{\partial\theta}\sigma_a^2(\theta)\right)^2\\ &> 0\end{aligned}$$

since by assumption $\frac{\partial^2}{\partial \underline{\delta}^2}\sigma_a^2(\theta) \leq 0$. We therefore have $\frac{\partial}{\partial \underline{\delta}}\frac{\partial}{\partial \theta}E[a(\theta)] < 0$. By continuity, we can conclude that there exists some $\epsilon > 0$ such that when $|\frac{\partial^2}{\partial \theta^2}a^*(\theta)| < \epsilon$ and $|\frac{\partial^2}{\partial \theta^2}a_d(\theta)| < \epsilon$, we have $\frac{\partial}{\partial \underline{\delta}}\frac{\partial}{\partial \theta}E[a(\theta)] < 0$ in a neighborhood around $\underline{\theta}$.

We now prove the second statement of part b). Consider the case where $\frac{\partial^2}{\partial \theta^2}a^*(\theta) = \frac{\partial^2}{\partial \theta^2}a_d(\theta) = 0$. Suppose $\frac{\partial}{\partial \overline{\delta}}\sigma_a(\theta) > 0$ and $\frac{\partial^2}{\partial \overline{\delta}^2}\sigma_a^2(\theta) \leq 0$ in a neighborhood around $\overline{\theta}$. Since $a_d(\theta)$ is interior, there exists a neighborhood around $\overline{\theta}$ for which $\frac{\partial}{\partial \overline{\delta}}\sigma_a(\theta) > 0$, $\frac{\partial^2}{\partial \overline{\delta}^2}\sigma_a^2(\theta) \leq 0$, and $a_d(\theta) < a^*(\theta)$. Note that for θ in this neighborhood, we have

$$
\begin{aligned}
\frac{\partial}{\partial \underline{\delta}}\frac{\partial}{\partial \theta}E[a(\theta)] &= -\frac{\partial^2}{\partial \theta^2}E[a(\theta)] \\
&= -\left(\frac{\partial^2}{\partial \theta^2}\lambda\right)[a^*(\theta) - a_d(\theta)] - 2\left(\frac{\partial}{\partial \theta}\lambda\right)\left[\frac{\partial}{\partial \theta}a^*(\theta) - \frac{\partial}{\partial \theta}a_d(\theta)\right]
\end{aligned}
$$

To see that the second term is negative, note that by assumption $\frac{\partial}{\partial \theta}a^*(\theta) - \frac{\partial}{\partial \theta}a_d(\theta) > 0$ and that

$$
\begin{aligned}
\frac{\partial}{\partial \theta}\lambda &= -\frac{\sigma_0^2}{(\sigma_a^2(\theta) + \sigma_0^2)^2}\frac{\partial}{\partial \theta}\sigma_a^2(\theta) \\
&= \frac{\sigma_0^2}{(\sigma_a^2(\theta) + \sigma_0^2)^2}\frac{\partial}{\partial \overline{\theta}}\sigma_a^2(\theta) > 0
\end{aligned}
$$

since $\frac{\partial}{\partial \overline{\theta}}\sigma_a^2(\theta) > 0$ by assumption. To see that the first term is negative, note that $a^*(\theta) - a_d(\theta) > 0$ by assumption and that

$$
\begin{aligned}
\frac{\partial^2}{\partial \theta^2}\lambda &= -\frac{\sigma_0^2}{(\sigma_a^2(\theta) - \sigma_0^2)^2} \cdot \frac{\partial}{\partial \theta^2}\sigma_a^2(\theta) + 2\frac{\sigma_0^2}{(\sigma_a^2(\theta) - \sigma_0^2)^3} \cdot \left(\frac{\partial}{\partial \theta}\sigma_a^2(\theta)\right)^2 \\
&= -\frac{\sigma_0^2}{(\sigma_a^2(\theta) - \sigma_0^2)^2} \cdot \frac{\partial}{\partial \overline{\delta}^2}\sigma_a^2(\theta) + 2\frac{\sigma_0^2}{(\sigma_a^2(\theta) - \sigma_0^2)^3} \cdot \left(\frac{\partial}{\partial \theta}\sigma_a^2(\theta)\right)^2 \\
&> 0
\end{aligned}
$$

since by assumption $\frac{\partial^2}{\partial \overline{\delta}^2}\sigma_a^2(\theta) \leq 0$. We therefore have $\frac{\partial}{\partial \underline{\delta}}\frac{\partial}{\partial \theta}E[a(\theta)] < 0$. By continuity, we can conclude that there exists some $\epsilon > 0$ such that when $|\frac{\partial^2}{\partial \theta^2}a^*(\theta)| < \epsilon$ and $|\frac{\partial^2}{\partial \theta^2}a_d(\theta)| < \epsilon$, we have $\frac{\partial}{\partial \underline{\delta}}\frac{\partial}{\partial \theta}E[a(\theta)] < 0$ in a neighborhood around $\underline{\theta}$ □

The following result formalizes how our model can generate excess sensitivity local to simply boundary points if cognitive noise is sufficiently sharply increasing away from the simoly points.

Proposition 5. *(Excess Sensitivity Near Simple Points) Suppose that $a_d(\theta)$ is interior. If $\underline{\theta}$ exists and $\frac{\partial}{\partial \underline{\delta}}\sigma_a^2(\underline{\theta})$ is positive and sufficiently large, then $\frac{\partial}{\partial \theta}a(\theta) > \frac{\partial}{\partial \theta}a^*(\theta)$ in a neigh-*

borhood around $\underline{\theta}$. Likewise, if $\overline{\theta}$ exists and $\frac{\partial}{\partial \overline{\delta}}\sigma_a^2(\overline{\theta})$ is positive and sufficiently large, then $\frac{\partial}{\partial \theta}a(\theta) > \frac{\partial}{\partial \theta}a^*(\theta)$ in a neighborhood around $\overline{\theta}$.

Proof. First prove the statement regarding $\underline{\theta}$. Note that

$$\frac{\partial}{\partial \theta}[a(\theta) - a^*(\theta)] = (1-\lambda) \cdot \frac{\partial}{\partial \theta}(a_d(\theta) - a^*(\theta)) + \frac{\partial}{\partial \theta}\lambda \cdot (a^*(\theta) - a_d(\theta))$$

Since $a_d(\theta)$ is interior, we have $a^*(\underline{\theta}) - a_d(\underline{\theta}) < 0$. We have

$$\frac{\partial}{\partial \theta}\lambda = -\frac{\sigma_0^2}{(\sigma_a^2(\theta) + \sigma_0^2)^2}\frac{\partial}{\partial \theta}\sigma_a^2(\theta)$$

and so if $\frac{\partial}{\partial \underline{\delta}}\sigma_a^2(\underline{\theta}) = \frac{\partial}{\partial \theta}\sigma_a^2(\underline{\theta})$ is positive and sufficiently large, then $\frac{\partial}{\partial \theta}\lambda \cdot (a^*(\underline{\theta}) - a_d(\underline{\theta})) > -(1-\lambda) \cdot \frac{\partial}{\partial \theta}(a_d(\underline{\theta}) - a^*(\underline{\theta}))$, and so $\frac{\partial}{\partial \theta}[a(\underline{\theta}) - a^*(\underline{\theta})] > 0$. By continuity, this implies that $\frac{\partial}{\partial \theta}[a(\theta) - a^*(\theta)] > 0$ for θ in a neighborhood of $\underline{\theta}$. The proof of the statement regarding $\overline{\theta}$ is analogous. □

As in the main text, let $P(a^*(\theta)|S = s(\theta))$ denote the DM's posterior distribution over the optimal action given the signal realization $s(\theta)$, and define cognitive uncertainty as $p_{CU}(\theta) = P(|a^*(\theta) - a(\theta)| > \kappa)$

Proposition 6. *(Measurement of Cognitive Noise) $p_{CU}(\theta)$ is increasing in $\sigma_a(\theta)$*

Proof. Given the signal $s(\theta)$, the DM's posterior over $a^*(\theta)$–$a(\theta)$ is distributed $N(0, \tilde{\sigma}_a(\theta))$. This implies that

$$p_{CU}(\theta) = 2\left[1 - \Phi\left(\kappa\sqrt{1/\sigma_a^2(\theta) + 1/\sigma_0^2}\right)\right]$$

which is increasing in $\sigma_a(\theta)$. □

F Information on Expert Consultation for Task Selection

As noted in the main text, we partly outsourced the selection of tasks to leading experts. This Appendix describes this process and issues we encountered along the way.

F.1 Overview

F.1.1 Expert Input for Task Selection: Design of Process

We identified those behavioral economists who published at least two papers in the 'top 5' journals in 2021–2023, a set that includes 29 researchers. These experts are very heterogeneous. Some are theorists, some experimentalists, and some applied researchers. They work in macro, finance, public, labor, environmental, and basic decision science. There is also great variety in the behavioral topics that our experts work on.

We had initially aimed for a total of 30 experiments, and deliberately invited fewer experts than needed to receive 30 proposals because we anticipated that some types of economic decisions might not be covered by the requests of the experts. Our thought was that by supplementing the expert tasks with our own, we would better be able to ensure that the task list would have the feel of an overview of the decision problems that are covered in, e.g., an intermediate micro class.

The expert consultation is described in detail in Appendix F. In a first step, we contacted the researchers, explained the attenuation hypothesis to them, and asked them to propose a setup that they consider economically relevant and in which they would like to know whether the elasticity of decisions to parameters is correlated with cognitive uncertainty. The full email invitation is reproduced in Appendix F.2.2.

Based on these proposals, we designed and programmed experiments. We piloted each of the experiments with a small number of subjects (10–30) to validate the flow of the experiment, the comprehension check questions, and that decisions indeed exhibit a monotonic relationship with the parameter that was proposed by the expert. After we had conducted our pilots, we re-contacted the experts to give them an opportunity to verify that our experimental software complied with their requests. About one third of the experts sent detailed comments on the implementation and requested that changes be made. Finally, before making a draft of our paper available online, we re-contacted the experts to share a draft and asked them for any comments.

F.1.2 Expert Input for Task Selection: Results

24 researchers replied to our invitation. The experts generally proposed tasks that are related to their own work. This has two advantages. First, we leverage domain-specific expertise about which decisions are considered important by leading experts in different

sub-fields. Second, we end up with tasks that are very heterogeneous, covering a broad range of research areas in economics.

The experts usually only provided broad guidance ("study effort supply as a function of a piece rate that varies across rounds in the experiment"), though some requests were very detailed. Two researchers sent us write-ups of theoretical models that they asked us to implement.

While our expert consultation process provided substantial guidance, the degree of our own influence in the selection of tasks varied across expert interactions. The collection of expert interactions resulted in 20 tasks that we categorize into two sets. The first set of ten tasks reflects interactions in which we had no influence on the selection process because the expert's proposal was sufficiently detailed and corresponded to the requirements outlined in our email invitation that we could move to implementation. We refer to these tasks as *expert tasks* and associate them with the respective proposer's name in what follows (or "anonymous", if they chose to remain so).

A second set of ten tasks also benefited from our expert consultation process, yet the underlying interactions were more heterogeneous and provided us with varying degrees of influence over the task selection that we did not anticipate when sending our email invittaion. We provide a list of these issues below. Almost all of these involve an initial expert proposal of multiple alternatives (from which we had to pick) or initially incomplete suggestions. Each of the resulting tasks was sent to the corresponding expert(s) for signoff prior to implementation. Still, we conservatively label them "EGOY+" tasks so as to not overstate the degree to which our hands were tied in the task selection process (EGOY refers to the authors of this paper).[26]

One of these "EGOY+" tasks is different from all other tasks in the sense that absent information-processing constraints, the elasticity of the decision to the parameter is zero. We, hence, additionally constructed 11 tasks ourselves, leaving us with 30 baseline tasks, plus one task designed to study the limits of attenuation.[27]

See Table 7 for an overview.

[26]For their involvement in these "EGOY+" tasks, we thank Marta Serra-Garcia, Alex Imas, Sandro Ambuehl, Jonathan Zinman, Aakaash Rao, Heather Sarsons, Leonardo Bursztyn, Emmanuel Vespa, Jason Somerville, Judd Kessler, Ernesto Reuben and two researchers who wished to remain anonymous.

[27]Our main findings emerge across all three categories of tasks, see Section 4 and Appendix Figure **??**.

Table 7: Overview of contributors of experimental tasks

Task and label	Decision	Fundamental	Incentive	Contributor
Financial decisions				
Savings – SAV	Amount saved	Interest rate	Choice	Taubinsky
Precaut. savings – PRS	Savings (IV)	Size of shock	Choice	Netzer
Portfolio allocation – POA	Equity share	Return expectat.	Choice	EGOY+
Forecast stock return – STO	Forecast asset value	Time horizon	Hypoth.	EGOY
Estimate tax burden – TAX	Tax estimate	HH income	Accuracy	EGOY
Newsvendor game – NEW	Production	Marginal cost	Choice	EGOY
Labor				
Effort supply – EFF	Tasks completed	Piece rate	Choice	DellaVigna %
Multitasking – MUL	Rel. effort allocation (IV)	Rel. importance	Optimality	EGOY
Search – SEA	Search effort (IV)	Search cost	Choice	EGOY+
Consumer choice				
Product demand – PRO	WTP for food item	Quantity of item	Hypoth.	EGOY
Budget allocation – CMA	Rel. product demand (IV)	Rel. prices	Optimality	
Avoid externalities – EXT	WTP to reduce emissions	Size of reduction	Choice	v.d. Weele / Schwardm.
Invest to save energy – ENS	WTP fuel-efficient car	Miles driven	Hypoth.	Allcott
Social decisions				
Fairness views – FAI	Amount redistributed	P [merit-based]	Choice	EGOY+
Dictator game – DIG	Giving	P [donation lost]	Choice	Roth
Contingent valuation – HEA	Societal WTP for vaccine	People saved	Hypoth.	EGOY+
Public goods game – PGG	Contribution to group	Efficiency	Choice	EGOY
Strategic decisions				

Table 7: Overview of contributors of experimental tasks

Task and label	Decision	Fundamental	Incentive	Contributor
Prisoner's dilemma – PRD	Cooperate / defect	Cooper. payoff	Choice	Exley
Beauty contest – GUE	Guess number	Multiplier	Accuracy	EGOY
Disclosure game – CHT	Reveal / withhold info	True state	Choice	EGOY+
Political decisions				
Voting – VOT	Vote or not (IV)	Number of voters	Choice	EGOY+
Policy evaluation – POL	Support for policy	Implied inflation	Hypoth.	EGOY
Risk and time preference elicitations				
Risk pref. elicitation – CEE	Certainty equiv.	P [upside]	Choice	EGOY
Risk pref. elicitation – PRE	Probability equiv.	Payout amount	Choice	EGOY
Intertemporal RRR – TID	PV future payment	Time delay	Hypoth.	EGOY
Beliefs and cognition				
Info demand – IND	WTP for info	Info accuracy	Choice	EGOY+
Belief updating – BEU	Posterior belief	Info accuracy	Prox. Bayes	Anonymous
Forecasting – FOR	Forecast asset value	Info accuracy	Prox. Bayes	EGOY+
Recall – REC	Recall company value	Company value	Accuracy	Kwon
Signal aggregation – SIA	Aggregate signals	Fraction of sources	Accuracy	EGOY+
Rational inattention – RIA	Lottery / safe paym.	Expected value diff.	Choice	EGOY+

Notes. IV = induced values. Choice = payoff determined by choice. Accuracy (Prox. Bayes) = bonus iff close to truth (to Bayes).

F.2 Details

This subsection provides additional information on the expert consultation. We first outline the sequence of events in the consultation process we designed. Second, we reproduce the email that was sent to the experts. Third, we list task proposals that failed the monotonicity requirement in the pilots. Fourth, we list issues in the consultation process that lead us to conservatively classify a task as "EGOY+" task rather than "expert task".

F.2.1 Steps in Expert Consultation Process

1. Send email invitation to contribute a task based on a template (see below). The template specifies the common deadline for submitting a contribution.

2. Experts who reply to invitation:

   (a) If expert proposes a single, qualifying task: Ask for additional clarification whenever necessary.

   (b) If expert does not propose a single qualifying application (see list of reasons in Appendix F.2.4): Further interactions to arrive at a qualifying proposal.

3. Design and implementation of the experimental task using a shared template for instructions and coding.

4. Pilot with small sample of $N = 10-30$ subjects to confirm monotonicity. Return to experts if monotonicity requirement fails (see also Appendix F.2.3).

5. Send link of final online experiment to corresponding expert, invite feedback with a deadline of one week.

6. Send paper draft to all contributing experts with invitation to check for accuracy before posting the first draft of the paper.

F.2.2 Email to Experts

Dear X,

I hope this finds you well. I'm writing to ask for a favor. The request is below, and would take very little of your time. Thanks very much for considering to participate!

We (Ben Enke, Thomas Graeber, Ryan Oprea and Jeffrey Yang) are preparing to run a large-scale experiment, and we are emailing you to ask for your input. We plan to evaluate a hypothesis (see below) across a wide range of experimental decision-making tasks. To design the most convincing and comprehensive test of our hypothesis, we hope to leverage the profession's knowledge by "crowdsourcing" the selection of tasks. We are emailing you in particular because we identified you as one of the few behavioral economists who published more than one paper in the profession's top five journals over the last three years. We invite you to propose an experimental task, and we commit to implement your proposal should you choose to participate. This will take very little of your time – your proposal can be as short as one sentence.

Topic of our paper:
Hypothesis ("behavioral attenuation"): Because people often rely on noisy and heuristic simplification strategies, observed decisions are usually insufficiently elastic ("attenuated") to variation in decision-relevant parameters.
Concretely: Take any economic decision that depends monotonically on an objective parameter. Then, we hypothesize that the elasticity of the decision to variation in the parameter is smaller among people who report higher cognitive uncertainty (lower confidence in the optimality of their own decision). Cognitive uncertainty is our empirical proxy for how noisy or heuristic a person's decision process is. We plan to implement 30 tasks overall, 20-25 of which we crowdsource and 5-10 of which we select ourselves.

What we request from you:
You propose a static decision that depends on an objective parameter that we can vary in the experiment. The parameter should have a non-trivial, monotonic impact on the decision-maker's decision. For example: "Elicit certainty equivalent for binary lotteries as a function of the payout probability." The parameter should be varied across a wide range. The reason is that we hypothesize that behavioral attenuation will appear only away from those boundaries of the parameter space that render the decision cognitively trivial (e.g., due to dominance relationships). In the lottery example, determining one's certainty equivalent for a p% chance of getting $25 is trivial for p=0% or p=100%. We only expect behavioral attenuation away from such trivial boundary points. Your proposal could include any of a large number of settings, ranging from preference elicitations to belief updating to generic optimization problems, covering domains involving risk, time, consumption-savings, effort supply, taxes, fairness, prediction, inference and more, in either individual decisions or strategic games.

You can select any decision task you'd like – ideally one that you consider economically relevant and where you would like to know whether behavioral attenuation is at play. Your proposal can be as short or detailed as you'd like. All we'd need from you is to fill in these bullet points:

- Decision: ...
- Parameter: ...

- Details (optional): ...

What would happen if you chose to participate:
If you agree, we will name you as the contributor of the task you propose in our paper. We will also fill in the details for the experimental task you propose and send you a link to the software so you can verify (if you like) that our implementation complies with your proposal.

We would be extremely grateful if you found the time to send us an idea by February 5, 2024, but please let us know in case you plan to submit an idea but will require more time. Please also let us know if you have any questions or comments.

We look forward to hearing from you! Thank you very much for considering our request!
Best wishes,
Ben, Jeffrey, Thomas and Ryan

F.2.3 Proposals that Failed Pilot Test for Monotonicity

We piloted each qualifying proposal with a small sample of between $N = 10-30$ subjects. Our condition for an application to be excluded due to a violation of the monotonicity requirement was the following: We ran OLS regressions of the decision on the experimental parameter in two samples: (i) the full sample and (ii) restricting attention to parameters that were not "simple boundary points" (e.g. a wage of zero). A task was counted as satisfying monotonicity when the OLS coefficients was significantly different from zero at the 10% level in both samples.

The following task proposals failed monotonicity:

- Sender-receiver disclosure game, where the proposal was to study the receiver's choice as a function of the degree of conflict between sender and receiver incentives. Because this did not produce monotonicity, after consultation with the expert we instead studied sender behavior in the disclosure game (task CHT).
- An extended dictator game inspired by Schumacher et al. (2017). The dictator can send money to receivers, where for each Dollar the dictator gives up, a Dollar is sent to each receiver. The proposal was to study the sensitivity of giving behavior to the number of receivers (because a higher number of receivers increases the efficiency of giving). We did not find monotonicity, leading the expert to drop the task and propose a new one (HEA).

F.2.4 Issues in Expert Consultation Process that Lead to "EGOY+" Classification

When we designed our expert consultation process, there was no template available in the literature for us to use. As a result, we encountered several issues that we did not anticipate and which lead us to conservatively classify a task as "EGOY+" (where EGOY refers to the authors of this paper) rather than as an expert task so as to not overstate the degree to which our hands were tied in the task selection process. With hindsight, our invitation email and procedures could have been clearer. We describe the issues we encountered below. Moreover, we also provide a suggestion for how – in our experience – other researchers who wish to follow a similar design strategy could pre-empt such issues going forward.

Each of the below issues was encountered in the interactions with at least one expert. Because these issue provided varying degrees of influence from our side on the selection of the task, in the interest of conservatism we consider each individual issue sufficient to classify a task as "EGOY+" task. We note in how many expert interactions we encountered each issue, yet to preserve privacy we refrain from associating the issues with specific experts (multiple issues can apply to a single expert interaction).

1. Six experts sent more than one qualifying proposal, requiring us to choose one of the alternative (our email did not emphasize enough that only one proposal should be sent).

   → Suggestion: Expert invitation should highlight that not more than one proposal can be sent, and that if more than one is sent, only the first one will be considered.

2. Five experts sent slightly ambiguous proposals (no concrete choice context) or incomplete proposals (no experimental decision or no exogenous parameter was specified). This triggered a back-and-forth with us, which means we had some degree of influence over the task selection.

   → Suggestion: If incomplete or ambiguous proposals are submitted, reply using a pre-specified template response that does not involve any suggestive language.

3. Three experts made their proposals on the phone or other mediums without available record.

   → Suggestion: Only rely on email and retain internal copies.

4. Two experts made very similar proposals, leading us to propose merging these tasks with minimal adjustment, which the respective experts agreed to. However, these

minimal adjustments mean that we had some influence over the selection of the task.

→ Suggestion: If proposal is close but not identical to an existing proposal, accept both versions or discard second one and ask for alternative. In general, coordinate timeline such that all proposals are considered jointly at a specific date (rather than sequentially based on order of arrival).

5. Three experts sent applications that feature a theoretically predicted sensitivity of zero. We discarded these proposals / asked for new ones, meaning we had some influence over task selection.

   → Suggestion: Specify task qualifications in an exhaustive way.

6. One expert sent a novel research hypothesis without an existing experimental paradigm. We discarded this proposal / asked for a new one, meaning we had some influence over task selection.

   → Suggestion: Specify task qualifications in an exhaustive way.

7. One expert selected a task from a set of example applications that we provided.

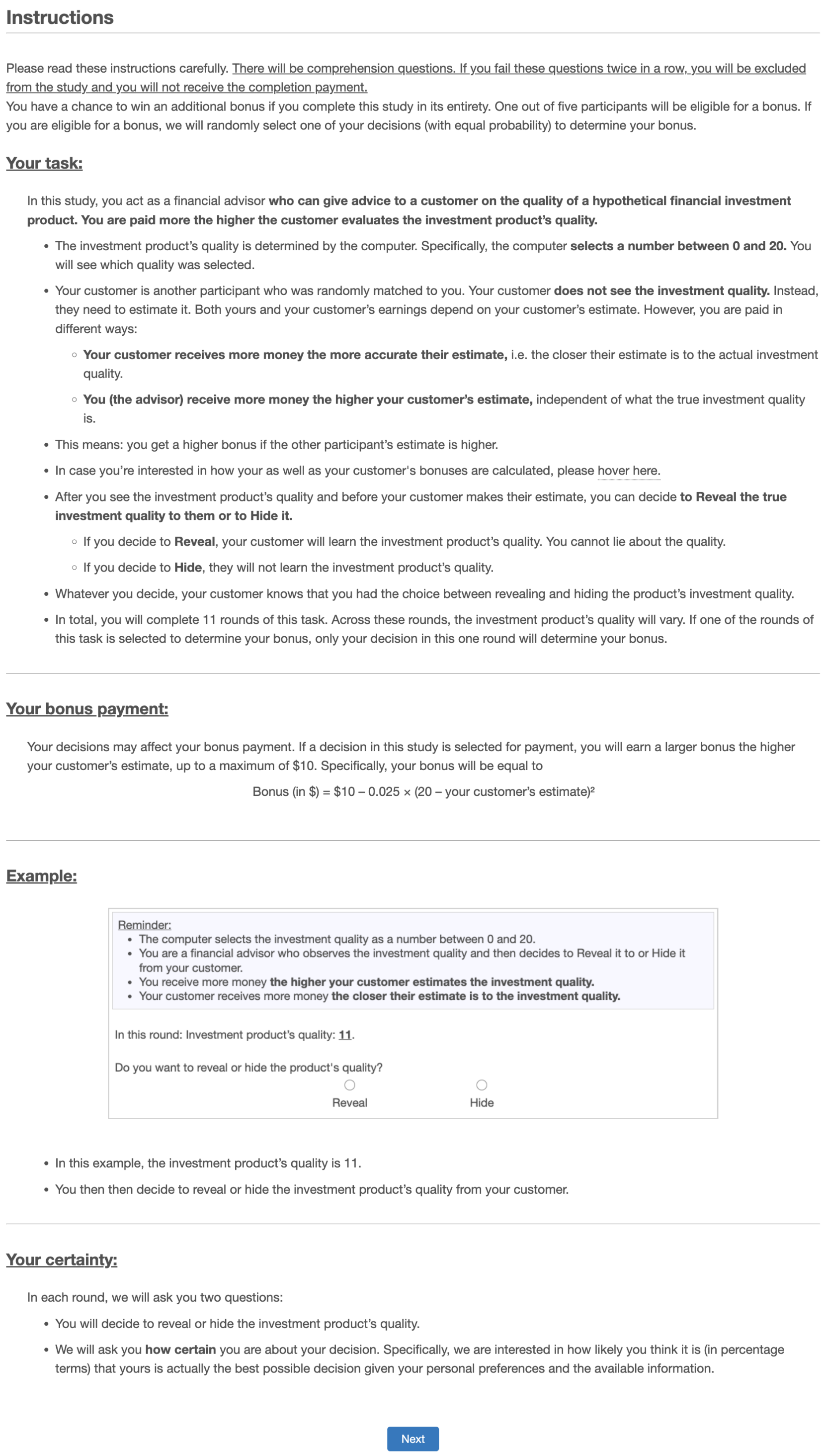
   → Suggestion: Avoid provision of examples or list to choose from.

In all, eleven experts sent proposals that lead to ten expert tasks, and 13 experts sent proposals that led to ten "EGOY+" tasks.

We emphasize again that the "issues" encountered in the expert interactions noted above are the result of our own imprecise invitation email and procedures. We are very grateful to all experts for volunteering their time and expertise for our study.

G Experimental Instructions and Decision Screens

G.1 CHT



Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, you act as a financial advisor **who can give advice to a customer on the quality of a hypothetical financial investment product. You are paid more the higher the customer evaluates the investment product's quality.**

- The investment product's quality is determined by the computer. Specifically, the computer **selects a number between 0 and 20.** You will see which quality was selected.
- Your customer is another participant who was randomly matched to you. Your customer **does not see the investment quality.** Instead, they need to estimate it. Both yours and your customer's earnings depend on your customer's estimate. However, you are paid in different ways:
  - **Your customer receives more money the more accurate their estimate,** i.e. the closer their estimate is to the actual investment quality.
  - **You (the advisor) receive more money the higher your customer's estimate,** independent of what the true investment quality is.
- This means: you get a higher bonus if the other participant's estimate is higher.
- In case you're interested in how your as well as your customer's bonuses are calculated, please hover here.
- After you see the investment product's quality and before your customer makes their estimate, you can decide **to Reveal the true investment quality to them or to Hide it.**
  - If you decide to **Reveal**, your customer will learn the investment product's quality. You cannot lie about the quality.
  - If you decide to **Hide**, they will not learn the investment product's quality.
- Whatever you decide, your customer knows that you had the choice between revealing and hiding the product's investment quality.
- In total, you will complete 11 rounds of this task. Across these rounds, the investment product's quality will vary. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus payment. If a decision in this study is selected for payment, you will earn a larger bonus the higher your customer's estimate, up to a maximum of $10. Specifically, your bonus will be equal to

$$\text{Bonus (in \$)} = \$10 - 0.025 \times (20 - \text{your customer's estimate})^2$$

Example:

Reminder:
- The computer selects the investment quality as a number between 0 and 20.
- You are a financial advisor who observes the investment quality and then decides to Reveal it to or Hide it from your customer.
- You receive more money **the higher your customer estimates the investment quality.**
- Your customer receives more money **the closer their estimate is to the investment quality.**

In this round: Investment product's quality: **11**.

Do you want to reveal or hide the product's quality?

Reveal   Hide

- In this example, the investment product's quality is 11.
- You then then decide to reveal or hide the investment product's quality from your customer.

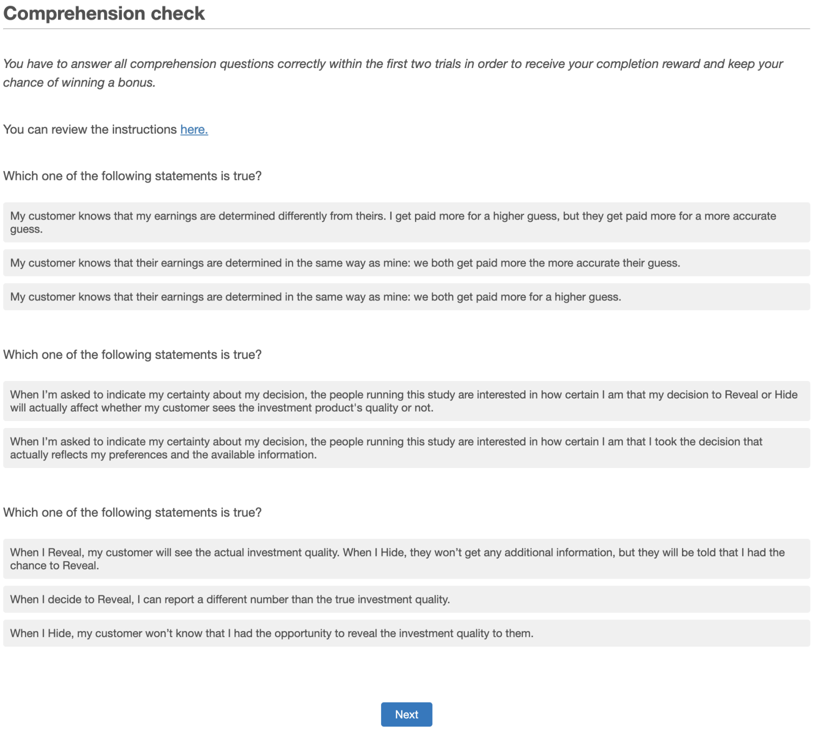
Your certainty:

In each round, we will ask you two questions:

- You will decide to reveal or hide the investment product's quality.
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that yours is actually the best possible decision given your personal preferences and the available information.

Next

Figure 21: The instruction screen for CHT task.



Comprehension check

You have to answer all comprehension questions correctly within the first two trials in order to receive your completion reward and keep your chance of winning a bonus.

You can review the instructions here.

Which one of the following statements is true?

- My customer knows that my earnings are determined differently from theirs. I get paid more for a higher guess, but they get paid more for a more accurate guess.
- My customer knows that their earnings are determined in the same way as mine: we both get paid more the more accurate their guess.
- My customer knows that their earnings are determined in the same way as mine: we both get paid more for a higher guess.

Which one of the following statements is true?

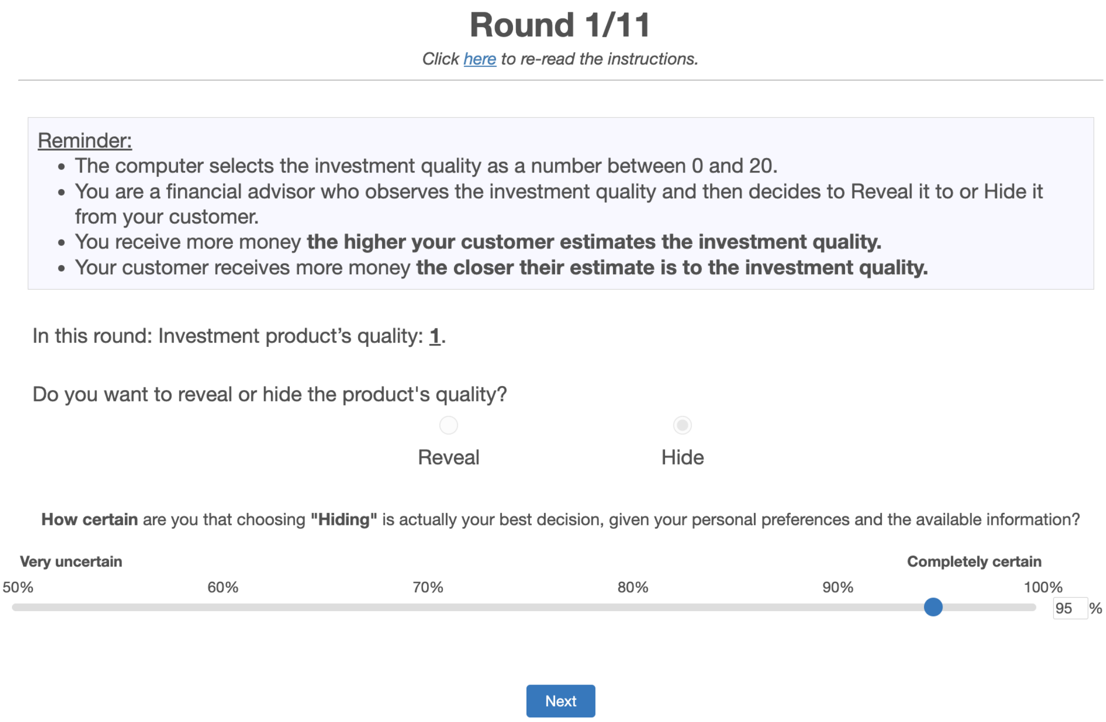
- When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am that my decision to Reveal or Hide will actually affect whether my customer sees the investment product's quality or not.
- When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am that I took the decision that actually reflects my preferences and the available information.

Which one of the following statements is true?

- When I Reveal, my customer will see the actual investment quality. When I Hide, they won't get any additional information, but they will be told that I had the chance to Reveal.
- When I decide to Reveal, I can report a different number than the true investment quality.
- When I Hide, my customer won't know that I had the opportunity to reveal the investment quality to them.

Next

Figure 22: Comprehension check for CHT task.



Round 1/11

Click here to re-read the instructions.

Reminder:
- The computer selects the investment quality as a number between 0 and 20.
- You are a financial advisor who observes the investment quality and then decides to Reveal it to or Hide it from your customer.
- You receive more money **the higher your customer estimates the investment quality.**
- Your customer receives more money **the closer their estimate is to the investment quality.**

In this round: Investment product's quality: 1.

Do you want to reveal or hide the product's quality?

Reveal Hide

How certain are you that choosing **"Hiding"** is actually your best decision, given your personal preferences and the available information?

Very uncertain **Completely certain**

50% 60% 70% 80% 90% 100%

95 %

Next

Figure 23: Decision screen for CHT task.

G.2 CMA

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. Every participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

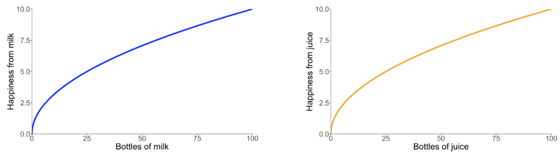
Your task:

In this study, you will act as a consumer who only consumes milk and juice. Your task is **to maximize the consumer's overall happiness by deciding how much juice and milk to consume**.

- The consumer's overall happiness is given by the square root of the amount of milk consumed plus the square root of the amount of juice consumed, where amounts are measured in bottles:

$$\text{Overall happiness} = \sqrt{\text{Bottles of milk}} + \sqrt{\text{Bottles of juice}}$$

Here's how the number of milk and juice bottles consumed translate into happiness:



$\text{Happiness from milk} = \sqrt{\text{Bottles of milk}}$ $\text{Happiness from juice} = \sqrt{\text{Bottles of juice}}$

- As you can see in the figures, the **consumer's happiness increases in how much milk and juice s/he drinks.** However, **each additional bottle of milk or juice produces less and less additional happiness.** For example, while the happiness derived from 100 bottles of milk is higher than the happiness derived from 99 bottles, the happiness **increase** resulting from the additional bottle is much smaller than the happiness **increase** that results from consuming one bottle instead of zero bottles.
- The consumer has a total budget of $100 to spend on milk and juice. You need to spend your entire budget in each round.
- Juice always costs $1 a bottle, **but the price of milk varies.**
- To keep things simple, we will ask you **what fraction (between 0 and 100%) of the bottles you consume should be milk bottles or juice bottles,** and then the computer will automatically and instantly display for you how many bottles of milk/juice you would get with the given prices. The computer will also instantly display for you how much you would spend on milk/juice.
- For instance, you may decide that 60% of the bottles you consume should be milk bottles and 40% juice bottles.
- In total, you will complete 11 rounds of this task. Across these rounds, the cost of milk varies. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus payment. If a decision in this study is selected for payment, you will receive $20 if your answer is within +/-1 percentage point of the answer that maximizes the consumer's overall happiness at the prevailing prices, and nothing otherwise.

Example:

Reminder: The consumer's budget is $100. The consumer's overall happiness is given by:
$$\text{Overall happiness} = \sqrt{\text{bottles of milk}} + \sqrt{\text{bottles of juice}}$$

In this round: Each bottle of milk costs **$2.10** and each bottle of juice costs **$1.00**.

What fraction of the bottles you consume (between 0 and 100%) are milk or juice?

Milk: ____%
Juice: ____%

	Price per bottle	Quantity bought	Total expenditure
Milk	**$2.10**	____ bottles	$____
Juice	**$1.00**	____ bottles	$____

- In this example, the price of milk is $2.10 per bottle.
- You then need to decide what fraction of the bottles you consume are milk. Based on your decision, the computer will instantly calculate how much milk and juice you would get, given the prices and your total budget.

Your certainty:

In each round, we will ask you two questions:

- What fraction of the bottles you consume are milk.
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that the decision you made is actually the best decision, by which we mean the decision that maximizes your bonus.

Next

Figure 24: The instruction screen for CMA task.

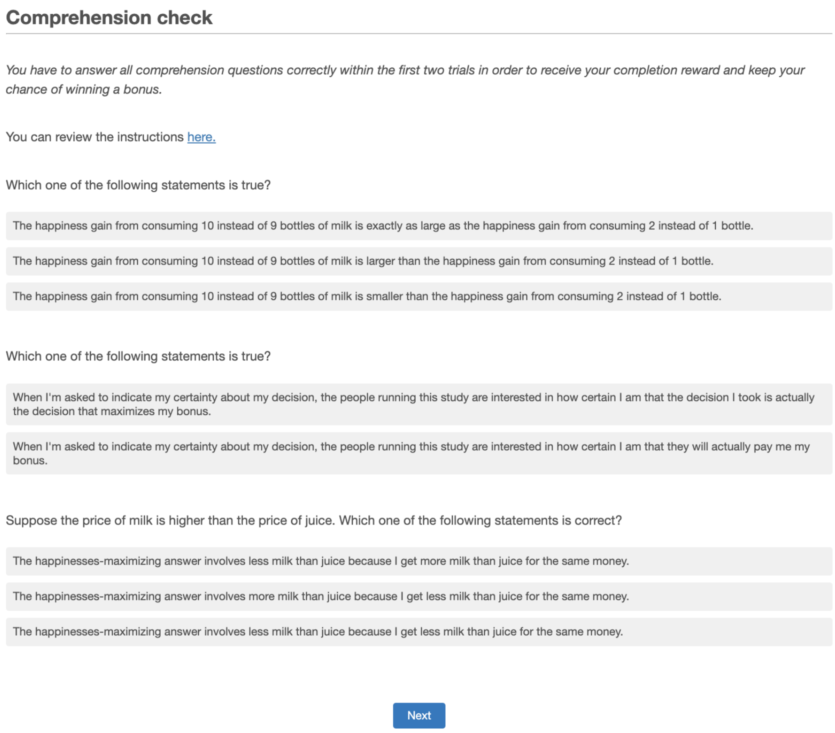


Figure 25: Comprehension check for CMA task.

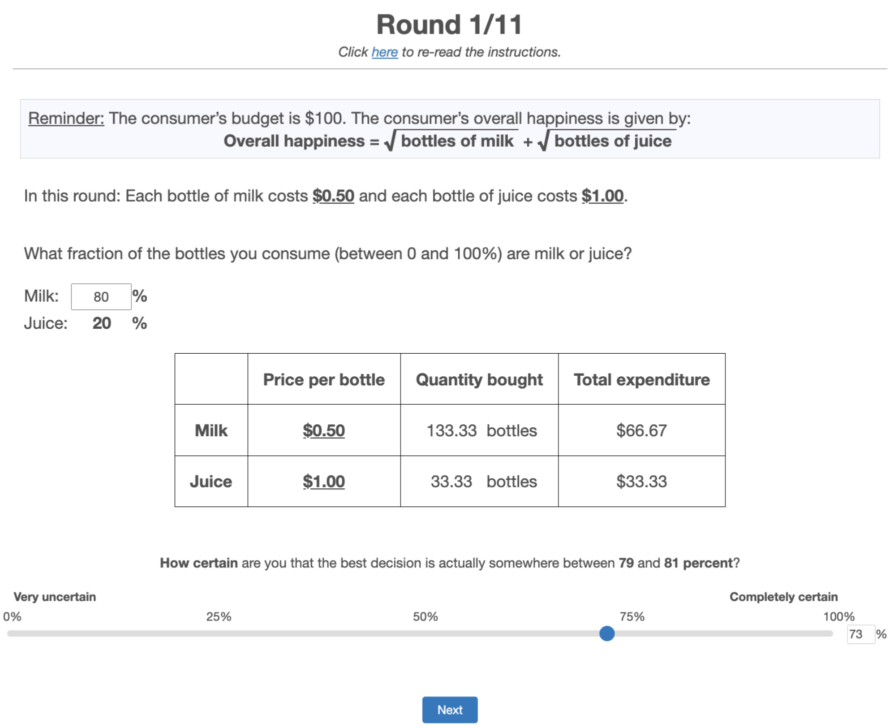


Figure 26: Decision screen for CMA task.

G.3 EXT

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, **you will choose between reducing carbon dioxide (CO2) emissions and receiving money for yourself.** There are always two options: Option A and Option B.

- **Option A does not give you a monetary payment,** but **reduces the amount of CO2 emissions in the atmosphere.** Specifically, we will actually implement these reductions in emissions by purchasing carbon offsets. Carbon offsets work by funding real projects that lower CO2 emissions (Hover here for more information on carbon offsets).
- Option B, by contrast, **gives you a monetary payment** (actually paid to you) but does not reduce CO2 emissions.
- In each round, you will be **told the amount CO2 emissions are reduced by choosing Option A**, and the amount of money earned by choosing Option B. You will then decide between the two options. You will make this decision **for a range of different amounts of money paid by Option B.**
  - To make the amount of CO2 emissions reduced by Option A easier to understand, we will tell you **how many weeks it would take a typical car used for commuting to produce the same amount of emissions**, according to estimates from the Environmental Protection Agency.
- The price we pay for carbon offsets that equal the emissions produced by car commuting for 8 weeks (0.5 metric tons) is roughly $2.50.
- In total, you will complete 11 rounds of this task. Across these rounds, the amount of CO2 emissions reduced by choosing Option A varies. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus and the reduction of CO2 emissions.

- Specifically, if you choose A, we will purchase carbon offsets that actually produce the described reduction in emissions. We will purchase these offsets from the United Nations Carbon Offset Platform, which certifies carbon reduction projects (click here for more information on the UN Carbon Offset Platform).
- If you choose Option B, you will receive the monetary payment provided by that option.

This means that it is in your best interest **to choose the option you actually prefer in each case.**

Example:

In this round: choosing Option A reduces CO2 emissions by **2.25 metric ton(s)**. This is equivalent to the emissions produced by a typical car used for commuting over a period of **36 week(s)**.

Option A: (Reduction of CO2 emissions)			**Option B:** (Monetary payment for yourself)
Reduce CO2 emissions by the amount produced by a commuting car over **36 week(s)** (**2.25 ton(s)** of emissions).	◉	○	Gain **$1**
	◉	○	Gain **$2**
	◉	○	Gain **$3**
	◉	○	Gain **$4**
	◉	○	Gain **$5**
	◉	○	Gain **$6**
	○	◉	Gain **$7**
	○	◉	Gain **$8**
	○	◉	Gain **$9**
	○	◉	Gain **$10**
	○	◉	Gain **$11**
	○	◉	Gain **$12**
	○	◉	Gain **$13**
	○	◉	Gain **$14**
	○	◉	Gain **$15**
	○	◉	Gain **$16**
	○	◉	Gain **$17**
	○	◉	Gain **$18**
	○	◉	Gain **$19**

- In this example, the amount of CO2 emissions reduced by choosing Option A is 2.25 metric tons.
- You will then decide between reducing CO2 emissions and receiving a monetary payment.
- You will make your decisions in a choice list, **where each row is a separate choice.**
  - In every list, the left-hand option (A) is a reduction of CO2 emissions that is identical in all rows. The right-hand option (B) gives you a monetary gain. This monetary gain increases from row-to-row as you go down the list.
  - To make a choice just click on the radio button you prefer for each choice (i.e. for each row).
  - **An effective way to complete these choice lists is to determine in which row you would prefer to switch from choosing the CO2 reduction (Option A) to choosing a monetary gain (Option B).** You can click on that row and we will automatically fill out the rest of the list for you, by selecting the CO2 reduction (Option A) in all rows above and the monetary gain (Option B) in all rows below your selected row.
  - Based on where you switch from reducing carbon emissions to receiving money in this list, we assess which monetary gain you value as much as the reduction in CO2 emissions.
  - For example, in the choice list above, your choice suggests that you value reducing CO2 emissions by 2.25 metric tons as much as a monetary gain between $6.00 and $7.00, because this is where you switched.
  - If a round in this study is selected for bonus payment, the computer will randomly select one of your choices from that choice list, and we will implement the option you selected in that choice.

Your certainty:

In each round, we will ask you two questions:

- You will decide between Option A and Option B. We will use these decisions to assess which monetary gain you value as much as a given reduction in CO2 emissions.
- We will ask you **how certain** you are about your decisions. Specifically, we are interested in how likely you think it is (in percentage terms) that your decisions actually reflect how much you value the reduction in CO2 emissions, given your personal preferences and the available information.

Next

Figure 27: The instruction screen for EXT task.

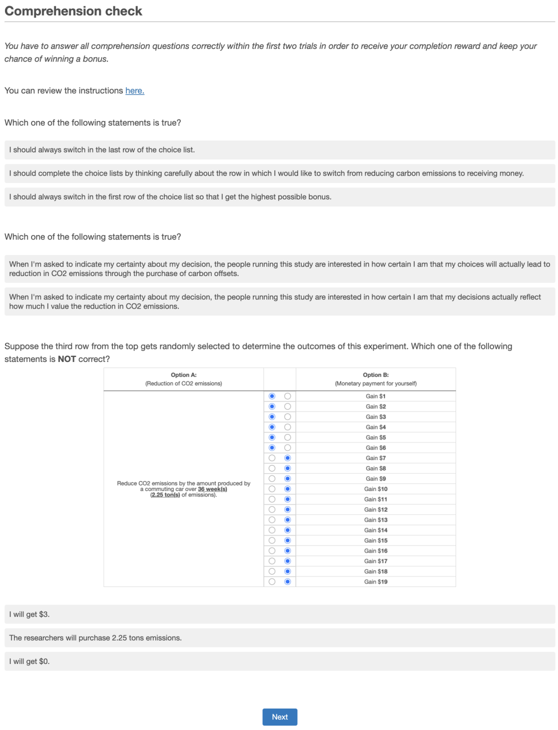


Figure 28: Comprehension check for EXT task.

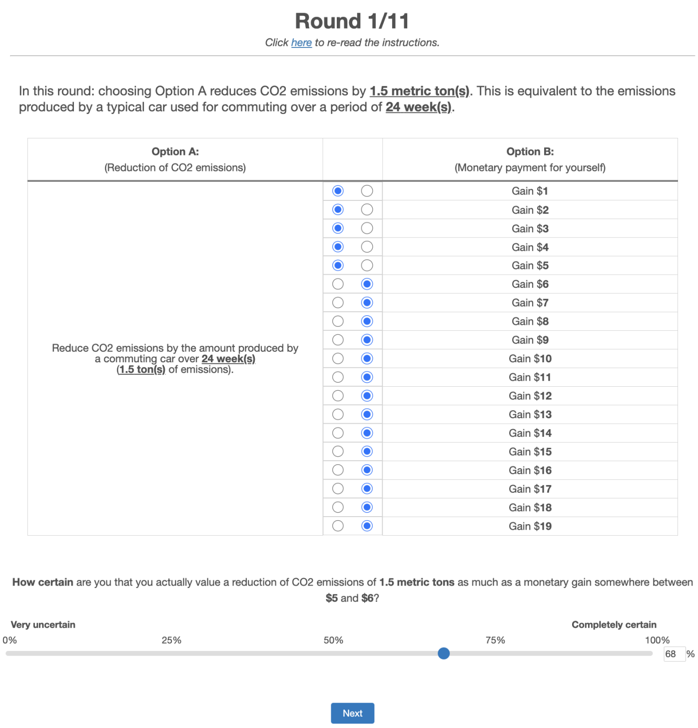


Figure 29: Decision screen for EXT task.

G.4 FAI

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, **you will decide how to distribute rewards from a contest between two other participants.**

- We asked two participants to participate in a contest.
    - The goal of participants was **to translate as many sequences of letters (shown on their screen) into numbers as possible in two minutes** (e.g. P is 390, H is 769, Y is 734 etc.).
    - The winner of the contest was determined in two possible ways: based on performance or based on random luck.
        - With some percentage chance, **the winner was selected to be whichever participant translated the most sequences** in two minutes.
        - With the remaining percentage chance, **the computer declared the winner by flipping a digital coin** (meaning each player wins with 50% chance).
- Whoever was declared by the computer to be **the winner of the contest was given 100 points** (each point is worth $0.05 to these previous participants).
- Your job in the experiment is to decide **how many of the points given to the declared winner you would like to transfer to the declared loser.**
- In each round, you will be matched with a different pair of other participants, and **told the percentage chance that the computer declared the winner based on performance instead of a coin flip.** You will **then decide how many points to transfer from the declared winner to the declared loser.**
- You can also transfer fractions of points, such as 6.7 points.
- In total, you will complete 11 rounds of this task. Across these rounds, the pair of participants and the percentage chance that the winner was declared based on their performance in the contest varies. These rounds are completely independent from one another. If one of the rounds of this task is selected to "count", only your decision in this one round will determine the bonuses of these previous participants.

Your bonus payment:

Your decisions may affect your bonus payment of previous participants. If a decision in this study is selected to count, your decision on how to transfer points will determine their bonuses.

Example:

Reminder: The declared winner of the contest was determined either based on performance or based on a coin flip. The declared winner received 100 points.

In this round: There was a **65%** chance that the declared winner was determined based on performance and a **35%** chance that the declared winner was based on a coin flip.

How many points (out of 100) do you transfer from the declared winner to the declared loser? ______ **points**

This means:
______ **points** to declared winner
______ **points** to declared loser

- In this example, there is a 65% chance the declared winner, who was awarded 100 points, won due to their performance in the task rather than due to the outcome of a coin flip.
- You then need to decide how many points to transfer from the declared winner to the declared loser.

Your certainty:

In each round, we will ask you two questions:

- How many points will you transfer from the declared winner to the declared loser.
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that the decision you made is actually your best decision, given your personal preferences and the available information.

Next

Figure 30: The instruction screen for FAI task.

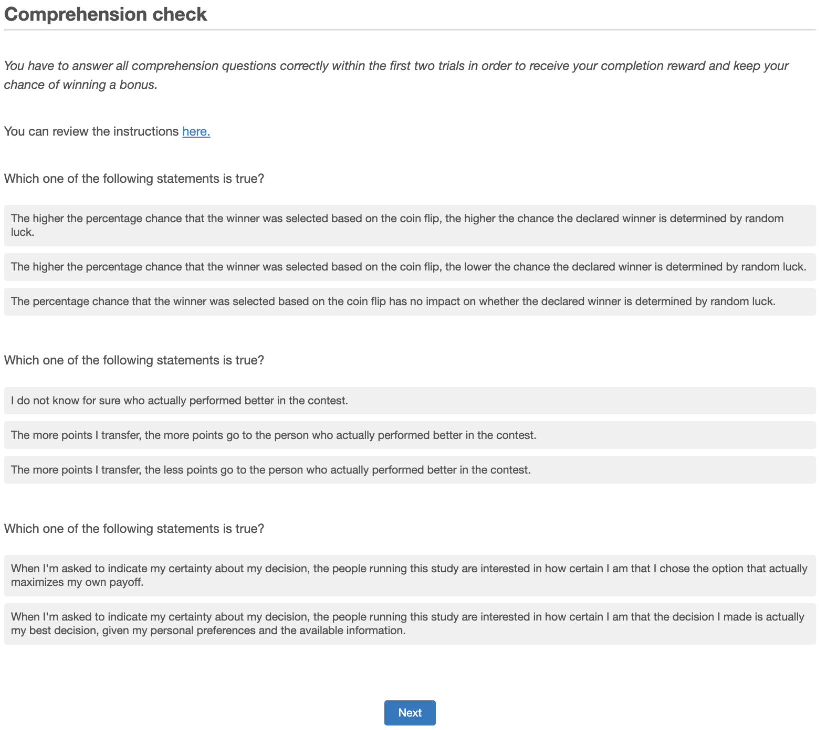


Figure 31: Comprehension check for FAI task.

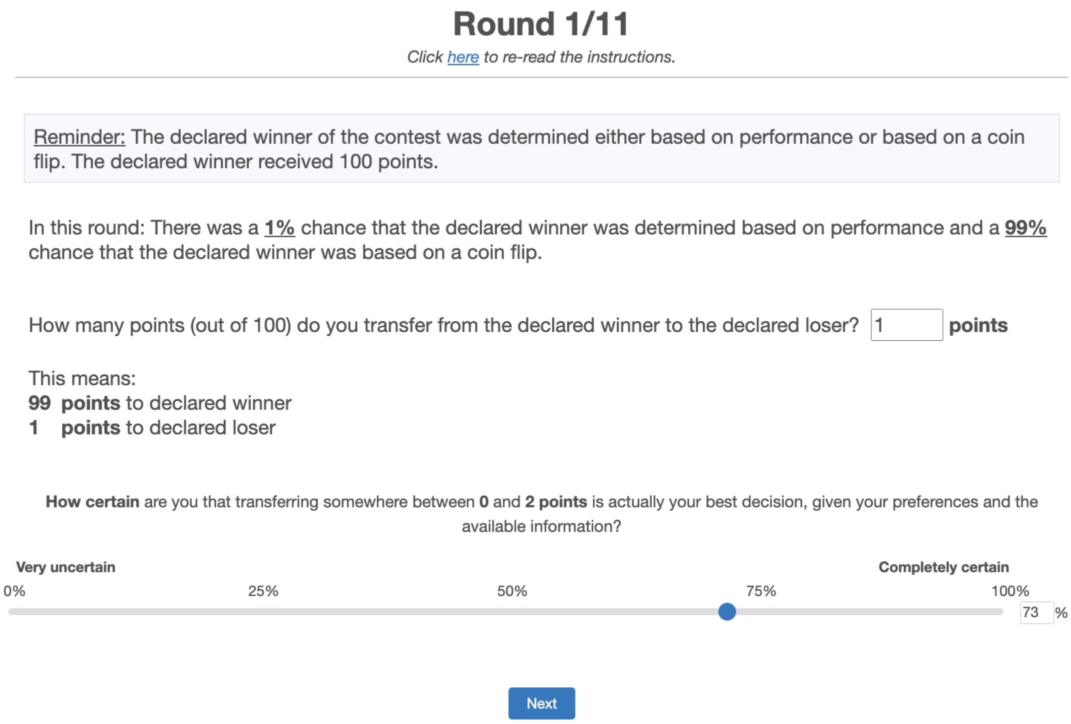


Figure 32: Decision screen for FAI task.

G.5 IND

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, **the computer will flip a digital coin which may land on Heads or Tails.**

With **50%** chance: **Heads**
With **50%** chance: **Tails**

- If this study is selected for bonus payment, you will guess whether the coin landed Heads or Tails. If your guess is correct, you will be paid a **$5 bonus.**
- You will have the chance **to obtain information that may help you make an informed guess about the coin flip.**
  - The information comes in the form of a **hint**, such as "The coin came up Heads."
  - The hint is not always correct but instead has an **accuracy rate**: the percent chance that the hint correctly states the outcome of the coin flip.
  - This accuracy rate is always between 50% and 100%.
    - If it is **50%:** The hint is **equally likely to be right or wrong.** This means that if you follow the hint, your guess will be **no more accurate than if you had guessed randomly.**
    - If it is **100%:** The hint is **always correct.** This means that if you follow the hint, your guess **is guaranteed to be correct**.
    - If it is greater than 50% but less than 100%, the hint is **more likely to be right than wrong.**
- In each round, we will **tell you what the accuracy rate of the hint is.** You will then indicate how much you would at most be willing to pay, out of a budget of $5, to actually receive the hint. As explained in greater detail below, the more you are willing to pay, the more likely it is that you actually receive the hint in the event that this round is selected for payment.
- In total, you will complete 11 rounds of this task. Across these rounds, the accuracy rate of the hint varies. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus payment. If a round in this study is selected for payment, you will be asked to guess the coin flip for a $5 bonus. Prior to making your guess, you may receive a hint, depending on how much you indicate you are willing to pay for it. This works as follows:

- You will be given a budget of $5, and the computer will randomly select a price between $0 and $5.
- If the price selected by the computer is lower than your stated willingness to pay for the hint, you will receive the hint, and the price selected by the computer will be subtracted from your budget. Then, your bonus payment will be your remaining budget plus $5 or $0, depending on whether you are able to correctly guess the side the coin landed on.
- If the price selected by the computer is higher than your stated willingness to pay for the hint, you will not receive the hint. Then, your bonus payment will be your budget plus $5 or $0, depending on whether you are able to correctly guess the side the coin landed on.
- This procedure may seem complicated, but all it means is that **it is in your best interest to truthfully indicate how much you would at most pay for the hint, and to make you best guess whether the coin came up Heads or Tails.**

Example:

Reminder: The computer flipped a coin, and if this round is selected for payment, you will receive $5 for correctly guessing whether the coin landed Heads or Tails. You can purchase a hint about which side the coin landed on.
- The hint has an accuracy rate between 50% and 100%.
- 100% means the hint is always correct.
- 50% means the hint is equally likely to be correct or incorrect (contains no new information).

In this round: The hint has an accuracy rate of **70%**.
→ This means that if you follow the hint, your guess will have a **70%** chance of being correct, and a **30%** chance of being incorrect.

How much (out of a budget of $5) are you at most willing to pay for the hint? $

- In this example, the hint has an accuracy rate of 70%. This means that if the coin flip landed on Heads, there is a 70% chance the hint will correctly say Heads, and if the coin flip landed Tails, there is a 70% chance the hint will correctly say Tails.
- You would then indicate how much you would at most be willing to pay for the hint.
- If this task is selected for payment, the computer will determine whether you receive the hint, following the procedure described above. You would then state your guess whether the coin came up Heads or Tails.

Your certainty:

In each round, we will ask you two questions:

- You will decide how much you are willing to pay for the hint.
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that your decision actually reflects how much you value the hint, given your personal preferences and the available information.

Next

Figure 33: The instruction screen for IND task.

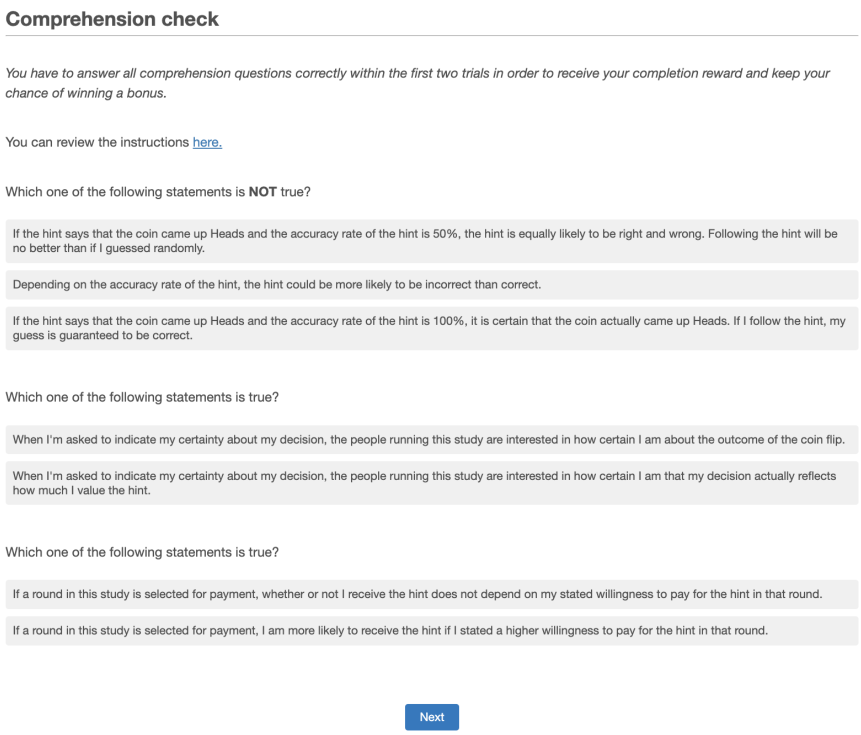


Figure 34: Comprehension check for IND task.

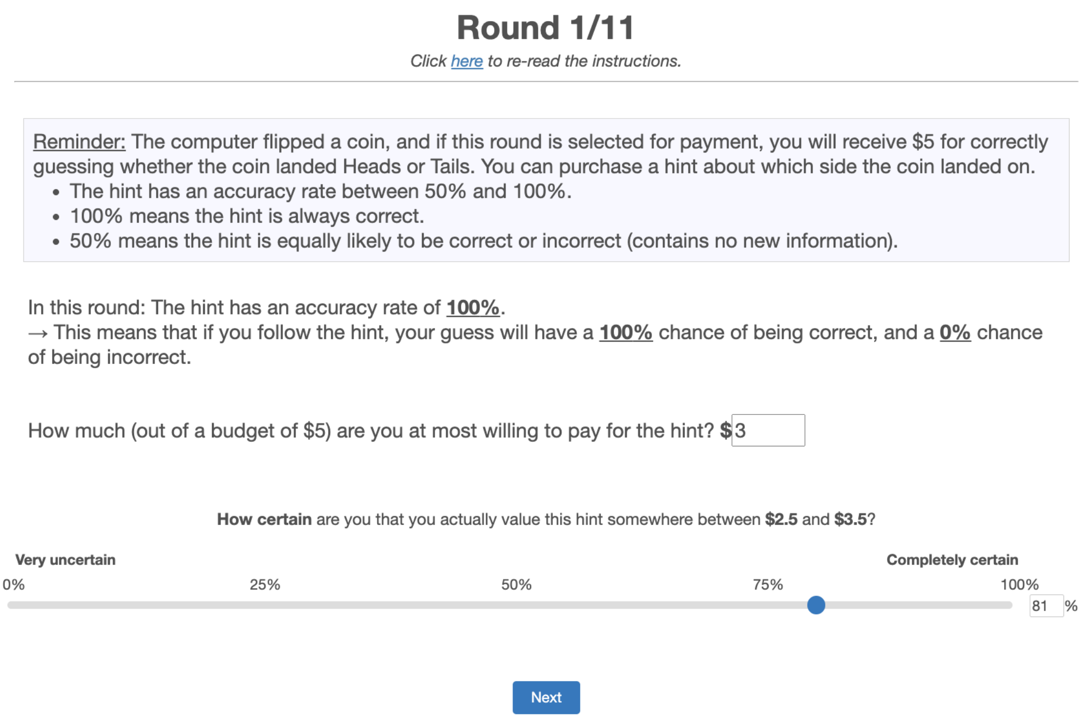
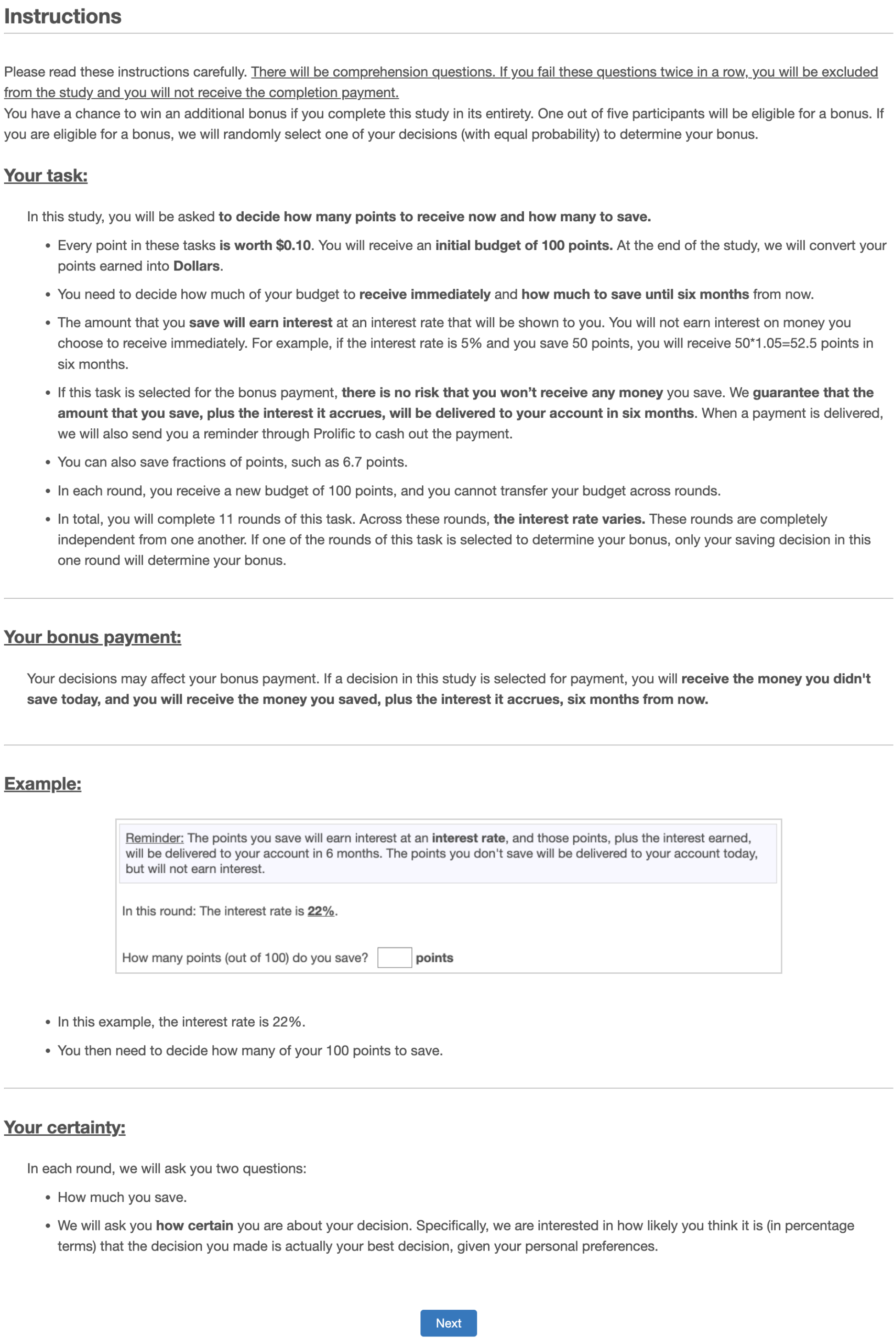


Figure 35: Decision screen for IND task.

G.6 SAV



Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, you will be asked **to decide how many points to receive now and how many to save.**

- Every point in these tasks **is worth $0.10**. You will receive an **initial budget of 100 points.** At the end of the study, we will convert your points earned into **Dollars**.
- You need to decide how much of your budget to **receive immediately** and **how much to save until six months** from now.
- The amount that you **save will earn interest** at an interest rate that will be shown to you. You will not earn interest on money you choose to receive immediately. For example, if the interest rate is 5% and you save 50 points, you will receive 50*1.05=52.5 points in six months.
- If this task is selected for the bonus payment, **there is no risk that you won't receive any money** you save. We **guarantee that the amount that you save, plus the interest it accrues, will be delivered to your account in six months**. When a payment is delivered, we will also send you a reminder through Prolific to cash out the payment.
- You can also save fractions of points, such as 6.7 points.
- In each round, you receive a new budget of 100 points, and you cannot transfer your budget across rounds.
- In total, you will complete 11 rounds of this task. Across these rounds, **the interest rate varies.** These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your saving decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus payment. If a decision in this study is selected for payment, you will **receive the money you didn't save today, and you will receive the money you saved, plus the interest it accrues, six months from now.**

Example:

Reminder: The points you save will earn interest at an **interest rate**, and those points, plus the interest earned, will be delivered to your account in 6 months. The points you don't save will be delivered to your account today, but will not earn interest.

In this round: The interest rate is **22%**.

How many points (out of 100) do you save? [ ] **points**

- In this example, the interest rate is 22%.
- You then need to decide how many of your 100 points to save.

Your certainty:

In each round, we will ask you two questions:

- How much you save.
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that the decision you made is actually your best decision, given your personal preferences.

Next

Figure 36: The instruction screen for SAV task.

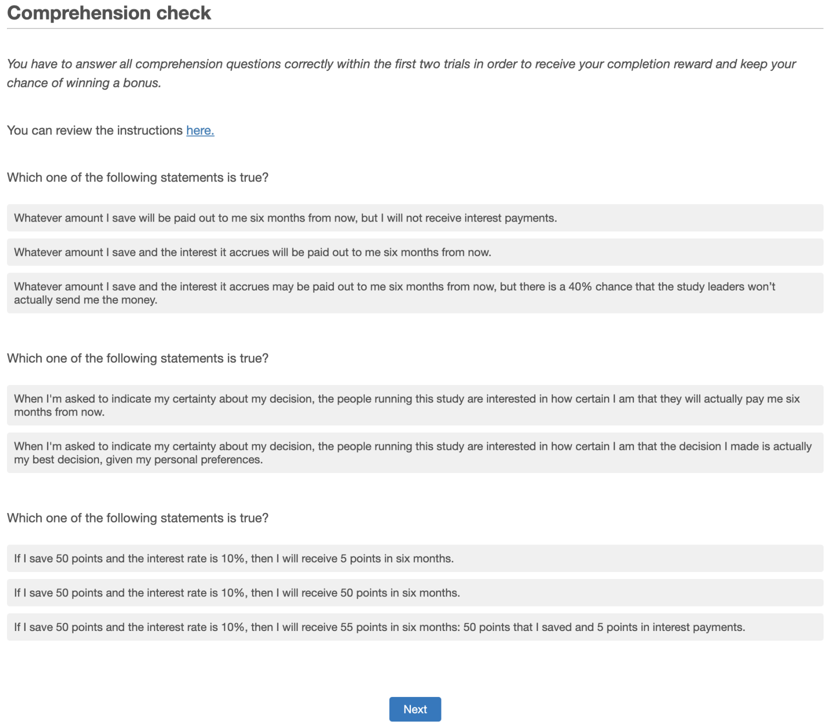


Figure 37: Comprehension check for SAV task.

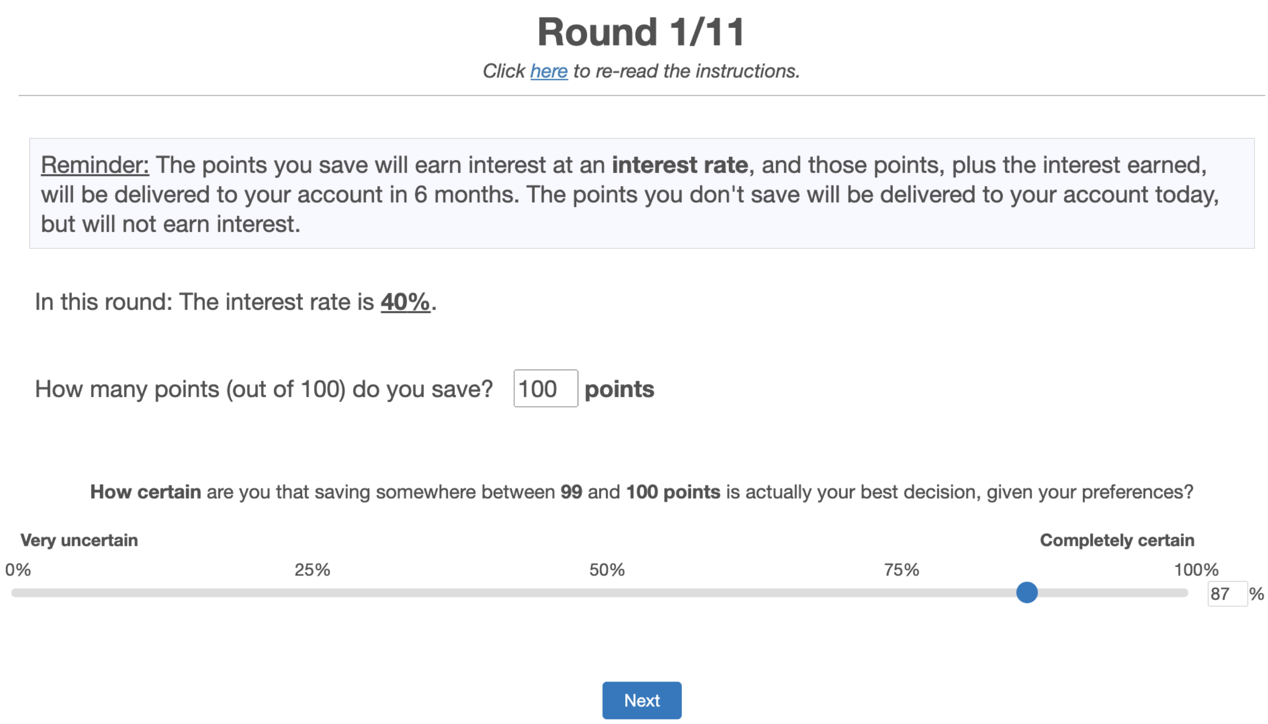
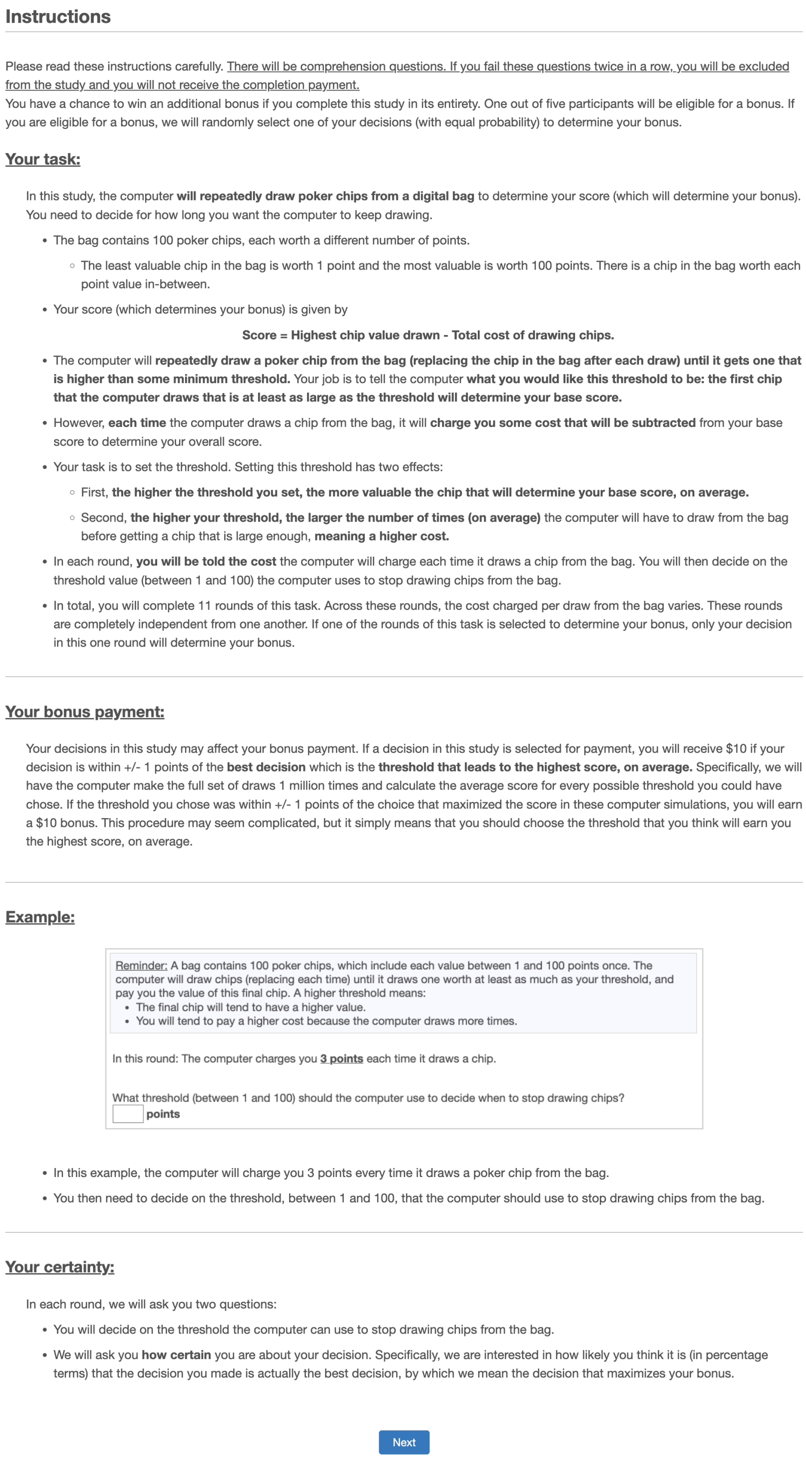


Figure 38: Decision screen for SAV task.

G.7 SEA



Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, the computer **will repeatedly draw poker chips from a digital bag** to determine your score (which will determine your bonus). You need to decide for how long you want the computer to keep drawing.

- The bag contains 100 poker chips, each worth a different number of points.
  - The least valuable chip in the bag is worth 1 point and the most valuable is worth 100 points. There is a chip in the bag worth each point value in-between.
- Your score (which determines your bonus) is given by

  Score = Highest chip value drawn - Total cost of drawing chips.
- The computer will **repeatedly draw a poker chip from the bag (replacing the chip in the bag after each draw) until it gets one that is higher than some minimum threshold.** Your job is to tell the computer **what you would like this threshold to be: the first chip that the computer draws that is at least as large as the threshold will determine your base score.**
- However, **each time** the computer draws a chip from the bag, it will **charge you some cost that will be subtracted** from your base score to determine your overall score.
- Your task is to set the threshold. Setting this threshold has two effects:
  - First, **the higher the threshold you set, the more valuable the chip that will determine your base score, on average.**
  - Second, **the higher your threshold, the larger the number of times (on average)** the computer will have to draw from the bag before getting a chip that is large enough, **meaning a higher cost.**
- In each round, **you will be told the cost** the computer will charge each time it draws a chip from the bag. You will then decide on the threshold value (between 1 and 100) the computer uses to stop drawing chips from the bag.
- In total, you will complete 11 rounds of this task. Across these rounds, the cost charged per draw from the bag varies. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions in this study may affect your bonus payment. If a decision in this study is selected for payment, you will receive $10 if your decision is within +/- 1 points of the **best decision** which is the **threshold that leads to the highest score, on average.** Specifically, we will have the computer make the full set of draws 1 million times and calculate the average score for every possible threshold you could have chose. If the threshold you chose was within +/- 1 points of the choice that maximized the score in these computer simulations, you will earn a $10 bonus. This procedure may seem complicated, but it simply means that you should choose the threshold that you think will earn you the highest score, on average.

Example:

Reminder: A bag contains 100 poker chips, which include each value between 1 and 100 points once. The computer will draw chips (replacing each time) until it draws one worth at least as much as your threshold, and pay you the value of this final chip. A higher threshold means:
- The final chip will tend to have a higher value.
- You will tend to pay a higher cost because the computer draws more times.

In this round: The computer charges you **3 points** each time it draws a chip.

What threshold (between 1 and 100) should the computer use to decide when to stop drawing chips?
points

- In this example, the computer will charge you 3 points every time it draws a poker chip from the bag.
- You then need to decide on the threshold, between 1 and 100, that the computer should use to stop drawing chips from the bag.

Your certainty:

In each round, we will ask you two questions:

- You will decide on the threshold the computer can use to stop drawing chips from the bag.
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that the decision you made is actually the best decision, by which we mean the decision that maximizes your bonus.

Next

Figure 39: The instruction screen for SEA task.

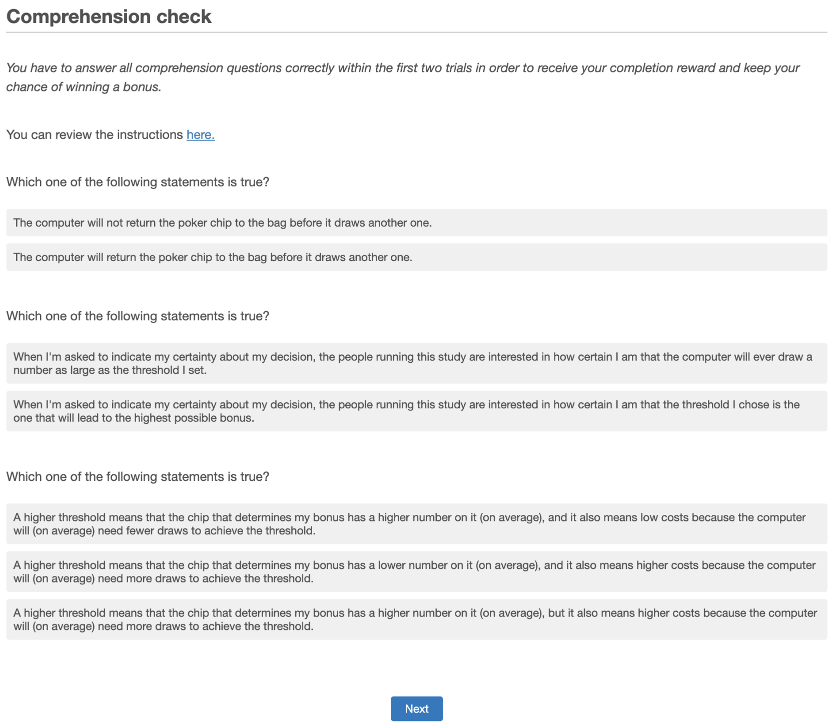


Figure 40: Comprehension check for SEA task.

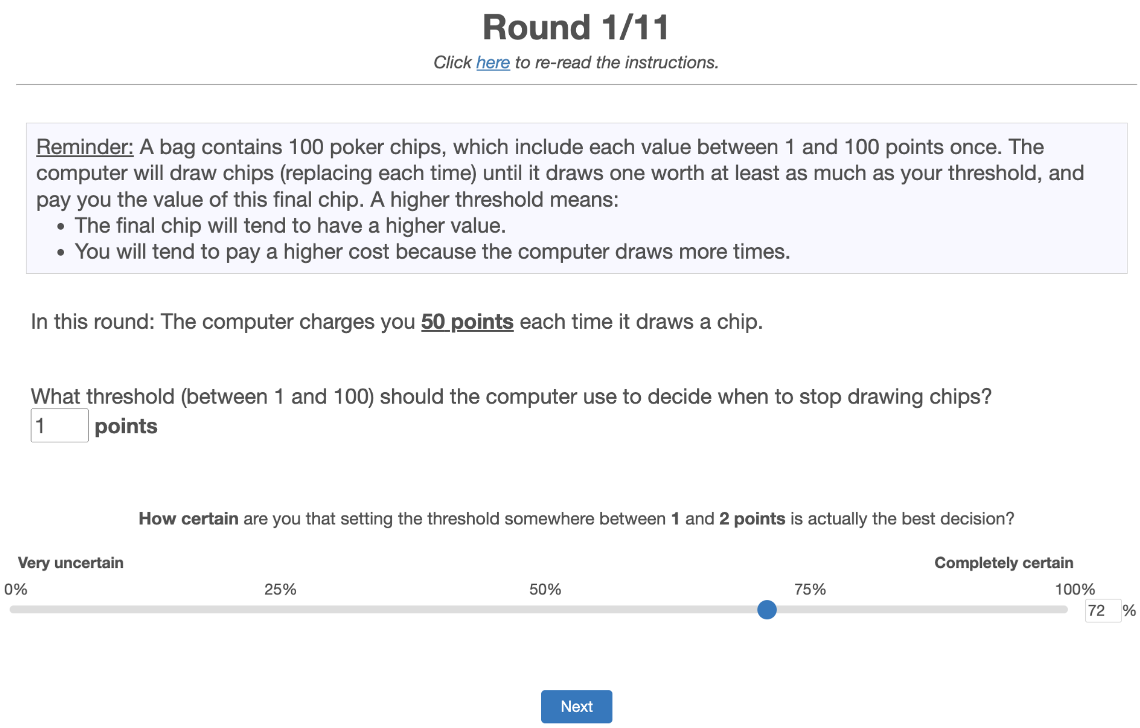
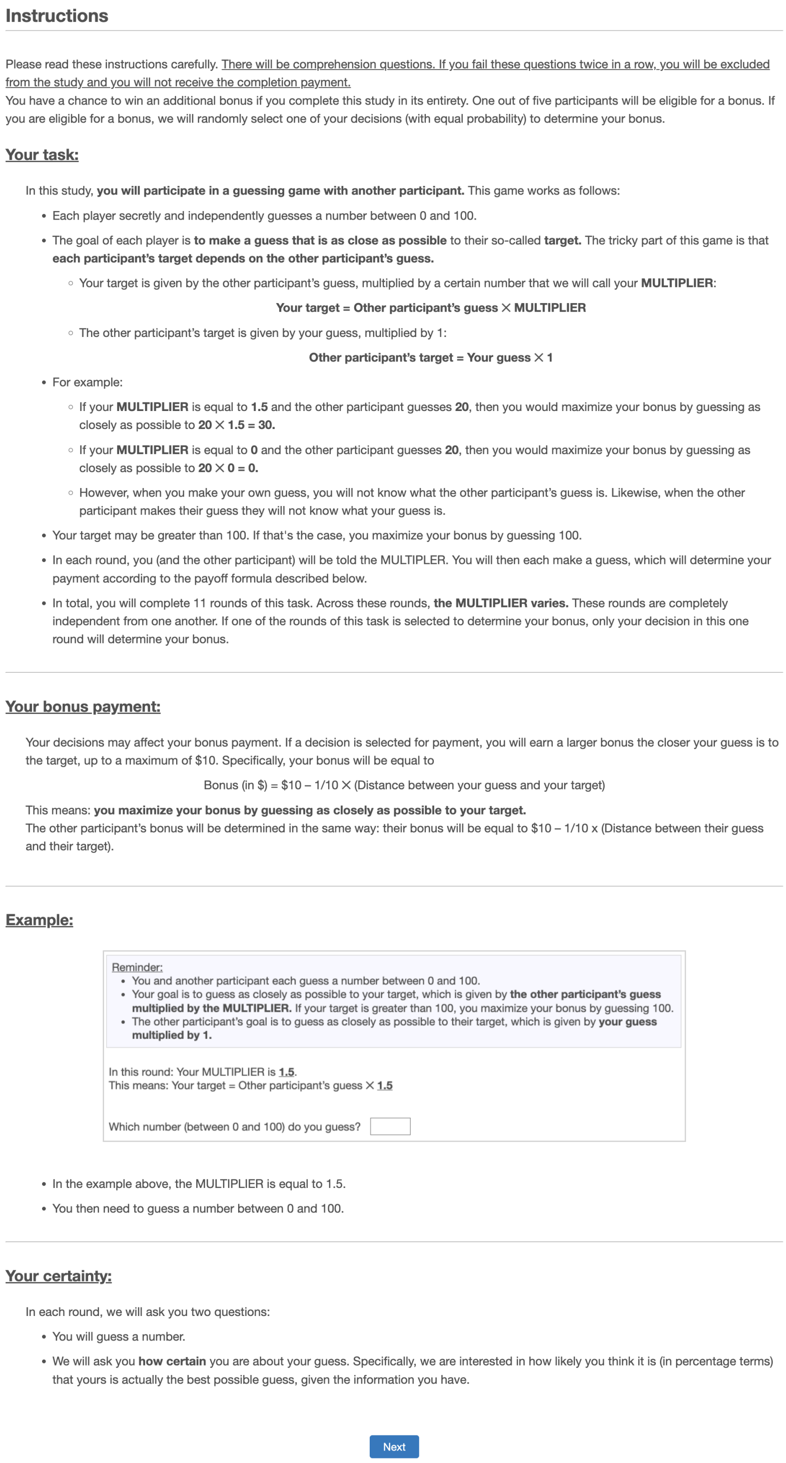


Figure 41: Decision screen for SEA task.

G.8 GUE



Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, **you will participate in a guessing game with another participant.** This game works as follows:

- Each player secretly and independently guesses a number between 0 and 100.
- The goal of each player is **to make a guess that is as close as possible** to their so-called **target.** The tricky part of this game is that **each participant's target depends on the other participant's guess.**
  - Your target is given by the other participant's guess, multiplied by a certain number that we will call your **MULTIPLIER**:

    Your target = Other participant's guess × MULTIPLIER
  - The other participant's target is given by your guess, multiplied by 1:

    Other participant's target = Your guess × 1
- For example:
  - If your **MULTIPLIER** is equal to **1.5** and the other participant guesses **20**, then you would maximize your bonus by guessing as closely as possible to **20 × 1.5 = 30.**
  - If your **MULTIPLIER** is equal to **0** and the other participant guesses **20**, then you would maximize your bonus by guessing as closely as possible to **20 × 0 = 0.**
  - However, when you make your own guess, you will not know what the other participant's guess is. Likewise, when the other participant makes their guess they will not know what your guess is.
- Your target may be greater than 100. If that's the case, you maximize your bonus by guessing 100.
- In each round, you (and the other participant) will be told the MULTIPLER. You will then each make a guess, which will determine your payment according to the payoff formula described below.
- In total, you will complete 11 rounds of this task. Across these rounds, **the MULTIPLIER varies.** These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus payment. If a decision is selected for payment, you will earn a larger bonus the closer your guess is to the target, up to a maximum of $10. Specifically, your bonus will be equal to

Bonus (in $) = $10 – 1/10 × (Distance between your guess and your target)

This means: **you maximize your bonus by guessing as closely as possible to your target.**
The other participant's bonus will be determined in the same way: their bonus will be equal to $10 – 1/10 x (Distance between their guess and their target).

Example:

Reminder:
- You and another participant each guess a number between 0 and 100.
- Your goal is to guess as closely as possible to your target, which is given by **the other participant's guess multiplied by the MULTIPLIER.** If your target is greater than 100, you maximize your bonus by guessing 100.
- The other participant's goal is to guess as closely as possible to their target, which is given by **your guess multiplied by 1.**

In this round: Your MULTIPLIER is 1.5.
This means: Your target = Other participant's guess × 1.5

Which number (between 0 and 100) do you guess?

- In the example above, the MULTIPLIER is equal to 1.5.
- You then need to guess a number between 0 and 100.

Your certainty:

In each round, we will ask you two questions:

- You will guess a number.
- We will ask you **how certain** you are about your guess. Specifically, we are interested in how likely you think it is (in percentage terms) that yours is actually the best possible guess, given the information you have.

Next

Figure 42: The instruction screen for GUE task.

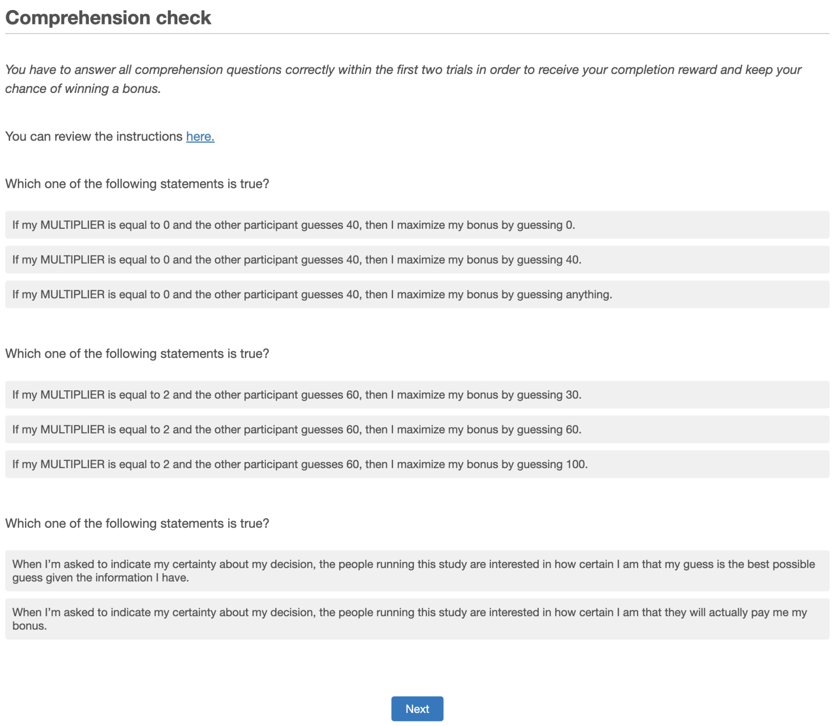


Figure 43: Comprehension check for GUE task.

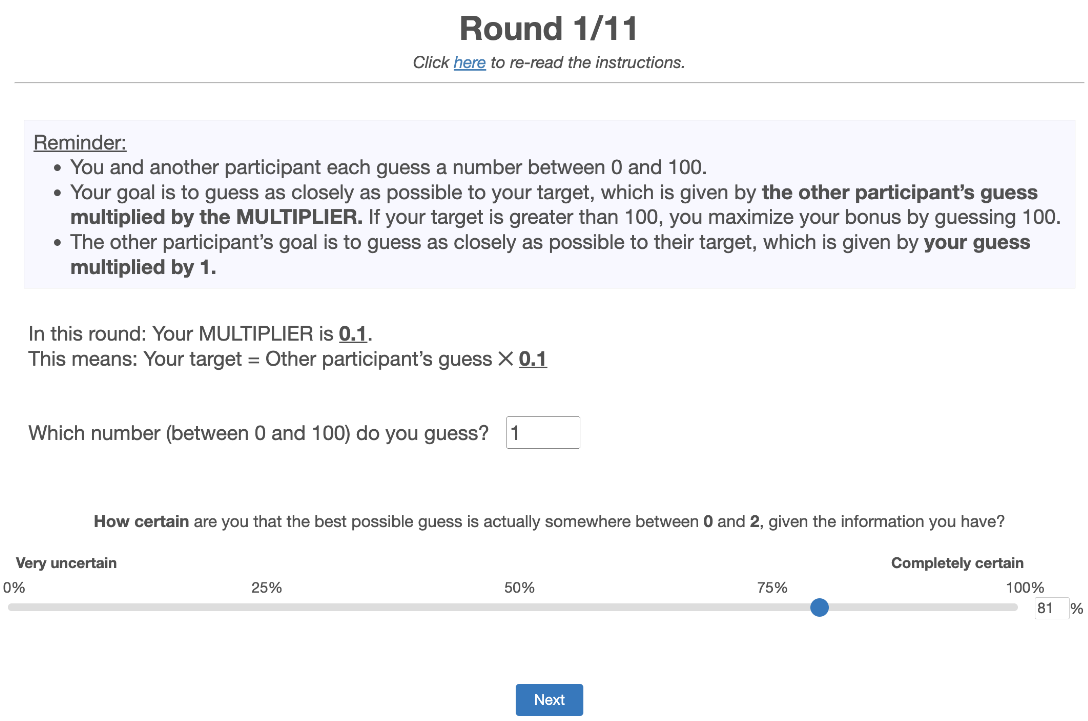


Figure 44: Decision screen for GUE task.

G.9 GPT

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.

Your task:

In this study, **you will make a series of hypothetical decisions about how much you would be willing to pay for a specific quantity of a given product.**

- Imagine that you are **given a budget of $30**. You will then see **a description of the product and the quantity you would receive.**
- Your task is to indicate the **precise dollar amount (between $0 and $30) that you would at most be willing to pay.**
- Imagine that these items would be shipped to your home address without any additional shipping costs, and that you get to keep whatever amount of the $30 you don't spend.
- In each round, you will be told **what the product is and which quantity is for sale.** You will then decide how much **you would at most be willing to pay** by indicating a dollar amount.
- You can also enter digits, such as $6.78.
- In total, you will complete 11 rounds of this task. Across these rounds, the quantity of the product that is for sale varies. These rounds are completely independent from one another.

Example:

In this round:

6 packs of

Pasta: Premium Organic Penne
Italian Macaroni product made from organic durum wheat semolina
1 pound per pack

How much (out of your budget of $30) are you at most willing to pay for this product?

My maximal willingness to pay for this product is $

- In this example, you evaluate 6 packs of organic penne.
- You then need to decide how much you would at most be willing to pay for this product.

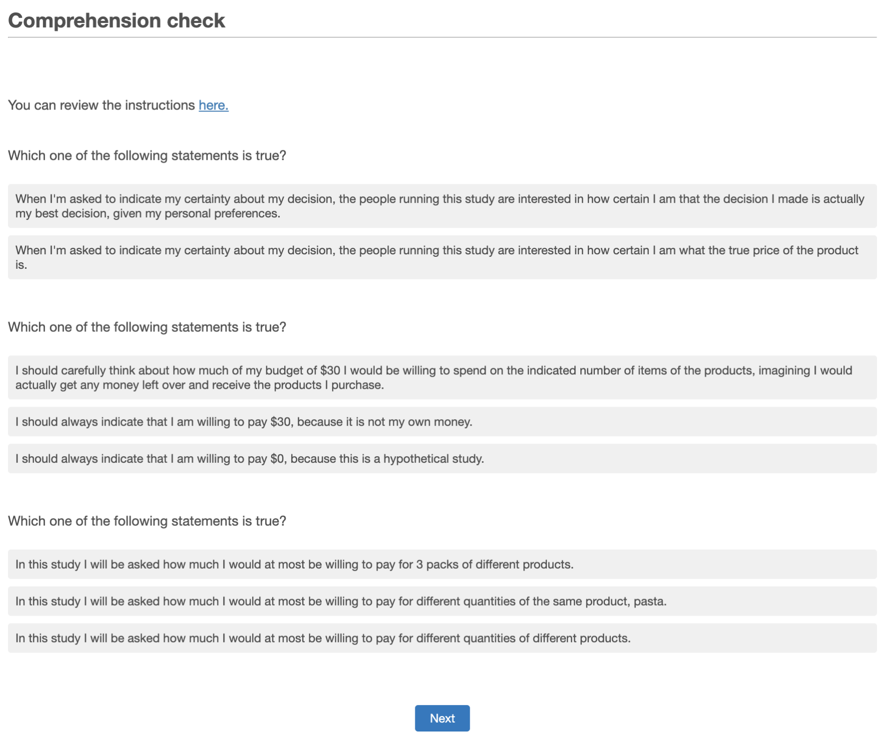
Your certainty:

In each round, we will ask you two questions:

- How much would you at most be willing to pay. We will use this answer to determine how much you value the product.
- We will ask you **how certain** you are about your decisions. Specifically, we are interested in how likely you think it is (in percentage terms) that your decisions actually reflect how much you value the product, given your personal preferences.

Next

Figure 45: The instruction screen for GPT task.


Comprehension check

You can review the instructions here.

Which one of the following statements is true?

- When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am that the decision I made is actually my best decision, given my personal preferences.
- When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am what the true price of the product is.

Which one of the following statements is true?

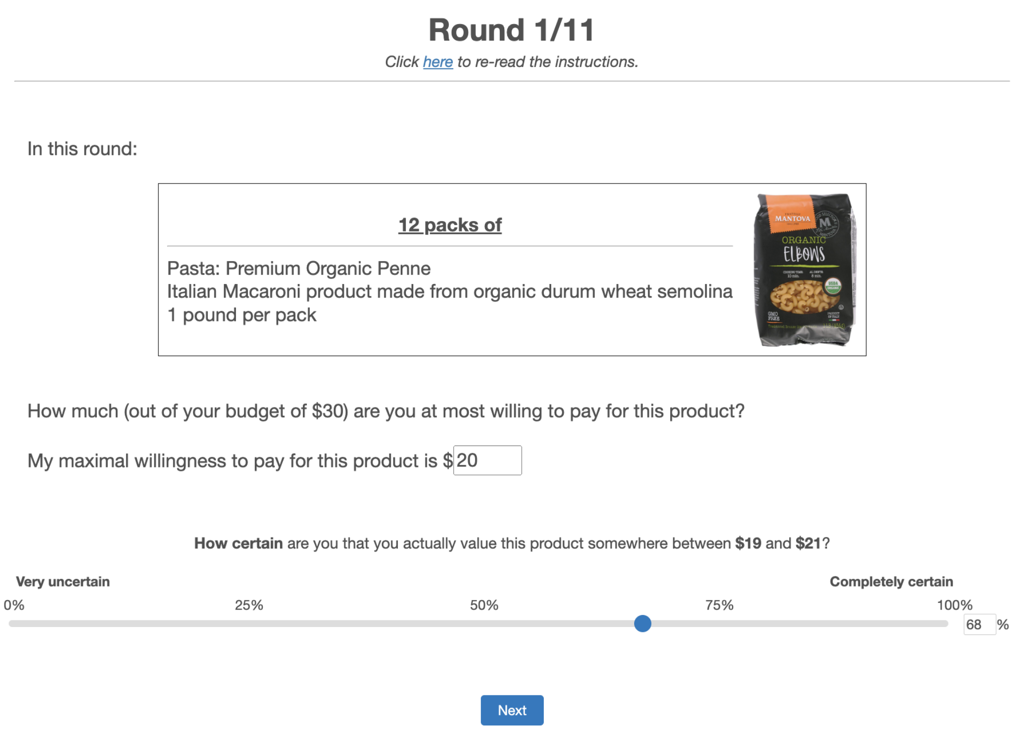
- I should carefully think about how much of my budget of $30 I would be willing to spend on the indicated number of items of the products, imagining I would actually get any money left over and receive the products I purchase.
- I should always indicate that I am willing to pay $30, because it is not my own money.
- I should always indicate that I am willing to pay $0, because this is a hypothetical study.

Which one of the following statements is true?

- In this study I will be asked how much I would at most be willing to pay for 3 packs of different products.
- In this study I will be asked how much I would at most be willing to pay for different quantities of the same product, pasta.
- In this study I will be asked how much I would at most be willing to pay for different quantities of different products.

Next

Figure 46: Comprehension check for GPT task.


Round 1/11

Click here to re-read the instructions.

In this round:

12 packs of

Pasta: Premium Organic Penne
Italian Macaroni product made from organic durum wheat semolina
1 pound per pack

How much (out of your budget of $30) are you at most willing to pay for this product?

My maximal willingness to pay for this product is $ 20

How certain are you that you actually value this product somewhere between **$19** and **$21**?

Very uncertain — **Completely certain**

0% 25% 50% 75% 100% 68 %

Next

Figure 47: Decision screen for GPT task.

G.10 PAC

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, you will **decide whether to participate in a lottery or not.**

- The lottery has two possible outcomes that are **equally likely, i.e. it is a 50-50 lottery.**
- One lottery outcome is a **loss**, the other lottery outcome is a **gain**. If it is a gain, you receive money. If it is a loss, you have to pay money.
- **You have a budget of 100 points** where each point is worth $0.05 in payment to you. The outcome of the lottery will be added to that budget if it is a gain, and subtracted from your budget if it is a loss.
- Your task is to decide **whether or not you want to accept the lottery** (have it played out for you to influence your payment), or reject it.
- Prior to making your decision, you can actually **find out what the randomly drawn lottery outcome is.** You can do so by verifying the correctness of math equations that will be shown to you on your screen. Specifically, 60 addition equations will be shown to you. Each equation is either correct, such as 60+29=89, or incorrect, such as 17+28=41.
  - If **50** equations are **correct** and **10** are **incorrect**, the lottery outcome is a **gain**.
  - If **10** equations are **correct** and **50** are **incorrect**, the lottery outcome is a **loss**.
- In each round, you will be told the two possible outcomes of the lottery, and 60 equations will be shown to you. You will then decide whether to accept or reject the lottery.
- In total, you will complete 11 rounds of this task. Across these rounds, the outcomes of the lottery will vary. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus. If a round in this study is selected for payment each point is worth $0.05. You will receive your budget of 100 points if you rejected the lottery. If you accepted the lottery, you will receive the sum of the budget and the lottery outcome:

- If the lottery outcome is a **gain**, your bonus will be **larger** than the budget.
- If the lottery outcome is a **loss**, you bonus will be **smaller** than the budget.

Example:

Reminder:
- If 50 equations are correct and 10 are wrong, the lottery outcome is the **gain**.
- If 10 equations are correct and 50 are wrong, the lottery outcome is the **loss**.
- You need to decide whether to accept or reject a lottery.

In this round:

With **50%** chance: **Get 63 points**
With **50%** chance: **Lose 37 points**

46 + 43 = 87	34 + 11 = 46	11 + 2 = 11
62 + 30 = 91	37 + 10 = 48	11 + 22 = 36
8 + 5 = 12	23 + 6 = 31	36 + 51 = 88
14 + 14 = 28	22 + 7 = 26	38 + 3 = 42
44 + 15 = 56	10 + 0 = 13	19 + 12 = 30
44 + 10 = 56	14 + 73 = 88	15 + 3 = 15
18 + 1 = 19	66 + 12 = 80	16 + 20 = 37
37 + 59 = 97	12 + 3 = 15	7 + 94 = 99
12 + 15 = 26	3 + 12 = 18	16 + 0 = 13
10 + 87 = 97	15 + 56 = 73	38 + 63 = 99
23 + 27 = 49	28 + 54 = 82	14 + 15 = 28
58 + 15 = 72	12 + 21 = 31	26 + 2 = 26
22 + 72 = 95	21 + 24 = 44	15 + 1 = 16
49 + 22 = 69	13 + 73 = 85	13 + 1 = 15
33 + 12 = 44	29 + 48 = 74	34 + 10 = 43
20 + 4 = 24	11 + 5 = 13	14 + 0 = 11
55 + 20 = 78	42 + 40 = 82	23 + 69 = 89
15 + 9 = 22	16 + 0 = 14	42 + 15 = 59
6 + 6 = 14	68 + 9 = 74	4 + 6 = 12
9 + 23 = 32	60 + 37 = 97	23 + 25 = 46

Do you accept or reject this lottery?

○ Accept ○ Reject

- In this example, the possible lottery outcomes are a 63 point gain and a 37 point loss.
- You then need to decide whether to accept or reject the lottery.

Your certainty:

In each round, we will ask you two questions:

- You will decide to accept or reject the lottery.
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that the decision you made is actually your best decision, given your personal preferences and the available information.

Next

Figure 48: The instruction screen for PAC task.

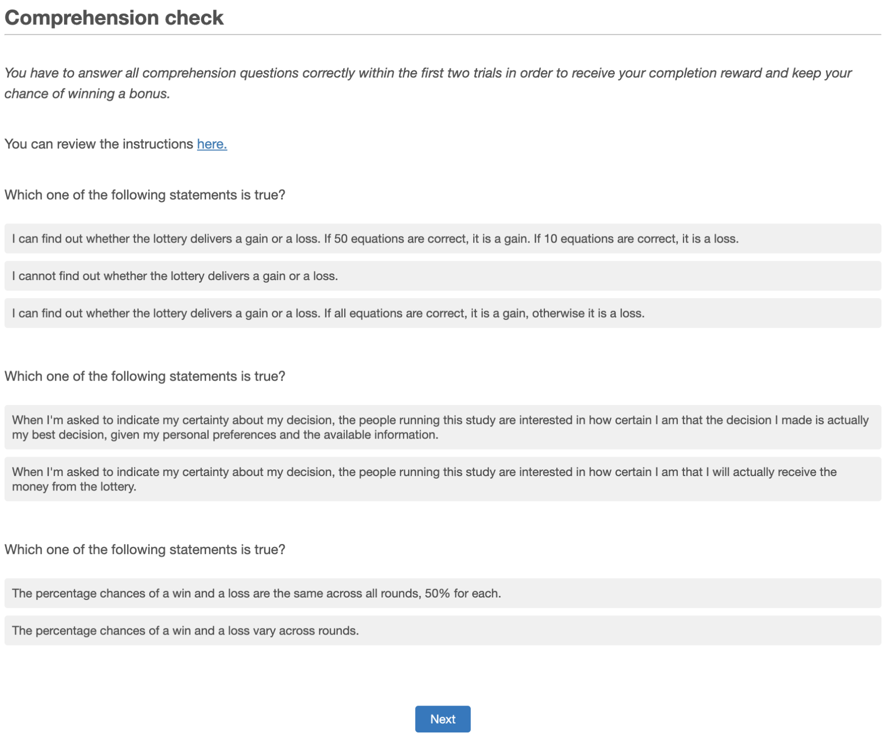


Figure 49: Comprehension check for PAC task.

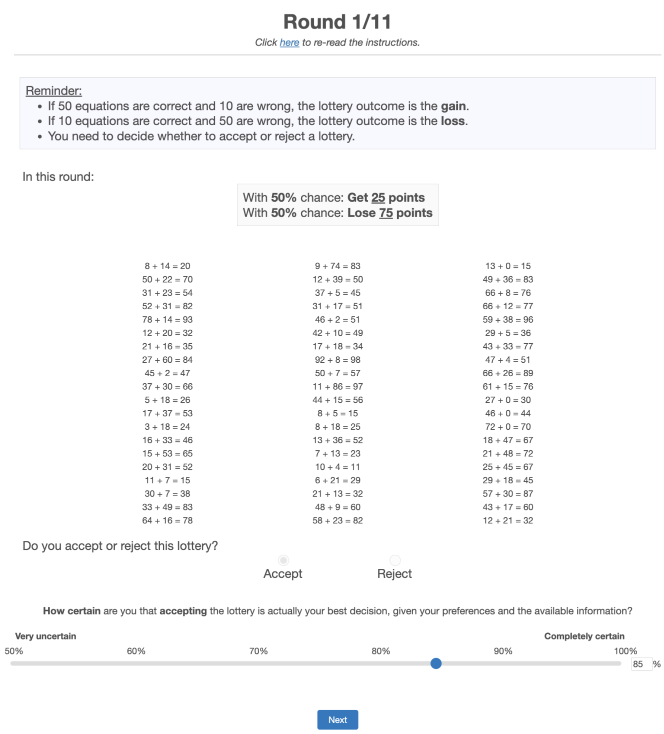


Figure 50: Decision screen for PAC task.

G.11 POA

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, **you will decide how to allocate money between two investment accounts: a bank account and a stock account.**

- Any amount of money you invest in an account will increase or decrease by some percentage over the next year – we call this the "percentage return" of the account.
  - The bank account delivers a **2% return** over the next year.
  - The stock account delivers a **return equal to the return of an exchange-traded fund (ETF)** over the next year. An ETF is a basket of stocks and other securities that tracks an underlying stock index.
- In each round, you will be told **which ETF determines the returns of the stock account.** This will be a real ETF that will generate some return over the next year.
- You will decide how to split $1,000 between the bank account and the stock account.
  - To help you with your decision, we will tell you the historical 1-year return of the ETF, which we compute as the average 1-year return over a prior period of five years. However, because the market conditions constantly change, the return of the ETF over the next year may be different from this earlier, past period.
  - Before you make your investment decision, we will also ask you to give an estimate of the return of the stock account over the next year.
- In total, you will complete 11 rounds of this task. Across these rounds, the ETF that determines the returns of the stock account will vary. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus payment. If a decision in this study is selected for payment, you will receive the total value of your investments in one year's time, divided by 100. That is, we will actually pay you based on your investment and the ETF's returns over the next year. As a result, **it is in your best interest to indicate how you would actually invest your money in each round.**

Example:

You are given $1000. You can allocate this money between two investments:
- **Bank Account:** This account delivers a safe 2% return over the next 12 months.
- **Stock Account:** The return on this account is uncertain and will be equal to the return of an ETF that tracks the U.S. **consumer discretionary sector (Ticker: RSPD)** over the next 12 months.

For this ETF: The historical 1-year return of this ETF is 9.77%. This historical return is computed as the average 1-year return over a period of five years.

What do you think the percentage return of the stock account will be over the next year? ____ %

How much (out of your budget of $1,000) do you invest in the stock account?

Investment in Stock Account: $____
Investment in Bank Account: $____

- In this example, you would give your estimate of the return of the stock account, and use the input field to indicate how you would allocate the $1,000 between the stock account and the bank account.

Your certainty:

In each round, we will ask you three questions:

- You will give your estimate of the return of the stock account.
- You will decide how to invest your money between the two accounts.
- We will ask you **how certain** you are about your investment decision. Specifically, we are interested in how likely you think it is (in percentage terms) that the investment decision you made is actually your best decision, given your personal preferences and the available information.

Next

Figure 51: The instruction screen for POA task.

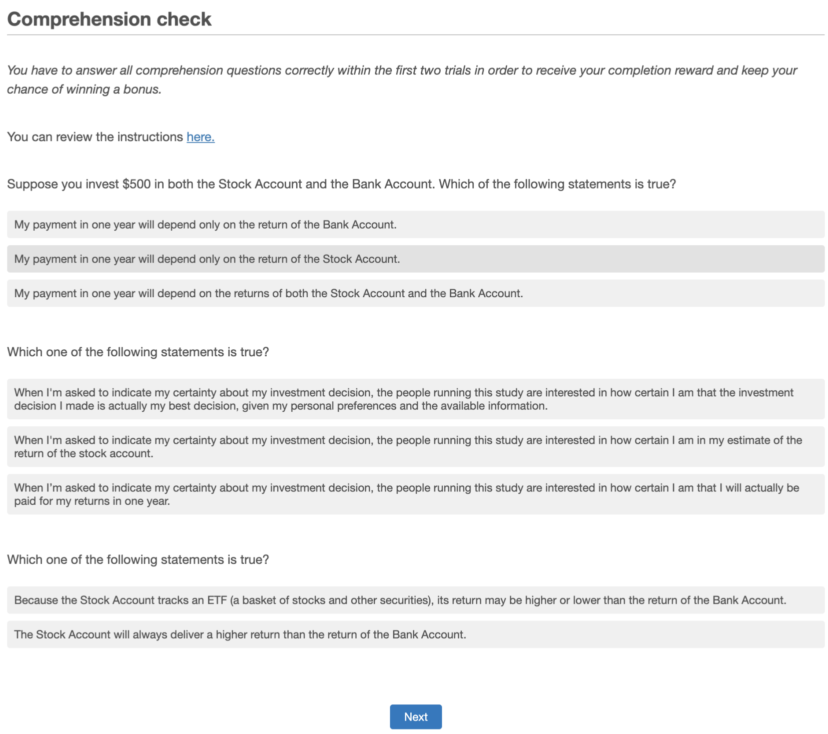


Figure 52: Comprehension check for POA task.

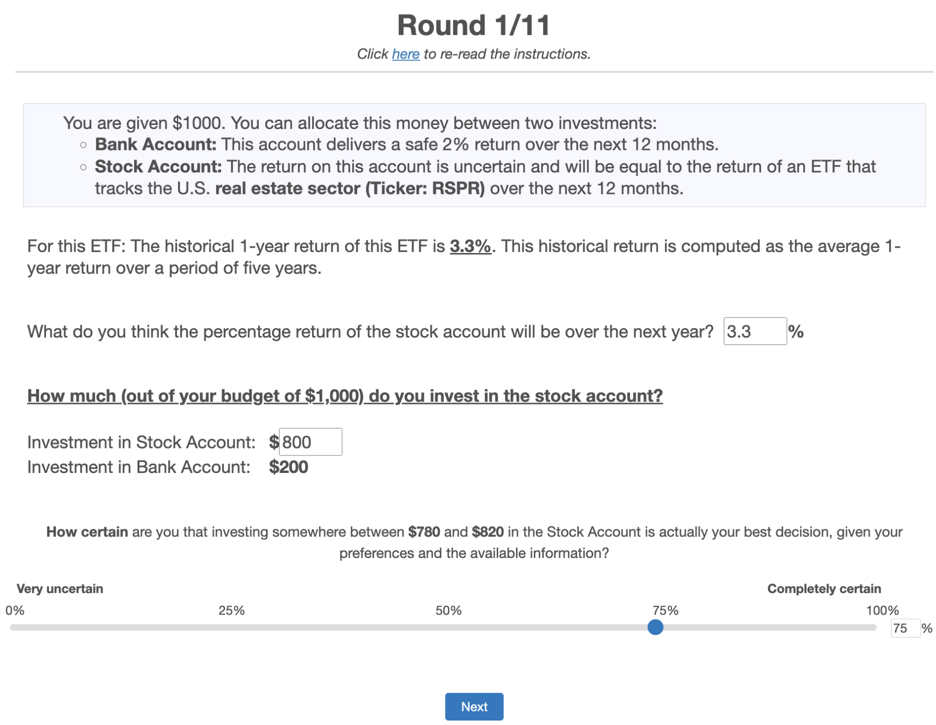


Figure 53: Decision screen for POA task.

G.12 PRD

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, **you will play a game with another participant. You will choose an action 'Top' or 'Bottom'.** You will be matched to **another participant in the study who will choose 'Left' or 'Right'.** The combinations of your two actions will determine each of your payments.

- Your earnings from your and the other player's choice will be shown in a payoff matrix like this one:

Other participant's choice → / Your choice↓	Left	Right
Top	$X, $X	$1, $7
Bottom	$7, $1	$2, $2

  - Your choice determines the row of the matrix determining the payments (top row or bottom row); the other player's choice determines the column of the matrix (left column or right column). **Together they determine which one cell of the matrix determines both of your payments.**
  - In each cell of the table (each combination of your and the other player's choices), the **first number (shown in blue) gives the amount you would earn** and **the second number (shown in red) the amount the other player would earn.**
  - The amount '**X**', i.e. the payment that occurs if you choose Top and the other player Left, **will vary from round to round in the task.**
- In each round, you (and the other player) will be told what X is. You will then each choose an action, which will determine your payment according to the payoff matrix.
- In total, you will complete 11 rounds of this task. Across these rounds, the payment X varies. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus payment. If a decision in this study is selected for payment, you and and the other player will earn the amounts in the matrix shown above that corresponds to your and the other player's choices.

Example:

Which action do you choose (click a button next to the table)?

Other participant's choice → / Your choice↓	Left	Right
Top	$3.3, $3.3	$1, $7
Bottom	$7, $1	$2, $2

- In the example above, X is equal to $3.30.
- You then need to decide whether to choose Top or Bottom.

Your certainty:

In each round, we will ask you two questions:

- You will choose an action, either Top or Bottom.
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that the decision you made is actually your best decision, given your personal preferences and the available information.

Next

Figure 54: The instruction screen for PRD task.

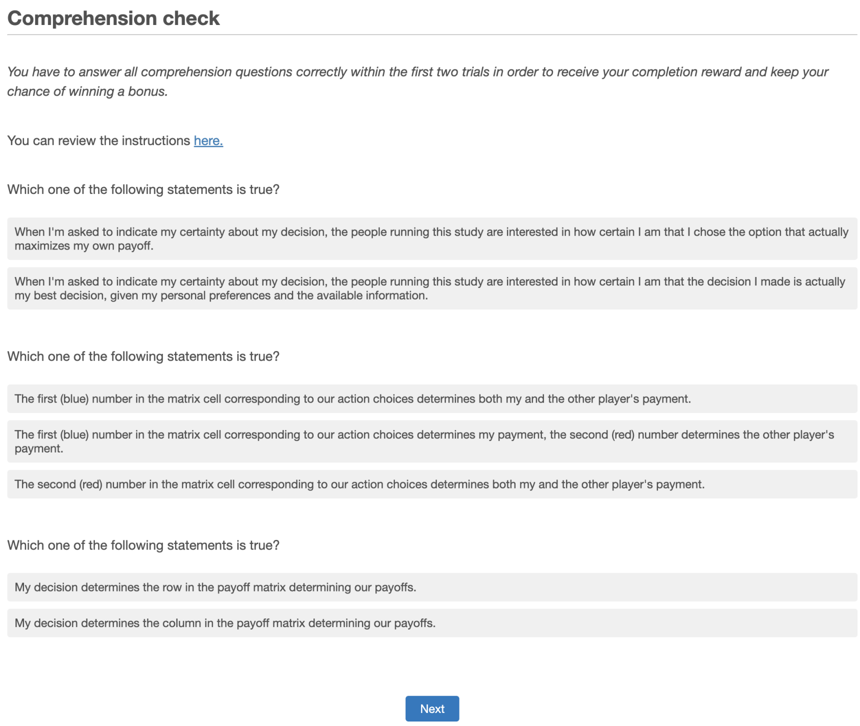


Figure 55: Comprehension check for PRD task.

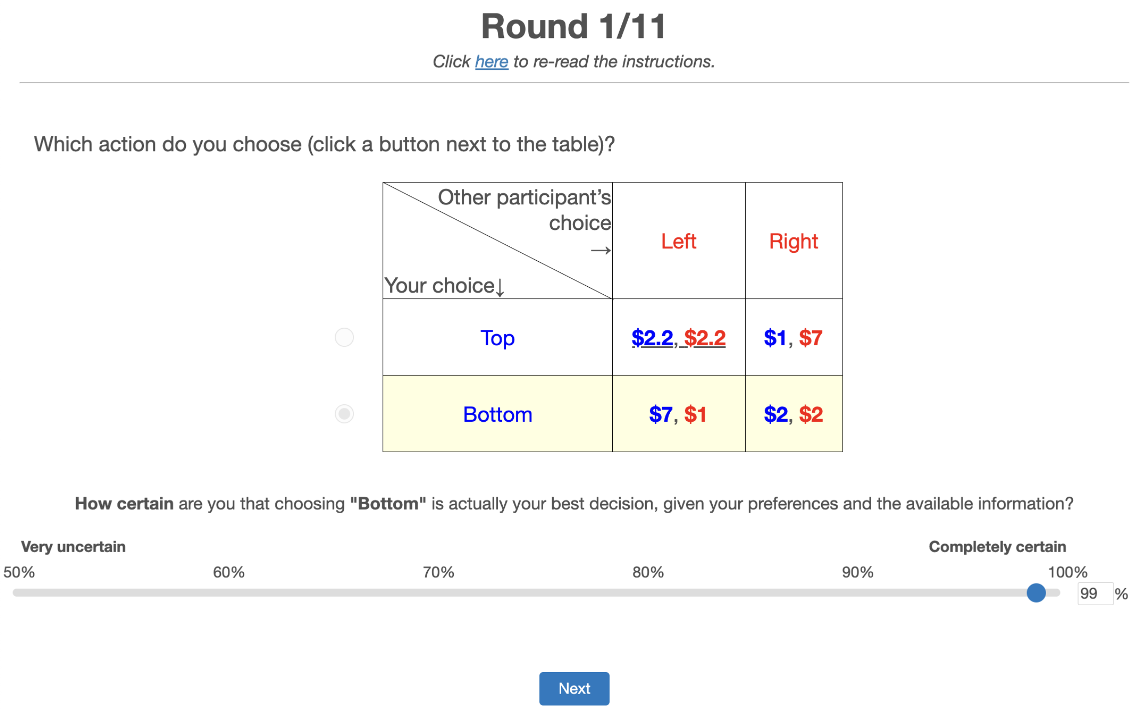


Figure 56: Decision screen for PRD task.

G.13 PRE

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, you will **decide between a lottery ticket and a safe payment.**

- A lottery ticket pays **$18 with some percentage chance, and $0 otherwise.**
- A safe payment is paid with certainty.
- In each round, you will be told **the amount of the safe payment.** You will then decide between the safe payment and lottery tickets with different percentage chances of paying $18.
- In total, you will complete 11 rounds of this task. Across these rounds, the safe payment will vary. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus.

- If you picked the lottery, you will receive the outcome of the lottery, implemented by the computer.
- If you picked the safe payment, you will receive that payment.

This means that it is in your best interest to **choose the option (lottery or safe payment) you actually prefer in each case.**

Example:

Safe payment			Lottery
$12	●	○	With **5%** chance: **Get $18.**
	●	○	With **10%** chance: **Get $18.**
	●	○	With **15%** chance: **Get $18.**
	●	○	With **20%** chance: **Get $18.**
	●	○	With **25%** chance: **Get $18.**
	●	○	With **30%** chance: **Get $18.**
	●	○	With **35%** chance: **Get $18.**
	●	○	With **40%** chance: **Get $18.**
	●	○	With **45%** chance: **Get $18.**
	●	○	With **50%** chance: **Get $18.**
	●	○	With **55%** chance: **Get $18.**
	●	○	With **60%** chance: **Get $18.**
	○	●	With **65%** chance: **Get $18.**
	○	●	With **70%** chance: **Get $18.**
	○	●	With **75%** chance: **Get $18.**
	○	●	With **80%** chance: **Get $18.**
	○	●	With **85%** chance: **Get $18.**
	○	●	With **90%** chance: **Get $18.**
	○	●	With **95%** chance: **Get $18.**

- In this example, the safe payment is $12.
- You then need to decide whether you prefer this safe payment or a lottery ticket with a specific percentage chance of winning $18.
- You will make your decisions in a choice list, **where each row is a separate choice.**
  - In every list, the left-hand option is a safe payment that is identical in all rows. The right-hand option is a lottery ticket. The percentage chance of the lottery ticket paying $18 increases from row-to-row as you go down the list.
  - To make a choice just click on the radio button you prefer for each choice (i.e. for each row).
  - **An effective way to complete these choice lists is to determine in which row you would prefer to switch from choosing the safe payment to choosing the lottery.** You can click on that row and we will automatically fill out the rest of the list for you, by selecting the safe payment in all rows above and the lottery in all rows below your selected row.
  - Based on where you switch from the safe payment to the lottery in this list, we assess which percentage chance of winning $18 you value as much as the safe payment.
  - For example, in the choice list above, your choice suggests that you value the safe payment as much as a lottery ticket that pays $18 with a percentage chance between 60% and 65% because this is where you switched.
  - If a round in this study is selected for bonus payment, the computer will randomly select one of your choices from that choice list, and you will receive the option you selected in that choice.

Your certainty:

In each round, we will ask you two questions:

- You will decide between a safe payment and different lottery tickets. We will use these decisions to assess which winning probability you value as much as the safe payment.
- We will ask you **how certain** you are about your decisions. Specifically, we are interested in how likely you think it is (in percentage terms) that your decisions actually reflect which winning probability you value as much as the safe payment.

Next

Figure 57: The instruction screen for PRE task.

Figure 58: Comprehension check for PRE task.

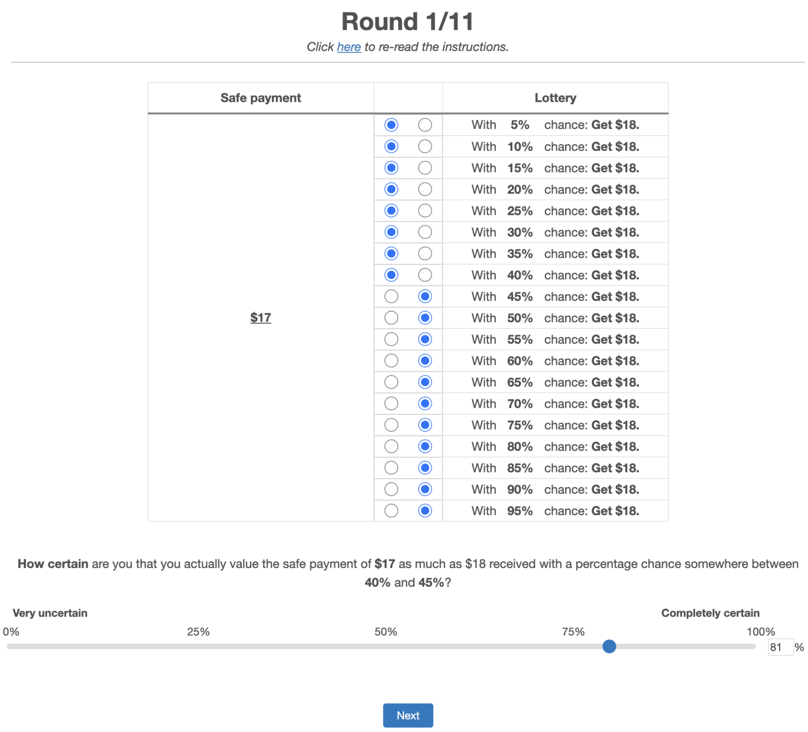


Figure 59: Decision screen for PRE task.

G.14 PRS

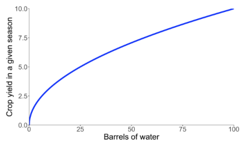
Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study you are a farmer who needs **to split 100 barrels of water for irrigating your crops between two growing seasons: Spring and Summer.** Your job is to allocate the water between seasons **to maximize your total crop yield.**

- Your total crop yield is equal to all of your Spring crop yield plus 90% of your Summer crop yield (some of your crop goes bad in the Summer months).
- Your crop yield in each season depends on how much water you allocate to that season. Specifically in each season your yield is determined by the following formula.



Crop yield in a given season = $\sqrt{\text{Barrels of Water}}$

  - **The more water you allocate to a season, the higher the crop yield in that season.** However, while the first barrels of water allocated to a season have a large yield, **the additional yield from allocating more and more water in the season gets smaller.**
  - For example, while the crop yield from 45 barrels of water in a given season is higher than the crop yield from 40 barrels of water, the yield boost derived from those additional 5 barrels is much smaller than the yield boost that results from using 5 versus 0 barrels of water.
  - This makes it valuable to allocate water **to both seasons.**
- In the Spring, the amount of water that determines the crop yield is exactly the amount you allocate. But **in the Summer there will be a weather shock that either increases or decreases the water** you allocate to the season:
  - **With 50% chance, a certain amount of water will be added,** increasing your yield in the Summer.
  - **With the remaining 50% chance, a certain amount of water will be removed,** decreasing your yield in the Summer (though you cannot have less than 0 barrels of water).
  - In each round, you will be told **the size of the weather shock: the amount of water that gets either added to or removed from the reservoir in the Summer.** You will then decide how you allocate your water between the Spring and Summer.
- The size of the weather shock is an important consideration for how you allocate your water:
  - **If the weather shock is large, you run the risk of having only very little water in the Summer,** which would have a large negative effect on your expected crop yield.
- You can also allocate fractions of Barrels, such as 6.7 Barrels.
- In total, you will complete 11 rounds of this task. Across these rounds, the size of the weather shock varies. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in that one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus. If a round in this study is selected for payment, the computer will randomly determine the outcome of the weather shock. We will then calculate your earnings as described above. Your bonus then equals

Bonus (in $) = Total yield/2

What this means is that it is in your best interest **to allocate your points in a way that maximizes the total crop yield.**

Example:

Reminder: Each additional barrel of water used in a given season creates less and less additional crop yield.
- Crop yield in a given season = $\sqrt{\text{Barrels of Water}}$
- Water available in Summer depends on both the water saved and the outcome of the weather shock
- Total crop yield = Spring yield + 90% of Summer yield

In this round: Size of weather shock in the Summer:
- With **50%** chance: **23 barrels of water added**
- With **50%** chance: **23 barrels of water removed**

How do you split your 100 barrels of water between the Spring and Summer seasons?

Spring Season: [ ] **barrels**
Summer Season: _____ **barrels** (before the outcome of the weather shock)

- In this example, the amount of water that gets randomly added to or removed from what's left in your reservoir in the Summer is 23 barrels.
- You then need to decide how to split your 100 barrels of water between the two seasons.

Your certainty:

In each round, we will ask you two questions:
- You will decide how to split the water between the two seasons.
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that the decision you made is actually your best decision, given your personal preferences and the available information.

Next

Figure 60: The instruction screen for PRS task.

Comprehension check

You have to answer all comprehension questions correctly within the first two trials in order to receive your completion reward and keep your chance of winning a bonus.

You can review the instructions here.

Which one of the following statements is true?

- In terms of having a high expected total crop yield, it is more important to allocate water to the Summer when the potential weather shock is small.
- In terms of having a high expected total crop yield, it is more important to allocate water to the Summer when the potential weather shock is large.

Which one of the following statements is true?

- Because the crop yield increase from additional water in the Spring gets smaller and smaller the more water is already allocated to the Spring, it never makes sense to allocate water to the Summer, because the yield from the Summer only increases my total crop yield with a weight of 90%.
- Because the crop yield increase from additional water in the Spring gets smaller and smaller the more water is already allocated to the Spring, it can make sense to allocate water to the Summer even though the yield from the Summer only increases my total crop yield with a weight of 90%.

Which one of the following statements is true?

- When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am that the decision I made is actually my best decision, given my personal preferences and the available information.
- When I'm asked to indicate my certainty about my decision, the study leaders are interested in how certain I am that water will be added rather than removed in the second season.

Next

Figure 61: Comprehension check for PRS task.

Round 1/11

Click here to re-read the instructions.

Reminder: Each additional barrel of water used in a given season creates less and less additional crop yield.

- Crop yield in a given season = $\sqrt{\text{Barrels of Water}}$
- Water available in Summer depends on both the water saved and the outcome of the weather shock
- Total crop yield = Spring yield + 90% of Summer yield

In this round: Size of weather shock in the Summer:

- With **50%** chance: **5 barrels of water added**
- With **50%** chance: **5 barrels of water removed**

How do you split your 100 barrels of water between the Spring and Summer seasons?

Spring Season: 70 **barrels**
Summer Season: **30** **barrels** (before the outcome of the weather shock)

How certain are you that allocating somewhere between **69** and **71 barrels** to Spring is actually your best decision, given your preferences and the available information?

Very uncertain **Completely certain**
0% 25% 50% 75% 100% 78 %

Next

Figure 62: Decision screen for PRS task.

G.15 REC

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. Every participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, **you have to estimate the stock price of a fictional company.**

- The stock price is determined by the number of good and bad pieces of news about the company.
- In total, there are 100 pieces of news about each company. The stock price is determined by the following formula:

  Stock price (in $)= 100 + number of positive news – number of negative news
- In each round, you will be shown **the number of positive and negative news.** Specifically, you will see **100 images**, some of which represent **positive news and and some of which represent negative news.**
- Based on your estimate of how many positive images and how many negative images there are, you will then estimate the stock price.
- This study has two sections. You will complete 6 rounds of the task in the first section, where each round is about a different company. **These firms are completely independent from one another.**
- Across these rounds, **the number of pieces of positive and negative news received will vary.**
- In the second section of the task, there will be another 6 rounds.
- If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus payment. If a round in the first or second section is selected for payment, you will recieve $20 if your answer is within +/- $1 of the correct stock price, and nothing otherwise.

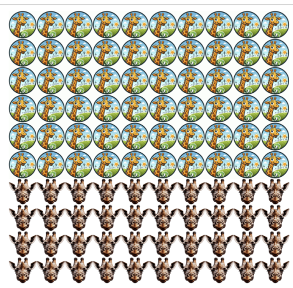
Example:

Reminder: **Stock price (in $) = 100 + number of positive news – number of negative news**

In this round:

Company name: GiraffeGrove Renewable

Positive news: Negative news:



What do you think is the stock price of this company? $

- In this example, positive news is represented by and negative news by .
- You then need to estimate the stock price.

Your certainty:

In each round, we will ask you two questions:

- You will make your estimate of the stock price.
- We will ask you **how certain** you are about your estimate. Specifically, we are interested in how likely you think it is (in percentage terms) that your estimate is actually correct.

Next

Figure 63: The instruction screen for REC task.

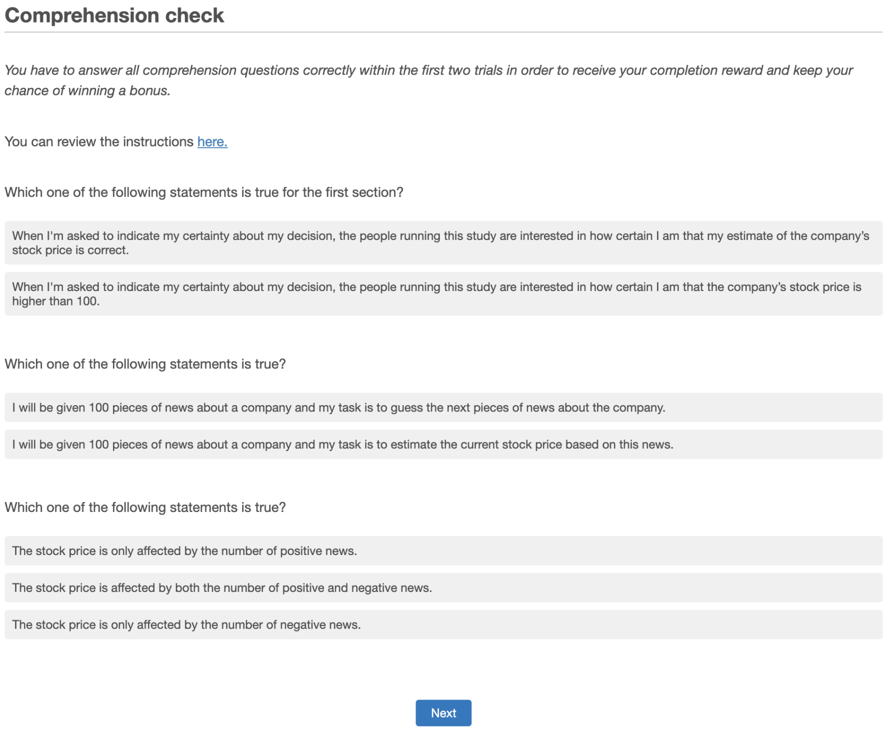


Figure 64: Comprehension check for REC task.

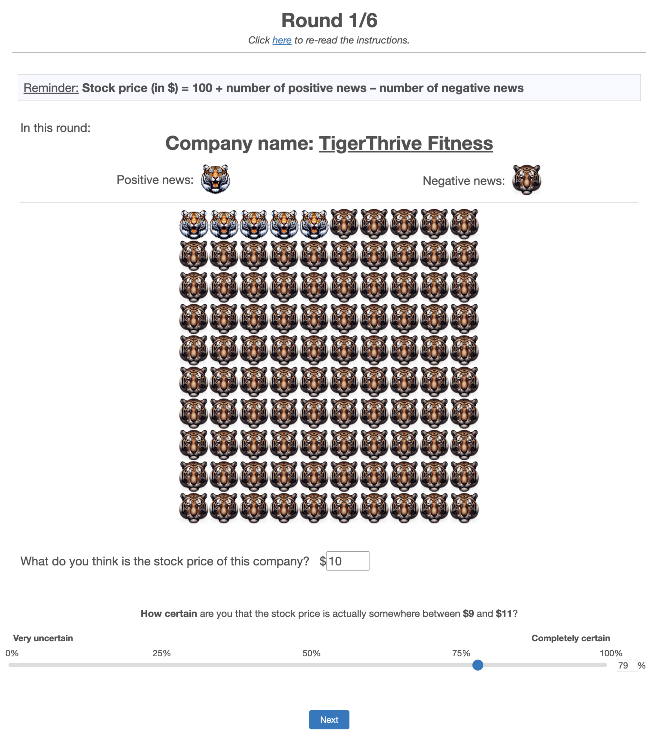
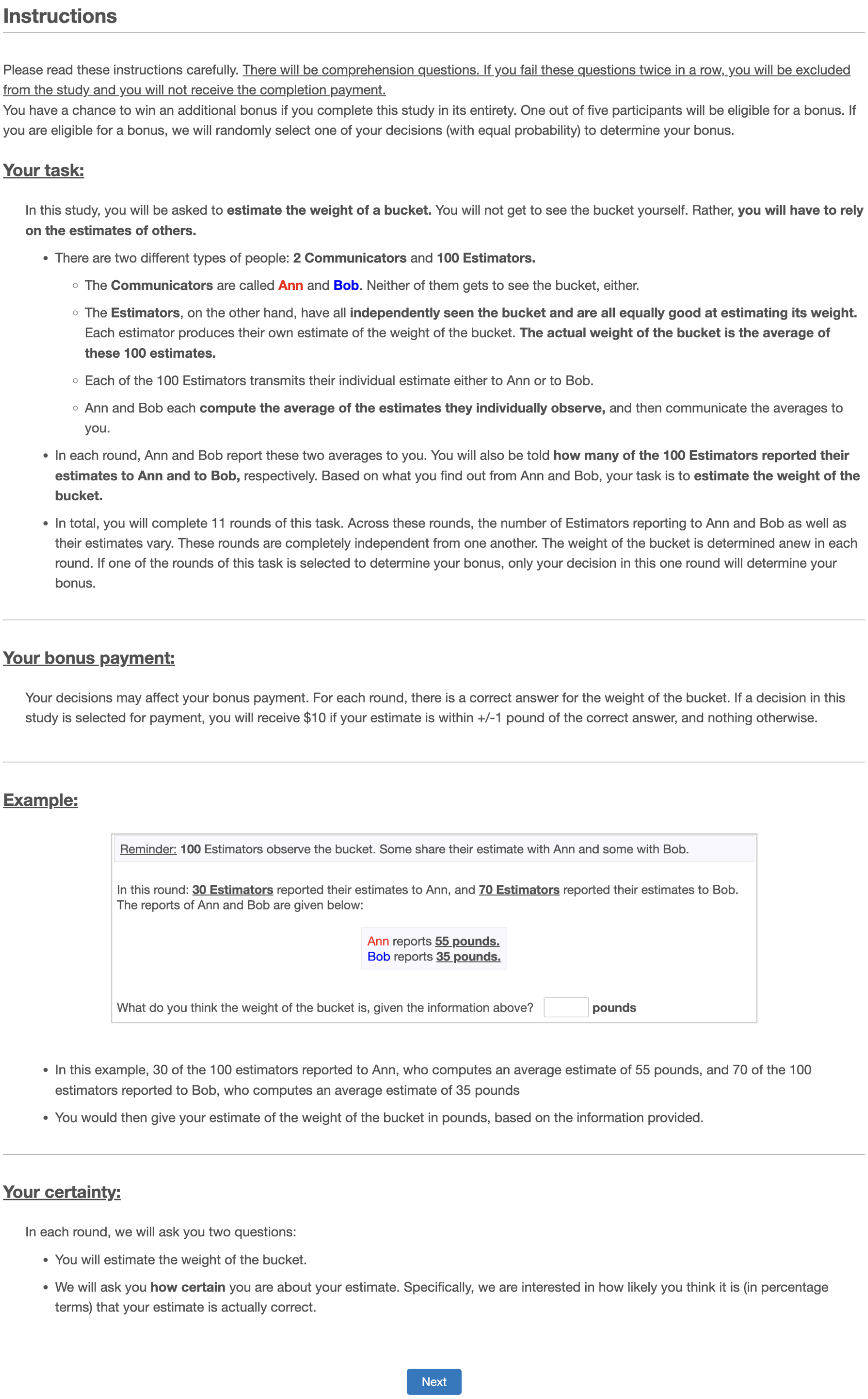


Figure 65: Decision screen for REC task.

G.16 SIA



Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, you will be asked to **estimate the weight of a bucket.** You will not get to see the bucket yourself. Rather, **you will have to rely on the estimates of others.**

- There are two different types of people: **2 Communicators** and **100 Estimators.**
  - The **Communicators** are called **Ann** and **Bob**. Neither of them gets to see the bucket, either.
  - The **Estimators**, on the other hand, have all **independently seen the bucket and are all equally good at estimating its weight.** Each estimator produces their own estimate of the weight of the bucket. **The actual weight of the bucket is the average of these 100 estimates.**
  - Each of the 100 Estimators transmits their individual estimate either to Ann or to Bob.
  - Ann and Bob each **compute the average of the estimates they individually observe,** and then communicate the averages to you.
- In each round, Ann and Bob report these two averages to you. You will also be told **how many of the 100 Estimators reported their estimates to Ann and to Bob,** respectively. Based on what you find out from Ann and Bob, your task is to **estimate the weight of the bucket.**
- In total, you will complete 11 rounds of this task. Across these rounds, the number of Estimators reporting to Ann and Bob as well as their estimates vary. These rounds are completely independent from one another. The weight of the bucket is determined anew in each round. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus payment. For each round, there is a correct answer for the weight of the bucket. If a decision in this study is selected for payment, you will receive $10 if your estimate is within +/-1 pound of the correct answer, and nothing otherwise.

Example:

Reminder: **100** Estimators observe the bucket. Some share their estimate with Ann and some with Bob.

In this round: **30 Estimators** reported their estimates to Ann, and **70 Estimators** reported their estimates to Bob.
The reports of Ann and Bob are given below:

Ann reports **55 pounds.**
Bob reports **35 pounds.**

What do you think the weight of the bucket is, given the information above? [ ] **pounds**

- In this example, 30 of the 100 estimators reported to Ann, who computes an average estimate of 55 pounds, and 70 of the 100 estimators reported to Bob, who computes an average estimate of 35 pounds
- You would then give your estimate of the weight of the bucket in pounds, based on the information provided.

Your certainty:

In each round, we will ask you two questions:

- You will estimate the weight of the bucket.
- We will ask you **how certain** you are about your estimate. Specifically, we are interested in how likely you think it is (in percentage terms) that your estimate is actually correct.

Next

Figure 66: The instruction screen for SIA task.

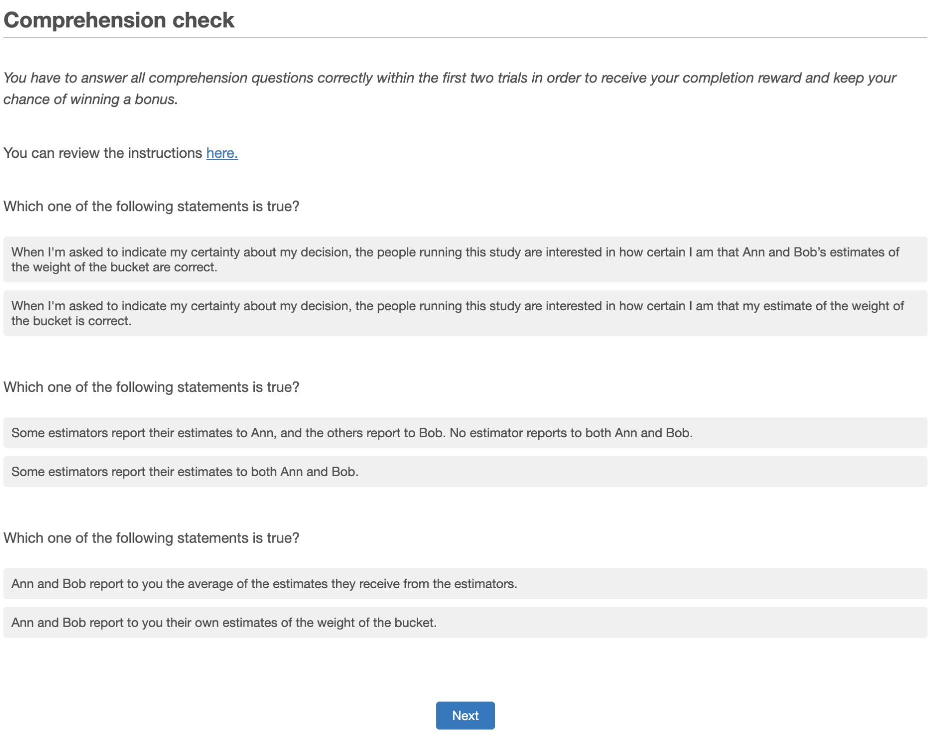


Figure 67: Comprehension check for SIA task.

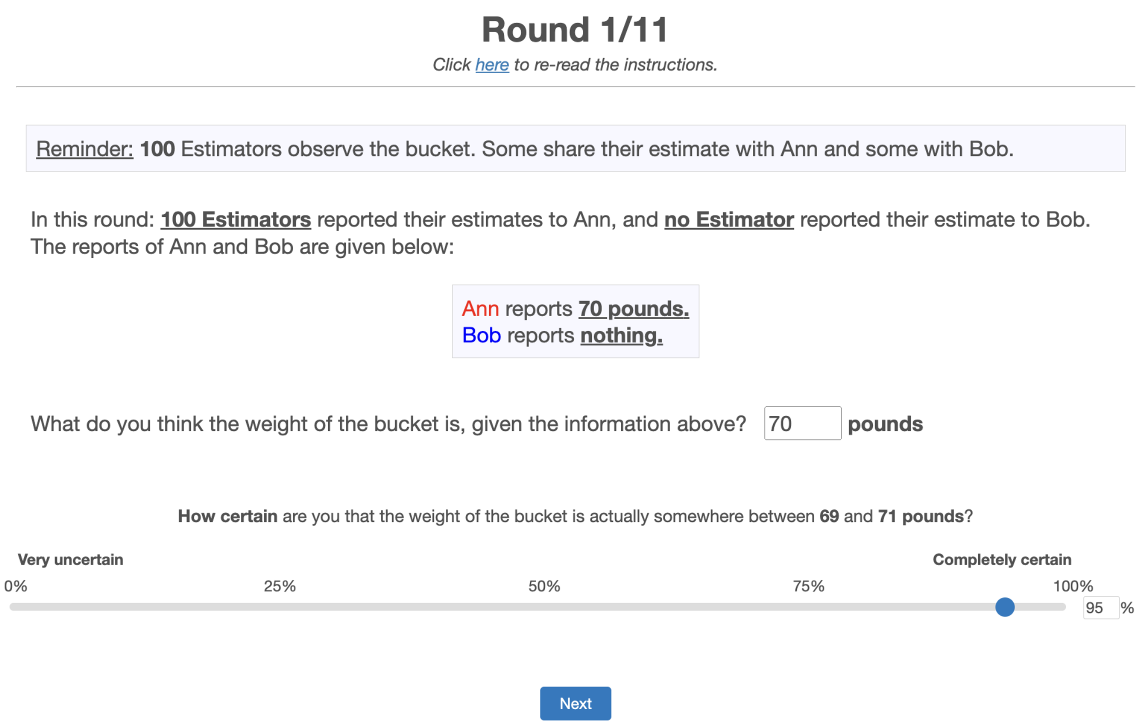


Figure 68: Decision screen for SIA task.

G.17 TAX

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, **you will estimate the income taxes owed by a hypothetical taxpayer named Fred.**

- Fred's income is subject to two taxes: a **federal tax** and **a state tax.**
- The federal income tax contains 5 tax brackets and the state income tax contains 3 tax brackets:

Federal Tax Rate	Income Bracket
12%	$0 to $20,000
18%	$20,000 to $50,000
26%	$50,000 to $80,000
32%	$80,000 to $120,000
42%	$120,000 and above

State Tax Rate	Income Bracket
3%	$0 to $30,000
7%	$30,000 to $70,000
10%	$70,000 and above

- These brackets work just as actual U.S. tax brackets do. Specifically, when Fred's income jumps to a higher tax bracket, he doesn't pay the higher rate on his entire income. **He pays the higher rate only on the portion of his income that's in the new tax bracket.**
  - For instance, if Fred's income is $35,000, he would pay federal taxes equal to 12% on the $20,000 portion of his income in the first bracket, plus 18% on the $15,000 portion of his income in the second bracket.
  - Similarly, in the scenario above Fred would pay state taxes equal to 3% on the $30,000 portion of his income in the first bracket, plus 7% on the $5,000 portion of his income in the second bracket.
- In each round, we will ask you to estimate the total income tax **(state plus federal)** that Fred would have to pay for different levels of income.
- In total, you will complete 11 rounds of this task. Across these rounds, the income of Fred varies. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions in this part of the study may affect your bonus payment. If a decision in this part is selected for payment, you will receive $10 if your answer is within +/-$300 of the correct answer.

Example:

Reminder: Fred's income is subject to a federal and state income tax, which have the following tax brackets:

Federal Tax Rate	Income Bracket
12%	$0 to $20,000
18%	$20,000 to $50,000
26%	$50,000 to $80,000
32%	$80,000 to $120,000
42%	$120,000 and above

State Tax Rate	Income Bracket
3%	$0 to $30,000
7%	$30,000 to $70,000
10%	$70,000 and above

Fred pays each tax rate only on the portion of his income that's in the corresponding tax bracket.

In this round: Fred's annual income is **$65,000**.

How much does he have to pay in total income taxes? **$**

- In this example, Fred's income is $65,000.
- You then need to estimate how much Fred would have to pay in total income taxes (state income taxes plus federal income taxes).

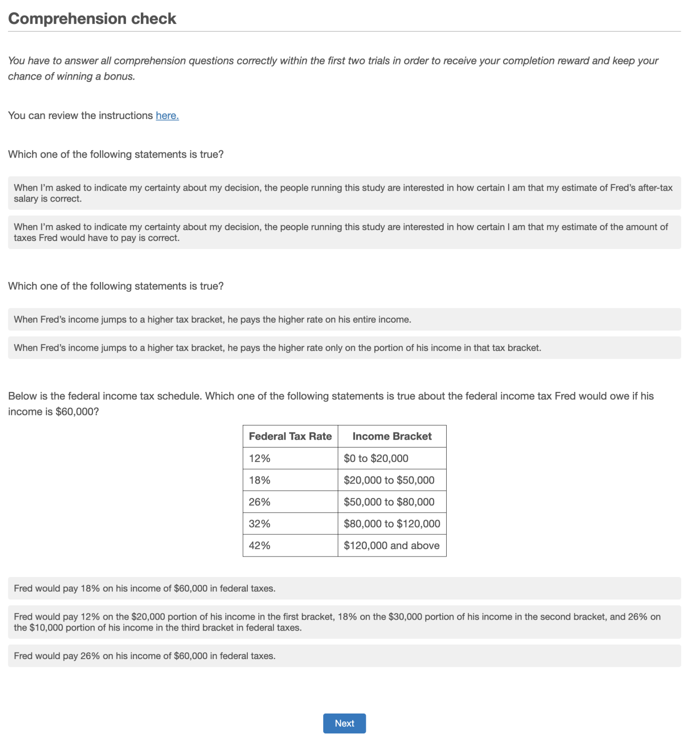
Your certainty:

In each round, we will ask you two questions:

- You will estimate how much Fred would have to pay in total income taxes.
- We will ask you **how certain** you are about your answer. Specifically, we are interested in how likely you think it is (in percentage terms) that your answer is actually correct.

Next

Figure 69: The instruction screen for TAX task.



Comprehension check

You have to answer all comprehension questions correctly within the first two trials in order to receive your completion reward and keep your chance of winning a bonus.

You can review the instructions here.

Which one of the following statements is true?

When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am that my estimate of Fred's after-tax salary is correct.

When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am that my estimate of the amount of taxes Fred would have to pay is correct.

Which one of the following statements is true?

When Fred's income jumps to a higher tax bracket, he pays the higher rate on his entire income.

When Fred's income jumps to a higher tax bracket, he pays the higher rate only on the portion of his income in that tax bracket.

Below is the federal income tax schedule. Which one of the following statements is true about the federal income tax Fred would owe if his income is $60,000?

Federal Tax Rate	Income Bracket
12%	$0 to $20,000
18%	$20,000 to $50,000
26%	$50,000 to $80,000
32%	$80,000 to $120,000
42%	$120,000 and above

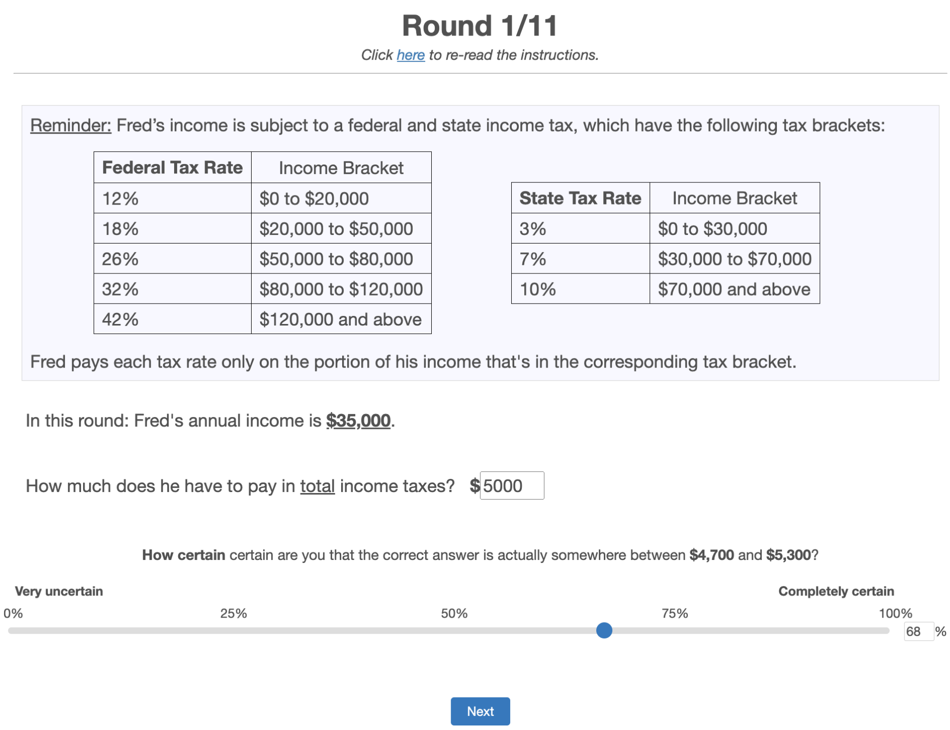
Fred would pay 18% on his income of $60,000 in federal taxes.

Fred would pay 12% on the $20,000 portion of his income in the first bracket, 18% on the $30,000 portion of his income in the second bracket, and 26% on the $10,000 portion of his income in the third bracket in federal taxes.

Fred would pay 26% on his income of $60,000 in federal taxes.

Next

Figure 70: Comprehension check for TAX task.



Round 1/11

Click here to re-read the instructions.

Reminder: Fred's income is subject to a federal and state income tax, which have the following tax brackets:

Federal Tax Rate	Income Bracket
12%	$0 to $20,000
18%	$20,000 to $50,000
26%	$50,000 to $80,000
32%	$80,000 to $120,000
42%	$120,000 and above

State Tax Rate	Income Bracket
3%	$0 to $30,000
7%	$30,000 to $70,000
10%	$70,000 and above

Fred pays each tax rate only on the portion of his income that's in the corresponding tax bracket.

In this round: Fred's annual income is **$35,000**.

How much does he have to pay in total income taxes? **$** 5000

How certain certain are you that the correct answer is actually somewhere between **$4,700** and **$5,300**?

Very uncertain **Completely certain**

0% 25% 50% 75% 100% 68 %

Next

Figure 71: Decision screen for TAX task.

G.18 VOT

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study **you will decide whether or not to submit a vote in an election for option A or option B.**

- In each round, you **start out with a wealth of $10.** If **option B wins** the election, you **must pay $8 in taxes**, leaving you with $2. But if **option A** wins the election, you won't be taxed and **will keep your entire $10**. **Submitting a vote (for option A) costs you $1**.
    - There are some number of other robot voters in the election. Each robot voter **has a 50% chance of randomly voting for A vs. B**. You will know how many other voters there are, but you won't know which way each of them is voting when you make your decision.
    - We will add up all of the votes for A and B (including yours if you submit one), and **declare A the winner if A receives strictly more votes than B.** If both get equally many votes, B is the winner.
    - Your decision is simply whether to pay $1 to submit a vote for A, or instead to not vote.
    - The outcome of the election will matter for your earnings, whether or not you decided to vote.
- In each round, you will be told **the number of other robot voters.** You will then decide **whether you would would like to pay $1 to vote for A**, or instead not vote.
- In total, you will complete 11 rounds of this task. Across these rounds, the number of other voters varies. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will influence your bonus.

Your bonus payment:

Your decisions in this part of the study may affect your bonus payment. If a decision in this part is selected for payment, you will start out with $10. You will be taxed $8 if B wins the election and pay $1 if you submitted a vote.

Example:

Reminder: You have a wealth of $10. Whether or not you vote, **you must pay $8 in taxes if B wins** the election, but you **pay no taxes if A wins the election**. The price of voting is **$1.** Each one of the other voters randomly votes for A or B with **equal probability**. A wins the election if it has more votes than B.

In this round: The number of other voters is **35**.

Which option do you prefer?

○ I would like to pay $1 to vote for A. ○ I would not like to submit a vote.

- In this example, the number of other voters is 35.
- You then need to decide whether to pay $1 to submit a vote for A.

Your certainty:

In each round, we will ask you two questions:

- Would you like to pay $1 to submit a vote for A?
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that the decision you made is actually your best decision, given your personal preferences and the available information.

Next

Figure 72: The instruction screen for VOT task.

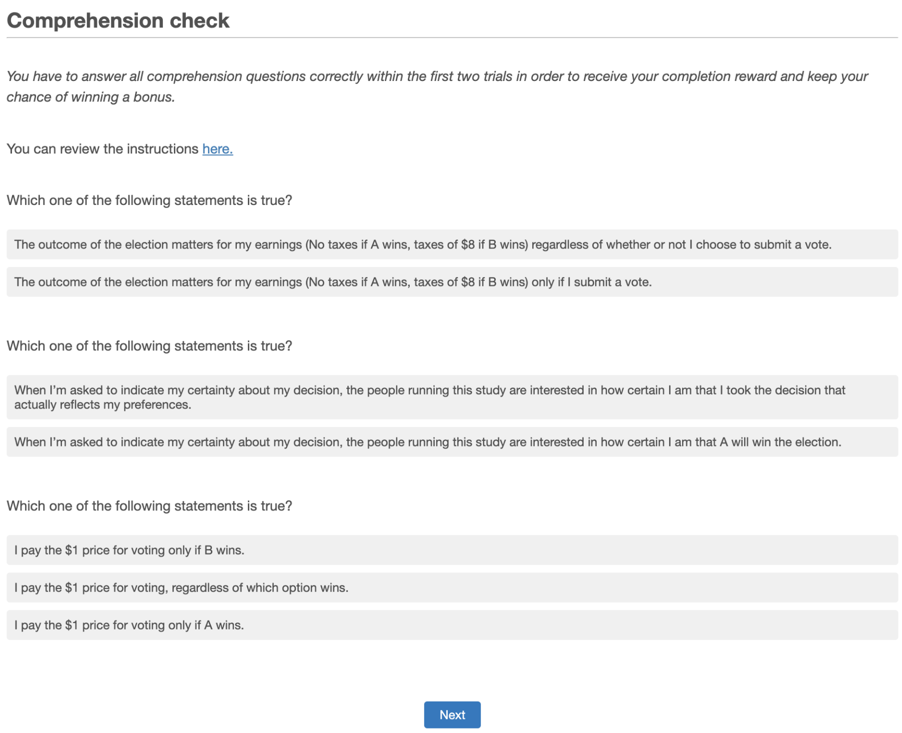


Figure 73: Comprehension check for VOT task.

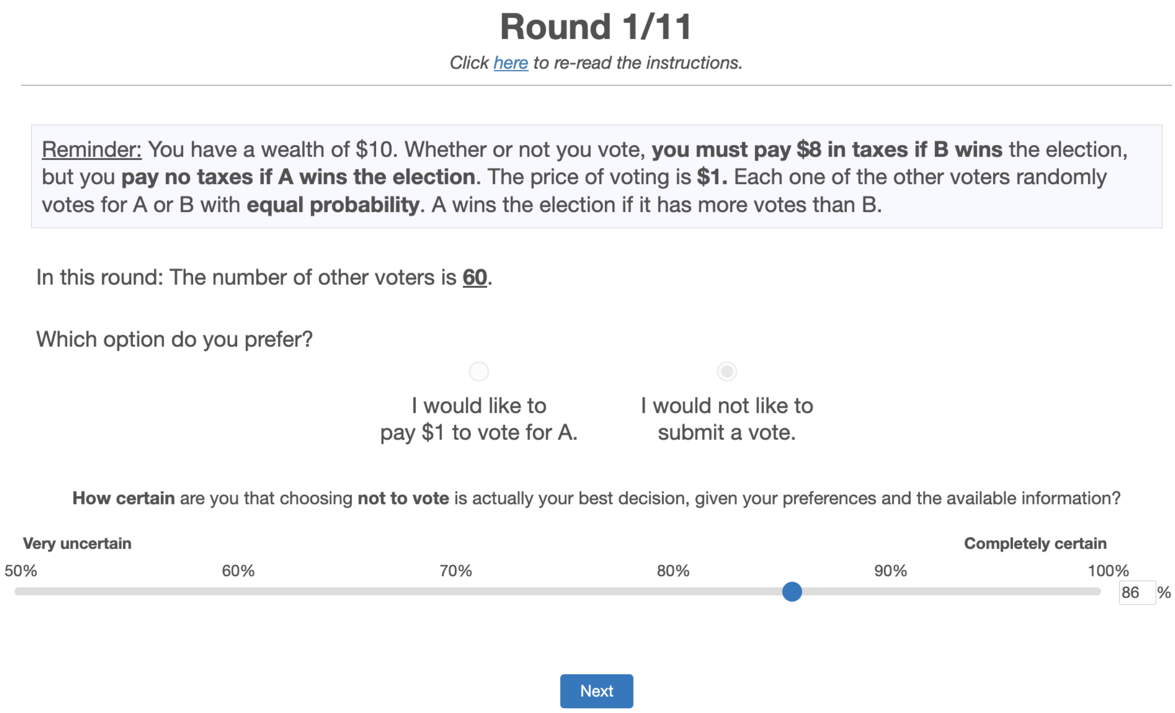


Figure 74: Decision screen for VOT task.

G.19 PGG

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, you will **play a game with 2 other participants**. This game works as follows:

- Each of you will be given **100 points**. At the end of the study, each participant will be paid 10 cent for each point they have.
- Each of you simultaneously and independently decides **how many points to transfer into a shared account.**
- Whichever number of points each player transfers into **the shared account gets multiplied by a number** that we will call the **Multiplier**. For example, if the Multiplier is 2 and you transfer 30 of your points into the shared account, then 60 points will end up in the shared account.
- This means: **the higher the Multiplier, the more points you and the other participants will get from the shared account for each point any of you transfer into the shared account.**
- After all participants have decided how many points to transfer, **all points in the shared account get distributed equally among the three participants.** For example, if there are 90 points in the shared account in total, then you each get 30 points from the shared account, regardless of how many points each of you transferred into the shared account.
- You will also each keep any of the 100 points you didn't put in the shared account.
- Your total point score is thus calculated as follows:

  Total points =
  Points not transferred into shared account + One third of total number of points in shared account

- In each round you will be told the Multiplier that determines how many points end up in the shared account for each point that you transfer. You will then decide how many points to transfer to the shared account (you will not see how many points the other participants sent to the shared account until the end of the study).
- In total, you will complete 11 rounds of this task. Across these rounds, the Multiplier varies. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your (and the other participants') bonus.

Your bonus payment:

Your decisions in this part of the study may affect your bonus payment and the bonus payment of the other participants. If a decision in this part is selected for payment you will be paid 10 cents for each point you have.

Example:

> Reminder: Three participants simultaneously decide how many of their 100 points to transfer into a shared account.
> - **Each point that gets transfered into the shared account will get multiplied by the Multiplier**, and the total will be distributed equally among all three of you.
> - Each point you don't transfer, you keep.
>
> In this round: The Multiplier is **1.7**.
>
> How many points (out of 100) do you want to transfer into the shared account? [ ]

- In this example, the Multiplier is 1.7.
- You then need to decide how many points to transfer to the shared account.

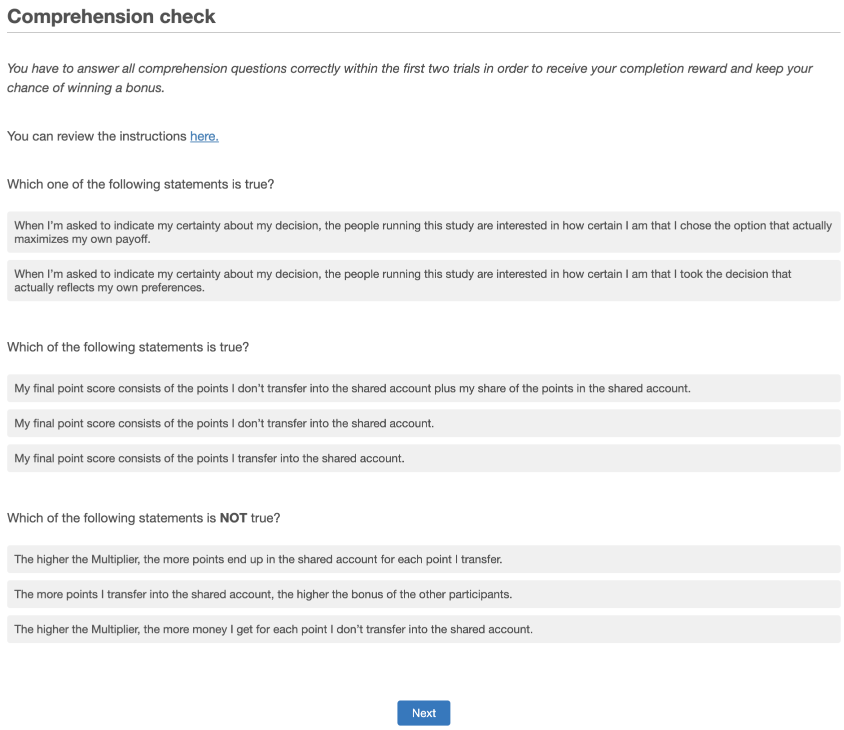
Your certainty:

In each round, we will ask you two questions:

- How many points you want to transfer into the shared account.
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that the decision you made is actually your best decision, given your personal preferences and the available information.

[Next]

Figure 75: The instruction screen for PGG task.


Comprehension check

You have to answer all comprehension questions correctly within the first two trials in order to receive your completion reward and keep your chance of winning a bonus.

You can review the instructions here.

Which one of the following statements is true?

- When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am that I chose the option that actually maximizes my own payoff.
- When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am that I took the decision that actually reflects my own preferences.

Which of the following statements is true?

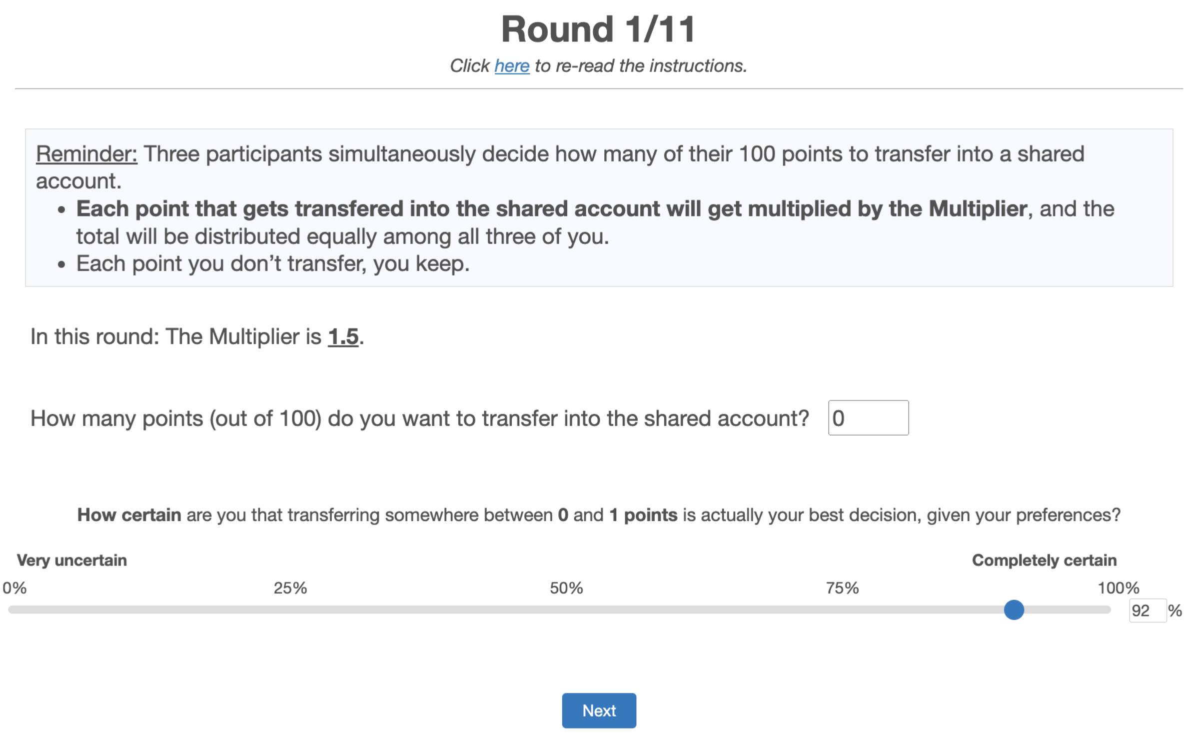
- My final point score consists of the points I don't transfer into the shared account plus my share of the points in the shared account.
- My final point score consists of the points I don't transfer into the shared account.
- My final point score consists of the points I transfer into the shared account.

Which of the following statements is **NOT** true?

- The higher the Multiplier, the more points end up in the shared account for each point I transfer.
- The more points I transfer into the shared account, the higher the bonus of the other participants.
- The higher the Multiplier, the more money I get for each point I don't transfer into the shared account.

Next

Figure 76: Comprehension check for PGG task.


Round 1/11

Click here to re-read the instructions.

Reminder: Three participants simultaneously decide how many of their 100 points to transfer into a shared account.

- **Each point that gets transfered into the shared account will get multiplied by the Multiplier**, and the total will be distributed equally among all three of you.
- Each point you don't transfer, you keep.

In this round: The Multiplier is **1.5**.

How many points (out of 100) do you want to transfer into the shared account? 0

How certain are you that transferring somewhere between **0** and **1 points** is actually your best decision, given your preferences?

Very uncertain **Completely certain**

0% 25% 50% 75% 100%

92 %

Next

Figure 77: Decision screen for PGG task.

G.20 POL

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.

Your task:

In this study, **you will be asked to evaluate a hypothetical policy.**

- In a bipartisan effort, Democrats and Republicans cobbled together a new bill that would **increase the income of each household in the U.S. next year by $10,000.** If the bill is not passed, incomes do not increase.
- However, the bill would also **lead to inflation next year**. The prices of all goods, including groceries and gas, would increase. The estimates of how much prices would increase vary. Experts agree that if the bill is not passed, there will be no inflation over the next year.
- In each round, we will tell you how much inflation there would be. You will then be asked to indicate **how much you would support the policy** (on a scale from 0 to 100).
- In total, you will complete 11 rounds of this task. Across these rounds, the degree of inflation varies. These rounds are completely independent from one another.

Example:

> Reminder: A proposed bill would **increase the annual income of each U.S. household next year by $10,000**. However, implementing the policy would also **produce inflation.**
>
> In this round: Inflation next year would be **6%**.
>
> On a scale from 0 to 100, how strongly do you support the policy? [ ]

- In this example, inflation would be 6%.
- You then need to indicate your support for the policy.

Your certainty:

In each round, we will ask you two questions:

- How much you would support the policy.
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that the decision you made is actually your best decision, given your personal preferences and the available information.

Next

Figure 78: The instruction screen for POL task.

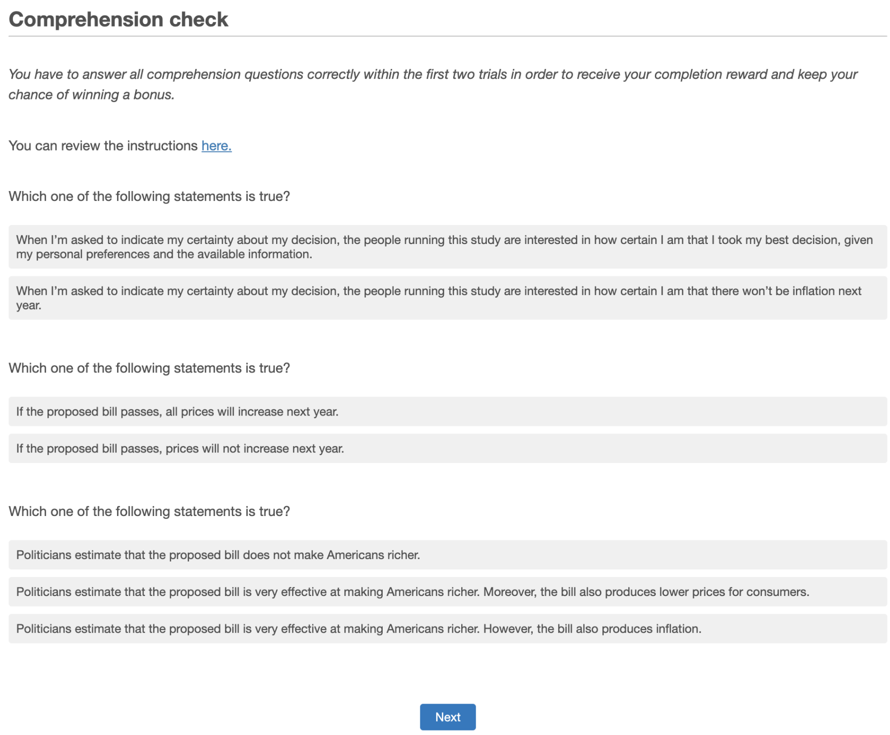


Figure 79: Comprehension check for POL task.

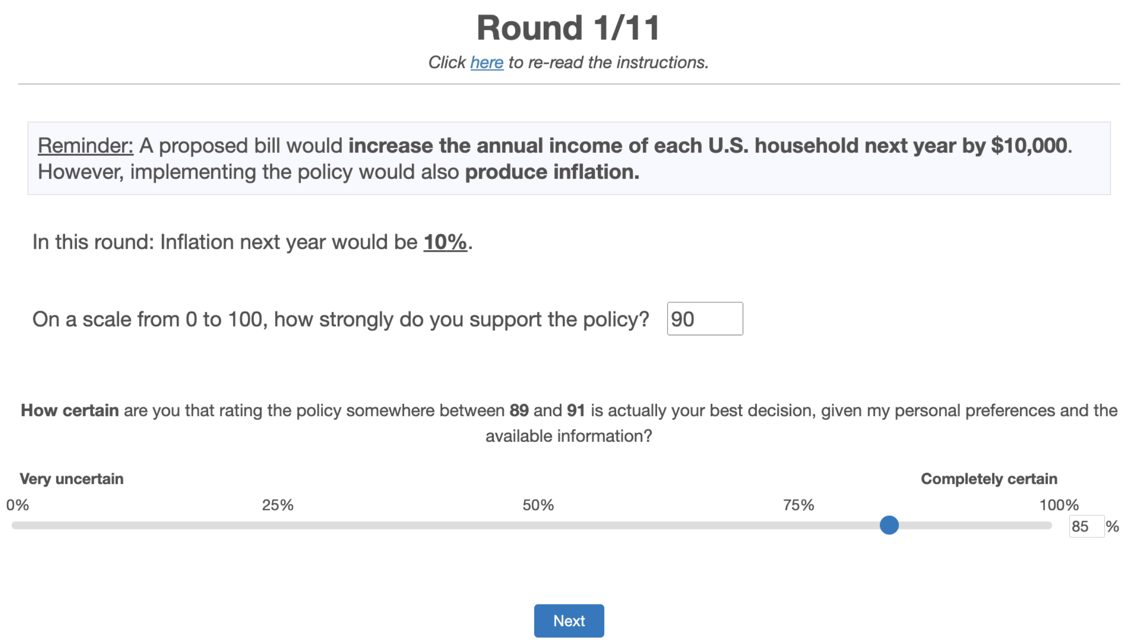


Figure 80: Decision screen for POL task.

G.21 STO

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.

Your task:

In this study, you will be asked **to forecast the value of a $100 investment into different financial assets for different time horizons.**

- Each financial asset will be an investment fund that replicates the performance of other assets, like stock indices, bonds, or commodities, and can be bought and sold on stock exchanges like individual stocks.
- In each round, we will tell you **what the investment fund is** and **what the time horizon is**. You will then be asked to **forecast the value of a $100 investment** into this asset over this horizon.
- In total, you will complete 11 rounds of this task. Across these rounds, the financial asset and the time horizon vary. These rounds are completely independent from one another.

Example:

Asset: A fund replicating the **S&P500 stock market index.**
Forecast horizon: **10 months**

What is your best estimate for the value of a $100 investment after **10 months**? [ ] **$**

- In this example, the asset is an investment fund replicating the S&P500 and the forecasting horizon is 10 months.
- You then need to forecast the value of a $100 investment into this fund in 10 months.

Your certainty:

In each round, we will ask you two questions:

- Your forecast of the future value of a $100 investment.
- We will ask you **how certain** you are about your forecast. Specifically, we are interested in how likely you think it is (in percentage terms) that yours is actually the best possible forecast, given the information you have today.

Next

Figure 81: The instruction screen for STO task.

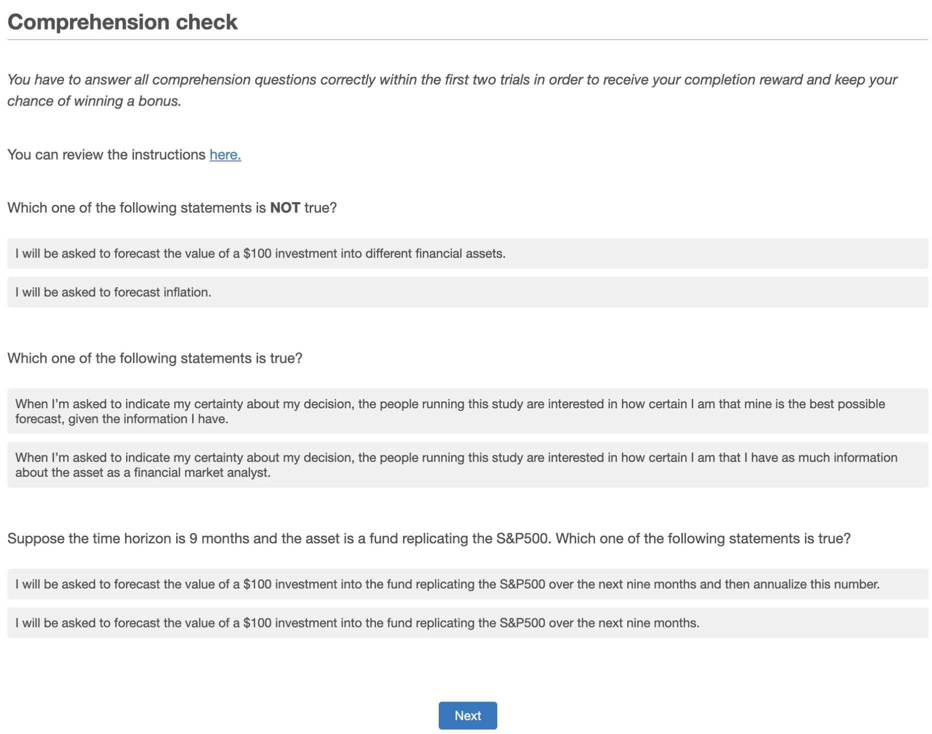


Figure 82: Comprehension check for STO task.

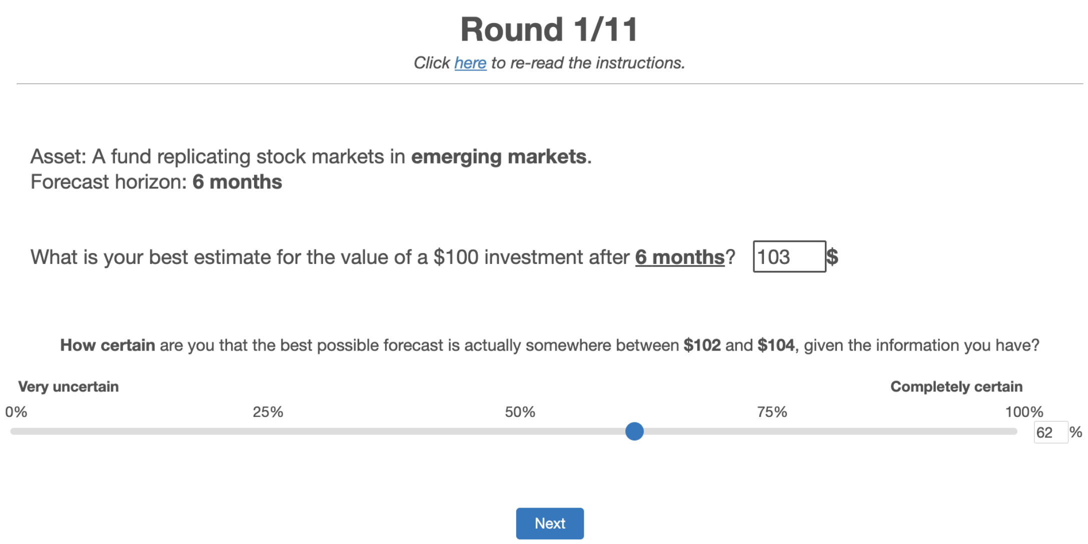


Figure 83: Decision screen for STO task.

G.22 TID

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.

Your task:

In this study, **you will decide between two hypothetical payments.**

- The **"future payment"** pays $100 **at some point in the future (i.e., with some specific delay).**
- The **"immediate payment"** pays **a specific amount now.**
- For all hypothetical payments in this study, **please treat them as if you know you will receive them with certainty,** even if they are delayed. That is, please assume there is no risk that you wouldn't actually get paid.
- In each round, you will be told the **delay of the future payment (of $100) as well as the amount of the immediate payment.** You will then decide between the two payments.
- In total, you will complete 11 rounds of this task. Across these rounds, the delay of the future payment will vary. These rounds are completely independent from one another.

Example:

Delayed payment			Immediate payment
$100 in **10 months**	◉	○	**$5** now
	◉	○	**$10** now
	◉	○	**$15** now
	◉	○	**$20** now
	◉	○	**$25** now
	◉	○	**$30** now
	○	◉	**$35** now
	○	◉	**$40** now
	○	◉	**$45** now
	○	◉	**$50** now
	○	◉	**$55** now
	○	◉	**$60** now
	○	◉	**$65** now
	○	◉	**$70** now
	○	◉	**$75** now
	○	◉	**$80** now
	○	◉	**$85** now
	○	◉	**$90** now
	○	◉	**$95** now

- In this example, the delay of the future payment is 10 months.
- You then need to decide whether you prefer this delayed payment or a given immediate payment.
- You will make your decisions in a choice list, **where each row is a separate choice.**
  - In every list, the left-hand option is a delayed payment that is identical in all rows. The right-hand option is an immediate payment. The immediate payment increases from row-to-row as you go down the list.
  - To make a choice just click on the radio button you prefer for each choice (i.e. for each row).
  - **An effective way to complete these choice lists is to determine in which row you would prefer to switch from choosing the delayed payment to choosing the immediate payment.** You can click on that row and we will automatically fill out the rest of the list for you, by selecting the delayed payment in all rows above and immediate payment in all rows below your selected row.
  - Based on where you switch from the delayed payment to the immediate payment in this list, we assess which immediate payment you value as much as the future payment.
  - For example, in the choice list above, your choice suggests that you value the future payment as much as an immediate payment between $30 and $35 because this is where you switched.

Your certainty:

In each round, we will ask you two questions:

- You will decide between a future payment and different immediate payments. We will use these decisions to assess how much the delayed payment is worth to you.
- We will ask you **how certain** you are about your decisions. Specifically, we are interested in how likely you think it is (in percentage terms) that your decisions actually reflect how much you value the delayed payment.

Next

Figure 84: The instruction screen for TID task.

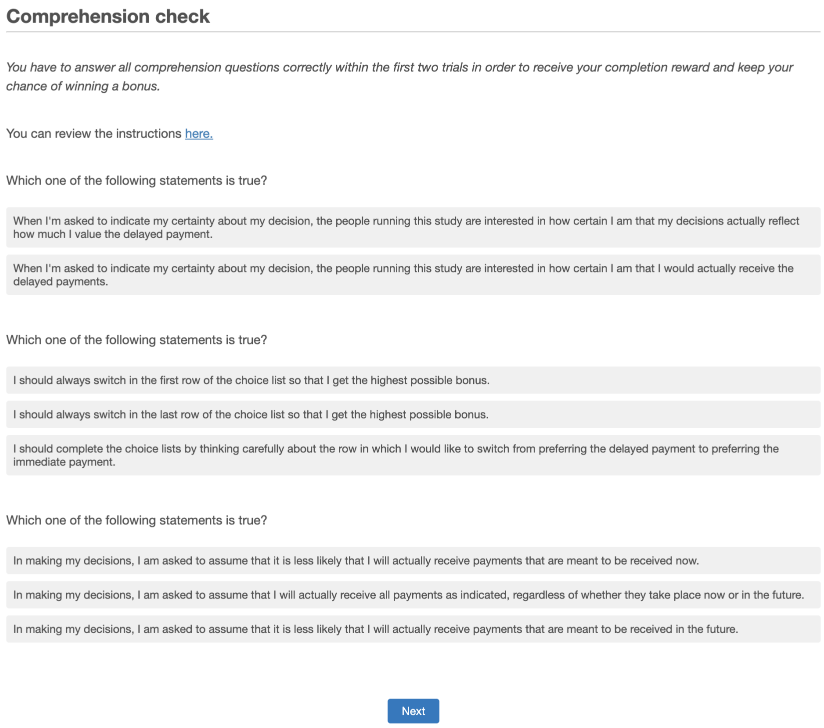


Figure 85: Comprehension check for TID task.

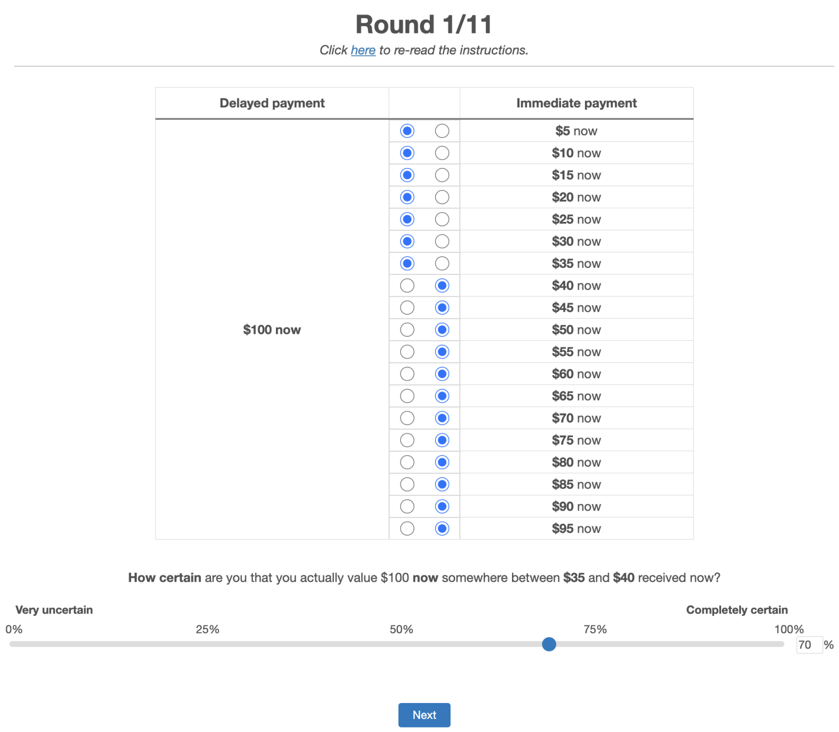


Figure 86: Decision screen for TID task.

G.23 BEU

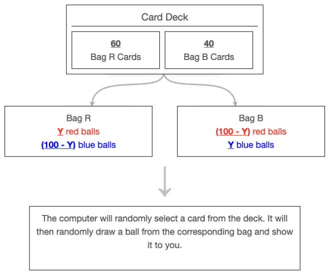
Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, **your task is to guess which of two bags was secretly selected by a computer.** As a hint, you will see a colored ball that was drawn from the secretly-selected bag.

- The setup is as follows:

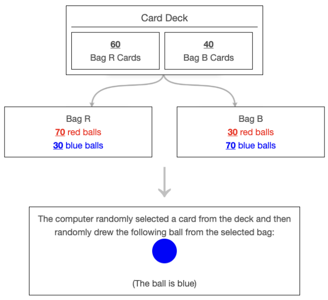


- There is a deck of **100 cards**, 60 of which have **"Bag R"** written on them and 40 of which have **"Bag B"** written on them.
- There are **two bags**, Bag R and Bag B. **Both bags contain 100 balls each,** some of which are red and some of which are blue. Bag R always contains at least as many red balls as blue balls, and Bag B always contains at least as many blue balls as red balls. **It is always the case that the number of red balls in Bag R is equal to the number of blue balls in Bag B.** We denote this number by **"Y"** because it varies across the rounds in this task.
  - For example, Bag R might contain 95 red balls and 5 blue balls, and so Bag B would contain 5 red balls and 95 blue balls.
- Each round proceeds as follows:
  - You will be told **how many balls in Bag R and Bag B are red or blue.**
  - The computer will **randomly select one of the 100 cards. If the card has "Bag R" written on it, the computer selects Bag R. If the card has "Bag B" written on it, the computer selects Bag B.** You will **not observe** which card was drawn, so you will not know for sure which bag was selected.
  - The computer will then **randomly draw one ball from the selected bag and show it to you.**
  - You will then be asked to provide **a percentage chance to indicate how likely you think it is that the computer selected Bag R or B.**
- In total, you will complete 11 rounds of this task. Across these rounds, the number of red and blue balls in Bag R and Bag B will vary. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus payment. For each round, there will be a statistically correct answer. If a decision in this study is selected for payment, you will receive $10 if your answer is within +/- 1 percentage point of the statistically correct answer, and nothing otherwise.

Example:



- In the example above, Bag R contains 70 red and 30 blue balls and bag B contains 30 red and 70 blue balls.
- A blue ball was drawn.
- You would then tell us the percentage chance you think the computer selected Bag R, based on the information provided.

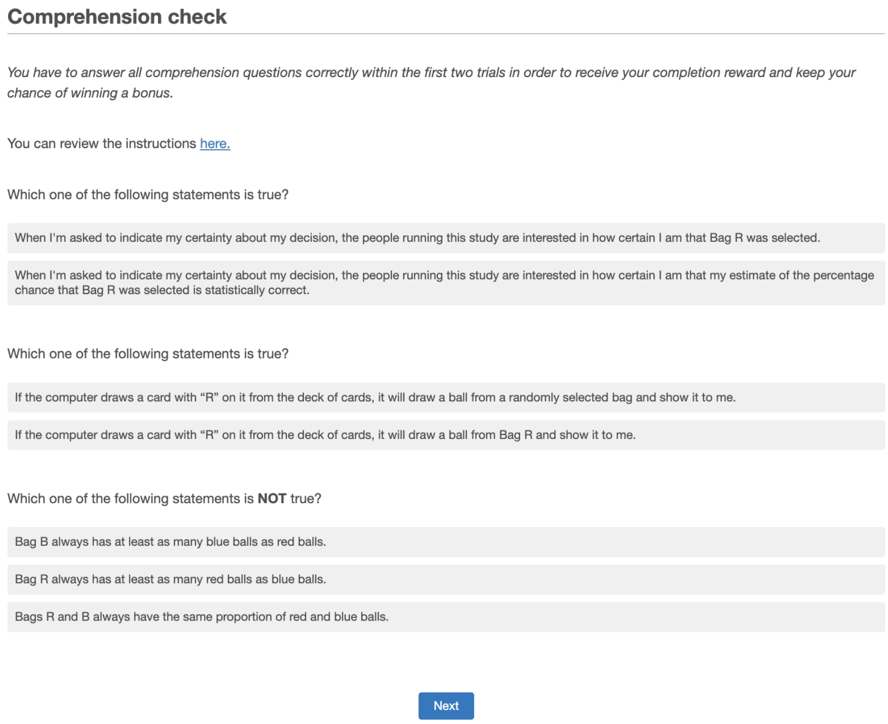
Your certainty:

In each round, we will ask you two questions:

- You will tell us the percentage chance you think the computer selected Bag R.
- We will ask you **how certain** you are about your answer. Specifically, we are interested in how likely you think it is (in percentage terms) that your answer is actually the statistically correct answer.

Next

Figure 87: The instruction screen for BEU task.



Comprehension check

You have to answer all comprehension questions correctly within the first two trials in order to receive your completion reward and keep your chance of winning a bonus.

You can review the instructions here.

Which one of the following statements is true?

When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am that Bag R was selected.

When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am that my estimate of the percentage chance that Bag R was selected is statistically correct.

Which one of the following statements is true?

If the computer draws a card with "R" on it from the deck of cards, it will draw a ball from a randomly selected bag and show it to me.

If the computer draws a card with "R" on it from the deck of cards, it will draw a ball from Bag R and show it to me.

Which one of the following statements is **NOT** true?

Bag B always has at least as many blue balls as red balls.

Bag R always has at least as many red balls as blue balls.

Bags R and B always have the same proportion of red and blue balls.

Next

Figure 88: Comprehension check for BEU task.

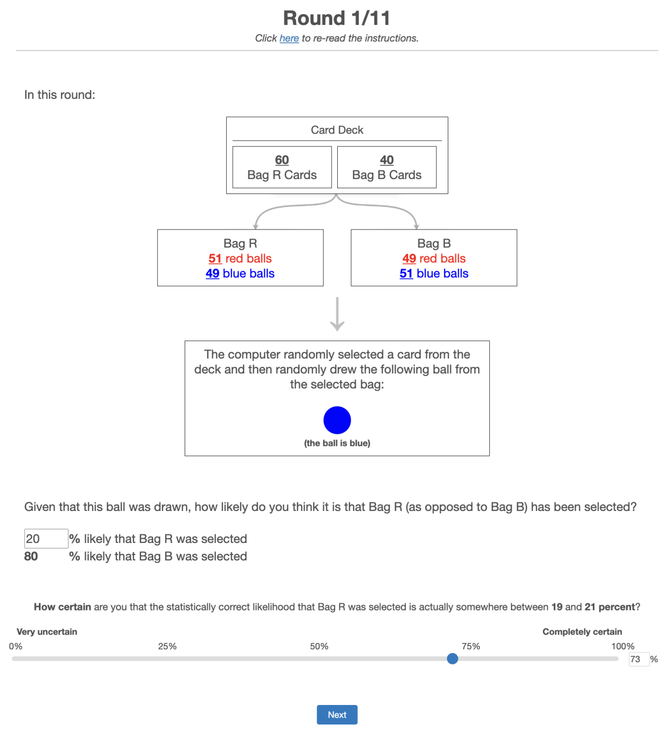


Figure 89: Decision screen for BEU task.

G.24 CEE

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, you will **decide between a lottery ticket and a safe payment.**

- A lottery ticket pays **$18 with some percentage chance, and $0 otherwise.**
- A safe payment is paid with certainty.
- In each round, you will be told the **percentage chance of getting $18 from the lottery ticket.** You will then decide between the lottery ticket and different safe payment amounts.
- In total, you will complete 11 rounds of this task. Across these rounds, the percentage chance the lottery ticket pays $18 varies. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus.

- If you picked the lottery ticket, you will receive the outcome of the lottery, implemented by the computer.
- If you picked the safe payment, you will receive that payment.

This means that it is in your best interest to **choose the option (lottery ticket or safe payment) you actually prefer in each case.**

Example:

Lottery			Safe payment
With **80%** chance: **Get $18** With **20%** chance: **Get $0**	●	○	$1
	●	○	$2
	●	○	$3
	●	○	$4
	●	○	$5
	●	○	$6
	●	○	$7
	●	○	$8
	●	○	$9
	●	○	$10
	●	○	$11
	●	○	$12
	●	○	$13
	○	●	$14
	○	●	$15
	○	●	$16
	○	●	$17

- In this example, the percentage chance of winning $18 is 80%.
- You then need to decide whether you prefer this lottery ticket or a given safe payment.
- You will make your decisions in a choice list, **where each row is a separate choice.**
  - In every list, the left-hand option is a lottery that is identical in all rows. The right-hand option is a safe payment. The safe payment increases as you go down the list.
  - To make a choice just click on the radio button you prefer for each choice (i.e. for each row).
  - **An effective way to complete these choice lists is to determine in which row you would prefer to switch from choosing the lottery to choosing the safe payment.** You can click on the radio button in that row and we will automatically fill out the rest of the list for you, by selecting the lottery in all rows above and safe payment in all rows below your selected row.
  - Based on where you switch from the lottery to the safe payment in this list, we assess which safe payment you value as much as the lottery.
  - For example, in the choice list above, your choice suggests that you value the lottery as much as a safe payment between $13 and $14 because this is where you switched.
  - If a round in this study is selected for bonus payment, the computer will randomly select one of your choices from that choice list, and you will receive the option you selected in that choice.

Your certainty:

In each round, we will ask you two questions:

- You will decide between a lottery ticket and different safe payments. We will use these decisions to assess how much you value the lottery ticket.
- We will ask you **how certain** you are about your decisions. Specifically, we are interested in how likely you think it is (in percentage terms) that your decisions actually reflect how much you value the lottery ticket.

Next

Figure 90: The instruction screen for CEE task.

Figure 91: Comprehension check for CEE task.

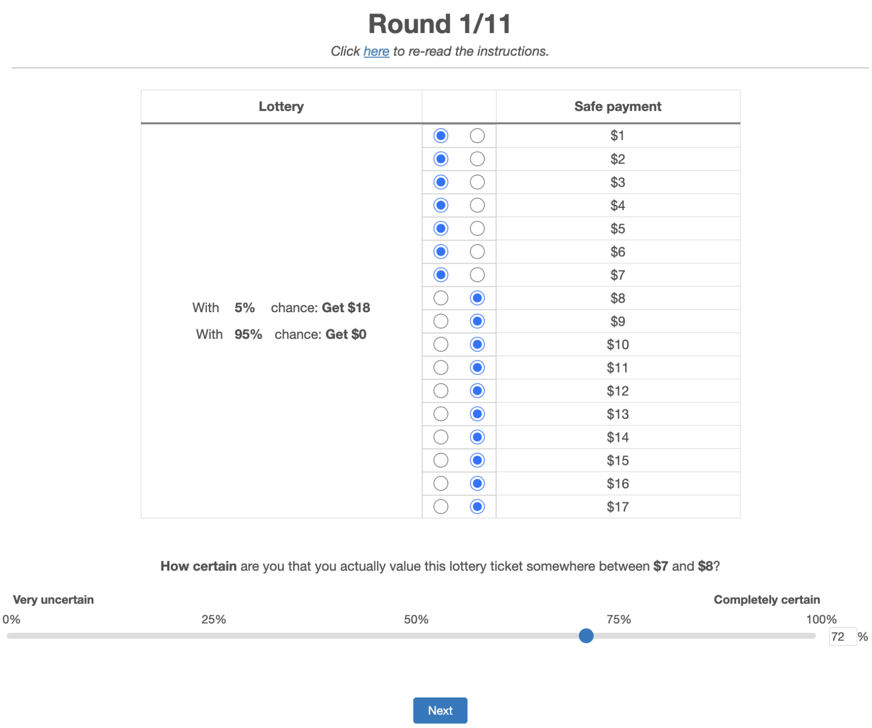


Figure 92: Decision screen for CEE task.

G.25 DIG

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, you will be given 100 points. At the end of the study, you will be paid $0.10 for each point you have.

- Your task is to decide **how many of those points to send to another participant in the study.** This other participant **starts out with 0 points.** They will receive **twice the number** of points you send and will be paid $0.10 for each point they have at the end of the study.
- There is, however, some **percentage chance** (between 0% and 100%), that **whatever points you decide to send to the other participant will disappear, and never be received by the other participant (or yourself).**
- In each round you will be told **the percentage chance that the money you send will disappear.** You will then decide how many points to send to the other participant.
- You can also send fractions of points, such as 6.7 points.
- In total, you will complete 11 rounds of this task. Across these rounds, the percentage chance that the money you send will disappear varies. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your (and the other participant's) bonus.

Your bonus payment:

Your decisions may affect your bonus payment and the bonus payment of another participant. If a decision in this study is selected for payment, you will be paid $0.10 for each point you keep and the other participant will be paid $0.10 for each point they receive.

Example:

Reminder: Each point you send to the other participant will be multiplied by two but disappears (goes to waste) with some percentage chance.

In this round: The percentage chance that the money you send will disappear is **45%**.

How many points (out of 100) do you send to the other participant? [ ] **points**

This means:
_____ **points** for the other participant, disappears with **45%** chance
_____ **points** for you

- In this example, the percentage chance that the money you send disappears is 45%.
- You then need to decide how many points to send to the other participant.

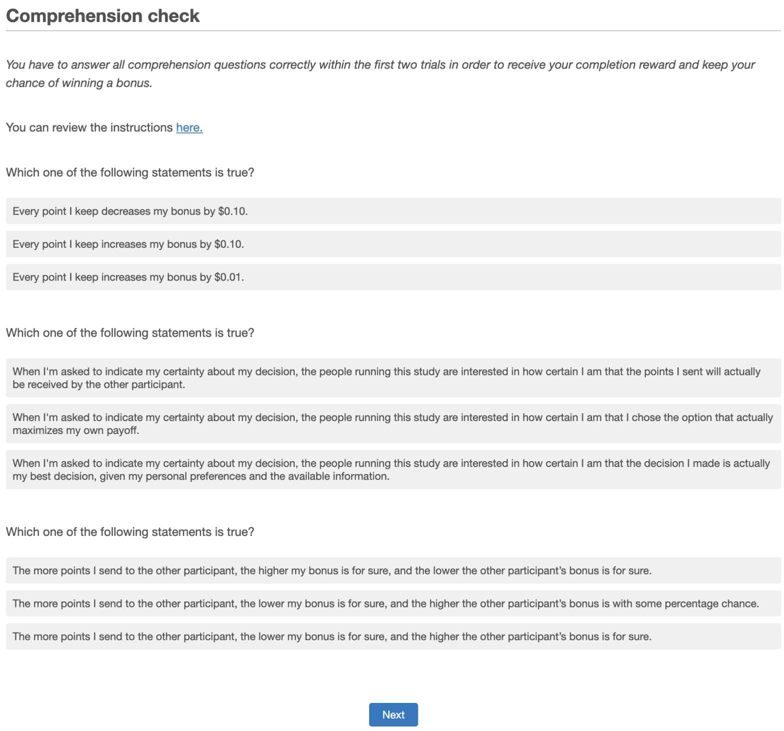
Your certainty:

In each round, we will ask you two questions:

- How many points you want to send to the other participant.
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that the decision you made is actually your best decision, given your personal preferences and the available information.

Next

Figure 93: The instruction screen for DIG task.



Comprehension check

You have to answer all comprehension questions correctly within the first two trials in order to receive your completion reward and keep your chance of winning a bonus.

You can review the instructions here.

Which one of the following statements is true?

- Every point I keep decreases my bonus by $0.10.
- Every point I keep increases my bonus by $0.10.
- Every point I keep increases my bonus by $0.01.

Which one of the following statements is true?

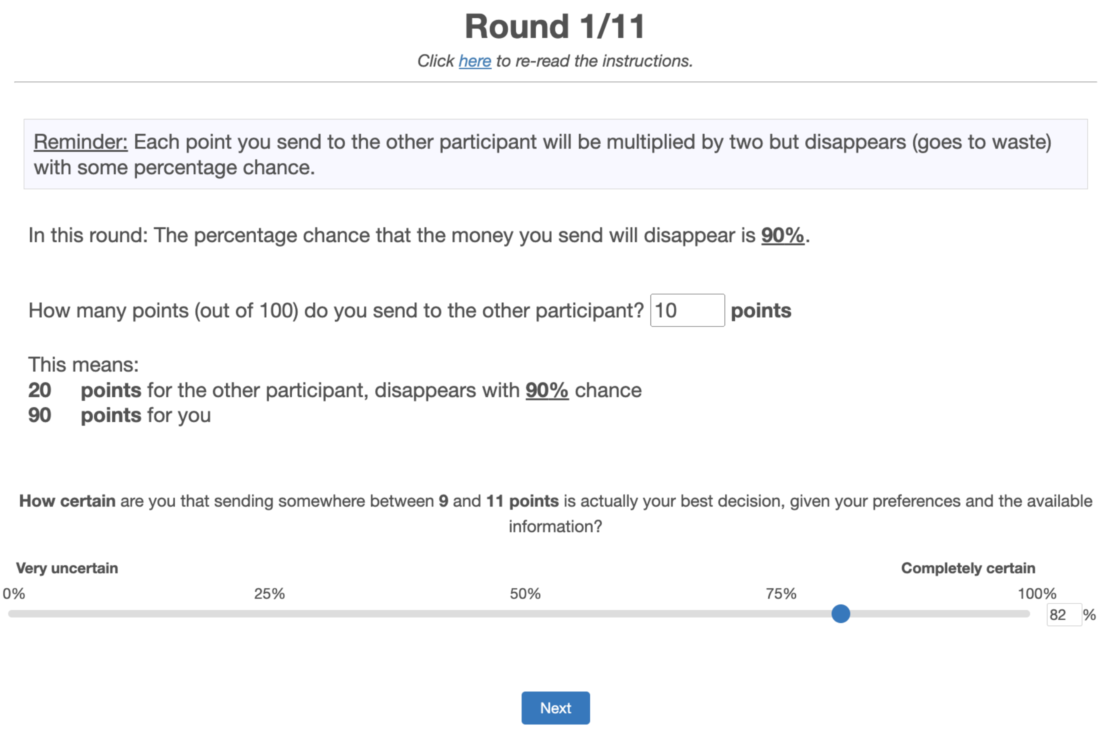
- When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am that the points I sent will actually be received by the other participant.
- When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am that I chose the option that actually maximizes my own payoff.
- When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am that the decision I made is actually my best decision, given my personal preferences and the available information.

Which one of the following statements is true?

- The more points I send to the other participant, the higher my bonus is for sure, and the lower the other participant's bonus is for sure.
- The more points I send to the other participant, the lower my bonus is for sure, and the higher the other participant's bonus is with some percentage chance.
- The more points I send to the other participant, the lower my bonus is for sure, and the higher the other participant's bonus is for sure.

Next

Figure 94: Comprehension check for DIG task.



Round 1/11

Click here to re-read the instructions.

Reminder: Each point you send to the other participant will be multiplied by two but disappears (goes to waste) with some percentage chance.

In this round: The percentage chance that the money you send will disappear is **90%**.

How many points (out of 100) do you send to the other participant? 10 **points**

This means:
20 **points** for the other participant, disappears with **90%** chance
90 **points** for you

How certain are you that sending somewhere between **9** and **11 points** is actually your best decision, given your preferences and the available information?

Next

Figure 95: Decision screen for DIG task.

G.26 EFF

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, you will **decide how many tasks you want to complete for a given wage.**

- You will be offered a wage for every task you complete. You then decide how many tasks you would like to be assigned. Your payment for the work assignment equals the **wage times the number of tasks you complete.**
- Each task you are assigned will require you to count the number of 1s in a table with 64 cells such as the one below:

6	5	4	2	0	5	7	0
6	0	7	4	7	6	3	8
7	3	2	5	8	8	9	2
8	6	7	3	4	9	6	8
2	3	3	1	5	6	4	8
8	6	5	4	5	1	5	8
5	9	6	7	8	4	1	9
0	8	6	3	9	3	8	6

- To complete a task successfully, you have to **correctly count the number of 1s.**
- A task that is not completed successfully will not count towards the total of tasks you need to complete for the assignment. Instead, **if you do not successfully complete a task, the computer will generate a new one.**
- The average time to complete a task is about 20 seconds.
- In each round, you will be told the wage per task. You will then decide how many tasks your work assignment should include.
- In total, you will complete 11 rounds of this task. Across these rounds, the wage varies. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus payment as well as how many tasks you will have to work on to receive your bonus. If a decision in this study is selected for payment, you will have to complete the number of tasks you selected and you will receive the total payment for the assignment. If you do not complete the total number of tasks your assignment includes, you will not receive any bonus payment. There is no partial payment for partially completed assignments.

Example:

Reminder:
- To complete a task successfully, you have to count the number of 1s in a table with 64 cells.
- For each task you choose to complete, you receive a wage. You will have to complete all tasks to receive a bonus payment, there are no partial payments.
- The average time to complete a task is about 20 seconds.

In this round: Your wage per completed task is **$0.22**.

How many tasks do you want to be assigned? [ ] **tasks**.

- In this example, the wage per completed task is $0.22.
- You then need to decide how many tasks to complete.

Your certainty:

In each round, we will ask you two questions:

- You will decide how many tasks you would like to complete given the wage you are offered.
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that the decision you made is actually your best decision, given your personal preferences.

Next

Figure 96: The instruction screen for EFF task.

Comprehension check

You have to answer all comprehension questions correctly within the first two trials in order to receive your completion reward and keep your chance of winning a bonus.

You can review the instructions here.

Which one of the following statements is **NOT** true?

- If the wage is $0.00, I will not receive any payment for completing all tasks.
- To complete a task, I need to count the number of times a 1 occurs in a table, and my guess has to be no further than 5 from the true number. If my guess is further away from the true number, a new task will be generated.
- To complete a task, I need to count the number of times a 1 occurs in a table. If I fail to count correctly, a new task will be generated.

Below is an example of a counting task. To show us that you understand and can perform the task, please select the the answer corresponding to the number of 1s in the table:

6	5	4	2	0	5	7	0
6	0	7	4	7	6	3	8
7	3	2	5	8	8	9	2
8	6	7	3	4	9	6	8
2	3	3	1	5	6	4	8
8	6	5	4	5	1	5	8
5	9	6	7	8	4	1	9
0	8	6	3	9	3	8	6

- 5
- 8
- 3

Which one of the following statements is true?

- When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am that the decision I made is actually my best decision, given my personal preferences.
- When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am that I have to work and receive the corresponding wage.

Next

Figure 97: Comprehension check for EFF task.

Round 1/11

Click here to re-read the instructions.

Reminder:
- To complete a task successfully, you have to count the number of 1s in a table with 64 cells.
- For each task you choose to complete, you receive a wage. You will have to complete all tasks to receive a bonus payment, there are no partial payments.
- The average time to complete a task is about 20 seconds.

In this round: Your wage per completed task is **$0.15**.

How many tasks do you want to be assigned? 4 **tasks.**

How certain are you that completing somewhere between **3** and **5 tasks** is actually your best decision, given your preferences?

Very uncertain **Completely certain**

0% 25% 50% 75% 100% 64 %

Next

Figure 98: Decision screen for EFF task.

G.27 FOR

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, **your task is to forecast the end-of-year earnings of a fictional firm** for the year 2024, based on the firm's earnings over the previous two years.

- The 2024 earnings of the firm are predictable. Specifically, the change in the firm's earnings from 2023 to 2024 is determined by two components:
  - A **firm trend** equal to the previous change in the firm's earnings from 2022 to 2023.
  - A **market trend** equal to **+5** in every year.
- The relative importance of these two components is given by P, a share between 0 and 100%. In particular, the earnings change is given by the formula

  2024 earnings – 2023 earnings =
  P% × (Firm trend) + (100 – **P**)% × (Market trend).

- In each round, you will be given a different firm to forecast. You will be told the earnings of that firm over the last two years, as well as the relative importance of each component, P. Your task is to **forecast the earnings of the firm in 2024.**
- In total, you will complete 11 rounds of this task. Across these rounds, the relative importance P will vary. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus payment. For each round, there will be a correct forecast of the earnings of the firm. If a decision in this part is selected for payment, you will receive $10 if your answer is within +/- $1 of the correct forecast, and nothing otherwise.

Example:

Reminder: The earnings change between 2023 and 2024 is determined by two components:
- A **firm trend** equal to the previous change in the firm's earnings between 2022 and 2023.
- A **market trend** equal to **+5** in every year.

The relative importance of these two components is determined by the share **P**.

In this round: The relative importance of the firm trend is **80%** and that of the market trend is **20%**, which means:

2024 earnings - 2023 earnings =
80% × (Firm trend) + **20%** × (Market trend)

The firm's earnings over the previous two years are given below:

2024 Earnings	?
2023 Earnings	**$127**
2022 Earnings	**$109**

What is your forecast of the earnings of this firm in 2024? **$**

- In this example, the importance of the firm trend is 80% and that of the market trend is 20%, and the firm's earnings over the last two years (2022 and 2023) are $109 and $127, respectively.
- You would give your forecast of the 2024 earnings of this firm, based on the information provided.

Your certainty:

In each round, we will ask you two questions:

- You will forecast the 2024 earnings of the firm.
- We will ask you **how certain** you are about your forecast. Specifically, we are interested in how likely you think it is (in percentage terms) that your forecast is actually the correct forecast.

Figure 99: The instruction screen for FOR task.

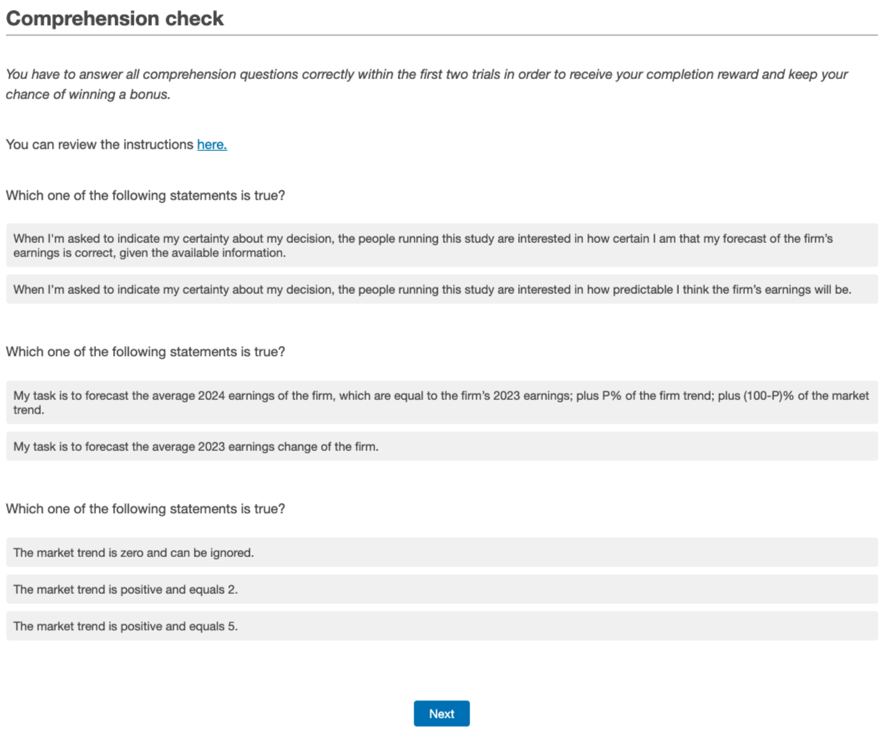


Figure 100: Comprehension check for FOR task.

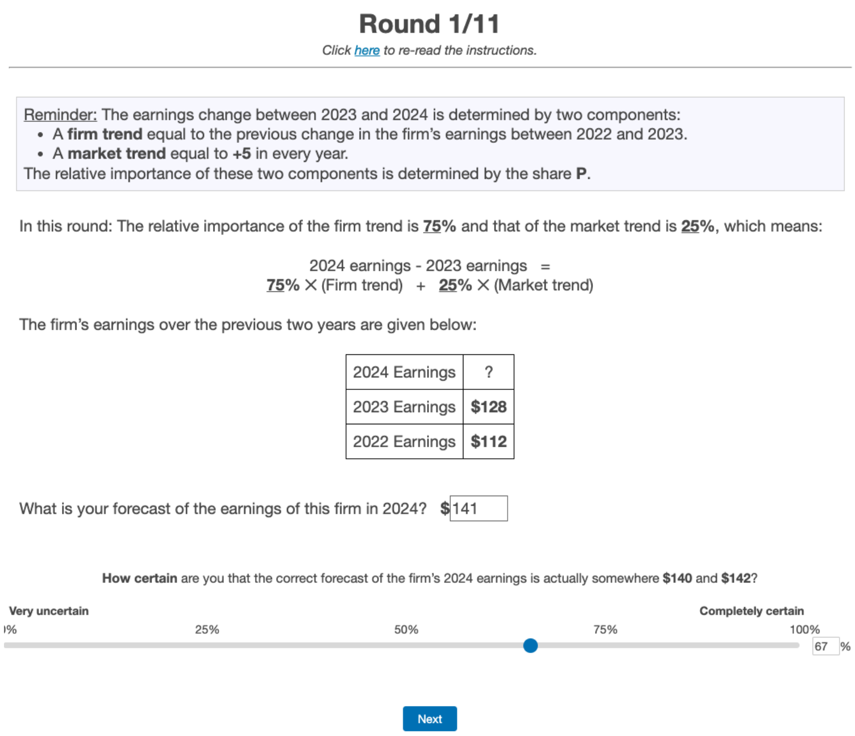


Figure 101: Decision screen for FOR task.

G.28 MUL

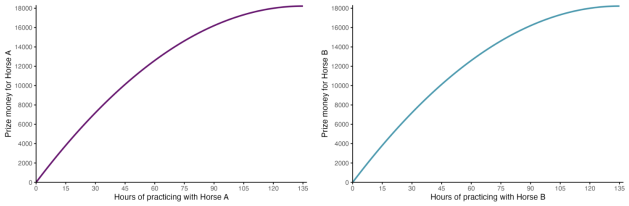
Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, there are two hypothetical racing horses called "**A**" and "**B**". Each of these horses wins prize money, where the more you practice with each horse, the more money it wins. In total, **you have 135 hours of practice that you need to allocate between the two horses to maximize the total prize money.**

- **You receive a certain percentage of each horse's prize money**, where the percentages across the two horses **always sum up to 90%**. For example, you may receive 50% of Horse A's prize money and 40% of Horse B's, or you may receive 75% of Horse A's and 15% of Horse B's prize money, and so on.
- The figures below show you how much prize money each horse wins depending on how many hours you practice with it. **Each horse wins more money the more you practice with it.**
  - As you can see, the **first** hours of practice with either horse **are very effective in generating more prize money**, but as **a horse practices more and more, ultimately additional hours of practice only generate small additional increases in prize money.**
  - Below each figure, you can find the precise mathematical formula that tells you how much prize money each horse wins.
  - There is **no uncertainty** about how much prize money each horse wins. The amount each horse wins only depends on how much you practice with it.



Prize Money for A =
Hours with A × (270 - Hours with A)

Prize Money for B =
18,225 - (Hours with A) × (Hours with A)

- In each round, you will be told **what percentages of each horse's prize money you receive**. You will then decide how you allocate practice time between the two horses.
- You can also allocate fractions of hours, such as 6.78 hours. These result in fractional prize money just like whole hours do.
- In total, you will complete 11 rounds of this task. Across these rounds, the percentages of the prize money you get for either horse vary. These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus payment. If a decision in this study is selected for payment, you will receive $10 if your answer is within +/- 1 hours of the training time that maximizes the prize money at the prevailing percentages of the prize money you get for each horse, and nothing otherwise.

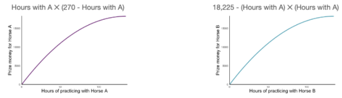
Example:

In this round, you receive:

35% of **Horse A's** prize money + **55%** of **Horse B's** prize money

Hours with A × (270 - Hours with A)

18,225 - (Hours with A) × (Hours with A)



How many hours (out of 135) do you practice with Horse A and B?

Horse A: ____ **hours**
Horse B: ____ **hours**

- In this example, you get 35% of Horse A's and 55% of Horse B's prize money.
- You then need to decide how many hours to practice with each horse.

Your certainty:

In each round, we will ask you two questions:

- How many hours to practice with each horse.
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that the decision you made is actually the best decision, by which we mean the decision that maximizes your bonus.

Next

Figure 102: The instruction screen for MUL task.

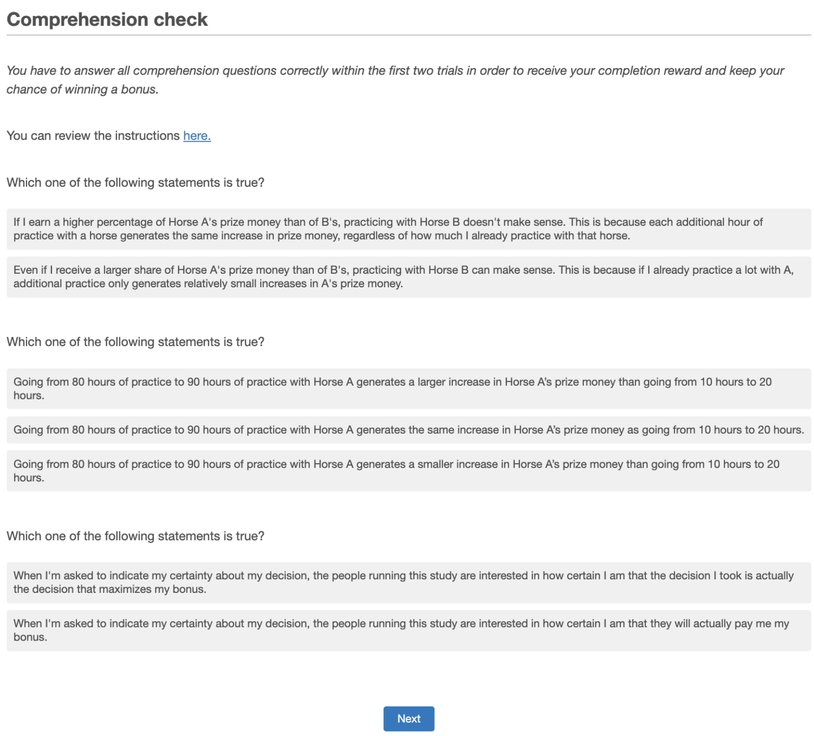


Figure 103: Comprehension check for MUL task.

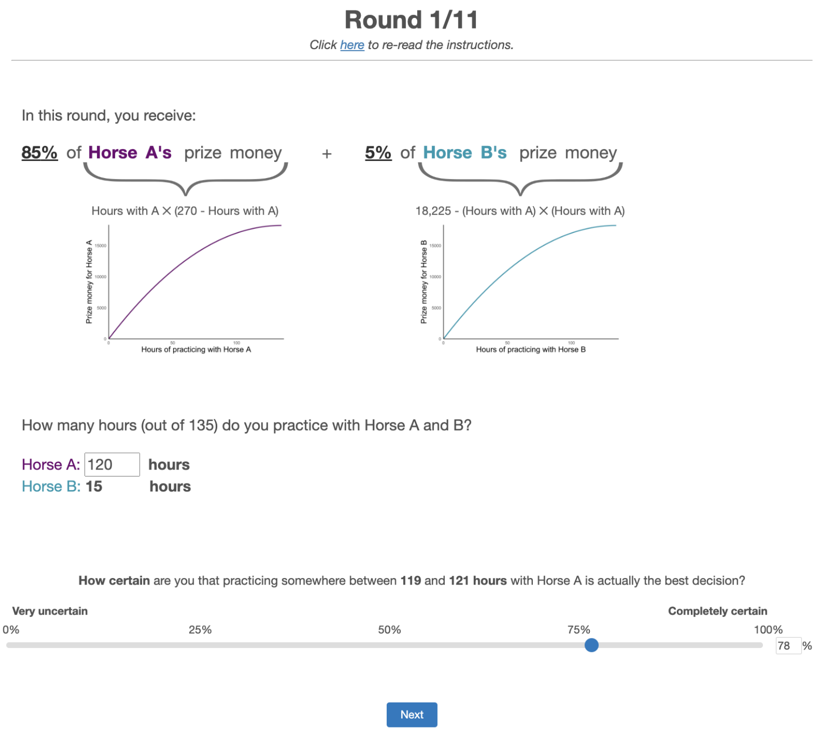


Figure 104: Decision screen for MUL task.

G.29 NEW

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.
You have a chance to win an additional bonus if you complete this study in its entirety. One out of five participants will be eligible for a bonus. If you are eligible for a bonus, we will randomly select one of your decisions (with equal probability) to determine your bonus.

Your task:

In this study, you will act as a **fictional firm that produces and sells a single product**: gallons of cola.

- You will choose how much cola to produce, between 0 and 100 gallons. You can **sell cola at a sales price of $12 per gallon.**
- Each gallon will cost you a certain amount to produce.
- In each round, you will be told how much each gallon costs to produce. You will then decide **how many gallons to produce.**
- You must decide how many gallons to produce **before** you know for certain the "demand" quantity: the amount of cola your customers actually want to buy. The computer **randomly selects the demand from a range of 0 to 100 gallons**, with each whole number in the range **equally likely**. Gallons that you produce but for which there is no demand go to waste.
- This means:
  - If you produce **fewer** gallons than the available demand, you sell **all gallons that you produced,** but you also **lose sales you would have made if you'd produced more.**
  - If you produce **more** gallons than the available demand, you only sell **those gallons that meet the available demand.** The remaining gallons that **can't be sold go to waste,** and you still need to **pay the cost of producing them.**
- The **firm's profit** is equal to the number of gallons you sell times the sales price of $12, minus the cost of producing gallons:

  Firm profit = Gallons sold × $12 – Gallons produced × Cost of producing each gallon
- You can also produce fractions of gallons, such as 6.78 gallons. These result in fractional revenue just like whole gallons do.
- In total, you will complete 11 rounds of this task. Across these rounds, **the cost of producing cola varies.** These rounds are completely independent from one another. If one of the rounds of this task is selected to determine your bonus, only your decision in this one round will determine your bonus.

Your bonus payment:

Your decisions may affect your bonus payment. If a decision in this study is selected for payment, we will calculate your profit as described above. Your bonus then equals:

Bonus (in $) = 4 + 1/300 × Firm profit (or loss)

While this may sound complicated, all it means is that it is in your best interest to **truthfully indicate the amount of cola you want to produce.**

Example:

Reminder: You can sell each gallon at a sales price of **$12**, but only to the extent that there is available demand.
The number of gallons demanded is equally likely to be any number **between 0 and 100.**

In this round: The cost of producing each gallon is **$5**.

How many gallons (out of 100) do you produce? [ ] gallons

- In this example, the cost of producing each gallon is $5.
- You then need to decide how many gallons to produce.

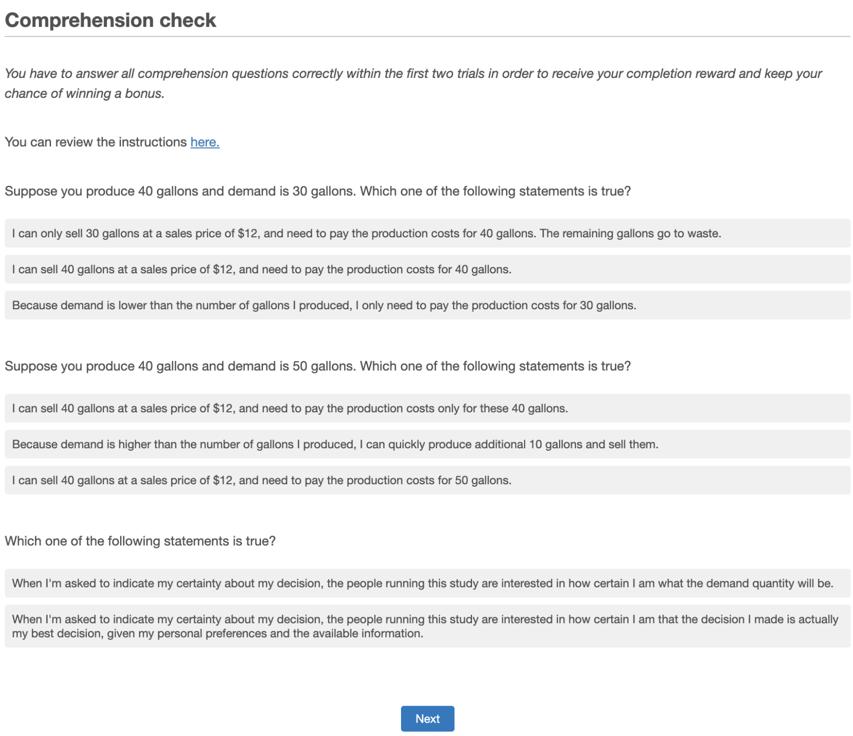
Your certainty:

In each round, we will ask you two questions:

- How many gallons you want to produce.
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that the decision you made is actually your best decision, given your personal preferences and the available information.

Next

Figure 105: The instruction screen for NEW task.



Comprehension check

You have to answer all comprehension questions correctly within the first two trials in order to receive your completion reward and keep your chance of winning a bonus.

You can review the instructions here.

Suppose you produce 40 gallons and demand is 30 gallons. Which one of the following statements is true?

- I can only sell 30 gallons at a sales price of $12, and need to pay the production costs for 40 gallons. The remaining gallons go to waste.
- I can sell 40 gallons at a sales price of $12, and need to pay the production costs for 40 gallons.
- Because demand is lower than the number of gallons I produced, I only need to pay the production costs for 30 gallons.

Suppose you produce 40 gallons and demand is 50 gallons. Which one of the following statements is true?

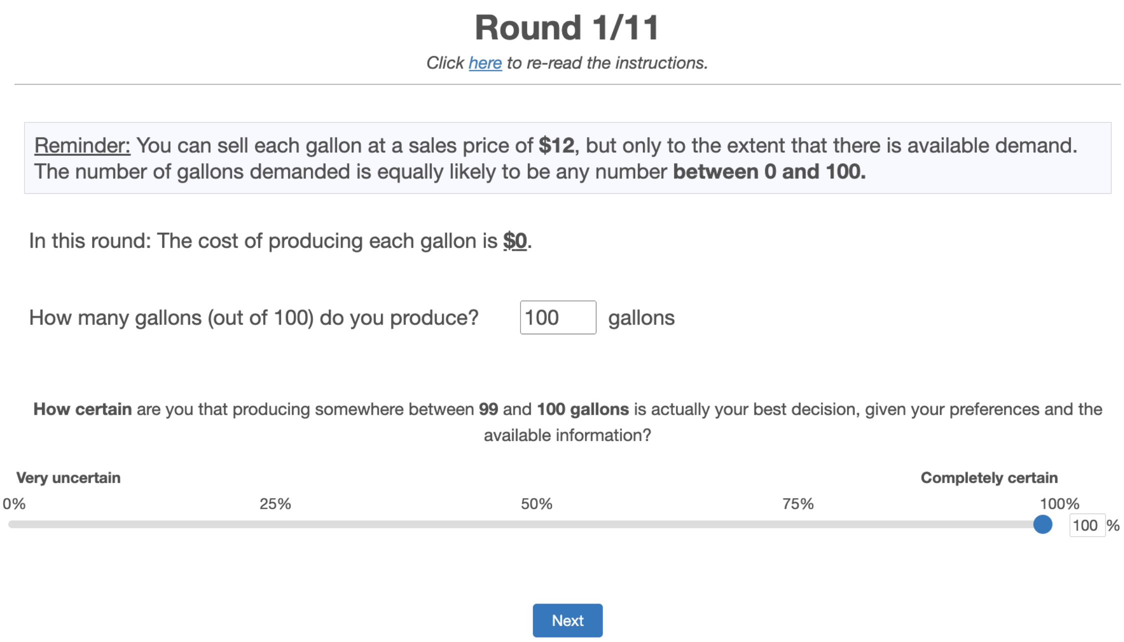
- I can sell 40 gallons at a sales price of $12, and need to pay the production costs only for these 40 gallons.
- Because demand is higher than the number of gallons I produced, I can quickly produce additional 10 gallons and sell them.
- I can sell 40 gallons at a sales price of $12, and need to pay the production costs for 50 gallons.

Which one of the following statements is true?

- When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am what the demand quantity will be.
- When I'm asked to indicate my certainty about my decision, the people running this study are interested in how certain I am that the decision I made is actually my best decision, given my personal preferences and the available information.

Next

Figure 106: Comprehension check for NEW task.



Round 1/11

Click here to re-read the instructions.

Reminder: You can sell each gallon at a sales price of **$12**, but only to the extent that there is available demand. The number of gallons demanded is equally likely to be any number **between 0 and 100.**

In this round: The cost of producing each gallon is **$0**.

How many gallons (out of 100) do you produce? 100 gallons

How certain are you that producing somewhere between **99** and **100 gallons** is actually your best decision, given your preferences and the available information?

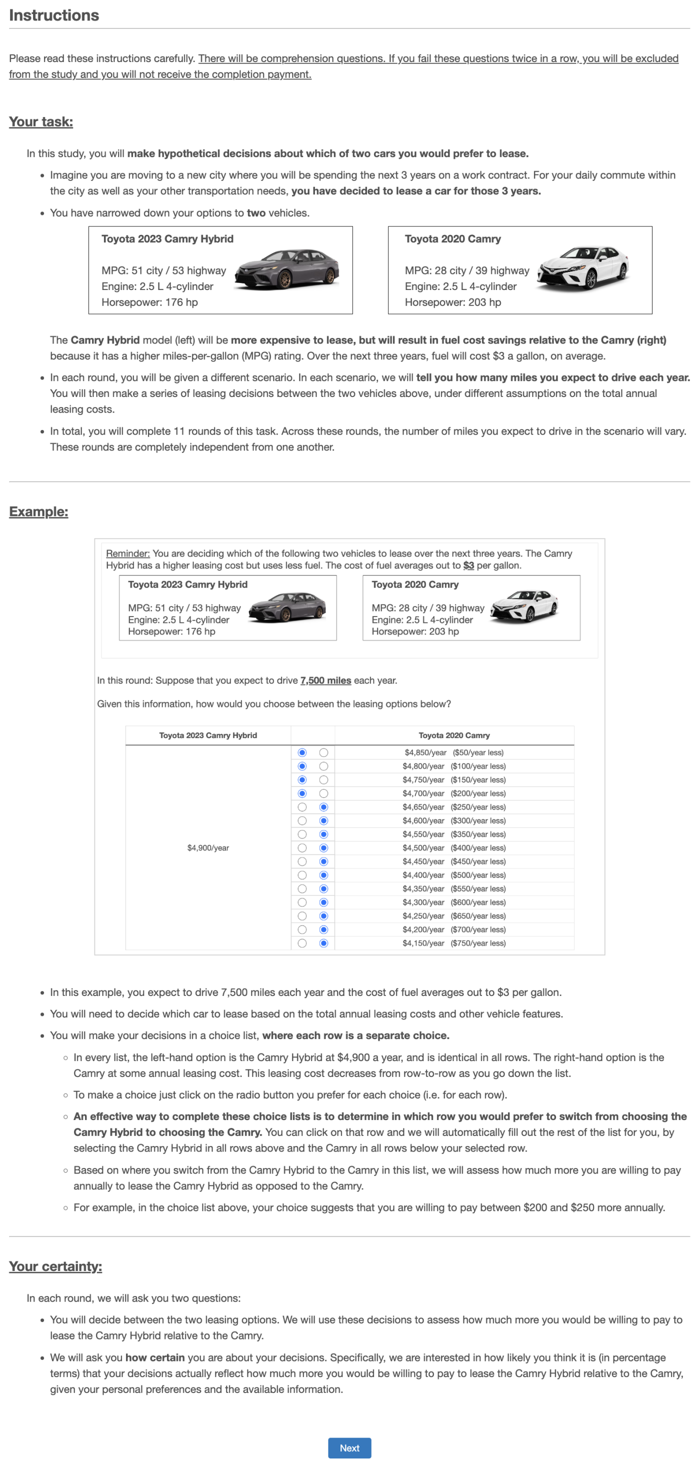
Very uncertain **Completely certain**

0% 25% 50% 75% 100% 100 %

Next

Figure 107: Decision screen for NEW task.

G.30 ENS



Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.

Your task:

In this study, you will **make hypothetical decisions about which of two cars you would prefer to lease.**

- Imagine you are moving to a new city where you will be spending the next 3 years on a work contract. For your daily commute within the city as well as your other transportation needs, **you have decided to lease a car for those 3 years.**
- You have narrowed down your options to **two** vehicles.

Toyota 2023 Camry Hybrid	Toyota 2020 Camry
MPG: 51 city / 53 highway Engine: 2.5 L 4-cylinder Horsepower: 176 hp	MPG: 28 city / 39 highway Engine: 2.5 L 4-cylinder Horsepower: 203 hp

The **Camry Hybrid** model (left) will be **more expensive to lease, but will result in fuel cost savings relative to the Camry (right)** because it has a higher miles-per-gallon (MPG) rating. Over the next three years, fuel will cost $3 a gallon, on average.

- In each round, you will be given a different scenario. In each scenario, we will **tell you how many miles you expect to drive each year.** You will then make a series of leasing decisions between the two vehicles above, under different assumptions on the total annual leasing costs.
- In total, you will complete 11 rounds of this task. Across these rounds, the number of miles you expect to drive in the scenario will vary. These rounds are completely independent from one another.

Example:

Reminder: You are deciding which of the following two vehicles to lease over the next three years. The Camry Hybrid has a higher leasing cost but uses less fuel. The cost of fuel averages out to **$3** per gallon.

Toyota 2023 Camry Hybrid	Toyota 2020 Camry
MPG: 51 city / 53 highway Engine: 2.5 L 4-cylinder Horsepower: 176 hp	MPG: 28 city / 39 highway Engine: 2.5 L 4-cylinder Horsepower: 203 hp

In this round: Suppose that you expect to drive **7,500 miles** each year.

Given this information, how would you choose between the leasing options below?

Toyota 2023 Camry Hybrid			Toyota 2020 Camry
	◉	○	$4,850/year ($50/year less)
	◉	○	$4,800/year ($100/year less)
	◉	○	$4,750/year ($150/year less)
	◉	○	$4,700/year ($200/year less)
	○	◉	$4,650/year ($250/year less)
	○	◉	$4,600/year ($300/year less)
	○	◉	$4,550/year ($350/year less)
$4,900/year	○	◉	$4,500/year ($400/year less)
	○	◉	$4,450/year ($450/year less)
	○	◉	$4,400/year ($500/year less)
	○	◉	$4,350/year ($550/year less)
	○	◉	$4,300/year ($600/year less)
	○	◉	$4,250/year ($650/year less)
	○	◉	$4,200/year ($700/year less)
	○	◉	$4,150/year ($750/year less)

- In this example, you expect to drive 7,500 miles each year and the cost of fuel averages out to $3 per gallon.
- You will need to decide which car to lease based on the total annual leasing costs and other vehicle features.
- You will make your decisions in a choice list, **where each row is a separate choice.**
  - In every list, the left-hand option is the Camry Hybrid at $4,900 a year, and is identical in all rows. The right-hand option is the Camry at some annual leasing cost. This leasing cost decreases from row-to-row as you go down the list.
  - To make a choice just click on the radio button you prefer for each choice (i.e. for each row).
  - **An effective way to complete these choice lists is to determine in which row you would prefer to switch from choosing the Camry Hybrid to choosing the Camry.** You can click on that row and we will automatically fill out the rest of the list for you, by selecting the Camry Hybrid in all rows above and the Camry in all rows below your selected row.
  - Based on where you switch from the Camry Hybrid to the Camry in this list, we will assess how much more you are willing to pay annually to lease the Camry Hybrid as opposed to the Camry.
  - For example, in the choice list above, your choice suggests that you are willing to pay between $200 and $250 more annually.

Your certainty:

In each round, we will ask you two questions:

- You will decide between the two leasing options. We will use these decisions to assess how much more you would be willing to pay to lease the Camry Hybrid relative to the Camry.
- We will ask you **how certain** you are about your decisions. Specifically, we are interested in how likely you think it is (in percentage terms) that your decisions actually reflect how much more you would be willing to pay to lease the Camry Hybrid relative to the Camry, given your personal preferences and the available information.

Next

Figure 108: The instruction screen for ENS task.

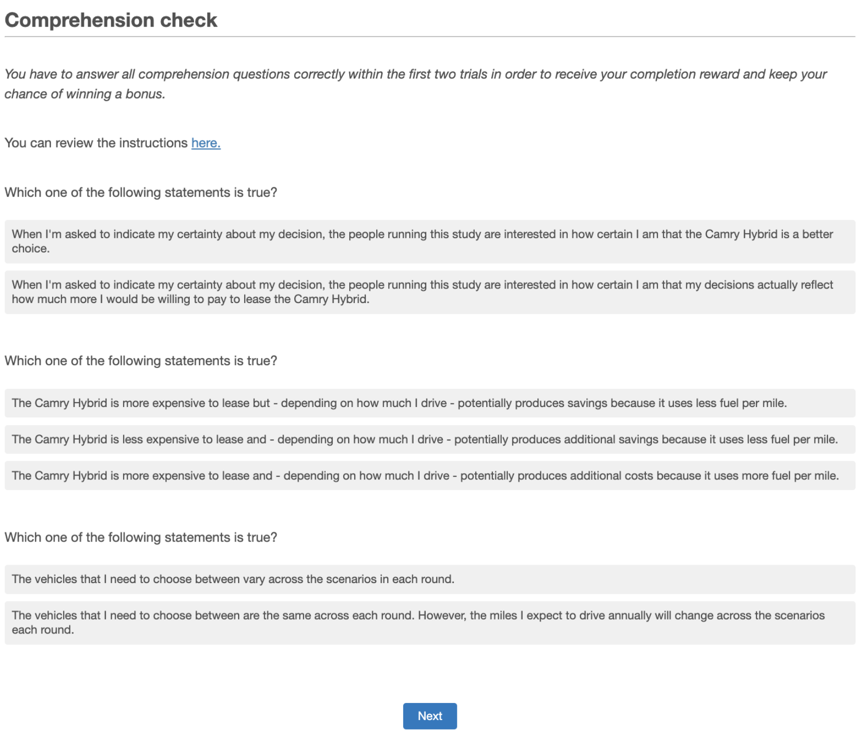


Figure 109: Comprehension check for ENS task.

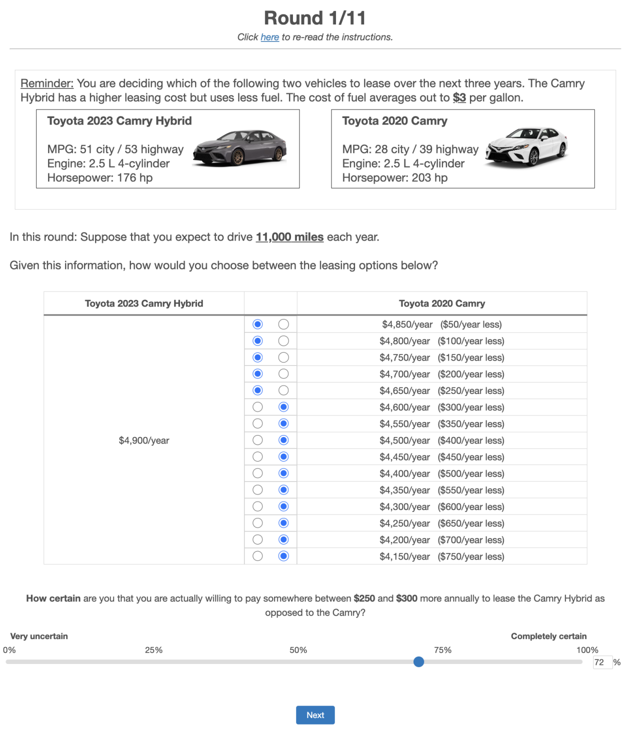


Figure 110: Decision screen for ENS task.

G.31 HEA

Instructions

Please read these instructions carefully. There will be comprehension questions. If you fail these questions twice in a row, you will be excluded from the study and you will not receive the completion payment.

Your task:

In this study, we will describe a hypothetical scenario in which some number of people are expected to be sick for one month due to a new disease. **You will decide how much money you think the government should spend on curing the disease.**

- In each round, you will be told **how many people are expected to be sick for a month due to the disease**. During their sickness, people cannot work and are generally heavily constrained in their activities. There are no secondary damages of the disease.
- Your task is to decide **how much money, between $0 and $1 million, the government should be willing to spend** to cure the disease, preventing people from being sick.
- In total, you will complete 11 rounds of this task. Across these rounds, the number of people expected to suffer from the disease varies. These rounds are completely independent from one another.

Example:

Reminder: Some number of people are expected to be sick for a month due to a disease. You will decide how much money the government should be willing to spend to cure the disease, preventing people from getting sick.

In this round: **5 people** are expected to get sick.

How much (between $0 and $1,000,000) should the government be willing to pay to cure the disease? $

- In this example, there are 5 people expected to get sick.
- You then need to type into the box the number (between 0 and 1,000,000) of dollars you think the government should spend to cure the disease.

Your certainty:

In each round, we will ask you two questions:

- How many dollars you think the government should be willing to spend.
- We will ask you **how certain** you are about your decision. Specifically, we are interested in how likely you think it is (in percentage terms) that the decision you made is actually your best decision, given your personal preferences and the available information.

Next

Figure 111: The instruction screen for HEA task.

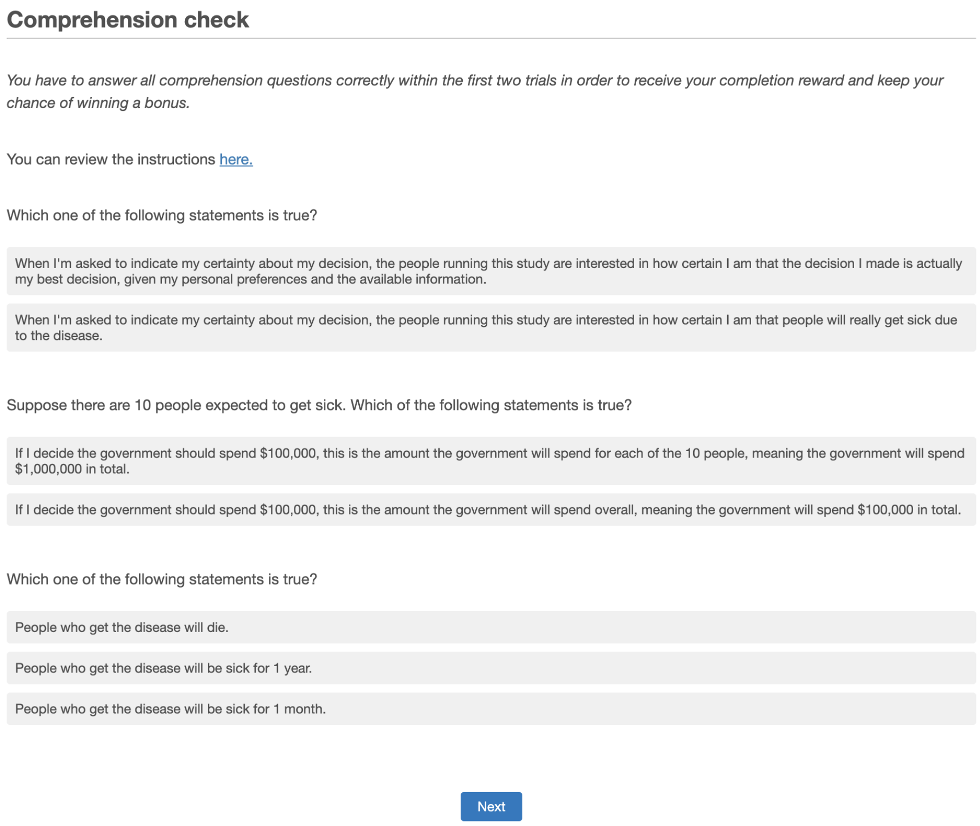


Figure 112: Comprehension check for HEA task.

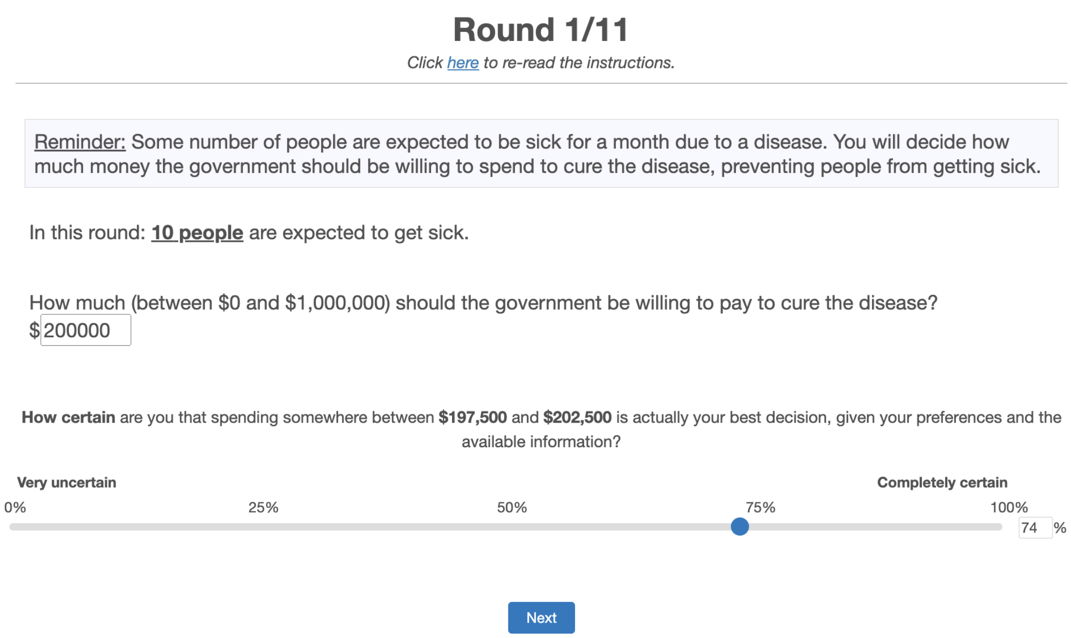


Figure 113: Decision screen for HEA task.